2025

SVP



Society of Vertebrate Paleontology

85th Annual Meeting

Birmingham

2025 ANNUAL MEETING LOGO
CREATED BY: **DR. MARK WITTON**

ANNUAL MEETING PROGRAM

INTERNATIONAL CONVENTION CENTRE
BIRMINGHAM, UK

NOVEMBER 12 – NOVEMBER 15, 2025

SVP
SOCIETY OF VERTEBRATE PALEONTOLOGY
www.vertpaleo.org

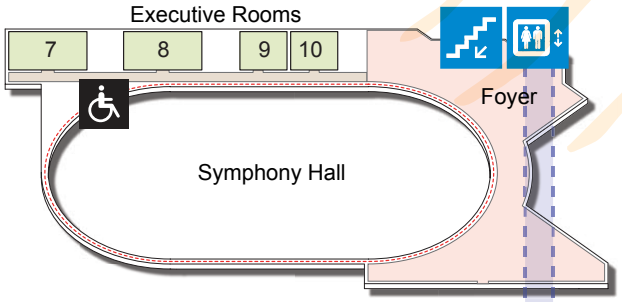
VISIT VERTPALEO.ORG FOR UP-TO-DATE MEETING INFORMATION



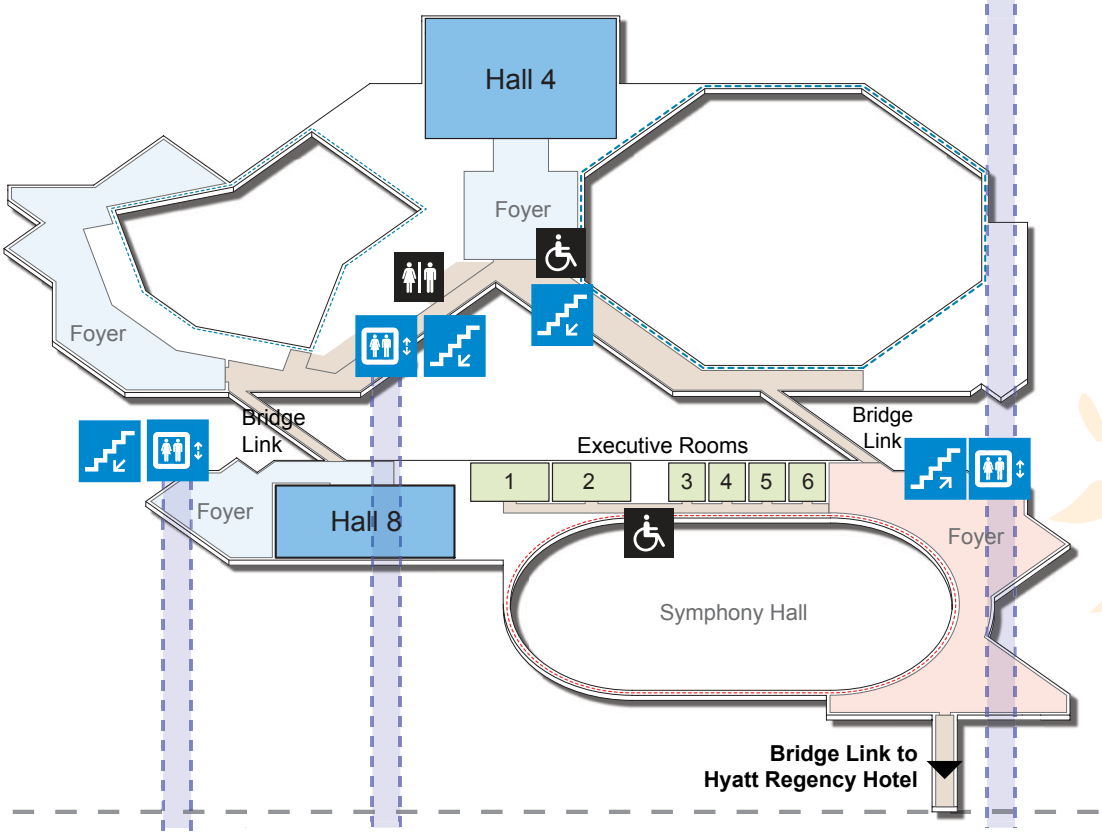
MAP LEGEND

- **Registration Desk**
  (Located in the foyer between Hall 1 and Hall 3 on Level 4)
- **Posters and Exhibits**
  (Hall 3 on Level 4)
- **3 Concurrent Session Rooms**
  (Hall 1 on Level 4, Hall 4 on Level 5, Hall 8 on Level 5)
- **After Party**
  (Hall 3 on Level 4)
- **Awards Banquet**
  (Hall 3 on Level 4)
- **Main Entrance**
  (Brindleyplace Entrance on Level 2)
- **Gender Neutral Bathroom**
  (Level 4 between Hall 1 and Hall 3)

Level 5a



Level 5



MAP LEGEND

- 3 Concurrent Session Rooms
  (Hall 1 on Level 4, Hall 4 on Level 5, Hall 8 on Level 5)
- Student Round Table
  (Hall 8 on Level 5)
- Committee Meetings
  (Executive Rooms 1, 2 and 5 on Level 5)

NOVEMBER 2025 ABSTRACTS OF PAPERS

HOST COMMITTEE
Richard Butler, Co-Chair; Ivan Sansom, Co-Chair; Plamen Andreev, Raheem Butt, Richard Dearden, Kirsty Edgar, Davide Foffa, Shan Huang, Ben Igielman, Stephan Lautenschlager, Susannah Maidment, Luke Meade, Harriet Nuttall, Zichuan Qin, James Rawson, Arindam Roy, Lisa Schnetz, Joseph Flannery Sutherland

EXECUTIVE COMMITTEE
Stuart Sumida, President; Margaret Smith, Past President;
Kristi Curry Rogers, Vice-President; Darin Croft, Secretary; Ted Vlamis, Treasurer;
Zerina Johanson, Member-at-Large; Paul Koch, Member-at-Large;
Taissa Rodrigues, Member-at-Large (Ethics); Anne Weil, Member-at-Large;
Lindsay Zanno, Member-at-Large (Ethics)

SYMPOSIUM CONVENORS

Kimberley Chapelle and Zoe Kulik
Synchrotron Radiation Micro-Computed Tomography Scanning inPalaeontology

Ryan Patterson and Tiffany Slater
Ancient Biomolecules

Stephan Spiekman, Eudald Mujal, Gabriela Sobral, and Randall Irmis
Evolution of Triassic Non-Marine Tetrapod Communities Through Time

Laura Porro, Emily Rayfield, and Stephan Lautenschlager
Multidisciplinary Approaches to Skull Function and Evolution

PROGRAM COMMITTEE
Alistair Evans, Co-Chair; Brandon Peecook, Co-Chair; Bin Bai, Juan Benito, Matthew Borths, Alessio Capobianco, Alessandro Chiarenza, Brian Davis, Rafael Delcourt, Stephanie Drumheller, Anthony Friscia, Timothy Gaudin, Aryeh Grossman, Yara Haridy, Juan Liu, Ingrid Lundeen, Julia McHugh, Benjamin Otoo, Felipe Pinheiro, Selina Viktor Robson, John Scannella, Tiago Simoes, Tara Smiley, Shuo Wang, Anne Weil, Megan Whitney, Cary Woodruff

PALEONTOLOGICAL PRACTICES & AWARD LIAISONS
Christina Byrd, Kerin Claeson, Lisa Herzog, Joshua Lively, Susannah Maidment, Joshua Miller, Matthew Miller, Ashley Poust, Kenshu Shimada, Lindsay Zanno

EDITORS
John Hunter, Nerita Turner, Evan Vlachos, Robin Whatley

WITH SPECIAL THANKS TO...
Collections & Repository Committee, Communications Committee, Education & Outreach Committee, Ethics Committee, Government Affairs Committee, Preparators' Committee

WELCOME TO BIRMINGHAM

The Host Committee for the 85th Annual Meeting is excited to welcome all participants to the Society of Vertebrate Paleontology's 2025 meeting in Birmingham, UK. This is only the second time that the Annual Meeting has been held in the UK, and the first time since 2009.

Birmingham is affectionately known as 'Brum' and its inhabitants as 'Brummies'. The UK's second city, Birmingham played a crucial role in the Midlands Enlightenment and the Industrial Revolution, and the latter left a legacy of an extensive and distinctive network of canals stretching throughout the city. Birmingham is also a significant cultural and sporting centre, as the birthplace of Ozzy Osbourne, Black Sabbath and heavy metal; the setting for the hugely successful BBC series *Peaky Blinders*; the childhood home of JRR Tolkien and inspiration for many of the settings of *The Hobbit* and *The Lord of the Rings*; the home of Aston Villa football club and Warwickshire County Cricket Club; and boasting highlights such as the City of Birmingham Symphony Orchestra and the Birmingham Royal Ballet. In November and December each year the city centre is taken over by the Frankfurt Christmas Market, the largest German market outside of Germany and Austria.

Your host committee is formed by members of the Palaeobiology group of the University of Birmingham. This year, the University's 125th anniversary, is a fitting time to welcome the Society of Vertebrate Paleontology. The University of Birmingham is ranked within the top 100 universities globally and a member of the prestigious Russell Group of research-intensive UK universities. Founded in 1900, the University was England's first civic university, a place where students from all backgrounds were accepted on an equal basis. The University's beautiful and expansive main campus in Edgbaston in south Birmingham is known for its distinctive clock tower, thought to have provided the inspiration for the Eye of Sauron in *The Lord of the Rings*. Each year, more than 40,000 students from across the world study at Birmingham.

The University of Birmingham hosts one of the largest groups of palaeontological researchers in the UK, with particular expertise in fish, dinosaurs and other Mesozoic reptiles, palaeobotany and micropalaeontology. Geology at the University was founded by Charles Lapworth, whose study of Palaeozoic fossils, most notably graptolites, led to him defining a new geological period, the Ordovician, among other major contributions. One of the most famous of all Chinese geologists, Li Siguang, completed his undergraduate and doctoral degrees at the University in the early 20th century. Other 20th century Birmingham researchers such as Russell Coope and Tony Hallam made groundbreaking contributions to our understanding of past climates, environmental change and mass extinction.

Today, palaeontological research at Birmingham is supported by excellent facilities, and continues to make major contributions, with recent notable examples including the oldest known vertebrate brains; new reconstructions of feeding mechanisms in the earliest vertebrates; key insights into the origins of flying reptiles; new understanding of dinosaur eye evolution; a major 'highway' of Jurassic dinosaur footprints; and the extreme armour of the oldest ankylosaur. Birmingham palaeontological research is highly international in outlook, with research collaborations and fieldwork in countries

WELCOME TO BIRMINGHAM (CONTINUED)

such as Australia, Brazil, China, Morocco, Argentina, Hungary, the USA and Kyrgyzstan. Geoheritage, geoconservation and geoethics are growing areas of impactful research for the group.

The University delivers specialist undergraduate degrees in Palaeontology, graduating around 20 students per year. Both education and research at the University are supported by the award-winning Lapworth Museum of Geology, dating to the foundation of the University and holding around 300,000 specimens with palaeontological displays reflecting the rich local Silurian, Carboniferous, Jurassic and Quaternary fossil records. We hope that attendees will take the opportunity to visit the Museum as part of the Welcome Reception, which will be hosted in the historic Aston Webb building on the University's campus.

Birmingham is located centrally within the UK, with an international airport and excellent rail, bus and road connections. Demographically the city is one of the youngest in Europe and highly diverse, and this is reflected in the cosmopolitan range of excellent food, including some of the UK's best Indian restaurants, with the city claiming invention of the famous 'balti' style of curry.

The wider English Midlands region boasts numerous attractions, including Shakespeare's hometown of Stratford-upon-Avon; Ironbridge, the birthplace of the Industrial Revolution; historic Warwick Castle; the Black Country UNESCO Global Geopark; and beautiful natural landscapes including the Cotswolds, Peak District National Park, and Shropshire Hills.

The meeting will be held at the International Convention Centre (ICC) in the city centre, which is conveniently surrounded by numerous hotels, restaurants and nightlife as well as cultural highlights such as the Birmingham Museum & Art Gallery, National Sea Life Centre, Library of Birmingham, and the Symphony Hall, and a short distance from the main train station, Birmingham New Street. Slightly further afield within the city centre, the Thinktank Museum has a display of spectacular vertebrate fossils from across the globe within a large science museum setting. The city's two botanical gardens – Birmingham Botanical Gardens and Winterbourne House – sit in leafy south Birmingham.

The meeting logos were designed by palaeoartist Dr Mark Witton. The main logo features the Triassic reptile *Rhynchosaurus articeps*, the fossils of which were recovered in Shropshire, to the west of Birmingham, and described by Sir Richard Owen in 1842.

We look forward to welcoming you to Birmingham!

Richard Butler,
SVP 85th Annual Meeting Host Committee Co-chair

Ivan Sansom,
SVP 85th Annual Meeting Host Committee Co-chair

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PRESENTATION POLICIES

SVP Abstracts are reviewed by the Program Committee and members of the Collections & Repository, Education & Outreach, Ethics, Government Affairs, Preparators', and Romer Prize and Colbert Prize Committees, as appropriate. Authors are responsible for the technical content of their articles.

Unless specified otherwise, coverage of abstracts presented orally at the Annual Meeting is strictly prohibited until the start time of the presentation, and coverage of poster presentations is prohibited until the relevant poster session opens for viewing. As defined here, "coverage" includes all types of electronic and print media; this includes blogging, tweeting, advanced online publication, and other intent to communicate or disseminate results or discussion presented at the SVP Annual Meeting.

Still photography, video and/or audio taping, or any other electronic recording at the SVP Annual Meeting is strictly prohibited, with the exception of the designated SVP press event. The SVP reserves the right to engage professional photographers or audio/videotape professionals to archive sections of the Meeting for the Society's use.

Editorial policies for unpublished work: If you are planning to submit, or have submitted, your work to a journal that has embargo policies, be sure you are familiar with any restrictions they may impose on disseminating it before publication.

Please address any questions about program practices to the Program Committee or to the Executive Committee.

Citing an Abstract in the 2025 SVP Program and Abstracts Book
This Program and Abstracts Book is an official supplement to the online version of the *Journal of Vertebrate Paleontology*. The citation format for an abstract printed in this book is: *Journal of Vertebrate Paleontology, Program and Abstracts*, 2025, <insert page number here>.

SVP CODE OF CONDUCT

The Society of Vertebrate Paleontology Code of Conduct

The Society of Vertebrate Paleontology (SVP) is committed to providing a courteous, professional, and harassment-free environment for all participants at our events. Attendees are expected to act with respect, integrity, and professionalism, whether in person or online.

This Code of Conduct applies to all SVP-sponsored activities, including meetings, field trips, and virtual events.

Key Principles

- Treat others with respect, consideration, and dignity, regardless of age, career stage, disability, ethnicity, gender, gender identity or expression, nationality, neurodiverse status, physical appearance, race, religion, sexual orientation, socioeconomic status, or other characteristics.
- All interactions—verbal, physical, or electronic—must remain professional, constructive, and focused on ideas rather than individuals or groups.
- Harassment, discrimination, intimidation, or retaliation of any kind will not be tolerated.
- Impairment due to intoxicants that affects your professional behavior or compliance with this Code is prohibited.
- Respect intellectual property: Do not record, photograph, or share presentations or artwork without *explicit permission* from the author(s).

Unacceptable Behavior

The following actions are strictly prohibited:

- Harassment, intimidation, or discrimination, including verbal abuse, slurs, derogatory jokes, negative stereotyping, or hostile behavior.
- Unwelcome sexual attention or advances, inappropriate physical contact, and sexually explicit or suggestive materials in presentations or public spaces.
- Disruption of talks, sessions, or events, including excessive noise, heckling, or interrupting presenters.
- Stalking or threatening behavior, either in-person or electronically.
- Unauthorized photography or recording without explicit consent.
- Retaliation against individuals who report violations or participate in investigations.

SVP CODE OF CONDUCT

The Society of Vertebrate Paleontology Code of Conduct (Continued)

Reporting a Violation

If you witness or experience prohibited behavior, you are strongly encouraged to submit a report via the NAVEX Platform. Only non-anonymous reports will be considered, and reports will be returned if they lack sufficient detail.

All reports must include:

1. Your name and affiliation
2. Name(s) or identifying information of the individual(s) involved.
3. Name(s) of the victim(s), if known.
4. Description of the incident(s), including date, location, and nature of the behavior.
5. Names of witnesses, if any.
6. Any relevant documentation or supporting material.
7. Disclosure of any potential conflicts of interest among those involved or overseeing the report.

If You Need Immediate Help.

- If there is an immediate threat to safety, call emergency services (e.g., 999 in the U.K.).
- If you need help during an SVP event but it's not an emergency, contact:
  - The event leader (e.g., field trip or session organizer)
  - A member of the SVP Executive or Ethics Committee
  - Anyone wearing a "Safe SVP" button

Then, submit a formal written report as soon as possible on NAVEX.

Required Reporters

All SVP members in leadership roles — including elected, appointed, or temporary (e.g., session or field trip leaders) — are required to report any observed or reported violations. These reports must include a description of the incident and the actions taken, and be submitted to the Ethics Committee for review.

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SOCIAL MEDIA GUIDELINES

Please Read Before You Post (or Blog, or Facebook, or Instagram...)

The Society of Vertebrate Paleontology encourages open discussion on social media and other outlets at our Annual Meeting. In order to find a balance between embracing social media and protecting authors' work, we set forth the following guidelines:

- SVP has an embargo in place on discussing presentations until the beginning of the talk or poster session. Please do not discuss presentations until this time if you do not have the authors' permission to do so.
- This embargo exists to protect the authors. As an author, you have permission to break your own embargo or permit someone else to do the same. This includes discussing your own presentation online, posting slides or posters, etc. However, to protect yourself, make sure you are aware of any potential future publisher's policies about early dissemination of work.
- Do not photograph or videotape a talk or poster without the authors' express permission. Never post any images or video without the authors' permission.
- While the default assumption is to allow open discussion of SVP presentations on social media, please respect any request by an author to not disseminate the contents of their talk. The following icons may be downloaded from the SVP website for inclusion on slides or posters to clearly express when an author does not want their results posted:



We want to thank everyone for following these basic guidelines for online posts of all kinds. As a reminder, the official hashtag of the meeting is **#2025SVP**. We look forward to seeing your thoughts and discussion online!

2025 SVP SCHEDULE OF EVENTS

All events are held at the International Convention Centre unless noted with **

TUESDAY, NOVEMBER 11

TIME	EVENT	LOCATION
2:00 PM – 7:00 PM	**Registration Open**	FOYER BY HALLS 1 AND 3
7:00 PM – 8:30 PM	**Special Event: *Walking with Dinosaurs* –** behind the scenes with the production team and Professor Steve Brusatte	**THE EXCHANGE IN BIRMINGHAM CITY CENTRE, A TWO-MINUTE WALK FROM THE MEETING VENUE *(THIS IS A TICKETED EVENT)*

WEDNESDAY, NOVEMBER 12

TIME	EVENT	LOCATION
7:00 AM – 6:00 PM	**Registration Open**	FOYER BY HALLS 1 AND 3
8:00 AM – 12:15 PM	**Symposium: Synchrotron radiation micro-CT scanning in paleontology** **Technical Session I: Dinosauria I: Ornithischia & Theropoda** **Technical Session II: Paleozoic Fishes**	HALL 1 HALL 4 HALL 8
9:30 AM – 6:30 PM	**Exhibit and Poster Viewing Hours** **Colbert Prize Competition Posters** (B1-B23) **Poster Session I** (B24-B159)	HALL 3
12:30 PM – 1:30 PM	**DrNeurosaurus Presents a Presidential Panel: a recorded panel interview**	HALL 1
1:45 PM – 4:15 PM	**Technical Session III: Carnivora** **Technical Session IV: Lepidosauria** **Technical Session V: Vertebrate Assemblages**	HALL 1 HALL 4 HALL 8
4:30 PM - 6:30 PM	**Exhibits/Poster Mixer** **Authors will be Present at the Following Posters:** **Colbert Prize Competition Posters** (B1-B23) **Poster Session I** (B24-B159)	HALL 3
7:00 PM – 10:00 PM	**Welcome Reception**	**ASTON WEBB BUILDING AND LAPWORTH MUSEUM OF GEOLOGY, UNIVERSITY OF BIRMINGHAM (A SHORT TRAIN RIDE FROM THE CITY CENTRE)

2025 SVP SCHEDULE OF EVENTS

All events are held at the International Convention Centre unless noted with **

THURSDAY, NOVEMBER 13

TIME	EVENT	LOCATION
7:30 AM – 6:00 PM	**Registration Open**	FOYER BY HALLS 1 AND 3
8:00 AM – 12:15 PM	**Romer Prize Session** **Technical Session VI: Mesozoic Seas & Skies** **Technical Session VII: Laurasiatheria**	HALL 1 HALL 4 HALL 8
9:30 AM – 6:30 PM	**Exhibit and Poster Viewing Hours** **Colbert Prize Competition Posters** (B1-B23) **Poster Session II** (B160-B294)	HALL 3
1:45 PM – 4:15 PM	**Symposium: Ancient Biomolecules** **Technical Session VIII: Mammal Ecology & Biogeography** **Technical Session IX: Synapsida**	HALL 1 HALL 4 HALL 8
4:30 PM - 6:30 PM	**Exhibits/Poster Mixer** **Authors will be Present at the Following Posters:** **Colbert Prize Competition Posters** (B1-B23) **Poster Session II** (B160-B294)	HALL 3
7:30 PM – 11:30 PM	**Student and Postdoc Liaison Committee Roundtable Forum**	HALL 8

2025 SVP SCHEDULE OF EVENTS

All events are held at the International Convention Centre unless noted with **

FRIDAY, NOVEMBER 14

TIME	EVENT	LOCATION
7:30 AM – 5:00 PM	**Registration Open**	FOYER BY HALLS 1 AND 3
8:00 AM – 12:15 PM	**Symposium: Evolution of Triassic non-marine tetrapod communities through time I**	HALL 1
	Technical Session X: Paleontological Practices	HALL 4
	Technical Session XI: Crocs & Turts	HALL 8
9:30 AM – 6:30 PM	**Exhibit and Poster Viewing Hours**	
	Colbert Prize Competition Posters (B1-B23)	HALL 3
	Poster Session III (B295-B430)	
12:30 PM – 1:30 PM	***Ancient DNA & Museum Collections Use: lessons & practices* roundtable**	HALL 8
1:45 PM – 4:15 PM	**Symposium: Evolution of Triassic non-marine tetrapod communities through time II**	HALL 1
	Technical Session XII: Mesozoic & Cenozoic Fishes	HALL 4
	Technical Session XIII: Euarchontoglires	HALL 8
4:30 PM - 6:30 PM	**Exhibits/Poster Mixer**	
	Authors Will Be Present at the Following Posters: Poster Session III (B295-B430)	HALL 3
7:00 PM – 8:30 PM	**Special Event: Authors' Panel Discussion and Book Signing with Tom Holland, Dr. Thomas Halliday, Dr. Elsa Panciroli and Dr. Henry Gee**	** UNIVERSITY OF BIRMINGHAM (A SHORT TRAIN RIDE FROM THE CITY CENTRE) *(THIS IS A TICKETED EVENT)*

2025 SVP SCHEDULE OF EVENTS

All events are held at the International Convention Centre unless noted with **

SATURDAY, NOVEMBER 15

TIME	EVENT	LOCATION
7:30 AM – 2:00 PM	**Registration Open**	FOYER BY HALLS 1 AND 3
8:00 AM – 12:15 PM	**Technical Session XIV: Mammalian Phylogeny & Function**	HALL 1
	Technical Session XV: Reptile'O'Rama	HALL 4
	Technical Session XVI: Dinosauria II: Aves	HALL 8
9:30 AM – 12:00 PM	**Exhibit Viewing Hours**	HALL 3
9:30 AM – 6:30 PM	**Poster Viewing Hours** **Colbert Prize Competition Posters** (B1-B23) **Poster Session III** (B431-B565)	HALL 3
1:45 PM – 4:15 PM	**Symposium: Multidisciplinary approaches to skull function and evolution**	HALL 1
	Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha	HALL 4
	Technical Session XVIII: Early Tetrapoda & Lissamphibia	HALL 8
4:30 PM - 6:30 PM	**Poster Mixer** **Authors will be Present at the Following Posters: Poster Session IV** (B431-B565)	HALL 3
7:30 PM – 10:00 PM	**Awards Banquet**	HALL 3
10:30 PM – 1:00 AM	**After Hours Party**	HALL 8

2025 SVP FIELD TRIPS

**For Pre-registered Attendees*

Sunday, November 9 – Tuesday, November 11

TIME	TRIP	MEETING POINT
NOVEMBER 9, 7:30 AM – NOVEMBER 11, LATE AFTERNOON	**EXPLORING THE JURASSIC COAST WORLD HERITAGE SITE**	CAMBRIDGE STREET, B1 2EA (BEHIND THE INTERNATIONAL CONVENTION CENTRE)

Tuesday, November 11

TIME	TRIP	MEETING POINT
9:00 AM – 5:00 PM	**MIDDLE TRIASSIC OF WARWICKSHIRE**	CAMBRIDGE STREET, B1 2EA (BEHIND THE INTERNATIONAL CONVENTION CENTRE)
4:00 PM – 6:00 PM	**LAPWORTH MUSEUM OF GEOLOGY: EXHIBITION AND COLLECTIONS TOUR**	LAPWORTH MUSEUM OF GEOLOGY, UNIVERSITY OF BIRMINGHAM, EDGBASTON, BIRMINGHAM B15 2TT

Sunday, November 16

TIME	TRIP	MEETING POINT
7:30 AM – 8:30 PM	**DINOSAUR FOOTPRINTS AND BONE BEDS: PENARTH AND WESTBURY-ON-SEVERN**	CAMBRIDGE STREET, B1 2EA (BEHIND THE INTERNATIONAL CONVENTION CENTRE)

Sunday, November 16 – Tuesday, November 18

TIME	TRIP	MEETING POINT
NOVEMBER 16 – NOVEMBER 18	**UK DINOSAURS: HISTORY AND SCIENCE**	CAMBRIDGE STREET, B1 2EA (BEHIND THE INTERNATIONAL CONVENTION CENTRE)

2025 SVP WORKSHOPS

**For Pre-registered Attendees*

Tuesday, November 11

TIME	TRIP	LOCATION
10:00 AM – 1:00 PM	**DESIGNING FOR ALL: CREATING ACCESSIBLE GRAPHICS FOR SCIENCE**	INTERNATIONAL CONVENTION CENTRE HALL 6
10:00 AM – 5:00 PM	**PALAEOART PAST AND PRESENT: THE VIEW FROM THE UK**	INTERNATIONAL CONVENTION CENTRE HALL 7

2025 SVP TALK SCHEDULE

Wednesday, November 12

TIME	HALL 1 SYMPOSIUM: SYNCHROTRON RADIATION MICRO-CT SCANNING IN PALEONTOLOGY	HALL 4 TECHNICAL SESSION I: DINOSAURIA I: ORNITHISCHIA & THEROPODA	HALL 8 TECHNICAL SESSION II: PALEOZOIC FISHES
8:00 AM	DOLLMAN, KATHLEEN	ALEXANDER, JANET	COATHAM, SAMUEL
8:15 AM	HARIDY, YARA	BERT, HUGO	SCHNETZ, LISA
8:30 AM	BYRNE, HANNAH	HOFFMAN, DEREK	SANSOM, ROBERT
8:45 AM	CHEN, DONGLEI	YOSHIDA, JUNKI	GAI, ZHIKUN
9:00 AM	JENKINS, XAVIER	MAIDMENT, SUSANNAH	BRAZEAU, MARTIN
9:15 AM	MCGAUGHEY, GARY	SCHERER, CHARLIE	ZHU, YOU-AN
9:30 AM	CHAPELLE, KIMBERLEY (KIMI)	FREWIN, JACOB	GREIF, MERLE
9:45 AM	MUKWEVHO, LUTENDO	DELCOURT, RAFAEL	KLUG, CHRISTIAN
10:00 AM	**COFFEE**		
10:15 AM	OBUSZEWSKI, KYLE	FUNSTON, GREGORY	BABCOCK, TOBIAS
10:30 AM	CIOU, CI-HONG	FREIMUTH, WILLIAM	ANDREEV, PLAMEN
10:45 AM	CANOVILLE, AURORE	LIAO, CHUN-CHI	VAKRUCHEV, ROBERTA
11:00 AM	PANCIROLI, ELSA	MCKEE, JUSTIN	MONDÉJAR FERNÁNDEZ, JORGE
11:15 AM	KULIK, ZOE	NORRIS, LIAM	STRONG, CATHERINE
11:30 AM	SHIFFERT, JARED	RAUN, GORM	RUTA, MARCELLO
11:45 AM	SANCHEZ, SOPHIE	ZANNO, LINDSAY	CARON, ABIGAIL
12:00 PM	–	NAPOLI, JAMES	LYONS-WEILER, ZACHARY
12:15 – 1:30PM	**LUNCH**		
TIME	**HALL 1** **TECHNICAL SESSION III:** **CARNIVORA**	**HALL 4** **TECHNICAL SESSION IV:** **LEPIDOSAURIA**	**HALL 8** **TECHNICAL SESSION V:** **VERTEBRATE ASSEMBLAGES**
1:45 PM	SCHMÖKEL, HUGO	MARKE, DANIEL	DUFFY, FRANKLIN
2:00 PM	WERDELIN, LARS	BIANCHIN, MARCO	PEECOOK, BRANDON
2:15 PM	ROBERTS, LUCY	IFTIKHAR, FATIMA	BUTLER, RICHARD
2:30 PM	POUST, ASHLEY	SARGENT, JONATHAN	SERAFINI, GIOVANNI
2:45 PM	TSENG, Z. JACK	HOWARD, ALEXANDRA	LANGER, MAX
3:00 PM	BILLET, GUILLAUME	DONG, LIPING	DAVESNE, DONALD
3:15 PM	CHATAR, NARIMANE	GEORGALIS, GEORGIOS	CRICHTON, ARTHUR
3:30 PM	JONES, KATRINA	HEAD, JASON	CARRILLO, JUAN
3:45 PM	MACLAREN, JAMIE	LAWING, A. MICHELLE	CRUZ, J. ALBERTO
4:00 PM	RULE, JAMES	ARMFIELD, ROXANNE	BEHRENSMEYER, ANNA

**SVP will not use closed captioning for talks during this meeting. However, we encourage all speakers to add concise text to slides in talks to help people of all abilities get more from your talk.*

2025 SVP TALK SCHEDULE

Thursday, November 13

TIME	HALL 1 ROMER PRIZE SESSION	HALL 4 TECHNICAL SESSION VI: MESOZOIC SEAS & SKIES	HALL 8 TECHNICAL SESSION VII: LAURASIATHERIA
8:00 AM	ZIETLOW, AMELIA	HU, YI-WEI	NORWOOD, ALEXANDRA
8:15 AM	WOODGATE, STEPHANIE	LIEBE DELSETT, LENE	WOOTEN, BRYNN
8:30 AM	VIÑOLA-LÓPEZ, LAZARO	PARDO-PÉREZ, JUDITH	ROBSON, SELINA VIKTOR
8:45 AM	UNO, YURIKA	MIEDEMA, FEIKO	WANG, BIAN
9:00 AM	SAN ROMÁN, CARLA	ZHANG, YING-AO	HECKEBERG, NICOLA
9:15 AM	RIEGLER, MITCHELL	MUSCUTT, LUKE	AMSON, ELI
9:30 AM	RAWSON, JAMES	GOLDSMITH, ERIKA	GIUFFRA, PIERO
9:45 AM	MORRISON, CASSIUS	REYES, WILLIAM	BENNION, REBECCA
10:00 AM	COFFEE		
10:15 AM	MEYER, DALTON	BYRNE, PAUL	STRAUCH, REBECCA
10:30 AM	LOUGHLIN, NORA	FITCH, ADAM	JONES, MATTHEW
10:45 AM	KOCÁKOVÁ, KRISTÍNA	BRONZATI, MARIO	WILSON, OSCAR
11:00 AM	JONES, MEGAN	BESTWICK, JORDAN	TISSIER, JÉRÉMY
11:15 AM	HILLAN, EMILY	FLAUNET, MAXIME	BAI, BIN
11:30 AM	HEATH, JOEL	UNWIN, DAVID	SELINI, ANASTASIA
11:45 AM	GORDON, CALEB	CAPUTO, COOPER	LANDRY, ZOE
12:00 PM	BURKE, PAUL	MARTÍNEZ-BARREDO, JULEN	MORETTI, JOHN
12:15 – 1:30PM	LUNCH		
TIME	**HALL 1** **SYMPOSIUM:** **ANCIENT BIOMOLECULES**	**HALL 4** **TECHNICAL SESSION VIII:** **MAMMALIAN ECOLOGY &** **BIOGEOGRAPHY**	**HALL 8** **TECHNICAL SESSION IX:** **SYNAPSIDA**
1:45 PM	WOLKENSTEIN, KLAUS	HOPKINS, SAMANTHA	SODANO, MEGAN
2:00 PM	ROY, ARINDAM	ARROYO-CABRALES, JOAQUIN	PEVSNER, SPENCER
2:15 PM	ROSSI, VALENTINA	CARTER, BENJAMIN	DAY, MICHAEL
2:30 PM	BARLOW, LUKE	LINDHOLM, ADAM	MACUNGO, ZANILDO
2:45 PM	DICKINSON, MARC	CHABROL, NILS	DUHAMEL, ALIENOR
3:00 PM	BURROUGHS, ROBERT	VAN DER HOEK, JULIEN	LANDI, DAMIANO
3:15 PM	GARCÍA-VÁZQUEZ, ANA	TABUCE, RODOLPHE	EHLER, KARA MIA
3:30 PM	JIAN, ANDREW	FOX, DAVID	ANGIELCZYK, KENNETH
3:45 PM	MILLER, MEGAN	SMITH, FELISA	SHI, YU-TAI
4:00 PM	WIEMANN, JASMINA	LINDSEY, EMILY	BRANT, ANNA

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2025 SVP TALK SCHEDULE

Friday, November 14

TIME	HALL 1 SYMPOSIUM: EVOLUTION OF TRIASSIC NON-MARINE TETRAPOD COMMUNITIES THROUGH TIME I	HALL 4 TECHNICAL SESSION X: PALEONTOLOGICAL PRACTICES	HALL 8 TECHNICAL SESSION XI: CROCS & TURTS
8:00 AM	MUJAL, EUDALD	MILLER, MATTHEW	FOSTER, WILLIAM
8:15 AM	VIGLIETTI, PIA	ROBERTS, AUBREY	HERMANSON, GUILHERME
8:30 AM	SMITH, ROGER	FORMOSO, KIERSTEN	EVERS, SERJOSCHA
8:45 AM	WOOLLEY, CHARLES	TOWNSEND, K.E.	CORNILLE, ALEXIS
9:00 AM	TOLCHARD, FREDERICK	MINJIN, BOLORTSETSEG	BHAT, MOHD SHAFI
9:15 AM	SOBRAL, GABRIELA	CHAVEZ-HOFFMEISTER, MARTIN	FRONIMOS, JOHN
9:30 AM	NETO, VOLTAIRE	BERNARD, EMMA	CLARK, JAMES
9:45 AM	IRMIS, RANDALL	SAGEBIEL, JAMES	JOHNSON, MICHELA
10:00 AM	COFFEE		
10:15 AM	PINHEIRO, FELIPE	MELSTROM, KEEGAN	RABI, MARTON
10:30 AM	FOFFA, DAVIDE	GHEZZO, ELENA	LEAPHART, DANIEL
10:45 AM	SCIPIONE, MATTHEW	HALL, LEE	SINGH, SURESH
11:00 AM	KNUTSEN, ESPEN	JOHNSTON, SCOTT	HOFFMAN, DEVIN
11:15 AM	SPIEKMAN, STEPHAN	SHINYA, AKIKO	COSSETTE, ADAM
11:30 AM	KAMMERER, CHRISTIAN	BALK, MEGHAN	SALAS-GISMONDI, RODOLFO
11:45 AM	WEISS, BAILEY	DUNNE, EMMA	LI, DAI-AN
12:00 PM	CHAKRAVORTI, SANJUKTA	BROWN, MATTHEW	BHARDWAJ LOCK, SACHIN
12:15 – 1:30PM	LUNCH		

TIME	HALL 1 SYMPOSIUM: EVOLUTION OF TRIASSIC NON-MARINE TETRAPOD COMMUNITIES THROUGH TIME II	HALL 4 TECHNICAL SESSION XII: MESOZOIC & CENOZOIC FISHES	HALL 8 TECHNICAL SESSION XIII: EUARCHONTOGLIRES
1:45 PM	EZCURRA, MARTIN	COOPER, SAMUEL	ROSE, MADISON
2:00 PM	QIN, ZICHUAN	AFONSO, GABRIEL	LÓPEZ-TORRES, SERGI
2:15 PM	GRIFFIN, CHRISTOPHER	HOEFLICH, JENNIFER	KIRK, EDWARD
2:30 PM	TALANDA, MATEUSZ	LIU, JUAN	KAY, RICHARD
2:45 PM	BURCH, HELEN	KIM, SORA	CHEN, ZEHUI
3:00 PM	SRIVASTAVA, SIMBA	CIRTINA, DAN	PUSCHEL, THOMAS
3:15 PM	SCHEYER, TORSTEN	COOPER, JACK	GARDNER, JACOB
3:30 PM	LOVEGROVE, JACK	STUMPF, SEBASTIAN	VENDITTI, CHRIS
3:45 PM	BOTHA, JENNIFER	STAGGL, MANUEL	BADGLEY, CATHERINE
4:00 PM	KLIGMAN, BEN	LEBLANC, AARON	JERNVALL, JUKKA

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2025 SVP TALK SCHEDULE

Saturday, November 15

TIME	HALL 1 TECHNICAL SESSSION XIV: MAMMALIAN PHYLOGENY & FUNCTION	HALL 4 TECHNICAL SESSION XV: REPTILE'O'RAMA	HALL 8 TECHNICAL SESSION XVI: DINOSAURIA II: AVES
8:00 AM	GOODCHILD, OWEN	MAHO, TEA	CRANE, ABI
8:15 AM	LE VERGER, KÉVIN	KNAUS, PHILIPP	MAREK, RYAN
8:30 AM	GAUDIN, TIMOTHY	REBILLARD, ARNAUD	TANG, JAMES
8:45 AM	DE VRIES, DORIEN	MACDOUGALL, MARK	O'CONNOR, JINGMAI
9:00 AM	MEADE, LUKE	YI, JIAN	NIXON-HERMANSEN, PING
9:15 AM	WISNIEWSKI, ANNA	BUFFA, VALENTIN	DEMUTH, OLIVER
9:30 AM	KNAPP, ANDREW	PUGH, ISAAC	WALTERS, BENTON
9:45 AM	WEISBECKER, VERA	MESTRINER, GABRIEL	WILSON, LAUREN
10:00 AM	**COFFEE**		
10:15 AM	FULGHUM, HENRY	WANG, WEI	PLATEAU, OLIVIA
10:30 AM	SCHULTZ, JULIA	PITTINGER, DAKOTA	BENITO, JUAN
10:45 AM	WALLS, KATHARINE	WHITNEY, MEGAN	FIELD, DANIEL
11:00 AM	BRAUMULLER, YANELL	CHAKRABORTY, URMI	SOMOGYI, STANLEY
11:15 AM	ALFSEN, APOLLINE	SEN, SULAGNA	NAVALON, GUILLERMO
11:30 AM	QI, MINBO	WILLS, SIMON	OYSTON, JACK
11:45 AM	BRUSATTE, STEPHEN	KUBO, MUGINO	BEGUESSE, KYLA
12:00 PM	BECK, ROBIN	DRUMHELLER, STEPHANIE	CARAZO DEL HOYO, BEATRIZ
12:15 – 1:30PM	**LUNCH**		
TIME	**HALL 1** **SYMPOSIUM: MULTIDISCIPLINARY APPROACHES TO SKULL FUNCTION & EVOLUTION**	**HALL 4** **TECHNICAL SESSION XVII: DINOSAURIA III: MACROEVOLUTION & SAUROPODOMORPHA**	**HALL 8** **TECHNICAL SESSION XVIII: EARLY TETRAPODA & LISSAMPHIBIA**
1:45 PM	DEARDEN, RICHARD	KE, YIHUI	AHLBERG, PER
2:00 PM	FORTNER, JOHN	LECHKI, STEPHANIE	COATES, MICHAEL
2:15 PM	BALLELL, ANTONIO	BARRETT, PAUL	SMITHSON, TIMOTHY
2:30 PM	POLLOCK, TAHLIA	UPCHURCH, PAUL	SO, CALVIN
2:45 PM	GARLAND, KATHLEEN	SETHAPANICHSAKUL, THITIWOOT	FRÖBISCH, NADIA
3:00 PM	BRIGHT, JEN	CHIARENZA, ALFIO	HEISE, PATRICK
3:15 PM	TUCKER, ABIGAIL	ARRISCORRETA, STEFAN	BREWINGTON, TREVOR
3:30 PM	HIGASHIYAMA, HIROKI	GRIFFIN, BENJAMIN	KONIETZKO-MEIER, DOROTA
3:45 PM	SHARP, ALANA	ZHAO, QI	MORENO, RAPHAEL
4:00 PM	POMMERY, YANNICK	KASKES, PIM	QUIGLEY, AARON

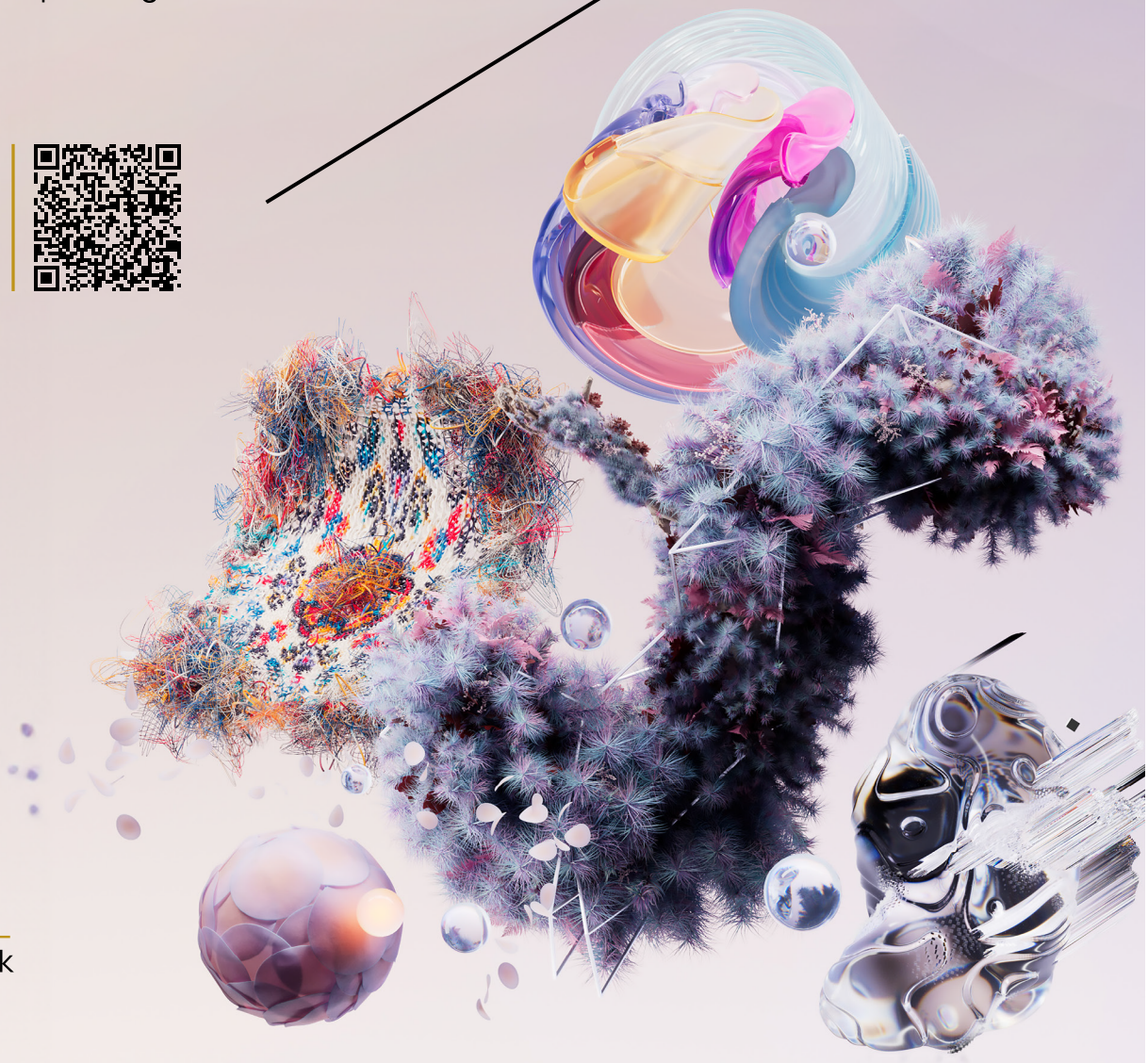
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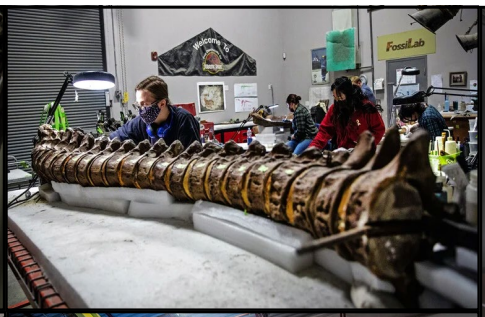
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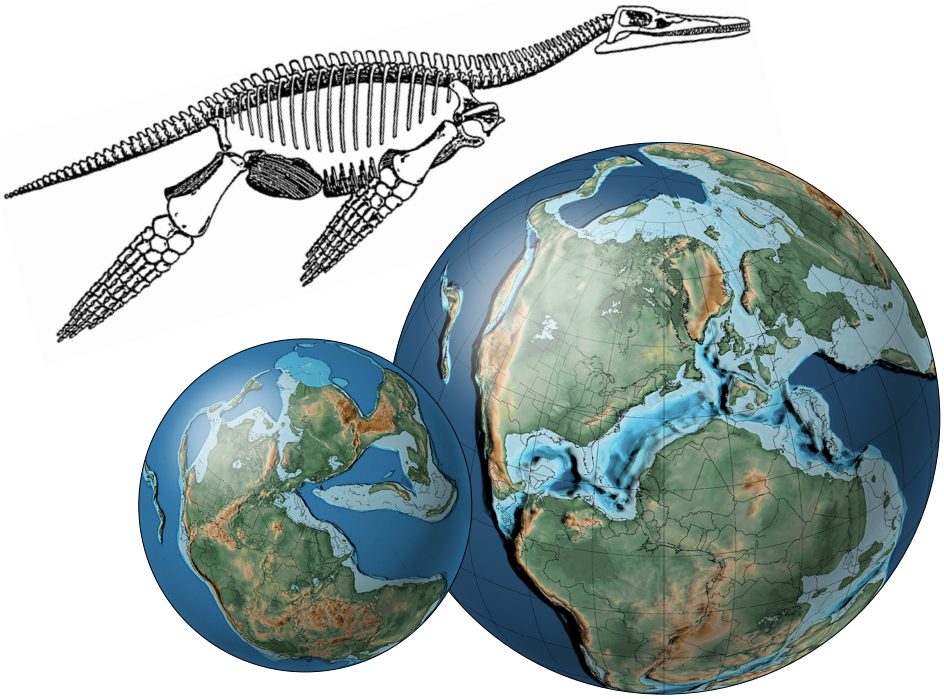


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SVP 2026

86TH ANNUAL MEETING

CLEVELAND, OHIO

WEDNESDAY, NOVEMBER 11 - SATURDAY, NOVEMBER 14

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List of Authors and Abstract Titles in Chronological Session Order

Wednesday Morning, November 12, 2025
Symposium: Synchrotron Radiation Micro-CT Scanning in Paleontology
Meeting Room Hall 1
Moderators: Kimi Chapelle and Zoe Kulik

8:00 **K. Dollman**, **V. Fernandez** Advancing natural heritage research through synchrotron X-ray imaging: applications, innovations, and future directions

8:15 **Y. Haridy**, **N. Shubin** Ordovician vertebrates and the origin of bone remodeling

8:30 **H.M. Byrne**, **E. Pedersen**, **R. Dearden**, **Z. Johanson**, **J. Leyhr**, **K. Dollman**, **M. Dean**, **T. Haitina**, **S.J. Sanchez**, **M. Rücklin** The evolution of tesselated calcified cartilage in fossil chondrichthyans

8:45 **D. Chen**, **R. Sheng**, **P.E. Ahlberg**, **G. Niedzwiedzki**, **H. Blom**, **M. Qvarnström**, **D. Snitting**, **J. Marshall** 3D visualization of the chondrocytes and osteoblasts repairing the gastralia in the structurally preserved skin of a new Devonian stem tetrapod

9:00 **X.A. Jenkins**, **V. Buffa**, **C.J. Marchant**, **D. Ford**, **C. Browning**, **V. Fernandez**, **K. Dollman**, **J. Choiniere**, **R.B. Benson**, **B.R. Peecook** A new late Permian younginid bearing a tympanic fossa clarifies the cranial evolution of Neodiapsida

9:15 **G.A. McGaughey**, **X.A. Jenkins**, **T.M. Scheyer**, **N. Klein**, **R.B. Benson**, **B.R. Peecook** Cranial osteology and evolutionary relationships of the Middle Triassic pachypleurosaur *Neusticosaurus edwardsii* revealed through high resolution synchrotron radiation micro-computed tomography scanning

9:30 **K. Chapelle**, **K. Dollman**, **A.H. Turner**, **B.M. Weiss**, **V. Fernandez**, **J. Choiniere** Synchrotron scanning reveals a diversity of small-sized vertebrates in one of the world's oldest known dinosaur nesting sites

9:45 **L. Mukwevho**, **J. Choiniere**, **R.B. Benson**, **J. Botha**, **K. Chapelle** Synchrotron histology of Norian theropod from the Elliot Formation of South Africa

10:00 Coffee Break

10:15 **K.D. Obuszewski**, **J.G. Napoli**, **M. Drakopoulos**, **N.T. Vo**, **Z. Zhong**, **L.E. Zanno** Contrasting conventional with synchrotron-based μCT in North America's oldest ceratopsian

10:30 **C. Ciou**, **T. Yang**, **C. Yao**, **S. Hong**, **Q. Zhao**, **B. Liang**, **C. Wang** A new insight into the linkage between osteocyte lacunae morphologies and flight behaviors in Paraves revealed by synchrotron X-ray nano-CT

10:45 **A. Canoville**, **J. Anné**, **L.E. Zanno** Testing controversial reports of avian reproductive tissues in the fossil record using a synchrotron-based multidisciplinary approach

11:00 **E. Panciroli**, **L.N. Weaver**, **E. Newham**, **G.F. Funston**, **R.B. Benson**, **V. Fernandez**, **K. Dollman**, **Z.T. Kulik**, **Z. Luo** Birth and growth in Jurassic mammals: synchrotron data from Scottish fossils provide life history insights

11:15 **Z.T. Kulik**, **F. Mao**, **R.B. Benson**, **L.N. Weaver**, **K. Dollman**, **J. Meng** Bone histology and synchrotron X-ray tomography provide the first glimpse into euharamiyidan life history

11:30 **J.M. Shiffert**, **E. Panciroli**, **E. Newham**, **G.F. Funston**, **Z.T. Kulik**, **R.B. Benson**, **M. Whitney**, **K. Dollman**, **L.N. Weaver** Bone histology of therian mammals from the Upper Cretaceous Bissekty Formation of Uzbekistan, with implications for the marsupial-placental dichotomy

11:45 **S.J. Sanchez** Synchrotron X-ray based virtual paleo-microanatomy and histology: a new dimension to reveal fossil bone inner structure

Wednesday Morning, November 12, 2025
Technical Session I: Dinosauria I: Ornithischia & Theropoda
Meeting Room Hall 4
Moderators: Chun-Chi Liao and Gorm Raun

8:00 **J. Alexander**, **P.J. Currie**, **E.B. Koppelhus** Not like other hadrosaurids: a review of growth rates and age segregation in *Edmontosaurus regalis* (Dinosauria: Hadrosauridae)

8:15 **H. Bert, H. N. Woodward, N. Rinder, R. Amiot, J.R. Horner, C. Lécuyer, M. Sena, J. Cubo** Assessing the degree of decessity for parental care in the hadrosaurid dinosaur *Maiasaura* based on its neonatal metabolic rate estimates

8:30 **D.A. Hoffman**, **A.A. Brink**, **G. Phillips**, **L. King**, **J. Starnes**, **N. Baghai-Riding**, **C. Hotton**, **O. Pharr**, **A. Prieto-Marquez** Comparative anatomy, morphometric analysis, and phylogenetic systematics of the Booneville hadrosaurid (early–middle Campanian Coffee Formation, Mississippi, USA)

8:45 **J. Yoshida**, **C. Tsogtbaatar**, **R. Takasaki**, **L.E. Zanno** Structural mechanics of the earliest dome-headed dinosaur, and the origin of the unique cranial structure

9:00 **S. Maidment**, **R. Butler**, **S. Brusatte**, **L. Meade**, **F.J. Augustin**, **Z. Csiki-Sava**, **A. Osi** Ceratopsian dinosaurs were widespread in the Upper Cretaceous of Europe

9:15 **C.R. Scherer**, **L. Durrant**, **C. Boisvert**, **A. Danison**, **C. Morrison** A reappraisal of *Metriacanthosaurus parkeri* from the Middle-Upper Jurassic Oxford Clay Formation of England and the evolutionary relationships of allosauroid theropod dinosaurs

9:30 **J. Frewin**, **B. Britt**, **R. Scheetz** New evidence of a large theropod dinosaur in the Yellow Cat Member (Barremian) of the Cedar Mountain Formation, Utah, USA

9:45 **R. Delcourt**, **O.N. Grillo**, **C. Hendrickx**, **M.C. Langer** Reassessing the anatomy and affinities of *Mirischia asymmetrica* (Theropoda: Coelurosauria) from the Early Cretaceous of Brazil

10:00 Coffee Break

10:15 **G.F. Funston**, **T. Dudgeon**, **D. Simon**, **D. Dufault**, **C.A. Boyd**, **D. Fowler**, **P.J. Currie**, **D. Evans** A remarkably complete caenagnathid (Dinosauria: Oviraptorosauria) skull reveals specializations for herbivory and potentially frugivory

10:30 **W.J. Freimuth**, **J.R. Lively**, **G.M. Erickson**, **L.E. Zanno** Osteohistology and population biology of two therizinosaurian bonebeds

10:45 **C. Liao**, **Z. Qin**, **L. Meade**, **X. Xu**, **S. Lautenschlager** Head to herbivore: new evidence for cranial functional evolution in early-branching therizinosaurs

11:00 **J. McKee**, **R. Irmis** First associated ornithomimid (Theropoda, Coelurosauria) skeleton from the Upper Cretaceous Straight Cliffs Formation of southern Utah, USA

11:15 **L. Norris** Implications for feeding behavior in Upper Cretaceous albertosaurines based on stable calcium isotopes ($\delta^{44/40}$Ca) from tooth enamel

11:30 **G.S. Raun**, **H.S. Sharpe**, **P.J. Currie** The apple doesn't fall far from the tree: *Tarbosaurus* has stable discrete characters through ontogeny

11:45 **L.E. Zanno**, **J.G. Napoli** EMBARGOED

12:00 **J.G. Napoli**, **L.E. Zanno** EMBARGOED

Wednesday Morning, November 12, 2025
Technical Session II: Paleozoic Fishes
Meeting Room Hall 8
Moderators: Zhikun Gai and Merle Greif

8:00 **S. Coatham**, **M.E. Rosti**, **A. Pradel**, **I.J. Sansom**, **L. Sallan** Swimming in early vertebrates: exploring the hydrodynamics of *Sacabambaspis*

8:15 **L. Schnetz**, **R. Dearden**, **A. Lanzetti**, **A.S. Jones**, **P. Andreev**, **K. Dollman**, **V. Fernandez**, **S. Giles**, **S. Lautenschlager**, **I.J. Sansom** Synchrotron scanning of *Doryaspis arctica* reveals an exceptionally preserved heterostracan feeding apparatus

8:30 **R. Sansom**, **E. Randle**, **J.N. Keating** A phylogeny for Heterostraci (stem gnathostomes)

8:45 **Z. Gai**, **M. Zhu**, **P. Donoghue** The anatomy of galeaspids (stem-gnathostomes) and its evo-devo implications

9:00 **M.D. Brazeau**, **Z. Chen**, **Z. Johanson**, **P. Jones**, **J.B. Pears** Evolution of the gnathostome head: jaws and girdles from a paleontological perspective

9:15 **Y. Zhu**, **M. Zhu** Diversity of Silurian maxillate placoderms: insights from historical and recent discoveries

9:30 **M. Greif**, **H. Botella**, **T.M. Scheyer**, **C. Klug** Diversity of tooth mineralization sequences and histological patterns at the stem of crown chondrichthyans

9:45 **C. Klug**, **M. Greif**, **A. Pohle**, **M.S. Ginter**, **M. Coates**, **W. Bel Haouz**, **A. Lagnaoui**, **L. Frey** The face of the oldest elasmobranch *Phoebodus* from the Moroccan Devonian

10:00 Coffee Break

10:15 **T.B. Babcock**, **L. Tapanila** A redescription of the holotype of the eugeneodontid *Sarcoprion edax* using CT scanning and 3D modeling to examine jaw morphology and function

10:30 **P. Andreev**, **Q. Li**, **W. Zhao**, **J. Wang**, **F. Marone**, **M. Rücklin**, **M. Zhu** Tooth patterning in the earliest osteichthyan

10:45 **R. Vakruchev**, **S. Bijl**, **A. Clement**, **P. Tafforeau**, **J.A. Long**, **K. Trinajstic**, **S.J. Sanchez** Long bone development in the stem tetrapod *Gogonasus*

11:00 **J. Mondéjar Fernández**, **D. Davesne**, **A. Clement** The stem-tetrapod *Glyptopomus kinnairdi*: redescription and phylogenetic implications close to the 'fish-tetrapod transition'

11:15 **C. Strong**, **S.E. Pierce** Evaluating trends in mandibular form and function across vertebrate water–land transitions

11:30 **M. Ruta**, **T.R. Smithson** The Tournaisian tetrapod *Diploradus austiumensis* (Ballagan Formation, Scotland) and the shape of the tetrapod stem

11:45 **A. Caron**, **M. Coates** Chondrostean signal within the early actinopterygian record

12:00 **Z.J. Lyons-Weiler**, **S. Giles**, **M. Friedman** Unexpected characters in a Pennsylvanian ray-finned fish

Wednesday Afternoon, November 12, 2025
Technical Session III: Carnivora
Meeting Room Hall 1
Moderators: Jamie MacLaren and Lucy Roberts

1:45 **H.G. Schmökel**, **M.R. Sánchez-Villagra**, **A. Urciuoli**, **F. Del Chicca**, **R. Hagen Argudin Pina**, **A. Farrell** Affected by nearing extinction: congenital pathologies in dwindling populations of the saber-toothed cat *Smilodon fatalis* and the dire wolf *Aenocyon dirus*

2:00 **L. Werdelin**, **T. Flink**, **J. Lagerström**, **Y. Sahle** When did spotted hyenas become social? Evidence from fossil endocasts

2:15 **L.E. Roberts**, **J. Charles**, **E. Comerford**, **K.T. Bates**, **A. Goswami** From dachshunds to dire wolves: Landmark free morphometrics reveals extreme shape variation in the appendicular skeleton of canids

2:30 **A.W. Poust**, **S. Tucker**, **S. Matson**, **R. Otto** Post-disaster signs of life: caniform tracks at Ashfall Fossil Beds suggest scavenging and survival

2:45 **Z. Tseng**, **C. Grohé**, **B. DesRocher**, **E. Waldman**, **J.J. Flynn** Emergent network properties link phenotypic modules to ecomorphological divergence in the skulls of carnivoran mammals

3:00 **G. Billet**, **L. Hautier**, **T.J. Gaudin**, **J.J. Flynn**, **I. Ruf**, **S. Ladeveze**, **C. Tornero**, **N.M. Wong**, **P. Gaubert** Unlocking phylogenetic signal: a remarkable network of diploic veins in pangolin and carnivoran crania

3:15 **N. Chatar**, **M. Vankelst**, **A. Pérez Ramos**, **T.I. Pollock**, **D. Tamagnini**, **M. Michaud**, **L.Y. Raskin**, **Z. Tseng** Supertooth: slicing, crushing, and the limits of carnassial design

3:30 **K. Jones**, **B. Figueirido**, **J.A. Schwab** What use is a vertebra? Understanding the ecomorphological utility of isolated serial elements

3:45 **J.A. MacLaren**, **I. Boutsen**, **N. Chatar**, **E. Annear** Experimental investigation into the physical feeding envelope of saber-toothed felids (Felidae: Machairodontinae) from the Pliocene–Holocene of Africa

4:00 **J.P. Rule**, **S. Ryan**, **U. Ishihara**, **S.M. Palmer**, **D. Hocking**, **L. Paterson-Crisp**, **T.I. Pollock**, **W.M. Parker**, **F.G. Marx**, **A.R. Evans** The origin of toothed filter feeding in seals

Wednesday Afternoon, November 12, 2025
Technical Session IV: Lepidosauria
Meeting Room Hall 4
Moderators: Georgios Georgalis and Fatima Iftikhar

1:45 **D. Marke**, **D.I. Whiteside**, **T. Sethapanichsakul**, **R. Coram**, **V. Fernandez**, **A. Liptak**, **E. Newham**, **M.J. Benton** Expected and unexpected features of the oldest crown lepidosaur

2:00 **M. Bianchin**, **A. LeBlanc**, **M.E. Jones** Evolution, development and function of tubular enamel in monophyodont reptiles

2:15 **F. Iftikhar**, **M. Caldwell**, **A. LeBlanc** Tooth attachment and replacement in mosasaurs: new insights from dental histology in modern teiid lizards

2:30 **J.A. Sargent**, **L. Ekstein**, **R.C. Fish**, **R. Garavito-Camacho**, **D. Suyom**, **A. Ben-Salahuddin**, **M. Stevens**, **J.H. Moore**, **L. King**, **K.L. Koeller** Convergence of sensory anatomy in fossorial, limbless lizards: olfactory bulb size correlates to ecology in squamates

2:45 **A. Howard**, **J. Head** Fossorial ecomorphologies in the skull roof of extant and fossil snakes revealed by geometric morphometrics

3:00 **L. Dong**, **S. Evans** Late Cretaceous anguimorphs from East Asia suggest a complex evolutionary history for the group

3:15 **G. Georgalis** Slightly before the collapse—new lizard and snake remains from the late Eocene (MP 19) of Escamps (Phosphorites du Quercy, France) reveal a fascinating and diverse squamate assemblage prior to the 'Grande Coupure'

3:30 **J. Head**, **M. Lawing**, **F. Kyalo Manthi**, **J. Müller**, **A.S. Hall**, **S. Muteti**, **D.J. Peppe**, **S. Cote**, **K.P. McNulty** Squamate reptiles from the Early to Middle Miocene of equatorial Eastern Africa: implications for paleoenvironments and the origins of modern diversity

3:45 **A. Lawing**, **J.L. McGuire**, **J. Müller**, **F. Kyalo Manthi**, **J. Head** Body size ecometrics in global squamate communities

4:00 **R.E. Armfield** Endless snakes most beautiful: searching for the drivers of cranial evolution across Constrictores

Wednesday Afternoon, November 12, 2025
Technical Session V: Vertebrate Assemblages
Meeting Room Hall 8
Moderators: Donald Davesne and Giovanni Serafini

1:45 **F. Duffy**, **M. Coates**, **J. Hagadorn**, **T. Lyson** A new Late Devonian sarcopterygian assemblage from the Parting Formation of Central Colorado

2:00 **B.R. Peecook**, **C.F. Kammerer**, **C.A. Sidor**, **R.M. Smith**, **S. Tolan**, **P.A. Viglietti**, **M. Whitney**, **K.D. Angielczyk** Successive assemblages of upper Permian vertebrates in the upper Madumabisa Mudstone Formation of the Luangwa Basin, Zambia

2:15 **R. Butler**, **E. Panciroli**, **S. Walsh**, **L. Meade**, **S. Evans**, **M.E. Jones**, **S. Maidment**, **R.B. Benson** The Kilmaluag Formation of the Isle of Skye: a site of exceptional vertebrate preservation in the Middle Jurassic

2:30 **G. Serafini**, **E.E. Maxwell**, **C.A. Papazzoni**, **S. Danise** Life and death in the Mesozoic deep-sea: paleobiology and taphonomy of pelagic vertebrate megafauna from the abyssal Upper Cretaceous of Northern Italy

2:45 **M.C. Langer**, **A. Batezelli**, **R. Delcourt**, **F. Muniz**, **T. Fachini**, **F. Iori**, **J. Ruiz**, **J. Silva Júnior**, **E. Chimpay**, **C. Camus** New tetrapods from the Cretaceous–Paleogene transition in the Peruvian Amazon

3:00 **D. Davesne**, **L. Lacome** The teleost fish fauna of Elam (Eocene of Iran): an exceptional glimpse into Paleogene deep-sea ecosystems

3:15 **A.I. Crichton** A diverse vertebrate assemblage from the late Oligocene of central Australia and its biochronological implications

3:30 **J.D. Carrillo**, **J.W. Moreno Bernal**, **A. Cárdenas**, **L. Mora-Rojas**, **C. Jaramillo**, **D. Silvestro** Fossil sampling bias, faunal composition, and Miocene climatic events: reassessing the palaeoecology of the La Venta mammal assemblage in tropical South America

3:45 **J. Cruz**, **E. Lindsey** Paleobiogeography patterns of amphibians and reptiles from Rancho La Brea

4:00 **A.K. Behrensmeyer**, **J.M. Hutson** ^{14}C dating of naturally occurring bones in two modern river systems: implications for time-averaging and taphonomy of vertebrate remains in paleochannel deposits

Wednesday – Saturday, November 12 – November 15, 2025
Colbert Prize Poster Session

Meeting Room Hall 3
Authors must be present from 4:30 – 6:30 p.m. on Wednesday, November 12 and Thursday, November 13

B1 **T. Yagura**, **Y. Kobayashi**, **C. Tsogtbaatar**, **G.F. Funston**, **P.J. Currie** Vertebral fusion in the terminal caudal series of an ornithopod dinosaur from the Lower Cretaceous Khuren Dukh Formation, Gobi Desert

B2 **N.S. Whalen** Testing the utility of reptilian enamel microstructure for taxonomic assessment: *Alligator mississippiensis* enamel microstructure shows substantial ontogenetic variation reflecting scaling and changing biomechanical demands

B3 **M.G. Varghese**, **S. Sova**, **A. Kaffash Hoshiar**, **J. Jernvall** Shaping dental complexity: the role of enamel in bear tooth evolution

B4 **Y. Utsuki**, **Y. Kobayashi** Functional evolution of the archosaurian neck and the origin of the avian S-curve

B5 **R.E. Sweedler**, **L.N. Weaver** Mammals from the Hewett's Foresight local fauna (Lance Formation, Bighorn Basin, Wyoming) suggest Laramide uplifts influenced terrestrial diversity patterns near the end of the Cretaceous

B6 **R. Sugawara**, **K. Tanaka**, **D.K. Zelenitsky** A novel approach to estimate body mass of non-avian dinosaur embryos

B7 **R. Sheng**, **D. Chen**, **G. Niedzwiedzki**, **J. Marshall**, **H. Blom**, **M. Qvarnström**, **D. Snitting**, **P.E. Ahlberg** A new, articulated, early tetrapod from the end-Devonian of Greenland

B8 **L. Rose**, **J. Fröbisch**, **A. Jannel** Fossoriality and forelimb function in early tetrapods: a comparative 3D range of motion analysis of the Permian recumbirostran 'microsaur' *Batropetes palatinus*

B9 **B. Pittard**, **J. Hansford**, **R. Felice**, **J. Cooper**, **J. Smith**, **P.D. Mannion** Utilizing past archives to create long-term biodiversity baselines for declining UK bird populations: enhancing conservation and ecological understanding

B10 **S.A. Patrocinio**, **E. Panciroli**, **F. Rotatori**, **O. Mateus**, **J. Milàn**, **L. Clemmensen**, **V.D. Crespo** Tracing docodontan origins: a new Triassic–Jurassic mammaliaform from East Greenland

B11 **S. Oyabu**, **Y. Kobayashi** Beak and occipital morphology reveal feeding and biogeographic patterns in ankylosaurs

B12 **S. Onitsuka**, **Y. Kobayashi**, **Y. Lee**, **K. Tsogtbaatar**, **C. Tsogtbaatar**, **D. Idersaikhan** Ontogenetic and evolutionary implications of gigantism-related morphology in *Deinocheirus mirificus* (Theropoda: Ornithomimosauria)

B13 **M.E. Montgomery**, **C. So**, **H.C. Maddin**, **A. Mann** Detailed anatomy of the neotype of *Amphibamus grandiceps* (YPM 794) revealed by high contrast micro-CT analysis

B14 **I. Milford**, **B. Rodwell**, **E.C. Kirk** Variable effects of endocranial volume on sulcal lengths in the mammalian Order Carnivora: an analysis of virtual endocasts based on micro-computed tomography.

B15 **O.A. Mendez**, **J. Head**, **J. Zonneveld**, **T. Smith**, **C.A. Brochu**, **Y. Zaim**, **A. -**, **Y. Rizal**, **A. Hascaryo**, **J.I. Bloch** First crocodyliform fossils from the Eocene of Indonesia

B16 **Z.E. Lewis**, **A. Farnsworth**, **M.J. Benton** Vertebrate latitudinal diversity dynamics across the Permo–Triassic boundary

B17 **A.E. House**, **N.I. Cookson**, **J. Pardo**, **A. Mann** A new sphenacodont synapsid from the early Permian Washington Formation of Ohio, USA

B18 **M. Herde**, **J.A. Nyakatura**, **P.A. van Bijlert**, **V. Díez Díaz** The rhythm of giants: modeling sauropod tail oscillations to infer energetically efficient walking kinematics

B19 **S. Citron**, **H.F. James**, **A. Keirnan**, **V. Weisbecker**, **A. Iwaniuk** When ibises acted like kiwis: niche convergence and nocturnality in an extinct Hawaiian ibis

B20 **T. Biot**, **D.R. Lomax**, **F. Miedema**, **E.E. Maxwell** A well-preserved specimen from the Lower Jurassic (Toarcian) of Whitby provides insights into caudal morphology in the genus *Stenopterygius*

B21 **S. Bijl**, **M. Fritzen**, **P. Tafforeau**, **J. Anderson**, **S.J. Sanchez** An embolomerid humerus inside out: life history traits of a non-amniote tetrapod revealed by synchrotron microtomography

B22 **E.F. Ayres**, **S. Brusatte**, **J. García-Girón** Were areas of higher ecological uniqueness consolidated as centres of recovery after the end-Cretaceous extinction?

B23 **A.F. Alfonso Rojas**, **R.M. Salas-Gismondi**, **A. Schmaltz Hsiou**, **J.I. Bloch**, **P. Antoine**, **J. Head** Pioneering snakes: reconstructing the early arrival of colubroids in South America

Wednesday Afternoon, November 12, 2025
Regular Poster Session I
Meeting Room Hall 3
Authors must be present from 4:30 – 6:30 p.m. on Wednesday, November 12

Symposium: Synchrotron Radiation Micro-CT Scanning in Paleontology

B24 **C.J. Marchant**, **X.A. Jenkins**, **B.R. Peecook** Night and day: synchrotron micro-CT scans illuminate scleral ring anatomy and diel activity patterns in stem reptiles

B25 **W. Lätt**, **P.E. Ahlberg**, **D. Chen** Three-dimensional synchrotron imaging offers new insights into the dentition of the Devonian tetrapod *Ichthyostega*

Paleozoic Fishes

B26 **T. Miyashita**, **P. Janvier**, **K. Tietjen**, **M. Coates** High-flow heart tract and increased ventilation in stem gnathostomes

B27 **X. Lin**, **H. Han**, **Z. Gai**, **M. Zhu** A super-sized eugaleaspiform fish (Galeaspida, Stem-Gnathostomata) from the Silurian of Yunnan, China and its palaeoecological implications

B28 **Y. Zhang**, **X. Shan**, **X. Lin**, **Z. Gai**, **P. Donoghue** A new genus of Dayongaspidae (stem-Gnathostomata) from the Silurian of Jiangxi, China, and a new interpretation of galeaspid oral apparatus

B29 **M. Mulligan** Discussing *Eldaaspis miklii* (Osteostraci) dermal hard tissue and vascular histology

B30 **A. El Fassi El Fehri**, **J.N. Keating**, **M. Grohganz**, **M.J. Benton** The taxonomy and phylogeny of British ‘cephalaspids’

B31 **Y. Asakura**, **T. Hirasawa** Evolution of cranial joints in jawed vertebrates: insights from paleontological and evo-devo perspectives

B32 **J.T. Flannery-Sutherland**, **A. Tims**, **L. Soul**, **J. Clarke**, **M. Friedman**, **S. Giles** The phylogenetic signal of extinction through the rise and fall of early vertebrates—field of bullets or clustered strike?

B33 **J.B. Pears**, **Z. Johanson**, **K. Dollman**, **M. Friedman**, **M.D. Brazeau** The anatomy of a rhenanid placoderm, *Jagorina pandora*, revealed by synchrotron radiation microtomography

B34 **H.C. Egli** The first Bashkirian-aged marine Chondrichthyan assemblage from the eastern United States, including the earliest occurrence of the ctenacanth *Glikmanius occidentalis*

B35 **W. Itano** The first report from Britain of the enigmatic Carboniferous chondrichthyan *Lagarodus*

B36 **S. Zhao**, **J. Li**, **Z. Sun** Three-dimensional dental vascular system and enameloid structure of Synechodontiformes from the Late Permian to the Middle Triassic of China

B37 **X. Shan** The dermal skeleton of stem-actinopterygian *Moythomasia* and its implications for the evolution of cosmine

B38 **M. Tumelty**, **S. Giles**, **B. Igielman** The earliest fossil evidence of stem polypterids

B39 **J. Lu**, **M. Zhu**, **X. Liu**, **M. Wang**, **W. Zhao**, **T. Qiao**, **L. Jia** Silurian–Devonian osteichthyans from South China illuminate early sarcopterygian evolution

B40 **Y. Mo**, **Y. Haridy**, **E. Daeschler**, **N. Shubin**, **T. Stewart** New fin material from the Devonian of Ellesmere Island, Arctic Canada and radial diversity in tetrapodomorph fishes

Dinosauria I: Ornithischia & Theropoda

B41 **N. Ju**, **X. Wang**, **C. Yu** Non-avialan theropod dinosaur mass reconstruction from bone measurements by machine learning

B42 **N. Zoller**, **K. Miller**, **T.A. Dececchi** Do what you can, with what you have, where you are: tracing the evolution of locomotory wing use diversity in theropods

B43 **T.R. Holtz** The Long and the Short of It: fore- and hindlimb proportions show variable degrees of correlation across non-volant theropod dinosaur diversity

B44 **M. Sakamoto**, **P.S. Anderson** DinoSAW: experimental biomechanics of whole-toothrow cutting function in theropod dinosaurs

B45 **E. Tasimov**, **A. Farnsworth**, **L. Mulvey**, **D. Černý**, **J. Marsola**, **Á.T. Kocsis**, **T. Clements**, **S. Lautenschlager**, **E. Dunne** *Veggiesaurus rex*: environmental and biotic drivers of herbivorous theropod biogeography and evolution

B46 **C.W. Garros**, **K.A. Beguesse**, **M.R. Doschak**, **P.J. Currie** In defense of destructive sampling: comparison of paired microCT and histological sampling of theropod metatarsals from the Dinosaur Park Formation (DPF) reveal the importance of histology for paleopathological interpretation

B47 **X. Wang**, **N. Ju**, **C. Yu** Morphological and size evolution of medium to large Jurassic theropods from China

B48 **A. Samathi**, **K. Puntanon**, **S. Suteethorn** Postcranial material of a spinosaurid (Dinosauria: Theropoda) from the Early Cretaceous of Khon Kaen, Thailand: implications for evolution and paleobiogeography of Asian spinosaurids

B49 **A. Zak**, **D. Hone** Skeletal indicators of webbed feet in birds and their applications to *Spinosaurus*

B50 **P. Rhynard**, **M. Stricklin**, **R. Ridgely**, **L.M. Witmer** An *Allosaurus* skull atlas: new insights into the skull anatomy of *Allosaurus jimmadseni* (Dinosauria, Theropoda) based on CT scanning, with an analysis of the use of paranasal sinuses in discriminating *Allosaurus* species

B51 **E. Malafaia**, **D. Estraviz-López** Reevaluating the phylogeny of the enigmatic Late Jurassic Portuguese theropod *Lourinhanosaurus antunesi* Mateus, 1998: allosauroid, megalosauroid or coelurosaur?

B52 **R. Pei** Integrated analyses reveal complexity of ecomorphology and reoccurring convergence in non-avialan coelurosaurians

B53 **D. Fahy**, **S.H. Burch** Myological reconstruction of the forelimb of *Yutyrannus huali* and muscular trends within Tyrannosauroidea

B54 **T.W. LaBarge** Age estimation of *Tyrannosaurus rex* tooth crowns using linear morphometrics

B55 **A. Lopez-Vaca**, **G. Elcombe** Neck deep in bite forces: a multibody dynamics pilot study of *Tyrannosaurus rex* feeding mechanics

B56 **C. Coppock**, **J.T. Voris**, **M.J. Powers**, **P.J. Currie** Taxonomic and biostratigraphic revision of tyrannosaurids from the Belly River Group of Alberta, Canada: insights into evolutionary history of Albertosaurinae

B57 **D.K. Smith** Locomotory changes within the therizinosaurian lineage from *Falcarius* to *Nothronychus*

B58 **C. Tsogtbaatar**, **A.L. Titus**, **J.J. Sertich**, **K. Knoll**, **L.E. Zanno** New material of an ornithomimid (Theropoda, Ornithomimosauria) dinosaur from the Upper Cretaceous Kaiparowits Formation of Utah reveals hidden diversity

B59 **D. Rourke**, **P.J. Currie** A new species of *Struthiomimus* from the Horseshoe Canyon Formation reveals a species complex within the genus

B60 **M. Fitzpatrick**, **H.D. Hanks**, **K. Shimada** A dromaeosaurid theropod tooth from an Upper Cretaceous (Turonian) marine deposit in northeastern South Dakota, USA

B61 **J.O. Bahena Mateos**, **K.M. Cantalice Severiano**, **M. Montellano Ballesteros**, **A. Torices Hernández** Description of large theropod dental material (Dinosauria, Theropoda) from the Campanian (Upper Cretaceous) of the El Gallo Formation, Baja California, Mexico

B62 **L.T. Dickson**, **V. Arbour** Identifying the trackmaker for the tetradactyl theropod ichnogenus *Saurexallopus*

B63 **T. Blakesley**, **P. dePolo**, **D. Ross**, **N. Clark**, **S. Brusatte** A new Hebridean morphotype series in the Middle Jurassic Valtos Sandstone and Kilmaluag Formations on the Isle of Skye, Scotland

B64 **E.P. Cerna**, **L.T. Yann**, **E. Petsios**, **D.J. Peppe** Documenting the formation and deposition of a theropod dinosaur trackway from the Upper Glen Rose Formation, Hamilton County, Central Texas, USA

B65 **S. Ashby**, **V. Boult**, **P.R. Bell**, **I. Walker**, **C.M. Brown**, **B. Pickles**, **S. Hurst**, **M. Rampe**, **P. Durkin** Excavating and recording dinosaur dominated tracksites of Dinosaur Provincial Park, Alberta, Canada: including The Skyline Tracksite

B66 **M. López Miguel**, **F. Ortega**, **A. Torices** Isolated theropod teeth from ‘Lo Hueco’ site, Upper Cretaceous, Cuenca, Spain

B67 **I. Aguilar Pedrayes**, **D. Button**, **E. Rayfield**, **M.J. Benton** Measuring ornithischian tooth complexity using patch count rotated analysis

B69 **A. Otomo**, **D.K. Zelenitsky**, **R. Sugawara**, **K. Tanaka**, **C. Sullivan**, **F. Therrien** Perinate hadrosaurid bones and associated eggshell fragments from the Upper Cretaceous (Upper Campanian) Oldman Formation of southeastern Alberta, Canada

B70 **PROGRAM ADJUSTMENT**

B71 **F. Manucci**, **F. Bertozzo**, **D. Vidal** Body mass reconstruction and new in-vivo restoration of *Parasaurolophus cyrtocristatus* (Dinosauria, Hadrosauridae)

B72 **G.M. McCullough**, **R. McCord**, **B. Bannon** Description of the first hadrosaurid dinosaur maxilla reported from Arizona, USA, from the Upper Cretaceous Fort Crittenden Formation

B73 **T. Dudgeon**, **D. Evans** Evolution of feeding mechanics in Iguanodontia (Ornithischia, Ornithopoda)

B74 **F. Bertozzo**, **S. Lautenschlager**, **C. Mallet** 'You get the thumb': the role and function of the spike-like pollex in *Iguanodon bernissartensis* (Dinosauria, Ornithopoda) via biomechanics approaches

B75 **J. Gônet**, **R. Allain**, **A. Houssaye** Locomotor reassessment of *Iguanodon*, *Ouranosaurus* and *Lurdusaurus* (Dinosauria, Ornithopoda) using comparative osteology

B76 **M. Ciudad Real Ballestero**, **F. Escaso**, **J.M. Gasulla**, **F. Ortega** Comparative neuroanatomy of three ornithopod individuals from the Lower Cretacous of Morella (Castellón, Spain)

B77 **J. Salas-Herrera**, **F. Escaso**, **J.M. Gasulla**, **F. Ortega** Pelvic and hind limb biomechanics of a limping basal styracosternan from the Lower Cretaceous of the Eastern Iberian Peninsula

B78 **J. Rubio Nieto**, **F. Torcida Fernández-Baldor**, **A. Torices** A preliminary study of the small ornithopod bones from the Barremian-Aptian site of Viajete (Burgos, northern Spain)

B79 **J. Kanipe**, **D. Winkler**, **L.E. Zanno**, **T.A. Gates** Cranial re-description of the early diverging iguanodontian (Rhabdodontomorpha) *Tenontosuarus dossi:* a case study of distinguishing biodiversity in the fossil record

B80 **F.J. Augustin**, **T. Treiber**, **Z. Csiki-Sava** New material of the rhabdodontid *Transylvanosaurus platycephalus* (Dinosauria: Ornithischia) from the uppermost Cretaceous of the Hateg Basin (western Romania)

B81 **A.M. Younk** Craniofacial and histological ontogeny of *Psittacosaurus mongoliensis* and *P. lujiatunensis:* toward evidence for the developmental underpinnings of species differences

B82 **A. Manning**, **L.M. Witmer**, **R. Ridgely**, **D. Evans**, **T. Williamson**, **Q. Zhang**, **S. Walsh**, **D.K. Smith**, **O.C. Bertrand**, **S. Brusatte** Brains or brawn? Endocranial and neuroanatomical changes during the evolution of ceratopsian dinosaurs

B83 **E.A. Ames**, **D. Button**, **A.J. Rowe** Using Finite Element Analysis to determine combative evolutionary drivers of ceratopsid horns.

B84 **B.C. Theurer**, **C. Sullivan** The posture of the hind limb in ceratopsid dinosaurs

B85 **W.H. Steelman**, **M.D. Angner**, **S. Persons**, **N.S. Levine** Mapping *Triceratops* Gulch: a GIS and drone photogrammetry approach to the Lance Formation beds of Glenrock, Wyoming

B86 **A.D. Straley**, **M. Loewen**, **J.J. Sertich** Postcranial anatomy of *Torosaurus* (Ceratopsidae: Chasmosaurine) from the Upper Cretaceous (Maastrichtian) Ojo Alamo Formation of the southeastern San Juan Basin, New Mexico, USA

B87 **K. Myhran**, **J. Mallon**, **L. Hall**, **L. Spicher**, **D. Johnson**, **J. Scannella** A new chasmosaurine (Ornithischia, Ceratopsidae) skull from the Judith River Formation (Campanian) of Montana, USA

B88 **E. Bamforth**, **J. Sweder** 'Big Sam': a new large skull of *Pachyrhinosaurus lakustai* from the Campanian (72 Ma) Wapiti Formation of northwest Alberta, Canada, with implications for intraspecies variation

B89 **T.M. Wallington**, **W.H. Steelman**, **S. Persons** The first ceratopsian tracksite of the Lance Formation

B90 **I. Walker**, **T. Williamson**, **A. Manning**, **R. Sullivan**, **S. Brusatte** The endocranial anatomy of the derived ankylosaurid *Ziapelta sanjuanensis* (Dinosauria, Ornithischia): endocasts of the brain, inner ear and nasal pathways reveal unique anatomical innovations with biological and ecological implications

B91 **A. Buschhaus**, **E. Teschner**, **J. Kriwet**, **S. Stumpf** From small to surprising: rethinking the Late Cretaceous island-dwelling ankylosaur *Struthiosaurus*

B92 **B. Green**, **J. Cavigelli**, **M. Forir**, **L. Vietti**, **A. Wroblewski** Micro-CT analysis of the internal bone structure of nodosaurid osteoderms: a comparative study of osteoderm morphology across the cervical, thoracic, and caudal regions of *Denversaurus*

B93 **K.C. Rayburn** Ichnotaxonomic and sedimentological analyses of the fossil record of Thyreophera (Dinosauria: Ornithischia) suggest that some degree of gregarious behavior was common to derived members of the clade

B94 **C.A. Forster**, **K. Poole**, **M.R. Spencer**, **J.M. Clark**, **X. Xu** A new ornithischian from the Upper Jurassic Shishugou Formation, Xinjiang, China, and a novel analysis of ornithischian phylogeny

Carnivora

B95 **X. Wang**, **O. Carranza-Castañeda** Latest Hemphillian Carnivora of Yepómera Basin, Chihuahua, Mexico

B96 **H. Pourabbas Vafaei** Paleontology of vertebrate carnivores: study of the late Miocene carnivorous mammals from the Maragheh region, northwestern Iran

B97 **S.M. Palmer**, **T.M. Kirkwood**, **J.A. Schwab**, **J.P. Rule**, **M. Michaud** Brain size and sensory tradeoffs in carnivoran evolution: insights from fossil and extant Caniformia

B98 **S.J. McKeon** Influences of locomotor mode and prey-capture strategies on upper cervical vertebral morphology in extant carnivores

B99 **J.R. Pardo-Judd**, **L. DeSantis** Body size plasticity in *Puma concolor*: morphological variation across time and ecosystems

B100 **S. Sarwar-Gaunt**, **P. Polly** A basal felid clade in North America at the end of the 'cat gap'

B101 **M.H. Haji-Sheikh** Is *Smilodon fatalis* the cat we think it is? Using computed tomography to find the answer

B102 **J. Jolie**, **A.J. Lang**, **K. Schüßler**, **T. Martin** Digital cranial and inner ear endocasts of *Hoplophoneus primaevus* and new implications for nimravid hunting behaviour

B103 **H. Chirchir**, **A. Clemens**, **A. Hotchner**, **J. Meachen** Quantifying internal and external bone morphology of *Miracinonyx* and other big cats

B104 **A.J. Lang** External cerebral morphology of *Panthera spelaea* in comparison to extant felids

B105 **V.L. Naples**, **M.H. Haji-Sheikh** Not so fast, rodents: hystricomorphy also occurs in extinct felids

B106 **K. Schüßler**, **A.J. Lang**, **J. Jolie**, **T. Martin** Canine replacement and cortex size of an Oligocene juvenile nimravid, *Dinictis* sp., with sabertooth adaptation

B107 **R.C. Stoddard**, **D. Lofgren**, **J. Scannella** A new nimravid from the Eocene Pipestone Springs Locality, Montana

B108 **J.A. Pérez-Claros**, **B. Figueirido**, **A. Martin-Serra** The evolution of the genus *Pachycrocuta*: current status and future perspectives

B109 **L. DeSantis**, **X. Wang**, **U. Adugba** Gnashing or gnawing? Contextualizing the dietary ecology of domesticated dogs (*Canis lupus familiaris, Canis lupus dingo)* via dental microwear comparison across continents

B110 **O.E. Stenberg**, **S. Viranta**, **J. Jernvall** Molar evolution in Canidae surmounts a developmental rule

B111 **D. Estraviz-López**, **A. García-Vázquez**, **M. Rios**, **A. Grandal-D`Anglade** Late Pleistocene fossil Ursidae from Portugal (Iberian Peninsula): morphometry and paleobiological inferences

B112 **T.M. Kirkwood**, **S. Shultz**, **M.T. Silcox**, **J.A. Schwab**, **S.M. Palmer**, **G.A. Lyras**, **A.A. van der Geer**, **K. Jones** Endocranial shape evolution across terrestrial–aquatic transitions in caniform carnivorans

B113 **W.M. Parker**, **T.I. Pollock**, **F.G. Marx**, **C. Loch**, **J. Velez-Juarbe**, **L. Paterson-Crisp**, **T. Park**, **E.M. Fitzgerald**, **A.R. Evans**, **J.P. Rule** Specialized canine teeth correlate with the deep-time evolution of pinniped mating systems

B114 **A.T. Boeye**, **W.J. Hart**, **O.A. Goodchild**, **K.B. Gormann**, **L. Horstmann** High bite forces reveal divergent ecological drivers in pinniped evolution

B115 **J.A. Schwab**, **T.M. Kirkwood**, **S.M. Palmer**, **K. Jones** Mosaic evolution of the neck and inner ear in aquatic carnivorans

B116 **L. Koper**, **S.L. Damico**, **M.G. Crowell**, **S.J. Rahmat** Bridging the past with the present: exploring the morphology of fossil seal ossicles with micro-CT scanning and visualization

B117 **A.M. Valenzuela-Toro**, **F. Busker**, **J. Cuitiño**, **M. Buono** New insights into the morphology and paleoecology of *Kawas benegasorum*, an enigmatic fossil seal from the Puerto Madryn Formation (Tortonian), Patagonia.

B118 **R. Boessenecker** A new record of the fur seal *Pithanotaria starri* (Mammalia: Otariidae) from the uppermost Miocene Purisima Formation of northern California reveals cryptic diversity in late Neogene pinniped assemblages from the eastern North Pacific

B119 **J.I. Bloch**, **J.R. Bourque**, **A.M. Jukar**, **R.E. Narducci**, **A. Woodruff**, **R.C. Hulbert** Oldest known New World river otter from North America coincident with high-latitude intercontinental mammalian dispersal event in the latest Miocene

B120 **S. Tomiya**, **C. Grohé**, **M. Longuet**, **N. Egi**, **T. Htike**, **Z. Maung Thein**, **M. Takai** Giant mustelids (Mammalia, Carnivora) from the lower member of the Irrawaddy Formation (upper Neogene) of Myanmar

B121 **B. Adrian** Locomotor diversity of giant otters from Plio-Pleistocene hominin sites in Africa

Lepidosauria

B122 **Q. Nasrullah**, **A.S. Tucker** The secrets behind continuous tooth replacement in reptiles

B123 **L. Kremers**, **F. Della Giustina**, **N. Chatar**, **D. Bastiaans**, **J.J. Hennekam** Mosasaurid jaw biomechanics provide insight into the role of the intramandibular joint in squamate biting performance

B124 **J. Maschke**, **P. Jiménez-Huidobro** Endocasts and associated neurovascular systems of two mosasaurines: *Plotosaurus bennisoni* and *Mosasaurus missouriensis* (Squamata, Mosasauroidea), from the Upper Cretaceous of North America

B125 **C.G. Gomez** Analysis and description of a partially prepared sub-adult *Mosasaurus missouriensis* (Squamata, Mosasauridae) from the Bearpaw Formation during the Upper Cretaceous in Western Canada

B126 **H.S. Sharpe**, **H. Street**, **T. Konishi**, **M. Caldwell** Revision of *Mosasaurus lemonnieri* reveals unique anatomy, significant variation, taxonomic issues, and a new species

B127 **D. Bastiaans**, **D. Cornelissen**, **J. Jagt**, **A.S. Schulp** The life and death of mosasaur ‘Carlo’, an unusual globidensine mosasaur from the upper Maastrichtian Gulpen Formation of the Maastrichtian type area (southeast Netherlands, northeast Belgium)

B128 **T. Konishi**, **A. Rojas**, **S. Saha**, **J. Mays**, **C. Miller** The earliest-known specimen of *Prognathodon* (Squamata, Mosasaurinae) from the middle Campanian Weskan Shale Formation, Kansas, USA, and its implications for the evolution of macrophagous, crunch-guild mosasaurines

B129 **P. Jiménez-Huidobro**, **J. Maschke**, **J. Jolie**, **J.A. Schultz**, **I. Ruf** Inner ear morphology of a tylosaurine mosasauroid from the Upper Cretaceous of North America

B130 **H. Yi**, **S. Hou**, **C. Zhou** Tail shedding in two Cretaceous lizards: autotomic structures revealed by X-ray CT scanning

B131 **T.I. Prause**, **B.R. Peecook**, **T.G. Kaye**, **M. Whitney** New Maastrichtian microsites update squamate diversity and biogeography of the Lance Creek Formation

B132 **M.J. Powers**, **F.F. Garberoglio**, **M. Caldwell** Boa grandfather and Madtsoia sister: new specimen of *Boavus idelmani* shakes up the family tree

B133 **A. Bolet**, **M.E. Jones**, **J.J. Hooker**, **S. Evans** The Late Eocene record of amphisbaenians (Reptilia, Squamata) from Hampshire Basin (UK)

B134 **C. Zak**, **E.R. Rolince**, **H.A. El-Saka**, **J. McCartney**, **E. Sieffert**, **M.R. Borths**, **H. Sallam** A partially articulated skeleton of a possible dwarf boa (Tropidophiidae) from the early Oligocene of the Fayum Depression, Egypt

B135 **A. Villa**, **A. Bolet**, **J. Klembara**, **A. Serrano-Martínez**, **À.H. Luján**, **J. Fortuny**, **M. Delfino**, **B. Schillinger**, **D. Alba** A new anguine lizard (Squamata, Anguidae, Anguinae) from the late Miocene (Vallesian) of the Vallès-Penedès Basin (NE Iberian Peninsula)

B136 **G. Varnham**, **J. Head** Fossil tests of hypotheses of competitive exclusion and geographic isolation in the evolution of gigantism in *Varanus*

B137 **M. Basa**, **A. Knapp**, **R. Felice** Drivers of morphological variation in the mandible of alethinophidian snakes

B138 **I. Donato**, **M.N. Hutchinson**, **E. Sherratt**, **E.H. Reed** A taphonomic analysis of the fossil lizards from Blanche Cave, Naracoorte Caves (South Australia)

B139 **J. Jacisin**, **M. Kemp** Cranioskeletal elements of *Anolis* lizards from the Greater Antilles exemplify rubato and harmonic variation within ecomorph specialists

B140 **A. Serrano-Martínez**, **L. García-Escolà**, **P. Cruzado-Caballero**, **A. Villa**, **C. Castillo**, **J. Fortuny** Relative shape and size of the brain in extant and extinct *Gallotia* lizards (Squamata, Lacertidae) and the neurosensorial and cognitive capabilities of the genus

B141 **C. Nacarino-Meneses**, **P. Álvarez Nieto**, **P. Cruzado-Caballero**, **C. Castillo**, **M. Köhler**, **J. Fortuny** Bone histology of *Gallotia* revisited: new insights into the growth and life history of the giant lizards from El Hierro (Canary Islands, Spain) obtained from paleohistogical analysis

B142 **B.M. Rothschild**, **J. Herrera-Flores**, **T. Stubbs**, **M.J. Benton** The fruits of collaboration across specialties: the earliest documentation of cartilage-related cancer, a chondrosarcoma, in the fossil record

Vertebrate Assemblages

B143 **B. Shipps**, **C.A. Sidor**, **K.D. Angielczyk** Tracking changes in tetrapod diversity throughout the upper Permian Usili Formation (Lopingian) of Tanzania

B144 **J.W. Reumer**, **I.R. Van der Beek**, **A.S. Schulp** The Winterswijk quarry (Anisian, Middle Triassic, The Netherlands): one of the richest fossil biomes of its time

B145 **S. Kryder**, **H.E. Burch**, **M.R. Stocker**, **S.J. Nesbitt** The microscopic past: using rarefaction analysis to optimize the processing of sediment from Late Triassic microvertebrate sites

B146 **E. Armour Smith**, **B.T. Kligman**, **A. Marsh** Microvertebrate assemblage from a Late Triassic bonebed in Arizona shows faunal diversity at the Adamanian–Revueltian boundary

B147 **E.E. Maxwell**, **G. Arratia**, **M. Ebert**, **M. Johnson**, **S. Stumpf**, **P. Vincent**, **S. Cooper** Understanding vertebrate faunal change through time in the Early Jurassic (Toarcian) Posidonienschiefer Formation

B148 **S.P. Finch**, **C. Tsogtbaatar**, **W.J. Freimuth**, **G. Bayasgaa**, **P. Delgerzaya**, **R. Tucker**, **L.E. Zanno** New vertebrate fossil discoveries from the Early Cretaceous Dzun Shakhai and Shine Usny Tolgod localities from the Eastern Gobi Basin of Mongolia

B149 **C. Underwood**, **D.J. Ward** Barren slopes and teeming rivers; the aquatic-based ecosystem of the Kem Kem deposits (mid Cretaceous, Morocco)

B150 **E.G. Cross**, **E. Hyland**, **S.P. Finch**, **C. Tsogtbaatar**, **R. Tucker**, **L.E. Zanno** Stable isotope geochemistry illustrates niche partitioning in the Bayanshiree Formation of Mongolia

B151 **R. Rogers**, **K. Curry Rogers**, **D.W. Krause** New insights into the geology and paleontology of the Upper Cretaceous (Turonian/Coniacian?) Ankazomihaboka sandstones, Mahajanga Basin, northwestern Madagascar

B152 **J.S. Cabrera Hernández**, **F. Ortega**, **A. Torices** Microvertebrate assemblage from the Upper Cretaceous site Lo Hueco (Cuenca, Spain).

B153 **A.G. Armagno**, **K. Shimada** Fossil vertebrate diversity and paleoecological implications of a new fossiliferous horizon from the Upper Cretaceous Smoky Hill Chalk, Logan County, Kansas

B154 **A. Torices**, **J.S. Cabrera Hernández**, **M. Montellano Ballesteros** Campanian-Maastrichtian vertebrate fauna from Laurasia: a comparative analysis between southern North American and Iberian Peninsula fauna

B155 **E.J. Cruz-Vega**, **J. Velez-Juarbe**, **H. Hu**, **H. Santos-Mercado** New vertebrate assemblage from the Upper Cretaceous (Maastrichtian) El Rayo Formation of Puerto Rico

B156 **U. Karmakar** A review of geological, floral and faunal changeover across Paleogene-Neogene boundary, along selected transects, Kutch Basin, Western India

B157 **P. Rummy**, **W. Huang**, **Y. Wu**, **X. Hu** Coprofauna from the Cenozoic of China: insights from Longgupo Cave on ecosystem complexity and coprolite taphonomic processes

B158 **A. Huseen**, **R. Bussert**, **M. Mohammednoor**, **U. Struck**, **S. Tsukamoto**, **A. Eisawi**, **F. Bibi** Paleoenvironment of Pleistocene vertebrates from the middle Atbara River, eastern Sudan

B159 **H. Blain**, **S. Parfitt**, **C. Sánchez-Bandera**, **A. Fagoaga**, **J. Bisbal-Chinesta**, **S. Lewis**, **R. Davis**, **N. Ashton** New palaeoecological investigations and post-glacial re-colonization process of the British Isles based on herpetofauna at the Hoxnian East Farm Barnham site (UK)

Thursday Morning, November 13, 2025
Romer Prize Session
Meeting Room Hall 1
Moderators: Sara Burch and Susie Maidment

8:00 **A.R. Zietlow** Reassessment of North American mosasaur morphology and diversity as informed by extant squamates

8:15 **S. Woodgate** Evolution through space and time: the fossil record of *Podarcis pityusensis,* the Ibiza wall lizard, as a system to link form-function-environment trajectories across scales of varying magnitude

8:30 **L.W. Viñola-López** Extinction and human niche construction lead to a reduction of functional ecology in terrestrial mammal communities across the Caribbean

8:45 **Y. Uno**, **T. Hirasawa** When and how did the propatagial structure evolve in the lineage towards birds?

9:00 **C. San Román** Deciphering the teleostean fishes from the paleowetland of Las Hoyas: implications on the early diversification of teleosts during the Cretaceous

9:15 **M. Riegler** An atlas of cranial anatomy for extant worm lizards (Squamata: Amphisbaenia) using diceCT to re-evaluate the fossil record of Rhineuridae

9:30 **J. Rawson** Homoplasy and functional innovation characterise the evolution of the mammalian jaw joint in probainognathian cynodonts

9:45 **C. Morrison**, **J. Bestwick**, **K. Schroeder**, **C. Jackson**, **J. Gregory**, **S. Gascoigne**, **P. Bills**, **L.B. Porro**, **P.D. Mannion**, **P.M. Barrett** Ontogenetic and spatial dietary partitioning as the ecological mechanism for high sympatric theropod diversity inferred from dental microwear texture analysis

10:00 Coffee Break

10:15 **D. Meyer** The anatomy of the carpus and tarsus of squamates provides novel morphologic support for key molecular clades

10:30 **N.E. Loughlin** Assessing changes in North American mammalian diversity and habitat suitability since Last Glacial Maximum based on ecological niche models

10:45 **K. Kocáková** Extinction mechanisms in sharks and rays: The role of age and spatial range across 145 million years of evolutionary history

11:00 **M. Jones** Vertebral functional morphology informs tail use in sthenurine giant kangaroos

11:15 **E.J. Hillan** New *Tiktaalik roseae* material reveals locomotor innovation in the water-to-land transition

11:30 **J. Heath** Regional and global drivers of Mesozoic dinosaur diversification

11:45 **C.M. Gordon** Phylogenetic machine learning predicts cryptic aquatic habits and soft-tissue features in extinct amniotes

12:00 **P.M. Burke** The internal cranial anatomy of Gavialoidea reveals profound implications for crocodylian evolutionary history

Thursday Morning, November 13, 2025
Technical Session VI: Mesozoic Seas & Skies
Meeting Room Hall 4
Moderators: Lene Liebe Delsett and David Unwin

8:00 **Y. Hu**, **J. Liu**, **Q. Li**, **P.S. Druckenmiller**, **N. Klein**, **T.M. Scheyer**, **N. Kelley**, **M. Sander** Osteohistological dichotomy suggests divergent marine lifestyles and thermometabolic strategies in thalattosaurs (Reptilia, Archosauromorpha)

8:15 **L. Liebe Delsett**, **A. Chinsamy**, **J. Kimball**, **M.G. Faure-Brac**, **V. Sukhavasi**, **P. Alam**, **A. Houssaye**, **N. Pyenson**, **L. Poori**, **B. Kear** Swim like a fish: vertebral perspectives on the locomotory convergence of ichthyosaurs and whales

8:30 **J. Pardo-Pérez**, **M. Malkowski**, **P. Zambrano**, **D.R. Lomax**, **C. Gascó Martín**, **J. Kaluza**, **H. Ortíz**, **A. Pérez**, **M. Cáceres**, **E.E. Maxwell** New morphological evidence of the gravid *Myobradypterygius hauthali* (Reptilia: Ichthyosauria) from the Hauterivian (Early Cretaceous) of southern Chilean Patagonia revealed by CT scan analysis: the 'Fiona' ichthyosaur

8:45 **F. Miedema**, **L.L. Delsett**, **C. Klug**, **M. Geiger**, **E.E. Maxwell** The complex evolutionary history and developmental trajectory of the neoichthyosaurian pelvic girdle and the second potential non-ophthalmosaurian ichthyosaur from the Cretaceous

9:00 **Y. Zhang**, **L. Diao**, **D. Jiang**, **R. Motani**, **Y. Liu** New anatomical information of *Atopodentatus unicus* (Sauropterygia, Reptilia) from the Middle Triassic of South China

9:15 **L.E. Muscutt**, **I. Karmpadakis** Hydrodynamic advantages of tandem flipper phasing in plesiosaur swimming: insights from an advanced robotic model

9:30 **E.R. Goldsmith**, **M.R. Stocker** What large teeth (sockets) you have! Using dental alveolus lengths to predict phytosaur skull size distributions in a phylogenetic and paleoecological context

9:45 **W. Reyes**, **M. Brown** Disparity in growth dynamics between early-diverging pseudosuchians and their kin

10:00 Coffee Break

10:15 **P.J. Byrne**, **D. Bottjer**, **N.D. Smith** Can bone-volume thickness detect bone pneumatized by pulmonary diverticula in extant and extinct archosaurs?

10:30 **A.J. Fitch**, **C. So**, **A. Mann** Pterosaurs show earliest known loss of vertebrate powered flight and deep origin of 'ornithoscelidan' anatomy

10:45 **M. Bronzati**, **A. Watanabe**, **R.B. Benson**, **R.T. Müller**, **S.J. Nesbitt**, **M. Fabbri** Pterosaur neuroanatomy converged with that of bird precursors but did not follow the avian path

11:00 **J. Bestwick**, **T. Stubbs**, **C. Miller**, **R. Pêgas**, **T.M. Scheyer** Functional morphology of pterosaurs and avialans and the impact of non-adults in facilitating competitive exclusion between these two volant clades in the Mesozoic

11:15 **M.M. Flaunet**, **V.T. Merino Salinas**, **D.M. Unwin**, **R.S. Smyth**, **J. Bestwick** Aerodynamic impacts of hind limb presence, size, and posture on the pterosaur flight apparatus

11:30 **D.M. Unwin**, **A. Hecker**, **C. Ifrim**, **H. Tischlinger**, **R. Smyth** A new structural model for the flight patagia of pterosaurs

11:45 **C. Caputo**, **T. Cullen**, **M.B. Habib**, **H. Zou**, **R. Gottardi**, **L. Bilenker** Multi-proxy isotope analysis refutes trans-oceanic foraging and reveals dietary complexity in pterosaurs

12:00 **J. Martínez-Barredo**, **T. Aureliano**, **C. Martínez-Pérez**, **Á. Saraiva**, **X. Pereda-Suberbiola**, **B. Holgado** Preliminary histotaphonomic analysis of pterosaur-bearing concretions from the Romualdo Formation in Jardim, Porteiras and Santana do Cariri (Araripe Basin, Brazil)

Thursday Morning, November 13, 2025
Technical Session VII: Laurasiatheria
Meeting Room Hall 8
Moderators: Rebecca Bennion and Bian Wang

8:00 **A.L. Norwood**, **D.R. green**, **B. Pobiner**, **J. Faith** An adaptable inverse model for recovering seasonality signals from serial mammalian tooth enamel isotopes

8:15 **B.B. Wooten**, **L. DeSantis** Role of body size in shaping the dietary ecology of the North American 'Hell Pig' (*Archaeotherium*) revealed through dental microwear texture analysis

8:30 **S. V. Robson**, **A. Prokop**, **A. Ashbaugh**, **S. Misati**, **S. Tucker**, **J. Theodor** Quantifying morphological disparity in the petrosal bone and the bony labyrinth: a case study using extinct and extant camelids

8:45 **B. Wang**, **Q. Wang**, **Z. Zhang** Oligocene ruminants from Saint Jacques, North China

9:00 **N.S. Heckeberg**, **E. Bärmann**, **J. Cantalapiedra**, **L. Costeur**, **Y. Li**, **B. Mennecart**, **R. Rozzi**, **L. Sorbelli**, **F. Bibi** The Ruminatrix—a dataset for investigating morphological evolution of ruminants (Mammalia, Artiodactyla)

9:15 **E. Amson**, **A. Alfsen**, **E. Berger**, **E. Peri**, **A.S. Gohar**, **H. Sallam**, **G.S. Ferreira**, **R.R. Chowdhury**, **T. van de Kamp**, **Q. Martinez** The endocranial anatomy of protocetids: implications for early whale bone mass increase and paleoneurology

9:30 **P. Giuffra**, **M.D. Uhen**, **A.M. Benites Palomino** A new bizarre basilosaurid from the Pisco Basin of Peru displaying unexpected primitive features challenges the major trends in cetacean evolution

9:45 **R. Bennion**, **G. Bianucci**, **A. Collareta**, **E. Coombs**, **F. Nobile**, **M. Merella**, **O. Lambert** Niche partitioning in the odontocete fauna from the Early Miocene Chilcatay Formation of Peru

10:00 Coffee Break

10:15 **R.J. Strauch**, **A.J. Werth**, **C.M. Peredo**, **M.D. Uhen** Can suction feeding be determined for fossil cetaceans? Morphological criteria for identifying suction specialists

10:30 **M.F. Jones**, **C.K. Siemann**, **D. den Ouden**, **S. Moghe**, **K. Beard** Subfamily-level relationships within Nyctitheriidae (Mammalia, ?Eulipotyphla) illuminate patterns of dispersal and evolution in a group of Paleogene insectivores

10:45 **O.E. Wilson**, **L.P. Bergqvist**, **J.N. Gelfo**, **T. Zanesco**, **J. Saarinen** The food the fire beasts ate: testing the universality of mesowear angles in bilophodont South American ungulates

11:00 **J. Tissier**, **T. Smith** PerissOrigin: re-examining the phylogeny of early perissodactyls reveals unnoticed dispersals of the first North American, European, and Asian 'horses'

11:15 **B. Bai**, **J. Meng**, **Y. Wang** A diverse perissodactyl fauna from the early Eocene of southern China

11:30 **A. Selini**, **T. De Ridder**, **P. Aerts**, **J.A. MacLaren** An opportune moment: investigating inertial properties of the distal limb of horses through an iconic evolutionary transition

11:45 **Z. Landry**, **C. Bataille**, **D. Fraser**, **L. Chauvey**, **J.H. Miller**, **S. Schiavinato**, **E. Scott**, **L. Tonasso-Calvière**, **G. Zazula**, **L. Orlando** New cranial material and nuclear genome sequences clarify evolutionary relationships of *Haringtonhippus francisci*

12:00 **J.A. Moretti** Insights into the origins of migratory and maternity colony behaviors in the free-tailed bat, *Tadarida brasiliensis*, from an exceptional Pleistocene fossil record in Inner Space Cavern, Texas

Thursday Afternoon, November 13, 2025
Symposium: Ancient Biomolecules
Meeting Room Hall 1
Moderators: Ryan Patterson and Valentina Rossi

1:45 **K. Wolkenstein** Quantitative detection of melanin pigments in fossil vertebrates using mass spectrometry

2:00 **A. Roy**, **E.T. Saitta**, **M. Musa**, **S. Al-Kindi**, **T.G. Kaye**, **M. Pittman** Experimental maturation of carotenoids and psittacofulvins indicates their lower preservation potential compared to melanin, in carbonaceous compression fossils

2:15 **V. Rossi**, **R. Unitt**, **M.E. McNamara** Melanin chemistry as a tool to investigate the phylogenetic affinity of enigmatic fossils: Mazon Creek Lagerstätte as a case study

2:30 **L.A. Barlow** Hamular cartilage is a conserved feature from the dawn of mammals

2:45 **M.R. Dickinson**, **L. Patinglag**, **K. Shaw**, **K. Penkman** Intracrystalline insights: refining mammalian evolution through enamel-based amino acid geochronology

3:00 **R.W. Burroughs**, **C.J. Percival**, **N.S. Vitek** Proteomic and phenotypic variation in rodent dentition from a feeding experiment

3:15 **A. García-Vázquez**, **G. González-Fortes**, **A. Pinto-Llona**, **E.M. Fernández-Bejarano**, **A. Barlow**, **M. Hofreiter**, **A. Grandal-D`Anglade** Integrating stable isotopes, ancient DNA, and radiocarbon dating to reconstruct the ecological and genetic history of Iberian brown bears

3:30 **A.J. Jian**, **L. Schwark**, **S.F. Poropat**, **A.I. Holman**, **L. Brosnan**, **M. Diaz Mateus**, **M.E. Böttcher**, **K. Grice** An organic and isotopic characterization of a concretion-entombed ichthyosaur: taphonomic insights into the Lower Jurassic Posidonia Shale (Germany)

3:45 **M.L. Miller**, **J. Wiemann** Genomic evidence combined with time-integrated biosignatures applied to new fossils suggests an archosaurian origin of avian endothermy

4:00 **J. Wiemann**, **M.L. Miller**, **L. Olden**, **M. Haase** Machine learning applied to modern and fossil biomolecules reveals the evolution of the vertebrate biomineralization toolkit

Thursday Afternoon, November 13, 2025
Technical Session VIII: Mammalian Ecology & Biogeography
Meeting Room Hall 4

Moderators: Joaquin Arroyo-Cabrales and Emily Lindsey

1:45 **S. Hopkins** Understanding Oligocene biogeography and stratigraphy of meniscomyine rodents: revising the biostratigraphic patterns in a lineage of burrowing rodents

2:00 **J. Arroyo-Cabrales**, **B.W. Schubert**, **J.C. Chatters**, **J.X. Samuels**, **J. Cruz**, **D. Rissolo**, **H. Barba-Meinecke** Hoyo Negro: an amazing deposit for Pleistocene fauna

2:15 **B.E. Carter**, **T.M. Smiley**, **J. Alroy**, **R. Feng**, **C. Badgley** Mountains can preserve ecological community functioning during periods of climate change: evidence from Miocene mammal assemblages of western North America

2:30 **A. Lindholm**, **R.A. Close** Persistent body size bias in the fossil record of North American Cenozoic mammals

2:45 **N. Chabrol**, **H. Morlon**, **G. Escarguel**, **J. Clavel** Detecting the effect of past biotic interactions and climate changes on phenotypic evolution

3:00 **J. van der Hoek**, **M. Ruta**, **K.E. Davis**, **R.T. Gilman**, **K. Jones** Evidence for deep-time clade interactions in the diversification of Cenozoic carnivores and artiodactyls

3:15 **R. Tabuce**, **B. Marandat**, **S. Adnet**, **K. Gernelle**, **F. Girard**, **L. Marivaux**, **J. Schnyder**, **E. Steurbaut**, **J. Storme**, **J. Yans** Mammalian faunal turnover in Europe triggered by a latest Paleocene Pre-PETM global warming event

3:30 **D.L. Fox**, **D. Birlenbach**, **N.E. Loughlin** Biogeography and diversity of Miocene ungulates in central and western North America in relation to topography

3:45 **F.A. Smith**, **E.A. Elliott Smith**, **C. Tomé**, **K. Lyons** The differing response of mammalian carnivores to the terminal Pleistocene extinction

4:00 **E. Lindsey**, **A.M. Jukar**, **M.I. Pardi**, **R. Feranec**, **C. Tomé**, **J. Southon**, **M.R. Waters** Climate, Clovis, and catastrophe: hundreds of new radiocarbon dates reveal near-synchronous extinction of North American megafauna across multiple regions 13,000–12,800 BP

Thursday Afternoon, November 13, 2025
Technical Session IX: Synapsida
Meeting Room Hall 8
Moderators: Zanildo Macungo and Megan Sodano

1:45 **M.P. Sodano**, **S.J. Czerkas**, **R. Irmis**, **A. Huttenlocker** Exceptionally preserved skeleton from a lower Permian interdune deposit in southeastern Utah sheds light on early synapsid phylogeny and ecomorphological diversity

2:00 **S.K. Pevsner**, **R.B. Benson** Comparative evidence for independent evolutionary reductions of tail length among stem mammals

2:15 **M.O. Day**, **J. Benoit**, **J. Ramezani**, **B.S. Rubidge** The Wordian/Capitanian boundary in the Karoo Basin: chronological constraints on the first occurrence of *Tiarajudens* (Therapsida, Anomodontia) in South Africa

2:30 **Z.A. Macungo**, **R. Araújo**, **M.O. Day**, **B.S. Rubidge**, **S. Jirah**, **J. Benoit** New species of large gorgonopsian from the *Eodicynodon* Assemblage Zone of South Africa and the diversity of middle Permian carnivores

2:45 **A. Duhamel**, **A. Huttenlocker**, **J. Benoit** The earliest-diverging cynodont? New middle Permian specimen sheds light on the early morphological evolution of eutheriodonts

3:00 **D. Landi**, **S.A. Singh**, **L. King**, **E. Rayfield**, **M.J. Benton** The early evolution of beaks across Permian and Triassic

3:15 **K. Ehler**, **K.D. Angielczyk**, **R. Araújo**, **M. Whitney** Tusk histology of Permian dicynodonts reveals a diversity in growth patterns and adaptations to seasonality

3:30 **K.D. Angielczyk** Morphological complexity, reduction, and loss of the postfrontal bone of Permian dicynodonts (Therapsida, Anomodontia)

3:45 **Y. Shi**, **J. Liu** A new species of *Dinanomodon* (Dicynodontia) from China and the paleobiogeographic implications of Pangaea during the late Permian

4:00 **A. Brant**, **C.A. Sidor** Intraspecific variation of the maxillary canal in a sample of green iguanas (*Iguana iguana*): preliminary implications for the reconstruction of fossil neurovasculature.

Thursday Afternoon, November 13, 2025
Regular Poster Session II
Meeting Room Hall 3
Authors must be present from 4:30 – 6:30 p.m. on Thursday, November 13

Mesozoic Seas & Skies

B160 **J. Liu**, **Y. Qiao**, **M. Iijima** A new hupehsuchian (Reptilia: Ichthyosauromorpha) with widely spaced autopodium from the marine Lower Triassic of South China

B161 **C.X. Su**, **D. Jiang**, **R. Motani**, **M. Zhou** Retrodeformation and jaw muscle reconstruction of a *Chaohusaurus brevifemoralis* (Ichthyosauriformes, Reptilia) skull from the Lower Triassic of South China

B162 **A.S. Wolniewicz**, **L. Gu**, **J. Liu** A new specimen of the Early Triassic ichthyosauriform *Chaohusaurus zhangjiawanensis* from Yuan'an, Hubei Province, South China

B163 **D. Jiang**, **R. Motani**, **M. Zhou**, **J. Huang**, **A. Tintori**, **N. Fraser**, **O. Rieppel** New *Sclerocormus* specimens confirming differences in the dentition between Nasorostra and Omphalosauridae

B164 **T. Fornari**, **N.B. Fröbisch** A unique tooth replacement pattern in the enigmatic Middle Triassic marine reptile, *Omphalosaurus*

B165 **P. Nordenhaug**, **A.J. Roberts**, **J. Hurum**, **V.S. Engelschiøn** Molar opposites: using radiography and micro-computed tomography to reveal unique dental morphologies and a previously unknown diversity of mixosaurid ichthyosaurs of the genus *Phalarodon* from the Middle Triassic of Svalbard

B166 **N.T. Counts**, **J. Blouet**, **N. Klein**, **Q. Li**, **J. Li**, **P. Sander** Stratigraphy of marine reptile horizons in the Anisian Fossil Hill Member (Middle Triassic, Nevada, USA) reveals trends in Panthalassic ichthyosaur diversity

B167 **S.O. Cancel-Matos**, **N. Kelley** Improvements in size estimation techniques and implications for the evolution of body size within Ichthyosauromorpha

B168 **D. Nau**, **R. Dederichs**, **J. Heijne** Evolution of gigantism in ichthyosaurs as revealed by volumetric modelling

B169 **M.G. Faure-Brac**, **L.L. Delsett** On ichthyosaurs' metabolism: first results

B170 **D.R. Lomax**, **J. Massare**, **E.E. Maxwell** A new long-snouted Early Jurassic (Pliensbachian) ichthyosaur illuminates a complex faunal turnover following the Triassic–Jurassic extinction

B171 **J.F. Delgado-Carrillo**, **K. Moreno**, **E.E. Maxwell**, **J. Pardo-Pérez** Biomechanics of swimming in ophthalmosaurian ichthyosaurs (Reptilia, Ichthyosauria) from the Lower Cretaceous of Torres del Paine National Park, Southern Chile

B172 **C.L. Kearns**, **H. Singleton**, **D.R. Lomax** Historical and taxonomic review of ichthyosaur specimens in the Beneski Museum of Natural History (Amherst College, Massachusetts, USA)

B173 **A.E. Henderson** Analysis of the reduction of diversity within ichthyosaurs through competition using ecospace variables

B174 **K.T. Gerken**, **D. Konietzko-Meier**, **N. Klein** Preliminary data about histology of the bone of attachment in Temnospondyli and Ichthyosauria

B175 **V. Fischer**, **F. Della Giustina**, **R. Bennion**, **J.A. MacLaren** The nature of the Cenomanian–Turonian turnover in marine reptiles

B176 **K.K. Formoso**, **K.T. Giljarhus**, **B.E. Flammang** Surface swimming drag of terrestrial amniotes and insights into secondarily aquatic transformations and lack thereof

B177 **L.H. Holmes** The comparative biomechanics and cranial hydrodynamics of Jurassic marine reptiles

B178 **M. Rychel**, **E. Bamforth**, **T. Marchant** Ontogeny of Late Cretaceous polycotylid plesiosaurs from the Western Interior Seaway in Saskatchewan, Canada: a histological approach to long bone microanatomy

B179 **T. Sato**, **T. Nishimura**, **T. Shinmura**, **T. Chitoku** A new Turonian polycotylid plesiosaur from Hokkaido, Japan

B180 **J.B. Davidson**, **T. Challands**, **D. Foffa**, **D. Ross**, **S. Brusatte** A plesiosaur deathfall from the Middle Jurassic of the Isle of Skye, Scotland

B181 **Q. Liu**, **L. Cheng**, **T. Stubbs**, **Z. Fang**, **L. Tian**, **C. Yan**, **M.J. Benton** Ontogenetic dietary partitioning in a Triassic sauropterygian: implications from a new juvenile specimen of *Brevicaudosaurus jiyangshanensis* (Reptilia: Diapsida)

B182 **J. Pople**, **T.M. Scheyer** A nothosaur-dominated reptile assemblage from the eastern Alpine Triassic (Anisian) of Switzerland

B183 **Q. Li**, **Y. Hu**, **Y. Shen**, **P. Sander**, **J. Liu** A new large *Nothosaurus* (Reptilia, Eosauropterygia) from the Middle Triassic of South China and the phylogeny of Eosauropterygia

B184 **A.A. Rytel**, **T. Skawinski** Re-discovery of well-preserved sauropterygian skeletons from the Gogolin Formation in Poland—insights into the early evolution and spread of aquatic reptiles in the Early/Middle Triassic

B185 **E. Patellos**, **C.H. Woolley**, **D. Bottjer**, **N.D. Smith** Osteoderms represent a major component of the fossil record for Upper Triassic tetrapods

B186 **D. Hill**, **J. Weinbaum** Assessing *Machaeroprosopus* (Archosauriformes, Phytosauria) squamosal morphology from the Martha's Butte Beds (Upper Sonsela Member Chinle Formation)

B187 **C.R. Munro-Flanagan**, **J.R. Hutchinson** A 3-D reconstruction of the pelvic musculature of *Riojasuchus tenuisceps* (Archosauria, Ornithosuchidae)

B188 **A. Ben-Salahuddin**, **J. Weinbaum** A northeastern Arizona bonebed of the Late Triassic archosaur *Typothorax coccinarum* provides an opportunity to test for ontogenetic and social dynamics

B189 **S. Herter**, **J.B. Desojo**, **U. Bachmann**, **T.M. Scheyer** Osteohistology of a new specimen of *Aetosaurus ferratus* (Archosauria, Aetosauria) from the Late Triassic of Frick (Canton Aargau, Switzerland)

B190 **N. Krivka**, **R. Irmis**, **A. Manafzadeh**, **S.J. Nesbitt** An articulated hind limb of *Dromomeron romeri* (Lagerpetidae) and its implications for interpreting early ornithodiran footprints

B191 **J. Song**, **S. Jiang**, **X. Wang** Pterosaur phylogeny revisited with novel characters and comprehensive analyses

B192 **D.J. Morgan**, **E. Puetz**, **S. Broadbent**, **J.M. Clark**, **B. Andres**, **A. Balanoff** Convergent evolution in endocranial morphology of pterosaurs and birds: how the brain shapes locomotory behaviors in archosaurs

B193 **N. Jirgal**, **R. Nudds** Evidence of temporal variation in pterosaur flight style

B194 **R.A. Frigot** Scramble or stride: pterosaur pelvic disparity suggests locomotor shift occurred gradually and independently of body size

B195 **M. Schneider**, **D. Henderson**, **L.P. Claessens** Functional morphology of the prepubis in Pterosauria

B196 **S.A. Ludwig**, **R. Smyth**, **D.M. Unwin**, **D.M. Martill**, **R.E. Smith** Assessing relationships between ungual morphology and terrestrial ecology in pterosaurs

B197 **B. Andres**, **J.M. Clark**, **R. Hernandez-Rivera**, **M. Montellano Ballesteros** The second species of *Dimorphodon*

B198 **D. Hone**, **R. Lauer**, **B.H. Lauer**, **A.J. Fitch**, **F. Spindler** New specimens from old localities: expanding the Solnhofen region pterosaur community with new taxa

B199 **S.N. McDavid**, **H.N. Thomas** Flying reptiles of the forgotten paleocontinent: revision of the pterosaurs of Appalachia and Eastern North America

B200 **D. Theda**, **D. Hone**, **R. Lauer**, **B.H. Lauer** A remarkable new 3D cranium of the ctenochasmatid *Gnathosaurus* reveals new anatomical details of the genus

B201 **F. Costa**, **G. Santos**, **C. Freire**, **J. Silva**, **F. Moura**, **B. Hörmanseder**, **R. Pêgas** Exploring the aerodynamic impact of the head crest in *Tupuxuara leonardii* (Pterosauria)

B202 **R. Buchmann**, **T. Rodrigues** The high bite force of *Tupandactylus navigans* (Pterodactyloidea: Tapejaridae) and implications for frugivory

B203 **H.N. Thomas**, **S.N. McDavid** Giant size convergently evolved multiple times in Azhdarchidae (Pterosauria, Azhdarchoidea)

Laurasiatheria

B204 **M. Longuet**, **S. Tomiya**, **R.A. Short**, **Z. Maung Thein**, **M. Takai** Reconstruction of the Neogene paleoenvironment in central Myanmar, using ecometric analysis of the artiodactyl calcaneus

B205 **B.D. Davenport**, **A.L. Norwood** Evaluating the relationship between ungulate herbivore muzzle width and $\delta^{13}C$ variability among modern species: implications for interpreting stable isotope data from the fossil record

B206 **A. Ashbaugh**, **H. Jamniczky**, **J. Theodor** You should look a gift horse in the mouth: using 2D occlusal cheek tooth morphology to study the evolution of molarization in hoofed mammals

B207 **F. Lihoreau**, **K. Uno**, **T.E. Cerling**, **G. Guinot**, **A. Houssaye**, **M. Orliac**, **L. Scribano**, **J. Boisserie** Recurrent adaptation of the Hippopotamoidea to life in water

B208 **L. Scribano**, **F. Lihoreau**, **A. Houssaye**, **N. Clarisse**, **J. Boisserie** Postcranial anatomy of the late Miocene hippopotamoids from Toros-Ménalla, Chad

B209 **S.O. Parod**, **D.R. Prothero, S. Kottkamp** Fossil camels from the Miocene Punchbowl, Crowder, and Cajon Valley formations of the Transverse Ranges, California

B210 **D.R. Prothero**, **K.I. Watmore**, **E. Welsh**, **M.R. Forcellati**, **S.M. Lukowski**, **S.O. Parod** Evolution of the protolabine camels (Artiodactyla, Camelidae)

B211 **G.E. Rössner** Not at all living fossils: recent advances in paleobiology of tragulids

B212 **H.R. Caldwell**, **H. N. Woodward** Osteohistologic variability between the femur and tibia of Rocky Mountain elk (*Cervus canadensis*): implications for ontogenetic interpretations in extinct cervids

B213 **J. Smith**, **M. Loewen** Antler morphology of an exceptional specimen of *Cervalces scotti* from northwestern New Jersey, USA

B214 **J. Gegner**, **J. Theodor** We're all ears: a comparison of five merycoidodontid petrosals

B215 **K.I. Watmore**, **D.R. Prothero** Interspecific and intraspecific variation in the horncores of the merycodonts (Mammalia, Artiodactyla, Antilocapridae, Merycodontinae) with implications for merycodont systematics

B216 **A. Grossman**, **S.E. Cromwell**, **N. Solounias**, **R. Calvo**, **R. Rabinovich** Fossil Giraffidae from Early Miocene deposits of the Hazeva Formation, northern Negev, Israel

B217 **A. Vohs**, **L.N. Weaver**, **S.G. Chester**, **T. Lyson** Dental microwear textures of archaic ungulates from the early Paleocene of the Denver Basin

B218 **N.D. Rosas**, **W.A. Barr** Astragalus shape characteristics of bovids (Bovidae) from the middle Miocene of Kenya and Pakistan suggest that exploitation of grasses for habitat preceded widespread adoption of grazing behavior

B219 **Q. Shi** New finds of fossil bovids from the Linxia Basin, northwest China, and their implications for biostratigraphy

B220 **J. Brophy**, **G. Matthews**, **D. de Ruiter** An examination of the enigmatic *Tragelaphus pricei*, an extinct bushbuck from South Africa

B221 **L. Sorbelli** Adaptability through time: biochronology and ecomorphology of *Bison* in the Western Palearctic during the Quaternary

B222 **M. Orliac**, **M. Mourlam**, **H. Bouaziz**, **M. Waqas**, **H. Thewissen**, **T. Smith**, **R. Weppe** Recent data on the enigmatic family Raoellidae: how aquatic…how cetacean?

B223 **A. Martin-Serra**, **A. Valverde**, **J.A. Pérez-Claros**, **B. Figueirido** Developmental mechanisms of axial evolution in stem and crown cetaceans (Mammalia, Artiodactyla)

B224 **Y. Soda**, **N. Kohno** Ecomorphological divergence of semicircular canals in cetaceans: implications for locomotor adaptation in diverse aquatic habitats

B225 **A. Gay**, **K.E. Kassegne**, **Y.Z. Amoudji**, **A. Johnson**, **M. Thiam**, **B. Sambou**, **A. Charruault**, **G. Guinot**, **J. Martin**, **L. Hautier** Taxonomic and ecological diversity of middle Eocene protocetids from Togo

B226 **A.S. Gohar**, **M.S. Antar**, **S. El-Sayed**, **H. Sallam** New giant protocetid pelves from the middle Eocene of Egypt: implications for hindlimb evolution in early whales

B227 **E. Marx**, **M. Harzhauser**, **J. Kriwet** Taxonomy, taphonomy and phylogeny of a historical *Stromerius nidensis s*pecimen (Cetacea, Basilosauridae) and other archaeocete material from the collection of the Natural History Museum Vienna

B228 **M.D. Nelson**, **F. Nobile** The 'squalodonts' of the Belluno sandstones: an updated study of systematics, taphonomy, and paleobiology of *Squalodon bellunensis* and *Squalodon peregrinus* (Cetacea, Odontoceti)

B229 **A. Ohguri**, **N. Kohno** A new fossil whale (Cetacea: Odontoceti) from the Lower Pliocene of the western North Pacific

B230 **T. Park**, **C. Cavero-Rozas**, **W.M. Parker**, **A.J. Tennyson**, **F.G. Marx** New data on the evolution of delphinids in the southern hemisphere

B231 **C. Cavero-Rozas**, **D. Ochoa**, **M. Carre**, **M. Urbina**, **R.M. Salas-Gismondi** Macroevolutionary dynamics of Odontoceti and the rise of Delphinidae in the Peruvian coast

B232 **M.R. Woolley**, **A. Chinsamy** Age estimation and life history traits of modern and fossil mysticetes from Southern Africa

B233 **F. Cailleux**, **L.W. van den Hoek Ostende**, **P. Joniak** Late Miocene insectivores as environmental indicators: an introduction to the North Pannonian eulipotyphlan metacommunities

B234 **S. Pommerening**, **T. Martin** Digital reconstruction of masticatory musculature and jaw mechanics in Soricidae

B235 **P. Medina-González** Do all mesotheriids move alike? Functional signals from morphospaces and angular kinematics profiles

B236 **D.C. Kalthoff**, **J.N. Gelfo**, **T. Mörs** Enamel microstructure in Eocene Sparnotheriodontidae (Mammalia, Litopterna) from Antarctica and southern South America

B237 **L.T. Holbrook**, **D.A. Croft**, **B.L. Beatty**, **B. Wynd** Variation in metaconid morphology and the distribution of twinned metaconids in Perissodactyla, Cambaytheriidae, Anthracobunidae, South American native ungulates, and Desmostylia

B238 **J.A. Gajewski** First subadult skeleton of *Teleoceras aepysoma* (Perissodactyla, Rhinocerotidae): insights into morphology and ontogeny in a North American rhinoceros

B239 **M.A. Khan**, **Z. Gul** Dental defects in the late Miocene to middle Pleistocene Siwalik Perissodactyla from Pakistan

B240 **G.S. Goncalves**, **R. Barrick** Using mesowear analysis on *Teleoceras fossiger* and *Teleoceras aepysoma* material to understand feeding ecology

B241 **D.P. Kirson**, **A. Kitchener**, **S. Brusatte** A new perissodactyl from the Eocene London Clay of England

B242 **C. Janis**, **T. Gunnarsdottir**, **N. Trepp Centellas**, **J.A. MacLaren** The feet of anchitheriine horses: padding the evidence?

B243 **M. Hullot**, **C. Martin**, **J. Tissier**, **J. Clavel**, **D. Becker** Paleoecological impacts of major crises on species diversification: insights from the high-resolution fossil record of Perissodactyla during the 'Grande Coupure' in Europe

B244 **R. Rabenstein**, **S. Engels**, **J. Habersetzer**, **N.B. Simmons** Now there are eight—a new *Palaeochiropteryx* species (Mammalia, Chiroptera) from the Middle Eocene of Messel, Germany

B245 **H. Bouaziz**, **C. Lezin**, **N. Robin**, **M. Orliac** Fossil evidence of advanced nasal echolocation in late Eocene Hipposideridae (Yinpterochiroptera, Chiroptera) from Quercy, France

B246 **F.A. Perini**, **L.D. Salles**, **C.R. Moraes-Neto**, **L. Costeur**, **T. Lehmann**, **K.T. Smith**, **R.M. Beck**, **M. Orliac**, **S. Hand**, **N.B. Simmons** New insights into wing evolution in bats: comparative forelimb morphology and yangochiropteran relationships (Mammalia, Chiroptera)

Symposium: Ancient Biomolecules

B247 **E.A. Mulder**, **S. Bijl**, **K. Ignatyev**, **T. Geraki**, **A.S. Schulp** *Archaeopteryx* color and paleoecology illuminated by synchrotron X-ray Fluorescence and spectroscopy

B248 **G. González-Fortes**, **E.M. Fernández-Bejarano**, **E. Trucchi**, **A. Grandal-D`Anglade** New genomic data shed light on the biogeographic history of *Lynx lynx* in Western Europe

B249 **C. Pessoa de Lima**, **R. Sansom**, **M. Buckley** The diagenesis of dental enamel proteins in different pH solutions during a thermal degradation experiment

B250 **M. Tagliavento**, **J. Tejada** Testing the preservation of $\delta^{15}N$ in intra-crystalline amino acids

B251 **N. Robin**, **H. Bouaziz**, **C. Lezin**, **M. Orliac** 'Immediate' phosphatization: understanding exceptional fossilization in the Quercy mummies (Eocene–Oligocene of France; MEDUSE-P)

B252 **B.T. Fuller**, **G.B. Davies**, **V. Grimes**, **M.A. Mannino**, **G. Van Biesen**, **K.E. Campbell**, **R. Dunn**, **E. Lindsey**, **J. Southon**, **M.R. Waters** 45,000 years of California turkey (*Meleagris californica*) paleoecology at Rancho La Brea reconstructed with radiocarbon dates paired with bulk and amino acid isotopic measurements

B253 **J.D. Ayala**, **W. Mason**, **E.R. Schroeter** Evaluating targeted hemoglobin extraction from extant and diagenetically altered bone

B254 **K. Penkman** Building a future for Ancient Biomolecular research & researchers

Mammalian Ecology & Biogeography

B255 **J. McMinn**, **E. Saupe**, **A. Goswami**, **A. Farnsworth** How has the biogeography of Gondwanan mammal clades varied across deep time?

B256 **L.D. Gilmore**, **S. Gili**, **P. Hagge**, **A. Akhtar**, **K. Hoppe**, **E. Niespolo**, **J. Higgins** Ca isotopes in tooth enamel and its potential for paleoenvironmental reconstruction

B257 **I.R. Newbins**, **R. Rogers**, **M.T. Carrano**, **G.P. Wilson Mantilla** New occurrences of eutherian mammals in the Judith River Formation of north central and central Montana: implications for eutherian biogeography in Laramidia during the Late Cretaceous (Campanian)

B258 **S.L. Shelley**, **J.J. Eberle**, **G.M. Erickson**, **P.S. Druckenmiller** New high-latitude multituberculates reveal mammalian dispersals and endemism in Late Cretaceous Alaska

B259 **H.E. Nuttall**, **J.T. Flannery-Sutherland** The great Gondwanan adventure: mapping the dispersal of metatherian mammals in the Palaeocene

B260 **A.W. Peng**, **N. Famoso** Investigating the effects of sample size on diversity and disparity measures in fossil assemblages of the John Day Basin, Oregon, USA

B261 **R. Weppe**, **G. Guinot**, **F. Condamine**, **F. Lihoreau**, **M. Vianey-Liaud**, **L. De Bonis**, **C. Blondel**, **M. Orliac** Drivers of the mammalian Grande Coupure in Western Europe at the Eocene–Oligocene transition

B262 **N. Baird** Tracing the formation of the North American hot deserts since the Miocene via mammalian paleoecology and body size distribution

B263 **S. Cote**, **K.P. McNulty**, **D.J. Peppe**, **A.L. Deino**, **M.W. Kioko**, **C. Ochieng**, **K.E. Jenkins**, **A.S. Hall**, **J. Head**, **J. Siembo** Meswa Bridge (~23 Ma) is now Tonde Bridge (21.4 Ma)

B264 **J. Sun**, **F. Bibi**, **I. de la Torre** Biogeography and community structure of Eurasian and African large mammals from the Late Miocene to the present: continental-scale turnover, functional stability, and no wave of dispersal associated with *Homo* out of Africa

B265 **S. Zubaid**, **A. Parker**, **J. Glöggler**, **M. Waseem**, **M. Tallavaara**, **L. Liu**, **J. Saarinen**, **I. Zliobaite** Dental ecometrics as a tracer of climatic change during Late Neogene in the Siwaliks

B266 **D. R. Ramoni**, **M. Montellano Ballesteros** Neogene–Quaternary biogeographic structuring of the mammalian associations in northern South America

B267 **F. Bibi**, **E. Abdallah**, **R. Bussert**, **A. Huseen**, **B. Kraatz**, **J. Müller**, **S. Tsukamoto**, **K. Salih**, **J. Zhang**, **A. Eisawi** PALEONILE: A new window onto the Mid–Late Pleistocene of Northeast Africa

B268 **A. Couzens**, **F. McInerney**, **G. Prideaux** Stable isotopes reveal dynamics of dietary change amongst late Cenozoic Australian herbivores

B269 **N.K. Turner**, **E.H. Reed** Bite at the end of the tunnel: a review of the taphonomic effects of large marsupial carnivores from Pleistocene Australia

B270 **T.L. Bampton**, **E.H. Reed**, **L. Arnold**, **M. Demuro**, **L. DeSantis**, **S.J. Bourne** Unravelling possible extinction drivers for Australia's Quaternary giants: using stable isotope analysis to reconstruct community level ecology of Late Pleistocene mammals from Naracoorte, South Australia

B271 **Y. Fernandez-Jalvo** Biostratigraphic and taphonomic studies from Middle–Late Pleistocene fossil mammals assemblages in the Argentine Pampas

B272 **I. Eijkelboom**, **L. van der Sluis**, **M. Gianni**, **F. Busschers**, **A.S. Schulp**, **T. Higham**, **F. Wesselingh** Reassessing late Quaternary megafaunal occurrences in Doggerland through amino acid ^{14}C dating

Synapsida

B273 **K. Nicholas**, **M. Malone**, **S.S. Sumida** New information and a three-dimensional digital atlas of an unusual stapes of *Dimetrodon* (Amniota, Synapsida, Sphenacodontidae) from a remarkably well-preserved specimen from the early Permian Clear Fork Formation of north-central Texas

B274 **N.I. Cookson**, **H. Sues**, **C.A. Sidor**, **A. Mann** Postcranial osteology of the gorgonopsian *Cyonosaurus,* and the impacts of postcranial characters on the phylogeny of Gorgonopsia

B275 **A. Mann**, **B.R. Peecook**, **C.A. Sidor** Cranial osteology of the large rubidgeine *Dinogorgon* from the upper Permian upper Madumabisa Mudstone Formation of Zambia

B276 **B.P. Stuart**, **A. Huttenlocker**, **B.M. Weiss**, **J. Botha** New eutheriodont (Synapsida: Therapsida) specimens from the Permo–Triassic boundary locality Nooitgedacht 68 in South Africa

B277 **E.S. Lund**, **F.P. Wolvaardt**, **R.M. Smith**, **J. Jodder**, **J. Benoit** Re-description of the Triassic cynodont *Cistecynodon parvus* and reassessment of its phylogeny

B278 **J.K. Lungmus**, **K.D. Angielczyk** Postcranial anatomy of a rare Emydopoidea: insights from *Compsodon helmoedi*

B279 **J. Benoit**, **L. Legendre**, **R. Araújo**, **F. Abdala**, **K.D. Angielczyk** The paleoneurology of *Lystrosaurus* (Therapsida, Dicynodontia) through the end-Permian Mass Extinction

B280 **J.L. Pinto**, **A. Huttenlocker**, **K.D. Angielczyk**, **J.J. Flynn**, **A. Wyss**, **L. Ranivoharimanana** An update on placeriine dicynodonts: comparative histology, a new taxon, and reorganized phylogeny reveal diversity in body size and life histories

Ichnology & Paleobiology

B281 **B.H. Lauer**, **R. Lauer**, **C. Duffin**, **D.J. Ward**, **A. Ward** Enigmatic sideritic coprolites from Madagascar

B282 **M. Roy**, **C. Widga** Walking Before Giants: Triassic fossil trackways from the Newark Basin and their evolutionary and behavioral implications for neotheropod dinosaurs

B283 **I.S. Hutchinson**, **C. Redman**, **R. Souberlich**, **Y. Sarubbi Jacks**, **C. Colman**, **A.D. Apgar**, **E. Koren**, **S. Fryberger**, **J.R. Moore** Evaluating trace fossil preservation in a megafan system: new insights from along the Pilcomayo River, Paraguay

B284 **J.R. Moore**, **C. Redman**, **R. Souberlich**, **Y. Sarubbi Jacks**, **C. Colman**, **A.D. Apgar**, **I.S. Hutchinson** Future fossils on fans: A four-year time-series of bone degradation in megafan environments from the Pilcomayo Fan, Paraguay

B285 **C.J. McClellan**, **B. Britt**, **R. Scheetz** The impact of insects on the fossil record: examples of insect-modified bones from the Yellow Cat Member of the Cedar Mountain Formation of Utah, USA

B286 **A.D. Apgar**, **H. Qiao**, **L. Scuderi**, **E. Saupe**, **A.T. Peterson**, **J. Soberon**, **J.R. Moore**, **C. Myers** Virtual taphonomy: examining preservational megabias in a simulated world

B287 **E. Straube** Unearthing the future: exploring implications of geographic range dynamics in the fossil record

B288 **J.S. Mitchell** Comparing ancient & modern gut contents: how do major groups differ in predatory style?

B289 **M. Mead**, **K. Kverkova**, **S. Grendeus**, **M. Osvath**, **P. Nemec**, **L.M. Witmer**, **S. Brusatte** Exploring the Endothermic Brain Hypothesis: did neuron numbers and the metabolism co-evolve?

B290 **E. Steell**, **A. Hsiang**, **A. Chen**, **D.J. Field** Relative homoplasy index: revealing patterns of homoplasy in discrete phylogenetic datasets with a new cross-comparable index

B291 **C. Scutt**, **N. Cooper**, **G. Thomas**, **T. Guillerme** Disparity analyses are robust to ancestral state estimation uncertainty

B292 **A. Capobianco** How many characters are needed to reconstruct a phylogeny?

B293 **J.S. Silviria** Direct inference of ontogenetic pathway networks in PhyG: A viable alternative to 'cladistic' Relative Maturity Assessment and ‘reticulistic’ Ontogenetic Sequence Analysis?

B294 **F.M. Holwerda**, **V. Díez Díaz**, **M. Belvedere**, **M. Depraetere**, **I. Alberti**, **J. Liston**, **D. Schwarz** How should I publish my digital fossil? Recommendations for the publication of comprehensive 3D datasets in palaeontological studies

Friday Morning, November 14, 2025
Symposium: Evolution of Triassic Non-Marine Tetrapod Communities Through Time I
Meeting Room Hall 1
Moderators: Eudald Mujal and Stephen Spiekman

8:00 **E. Mujal**, **A. Miralles-Carreras**, **H. Sues**, **R. Moreno**, **J. Schaeffer**, **G. Sobral**, **S. Chakravorti**, **S. Spiekman**, **R.R. Schoch** Revisiting the Triassic in the Central European Basin: evolution of terrestrial tetrapod communities and their environments

8:15 **P.A. Viglietti**, **K.D. Angielczyk**, **A. Huttenlocker**, **J. Botha**, **R.M. Smith**, **J. Crowley**, **C. Browning**, **C.P. Abbott**, **T.M. Seerane** Survival and recovery in the Triassic Karoo Basin: insights from Bayesian age models and paleoecological patterns

8:30 **R.M. Smith**, **F.P. Wolvaardt**, **J. Cisneros**, **F. Pinheiro**, **J. Bevitt**, **J. Benoit** Skeletal accumulations of the parareptile *Procolophon trigoniceps* reflect fossorial response to Early Triassic climatic instability across southern Gondwana

8:45 **C.H. Woolley**, **C.A. Sidor**, **N.D. Smith**, **M. Whitney**, **P. Makovicky**, **A. Shinya**, **R.B. Benson**, **J.A. McIntosh** New digital data advances our understanding of Early Triassic reptile diversity at the bottom of the world (Fremouw Formation, Antarctica)

9:00 **F.B. Tolchard**, **K. Dollman**, **J.P. Hancox**, **A.B. Heckert**, **J. Botha**, **J. Choiniere** New insights into the Early Triassic archosauromorph radiation from a South African Lagerstätte site

9:15 **G. Sobral**, **M.D. Ezcurra** The paleobiology of *Prolacerta broomi*: inferences from paleoneurology

9:30 **V.D. Neto**, **A. Machado**, **A. Martinelli**, **M.D. Ezcurra**, **C. Schultz**, **Á. Da-Rosa**, **A. Ribeiro**, **T.R. Simoes**, **S.E. Pierce**, **F. Pinheiro** The western Gondwana as a window into archosauromorph diversification following the end-Permian mass extinction

9:45 **R. Irmis**, **A.C. Mancuso**, **R. Mundil**, **C.A. Marsicano**, **V. Krapovickas**, **K.D. Angielczyk** Definitive Early–Middle Triassic vertebrate assemblages from Argentina and their implications for non-marine ecosystem evolution

10:00 Coffee Break

10:15 **F. Pinheiro**, **A. Machado**, **V. Paes Neto**, **A. Farnsworth**, **T.R. Simoes**, **S.E. Pierce** News from the South: a Brazilian Perspective on the Triassic Evolutionary Upheaval

10:30 **D. Foffa**, **S.J. Nesbitt**, **M.R. Stocker**, **B.T. Kligman**, **A. Marsh**, **W.G. Parker**, **R. Butler** The vertebrate fauna of the Moenkopi Formation, including a new microvertebrate locality, and the diversification of low-latitude Triassic communities

10:45 **M. Scipione**, **E. Knutsen**, **E.M. Roberts**, **J. Esterle**, **R. Vaucher** Revised Triassic chronology of the Rewan Group and its implications for vertebrate recovery in the Northern Bowen Basin

11:00 **E. Knutsen**, **M. Scipione**, **A.M. Turner**, **R. Vaucher**, **D. Konovalov**, **J. Bevitt** A new look at the Triassic of Queensland, Australia

11:15 **S. Spiekman**, **C. Foth**, **V. Rossi**, **T.S. Slater**, **O. Bath Enright**, **K. Dollman**, **G. Serafini**, **M.E. McNamara**, **H. Sues**, **R.R. Schoch** A drepanosauromorph from the Grès à Voltzia fossil Lagerstätte (early Anisian) of northeastern France reveals early diversification of integumentary appendages among Diapsida

11:30 **C.F. Kammerer**, **Z.T. Kulik**, **K.D. Angielczyk** A new species of *Dolichuranus* from the Manda Beds of Tanzania and dicynodont diversity through the Triassic

11:45 **B.M. Weiss**, **R.B. Benson**, **S.J. Nesbitt**, **K. Dollman**, **K. Chapelle**, **R.B. Sookias**, **J. Choiniere** The evolution of terrestrial pseudosuchian body size and posture through the Triassic

12:00 **S. Chakravorti** Ecomorphospace partitioning in Gondwana: testing niche conservatism vs. diversification models in post-Permian Indian temnospondyls

Friday Morning, November 14, 2025
Technical Session X: Paleontological Practices
Meeting Room Hall 4
Moderators: Kiersten Formoso and Akiko Shinya

8:00 **M.T. Miller**, **J. Corcoran**, **A. Naughton**, **P. Towler** Criteria for improving the educational content of extinct organisms in children's print media at the Department of Paleobiology, National Museum of Natural History (NMNH), Smithsonian Institution

8:15 **A.J. Roberts**, **W. Erlien**, **Ø. Sørborg**, **Ø. Hammer**, **J. Hurum** Bringing paleontology into the classroom: a digital teaching unit on evolution using ongoing research

8:30 **K.K. Formoso**, **S.A. Ludwig** Using Discord-based community gaming servers as a means to teach paleontology

8:45 **K.B. Townsend**, **L. Thompson**, **C. Clifford**, **A. Friscia**, **P.C. Murphey**, **L. Stroik**, **P. Higgins, A. Kumpf** Race to adapt: engaging diverse public audiences with vertebrate responses to climate change via interactive media and field-based learning

9:00 **B. Minjin**, **B. Munkhbat**, **U. Tumen**, **B. Munkh-Ochir**, **E. Batbayar**, **M. Ulziitogtokh**, **U. Eren** Bringing paleontology to remote communities in Mongolia

9:15 **M.F. Chavez-Hoffmeister** Paleontological assessment of Atacama, Chile: a model for fossil heritage protection

9:30 **E.L. Bernard**, **T. Fogerty**, **L. Gallagher**, **D. Tangunan**, **J. Witts**, **P. Bown**, **R. Twitchett** Unlocking dark data in historic collections to address key scientific questions: a case study of the Chalk fish from Southern England

9:45 **J.C. Sagebiel** Reevaluation of a destructive sampling program

10:00 Coffee Break

10:15 **K.M. Melstrom**, **J.K. Lungmus** Bite-sized scanning: small object digitization using intraoral scanners

10:30 **E. Ghezzo**, **E. Kustatscher**, **G. Marramà**, **G. Carnevale**, **B. Cavalazzi**, **L. GIusberti**, **M. Massironi** HYPERPAST—non-invasive fossil screening for material identification, preservation assessment, and conservation management

10:45 **L. Hall**, **E.T. Metz**, **E. Lamm**, **C. Knight**, **L. Meld**, **D.D. Johnson**, **J. Scannella** Operational impacts and recovery of a paleontology research program following the COVID-19 pandemic: a case study from Museum of the Rockies

11:00 **S.R. Johnston**, **C. Green** Testing the critical failure of Paraloid B-72 under various stresses

11:15 **A. Shinya**, **J. Holstein**, **E. Fitzgerald**, **C. Van Beek**, **A. Sucher**, **F. Herrera** Stabilizing a large fossil specimen from the Green River Formation for long-term conversation and display

11:30 **M.A. Balk**, **FAIR OS RCN** Early career researcher needs, challenges, & opportunities in ethical open science

11:45 **E. Dunne**, **N. Raja**, **T. Halliday**, **E. Vlachos**, **P. Medina-García**, **T. Wong Hearing**, **T. Clements**, **B. Gee**, **E. Tschopp**, **S. Greene** Entitlement: the naming and claiming of dinosaur species

12:00 **M. Brown** Specimens as intellectual property: implications for preparation, collections management, and authorship

Friday Morning, November 14, 2025
Technical Session XI: Crocs & Turts
Meeting Room Hall 8
Moderators: Michela Johnson and Suresh Singh

8:00 **W. Foster**, **P. Gensbigler**, **T. Lyson**, **G.S. Bever** Early morphogenesis of the turtle body wall: a new origin model for the turtle carapace based on fossils and embryos

8:15 **G. Hermanson**, **S.W. Evers** Distinct disparity trajectories characterize the evolution of cranial and shell morphology of turtles

8:30 **S.W. Evers**, **G. Hermanson** Drivers and constraints in the evolution of the turtle body plan

8:45 **A.D. Cornille**, **K.A. Beguesse**, **F. Clarac**, **E. Wolff**, **P. Asbach**, **C. Zinner**, **F. Witzmann** The osteopathology of extant crocodiles as a window into the paleopathology of phytosaurs and other extinct archosauriforms

9:00 **M. Bhat**, **T. Cullen**, **R. Wilhite** Growth dynamics and histological variation of *Alligator mississippiensis*: implications for archosaur physiology

9:15 **J. Fronimos**, **R. Wilhite** Soft-tissue anatomy of intervertebral joints in *Alligator mississippiensis*

9:30 **J.M. Clark**, **A.A. Ruebenstahl**, **H. Li**, **S. Bi** *Platyognathus* from the Lower Jurassic Lufeng Formation of Yunnan extends the record of gobiosuchid crocodyliforms back 67 million years

9:45 **M. Johnson**, **E. Mujal**, **E.E. Maxwell** Traumatic face-biting in a teleosauroid crocodylomorph and implications for conspecific interactions

10:00 Coffee Break

10:15 **M. Rabi**, **J.D. Walter**, **A. S. Paiva**, **T. Massonne**, **É. Bergerot**, **J. Martin**, **M. Delfino** Ain't no 'greater alligator': *Deinosuchus* reconsidered as a giant stem-crocodylian apex predator widespread due to saltwater tolerance

10:30 **D.R. Leaphart**, **K. Lindblad**, **J.W. Moreno-Bernal**, **C.A. Brochu** Phylogenetic relationships of *Borealosuchus griffithi* and potential challenges to the monophyly of *Borealosuchus*—insights from a new specimen from the Paleocene Ravenscrag Formation of Saskatchewan

10:45 **S.A. Singh**, **T. Stubbs**, **L. Mander**, **T.F. Rangel**, **P.B. Holden**, **N. Edwards** Ecological and environmental controls on crocodyliform diversity and macroevolution in South America across the Cenozoic

11:00 **D. Hoffman**, **C.S. Nicholl**, **P.D. Mannion** Evolution of growth dynamics in Notosuchia informed by osteohistology of the Eocene notosuchian crocodyliform *Sebecus icaeorhinus* with implications for survivorship across the K–Pg mass extinction

11:15 **A.P. Cossette**, **J. LeBlanc**, **N. Pyenson**, **F. Sakal** The first crocodylian from Qatar: a new species of tomistomine from the early Miocene (Aquitanian and Burdigalian) Dam Formation

11:30 **R.M. Salas-Gismondi**, **T.M. Scheyer**, **M. Delfino**, **R. Sánchez**, **J.D. Carrillo-Briceño**, **C. Zamora-Vega**, **M.R. Sánchez-Villagra** A systematic reassessment of giant *Gryposuchus* and *Hesperogavialis* species (Crocodylia, Gavialidae) from the late Miocene of Venezuela

11:45 **D. Li**, **T. Yang**, **N. Klein** Bone histology reveals the life history and niche of the oldest crocodilian fossil from Taiwan

12:00 **S. Bhardwaj Lock**, **J. Hansford**, **S. Turvey**, **A.M. Jukar**, **P.D. Mannion** Understanding the paleoecology and extinction dynamics of the Cuban crocodile (*Crocodylus rhombifer*) across the Holocene Caribbean

Friday Afternoon, November 14, 2025
Symposium: Evolution of Triassic Non-Marine Tetrapod Communities Through Time II
Meeting Room Hall 1
Moderators: Randall Irmis and Gabriela Sobral

1:45 **M.D. Ezcurra**, **F.E. Novas**, **F.L. Agnolín**, **L.E. Fiorelli**, **B. von Baczko**, **A. Martinelli**, **J.A. Garcia Marsà**, **M. Trotteyn**, **J.B. Desojo** New specimens of *Lewisuchus admixtus* (early Carnian, Argentina) inform about the origin of the dinosaur body plan

2:00 **Z. Qin**, **S. Maidment**, **K. Dollman**, **L. Meade**, **I.J. Sansom**, **V. Fernandez**, **S. Lautenschlager**, **R. Butler** Pneumatic cavities and pneumosteum in Triassic dinosauriform vertebrae reveal deep evolutionary origins of the avian respiratory system

2:15 **C. Griffin**, **D. Munyikwa**, **M. Zondo**, **T. Broderick**, **S.J. Nesbitt**, **V. Trinidad**, **S. Tolan** Large body sizes were widespread among the earliest carnivorous dinosaurs

2:30 **M. Talanda**, **D. Drózdz**, **J.B. Desojo**, **E. Teschner**, **V. Fernandez**, **T. Sulej** Early development of aetosaurs (Archosauria, Pseudosuchia)—a key to their success in the Late Triassic ecosystems?

2:45 **H.E. Burch**, **M.R. Stocker**, **A. Dineen**, **D. Foffa**, **S. Kryder**, **E. Keeble**, **B.T. Kligman**, **A. Marsh**, **W.G. Parker**, **S.J. Nesbitt** Composition, trophic interactions, and community structure of a diverse Upper Triassic microvertebrate assemblage from the Chinle Formation of northeastern Arizona, USA

3:00 **S. Srivastava**, **C. Colleary**, **C. Griffin**, **S.J. Nesbitt** Combining perspectives on archosaur ontogeny reveals the first multitaxic assemblage of "sphenosuchians" from the same Upper Triassic vertebrate community

3:15 **T.M. Scheyer**, **J. Bestwick**, **J.B. Desojo**, **F. Miedema**, **S. Herter**, **U. Bachmann**, **B. Pabst** Recent excavations in the Upper Triassic '*Plateosaurus'* graveyard of Frick, Canton Aargau, northern Switzerland, revealed unexpected taxonomic diversity by abundant novel small vertebrate remains (Reptilia, Diapsida)

3:30 **J. Lovegrove**, **S. Beeston**, **P.D. Mannion**, **P. Upchurch**, **P.M. Barrett** Dinosaur of the round table: a redescription of the Late Triassic dinosaur *Camelotia borealis* highlights its importance to our understanding of sauropod origins

3:45 **J. Botha**, **J. Choiniere**, **A. Moopen**, **K. Chapelle**, **Z.T. Kulik**, **R.B. Benson** Growth strategy did not influence the survival of sauropodomorph dinosaurs through the end-Triassic extinction

4:00 **B.T. Kligman**, **R.L. Whatley**, **J. Ramezani**, **A. Marsh**, **T. Lyson**, **A.J. Fitch**, **W.G. Parker**, **A.K. Behrensmeyer** Microvertebrate bonebeds with radioisotopic dates—bridging the gap in non-marine paleocommunities preceding the end-Triassic extinction

Friday Afternoon, November 14, 2025
Technical Session XII: Mesozoic & Cenozoic Fishes
Meeting Room Hall 4
Moderators: Samuel Cooper and Jennifer Hoeflich

1:45 **S. Cooper**, **E.E. Maxwell** Unique early-diverging pachycormid fish (Pachycormiformes) elucidates the origins and early evolutionary history of the group

2:00 **G. Afonso**, **M. Friedman**, **M. Pastana**, **E.J. Hilton** Body elongation in Osteoglossomorpha (Teleostei): evolutionary patterns revealed by fossil taxa

2:15 **J. Hoeflich**, **J. Liu** Understanding North American catfish evolution through hearing reconstruction using Dynamic Finite Element Methods

2:30 **J. Liu**, **M. Newbrey** Opening a window to a warm Earth: age and growth of catostomid fishes from the Eocene Okanagan Highlands in North America

2:45 **S. Kim**, **G. Larocca Conte**, **J. McCormack**, **M. Bazzi**, **P.A. Holroyd**, **J. Kriwet**, **T. Mörs** Exploring ecological niche overlap among Eocene sandtiger sharks from La Meseta Formation in Seymour Island, Antarctica

3:00 **D. Cirtina**, **M.E. McNamara**, **V. Rossi** Melanosome geometry in fish illuminates light modulation strategies through deep time

3:15 **J. Cooper**, **C. Pimiento** Functional diversity of sharks through time: past, present and future

3:30 **S. Stumpf**, **E. Villalobos-Segura**, **F.A. López-Romero**, **G. Cuny**, **J. Kriwet** Decoding the demise of hybodontiforms: phylogenetic clues to a Mesozoic mystery

3:45 **M.A. Staggl**, **E. Straube**, **P.L. Jambura**, **E. Villalobos-Segura**, **F.A. López-Romero**, **M.J. Steinbauer**, **M.J. Benton**, **J. Kriwet** Environmental drivers of neoselachian diversity and turnover across the Mesozoic and Cenozoic

4:00 **A. LeBlanc**, **M. Caldwell** What is 'Bone of Attachment'? Re-discovering Tomes' histological sections and its implications for gnathostome tooth attachment tissue homology

Friday Afternoon, November 14, 2025
Technical Session XIII: Euarchontoglires
Meeting Room Hall 8
Moderators: Jukka Jernvall and Thomas Puschel

1:45 **M. Rose**, **J.I. Bloch**, **D.M. Boyer**, **S.G. Chester**, **K.D. Rose**, **E.J. Sargis**, **M.T. Silcox** The first known dentally associated postcrania of a microsyopid plesiadapiform (Mammalia, Euarchonta) from the Eocene of Wyoming reveals specialized traits of the wrist and ankle

2:00 **S. López-Torres**, **A.S. Hall**, **K.E. Jenkins**, **T. Lehmann**, **L. Michel**, **S. Muteti**, **D.J. Peppe**, **K.P. McNulty** An exceptionally well-preserved maxilla of *Komba walkeri* (Galagidae, Primates) from the Early Miocene of Rusinga, Kenya

2:15 **E.C. Kirk**, **M. Brown**, **C.D. Henry**, **S.V. Olson**, **B. Rodwell** New late Duchesnean primates from the Tornillo Basin of Texas: implications for primate endemism in North America and the timing of the Duchesnean–Chadronian transition

2:30 **R.F. Kay**, **C. Organ**, **P.E. Morse**, **K. Allen**, **E.C. Kirk** Visual inputs drove neocortex size increases in crown primates: evidence from a comparative analysis of extant and fossil euarchontan endocasts

2:45 **Z. Chen** Mitogenomes of the extinct and extant species within the *Nomascus* genus add new insights into gibbon evolution, species identification, and their past movements.

3:00 **T.A. Puschel**, **J. Avaria-Llautureo**, **A. Meade**, **J. Baker**, **S. Nicholson**, **C. Venditti** The radiation and geographic expansion of primates through diverse climates

3:15 **C. Venditti**, **T. Püschel**, **J. Avaria-Llautureo** Female driven reduction of sexual dimorphism in hominins

3:30 **J. Gardner**, **T. Püschel**, **S. White**, **M. Sakamoto**, **C. Venditti** Hominin body mass increased between but not within species over time

3:45 **C. Badgley**, **R.C. Terry**, **F.C. Hardy**, **T.M. Smiley**, **D.L. Fox**, **B. Yanites**, **S. Hopkins**, **J. Arroyo-Cabrales** Of mice and mountains: small-mammal diversity and mountain building past and present

4:00 **J. Jernvall**, **A. Kaffash Hoshiar**, **O.E. Stenberg**, **O. Hallikas** Linking continuous to discontinuous variation in the increase of mammalian dental complexity

Friday Afternoon, November 14, 2025

Regular Poster Session III
Meeting Room Hall 3
Authors must be present from 4:30 – 6:30 p.m. on Friday, November 14

Symposium: Triassic

B295 **A.M. Turner**, **E. Sherratt**, **F. Witzmann**, **D. Konovalov**, **J. Bevitt**, **C. Hoskin**, **E. Knutsen** Revisiting *Lapillopsis nana* from the Triassic Arcadia Formation of Central Queensland, Australia

B296 **P.E. Olsen**, **B. Slibeck**, **N.G. McDonald** Keeping grounded: podathecae, feature scales, and feathers—tracks, simple-minded cladistic thinking, and the insulated ancestral state condition in the Avemetatarsalia

B297 **E. Teschner** Triassic time of transitions: does the high growth pattern variability within Archosauriformes have a palaeclimatic origin?

B298 **D. Schwarz**, **S. Lautenschlager**, **S. Van Wassenbergh**, **R.R. Schoch** Feeding the dead: I. *Mastodonsaurus giganteus*

Crocs & Turts

B299 **F.J. Torres**, **E. Huang**, **G.S. Bever** Genetic polymorphism, morphological evolution, and the origin of turtles

B300 **R. Piechowski**, **D. Drozdz**, **J.R. Hutchinson**, **J. Zariwala**, **T. Szczygielski** Whose tracks are these? 3D reconstruction of the fossil turtle *Proganochelys quenstedtii* to estimate its locomotion—preliminary results

B301 **T.J. Stock**, **J.F. Parham** A well-preserved specimen of fossil sea turtle sheds light on the evolution of pelagic specializations

B302 **S. Tada**, **R. Hirayama**, **S. Kawabe**, **T. Ikeda**, **T. Tanaka** Cranial morphology of *Mesodermochelys undulatus* (Testudines: Chelonioidea) and its systematic revision

B303 **B. Radstaak**, **M. Caldwell**, **D. Brinkman** Newly described *Chelosphargis advena* specimen from Niobrara, Kansas allows for better understanding of Cretaceous protostegid phylogenetics (Protostegidae, Chelospharginae)

B304 **J.C. Menon**, **W. Joyce** New data on the homology of the midline elements of the turtle shell exemplified by *Glyptochelone suyckerbuykii* (Ubaghs 1879), an enigmatic fossil sea turtle (Pan-Chelonioidea) from the Late Cretaceous of Europe

B305 **J. Sterli**, **E. Vlachos**, **J. Cuitiño**, **I. Cerda**, **C. Garnier**, **M. Buono** The southernmost and first occurrence of a leatherback turtle in the Southern Hemisphere in the Neogene

B306 **C. Mazier**, **R. Amiot**, **J. Martin**, **A. Vinçon-Laugier**, **L. Leuzinger**, **L. Kocsis**, **C. Meyer**, **J. Anquetin** The ecology of Late Jurassic turtles from Europe revealed by oxygen isotope compositions ($\delta^{18}O$)

B307 **G.E. Spicher**, **P. Gueriau**, **K. Peyer**, **V. Reneleau**, **W. Joyce**, **J. Anquetin** Revision of the turtles from the Upper Jurassic Canjuers lagerstätte (SE France)

B308 **J. Anquetin**, **N. Bouchema**, **N. Vallée-Gillette**, **R. Roch**, **S. Olive**, **N. Robin**, **P. Godefroit**, **L. Cavin**, **S. Maksoud**, **D. Azar** A new Pan-Chelidae (Testudines, Pleurodira) from the Early Cretaceous of the northern margin of Gondwana (Lebanon)

B309 **B.A. Clark**, **Z. Hannebaum**, **D.J. Varricchio** High resolution CT scanning reveals a new macrobaenid turtle from the Cenomanian Blackleaf Formation, Montana

B310 **S.M. Bellotti**, **S.W. Evers**, **Y. Rollot**, **W. Joyce**, **D. Brinkman** Ontogenetic and intraspecific variation in the Campanian baenid turtle *Plesiobaena antiqua*

B311 **H.F. Smith**, **B. Adrian**, **B.F. Mohler** New Campanian plastomenid turtle material from the San Juan Basin, New Mexico, and a reassessment of the genus *Helopanoplia*

B312 **J.A. Wilson Mantilla**, **D.M. Mohabey**, **A. Dhobale**, **B. Samant**, **A.J. Tholt**, **P. Renne**, **S. Anantharaman**, **T. Tobin**, **G.P. Wilson Mantilla** A new kurmademyine turtle from the Late Cretaceous–Paleocene intertrappeans of Upparhatti (Karnataka State), India

B313 **L.C. Girard**, **W. Joyce** The cranial and mandibular anatomy of soft-shell turtles (Trionychidae): a revised character list and phylogenetic analysis

B314 **Y. Pochat-Cottilloux**, **S. López-Torres**, **M. Chroust**, **G. Georgalis**, **M. Górka**, **M. Talanda** First occurrences of Trionychidae (Testudines, Cryptodira) from the Miocene of Poland expand the biogeographic range of the family

B315 **C.M. Simmons**, **J.K. Lungmus** New *Hesperotestudo* specimen from Western Oklahoma and the functional morphology of the humerus regarding testudine locomotion

B316 **Y. Liaw**, **C. Tsai** Old turtles, new stories: Pleistocene fossils from Taiwan reveal the past distributions of extant species

B317 **E.H. Bodenham**, **S. Spiekman**, **S. Maidment**, **P. Upchurch**, **P.D. Mannion** A second species of non-crocodyliform crocodylomorph from the Late Triassic fissure deposits of southwestern UK

B318 **H. George**, **M. Johnson** Osteology and ecology of the Middle Jurassic teleosauroid thalattosuchian *Neosteneosaurus edwardsi*

B319 **C.C. Pligersdorffer**, **M.T. Young**, **L.M. Witmer**, **Y. Herrera**, **O. Katsamenis**, **S. Brusatte** Hungry for more: neuroanatomical insights into the evolution of macrophagy in metriorhynchid crocodylomorphs

B320 **M.T. Young**, **E. Wilberg**, **Y. Herrera** Exploring the phylogenetic relationships of thalattosuchian crocodylomorphs

B321 **M. McKeown**, **S. Sachs**, **E. Wilberg** Estimating visual performance in metriorhynchoid thalattosuchians and other Mesozoic marine reptiles using preserved scleral rings

B322 **F.D. Urpia**, **C.C. Ferreira**, **R. Delcourt**, **D. Martucci**, **T. Fachini**, **A. Schmaltz Hsiou**, **M.C. Langer** Tooth morphology of *Pepesuchus deiseae* (Itasuchidae: Notosuchia), a Late Cretaceous crocodyliform from south-central Brazil

B323 **B. Rakotozafy**, **P.M. O'Connor**, **J.J. Sertich**, **J. Groenke**, **A.H. Turner**, **L. Ranivoharimanana** Ecomorphology of notosuchian crocodyliforms from Late Cretaceous (Maastrichtian) Maevarano Formation, northwestern Madagascar

B324 **C.S. Nicholl** New notosuchian phylogeny elucidates the complex evolutionary history of sebecid crocodyliforms

B325 **M. Stricklin**, **A.C. Pritchard**, **M.R. Stocker** Pain in the neck: first report of vertebral osteomyelitis in *Deinosuchus*

B326 **B.S. Salem**, **S. Saber**, **K. Ouda**, **A.S. Gohar**, **S. El-Sayed**, **P.M. O'Connor**, **H. Sallam** A middle Campanian dyrosaurid skull from Egypt illuminates the origin and early biogeography of the clade

B327 **S.A. Boerman**, **J. Vellekoop**, **S. Jouve**, **M. Rabi**, **N. Vallée-Gillette**, **T. Oudoire**, **T. Smith** Revision of the longirostrine crocodylian *Thoracosaurus isorhynchus* from the Maastrichtian–Danian of northwestern Europe

B328 **L. Barbini**, **M. Romano**, **P.D. Mannion** Digital reconstruction of the endocranial anatomy of species of the Cenozoic European crocodylian *Diplocynodon*

B329 **Y. Cho**, **C. Tsai** New *Alligator* fossils from Taiwan: the oldest record in tropical Asia

B330 **C.A. Brochu**, **S.K. Drumheller**, **C. Campisano**, **G. Tekle**, **T. Getachew**, **J. Head** Lucy's peril: a Pliocene crocodile from the Hadar Formation (Afar Regional State, Ethiopia) and its importance to understanding the phylogeny and biogeography of *Crocodylus* in the Cradle of Humanity

B331 **M.I. Bari**, **D. Chu** First preliminary report on crocodilian remnants from Brahmaputra River Bed, Bangladesh: a key to unveil Holocene fluvial system fauna

B332 **S. Newsom**, **M. Riegler**, **O.A. Mendez**, **L.W. Viñola-López**, **J.I. Bloch** Assessing the utility of enamel micro-structure in ziphodont crocodyliforms for taxonomy with applications to the fossil record

B333 **M.L. Gold**, **M.I. Natale Castillo** A freely accessible, digital, cranial atlas of hatchling *Gavialis gangeticus* and notes on the paranasal and paratympanic sinuses, endocranium and associated nervous structures, and ossification of the crista interfenestralis and the first three cervical vertebrae

B334 **M. Turala**, **B.W. Schubert**, **J.X. Samuels**, **D. Gunnin** Reconstructing body size of extinct crocodilians based on skeletal remains

B335 **J. Hansford**, **E. Saupe**, **S. Turvey**, **G. Varnham**, **M. Grace**, **H. Ma**, **P.D. Mannion** Incorporating the fossil record into modern species recovery objectives

Paleontological Practices

B336 **D. Levering** A sea of change: breaking down Sternberg Museum Science Camps as an alternative funding model in a time of crisis

B337 **L. Kells**, **A. Wang**, **J. Shatz**, **T. Sato** Fossil Preparation Training Program at the American Museum of Natural History

B338 **A.K. Hastings**, **G. DeVault** Pathologies and poop: developing an education kit for the Wannagan Creek Fossil Collection (Paleocene; North Dakota, USA)

B339 **L. Herzog** Science education through the lens of paleontology laboratory exhibit design at the North Carolina Museum of Natural Sciences

B340 **T.M. Seerane**, **G.M. Bybee**, **P.A. Viglietti** An analysis of *Lystrosaurus* Calcium apatite: insights into the survival strategies across the Permo–Triassic boundary

B341 **L.J. Hart**, **L. Tuohilampi** Exploring the benefits of palaeontology for education in Australia

B342 **A. Biju** Holistic grassroot outreach methods in India and their effectiveness in paleontological education

B343 **L.D. White**, **D.M. Leong** Bringing paleontology to life: engaging community college students through hands-on, specimen-based labs at the UC Museum of Paleontology

B344 **G.R. Hancock**, **L.M. Kastroll** The Camouflage Dinosaur Project: teaching ecology and evolution by hiding dinosaurs

B345 **R.J. Gay**, **C.I. Westermire**, **S.M. Lukowski**, **S. Werbeach**, **S. Rivera**, **A.E. Hall**, **T. Tran**, **E. Seymour** Regional implementation of a non-intrusive evaluation tool to assess program and educational quality

B346 **E. Bamforth** From Paddles to *Pachyrhinosaurus:* A novel public program provides a river raft-based fossil experience in northwest Alberta, Canada

B347 **M. Cone** Using pop-culture phenomenon to engage wider audiences in museum and informal learning spaces: integrating demographic and survey data to inform specialized outreach strategies for high-impact fossil programming

B348 **D. Anduza**, **E. Warner-Cowgill**, **J.I. Kirkland**, **D.D. DeBlieux**, **K.C. Rayburn**, **Q.C. Hawkins** LIVE from the field: paleontological fieldwork livestreams as impactful outreach

B349 **E. Koren**, **C. Redman**, **Y. Sarubbi Jacks**, **R. Souberlich**, **C. Colman**, **A.D. Apgar**, **I.S. Hutchinson**, **J.R. Moore** From the field to the feed: engaging the public with real-time paleontological research on the Pilcomayo megafan in Paraguay

B350 **A.E. Hall**, **M. Widdicombe** Virtual Fossil Friday: expanding museum education beyond walls and borders

B351 **B.K. Burke**, **A.E. Hall**, **B. Martens**, **A. Konrad** Strengthening the paleontological network: the case for sister museum partnerships between large and small institutions

B352 **M.L. Gold** Patching the 'leaky pipeline' in paleontology through *DrNeurosaurus*, a YouTube channel showcasing women paleontologists

B353 **K.L. Koeller**, **J.L. King** Dismantling barriers: grassroots inclusivity builds professional development in paleontology

B354 **A. Milner**, **J.C. Buchwitz**, **H.A. Carter**, **D. Anduza**, **C.A. Suarez**, **J.W. Martz**, **R.J. Gay**, **J.R. Lively**, **R. Irmis**, **J.I. Kirkland** The Substation Quarry (earliest Jurassic Moenave Formation): infrastructure development results in the discovery of important bonebeds through the cooperation of city government and city museum

B355 **V.D. Neto**, **M. Lacerda**, **A. Machado**, **F. Pretto**, **R.C. da Silva**, **M.B. Soares**, **F. Pinheiro**, **A.W. Kellner** The oldest dinosaur fossils ever collected in the Triassic of Brazil

B356 **M.E. Jones**, **E.L. Bernard**, **S. Pappa**, **N.F. Adams**, **M.O. Day**, **S. Maidment** The fossil vertebrate collections at the Natural History Museum, London, UK

B357 **E.G. Flint**, **J. Hoffman** Getting a head: the *Mammuthus exilis* Crania Preservation Project

B358 **P.A. Holroyd** Recovering lost contextual data from early excavations at the Rancho La Brea and McKittrick tar seeps, California, USA, and disambiguating imperfect data

B359 **G. DeVault**, **A.K. Hastings** Catalog number woes: strategies for digitizing a poorly-cataloged collection

B360 **V.R. Rhue** What goes in must come out: principles for leveraging relational databases to track transactions

B361 **J. Slowiak**, **K. Przestrzelska**, **T. Szczygielski** Conservation of the Mongolian dinosaur collection of the Polish Academy of Sciences

B362 **G. Wilbert**, **K. Davies**, **J.K. Lungmus** Restoring scientific access to historically mounted fossils containing asbestos-based texturing

B363 **W. Mones**, **T. Sato** Optimizing fossil repair: white graphite, pipe cleaners, and scaffold with adjustable 'finger'

B364 **B.J. Rotenberg**, **K. Abrams** Splash proof! Nesting sieve bins: a novel preparation method that prioritizes safety and efficiency in chemical preparation of fossiliferous concretions

B365 **T. Sato** A practical process for repairing and reinforcing damaged field jackets

B366 **V. Trinidad**, **R.W. McCune**, **T.G. Kaye**, **B.R. Peecook**, **M. Whitney** Methodological approaches to microfossil data collection: sorting vs. CT-scanning

B367 **E.I. De Santo**, **C. Redman**, **J.R. Moore** Tiny teeth make tiny holes: breakage patterns of microfossils from microvertebrates in the Chadronian and Orellan periods from the White River Group

B368 **J.K. Lubeek** A microtaphonomic assessment of Pleistocene fossiliferous cave sediments: implications for skeletal preservation of *Gigantopithecus blacki* in Guangxi, southern China

B369 **P. Kapur**, **B. Shipps**, **Z. Zamudio**, **M. Vandenberg**, **C.A. Sidor** 3-D modeling through a paleobiological lens: evaluating iPhone photogrammetry for assessing oral morphological complexity (via OPCr) in extant turtle skulls relative to micro-CT and DSLR techniques

B370 **Z. Zamudio**, **B. Shipps**, **P. Kapur**, **M. Vandenberg**, **C.A. Sidor** A comparison of 3D models created using photogrammetry and 3D models created using CT scanning using Orientation Patch Count (OPCr)

B371 **A.H. Crane**, **F. Alvarez-Borges**, **K.E. Rankin**, **C.E. Clarkin**, **K.A. Williams**, **N.J. Gostling** Limited-angle computed tomography (LACT): a simple approach to improve scan quality for plate-like fossils

B372 **A. Lanzetti** From slices to structures: speeding up segmentation of CT images of fossils using AI-assisted tools

B373 **M.G. Price** Between discovery and destruction: scientific access vs. conservation in a Pierre Shale crocodyliform

B374 **M. Hullot**, **X. Jordana**, **G. Billet**, **H. Gomes Rodrigues** Overcoming the challenges presented by the study of enamel histology in extinct mammalian orders: case study of toxodont notoungulates

B375 **E. Vickers** Fungal spores found in the dental pulp chamber of *Enchodus* ray finned fish (late Cretaceous) by scanning electron microscopy.

B376 **K. Prehm**, **B. Goode**, **K. Shimada** Using filtered longwave ultraviolet light to detect fossil shark teeth at night in the Upper Cretaceous Cliff House Sandstone Formation of the San Juan Basin in New Mexico, USA

B377 **S. Halvadwala** Validation of predictive modelling with field observation in the vertebrate paleontology of the Central Narmada Valley

B378 **N.L. Hiotis**, **M.N. Hutchinson**, **E. Sherratt**, **E.H. Reed** Character matrices vs. geometric morphometrics: evaluating uncertainty in frog fossil identification amid missing data

B379 **C. Zhang** Bayesian tip-dating integrating discrete and continuous morphological characters

B380 **J. Gardner**, **J. Baker**, **C. Venditti**, **C. Organ** Phylogenetic prediction outperforms other methods in simulated and real data

B381 **L. King** Dicynodonts, taxonomic pareidolia, and geomythology: a historical and ethnographic reassessment of South African cave art

B382 **L.C. Blincoe**, **E. Dunne**, **S. Lautenschlager** The price of preservation: commercial fossil purchasing, and the longevity of paleontological museums

B383 **F. Bibi** I'm just here for the fossils: Academic responsibility, political injustice, and the paleontologist as public intellectual

Mesozoic & Cenozoic Fishes

B384 **D. Conedera**, **A. Tintori**, **R. Gatto**, **S. Monari** In situ otoliths from Triassic Fishes

B385 **J. Li**, **Z. Sun** An unusual hybodontoid skull from the Middle Triassic of South China

B386 **D.S. Jasicki-Velin**, **M.R. Stocker**, **C. Flis**, **A. Marsh**, **D. Foffa**, **B.T. Kligman**, **S.J. Nesbitt** Bridging gaps in the fossil record: diagnostic features of fossilized shark cartilage from the Upper Triassic of southwestern USA

B387 **C. Duffin**, **D.J. Ward**, **B.H. Lauer**, **R. Lauer** New holomorphic specimen of *Hybodus fraasi* Brown, 1900—a very rare hybodont shark from the Late Jurassic of the Solnhofen Archipelago

B388 **K. Spence**, **J. Witts**, **E.L. Bernard**, **J. Brown**, **R. Twitchett** The size-temperature relationship in *Ctenothrissa* (Ctenothrissiformes) and *Macropoma* (Coelacanthiformes) in the Late Cretaceous UK Chalk Sea

B389 **R. Twitchett**, **C. Underwood**, **J. Witts**, **D. Tangunan**, **E.L. Bernard**, **S. Sinha**, **M. Sharma** Sharks of the English Chalk (Upper Cretaceous); extracting new data from classic collections

B390 **J. Doyon** The Late Cretaceous fishes of Lac des Bois, Northwest Territories, Canada: implications for marine conservation

B391 **E. Garcia**, **K. Shimada** The oldest North American occurrence of the extinct 'snouted' bony fish genus *Plethodus* (Tselfatiiformes, Plethodidae) from the mid-Cenomanian of Texas, USA

B392 **M.R. Sánchez-Villagra**, **J.D. Carrillo-Briceño**, **T. Argyriou** Marine ray-finned fishes from the Cenomanian–Turonian of the La Luna Formation in Venezuela illuminate the Late Cretaceous biodiversity of the Proto-Caribbean

B393 **D. Ehret**, **K. Claeson**, **P.E. Olsen**, **J. Benedict** Late Cretaceous (Turonian) hybodont (Chondrichthyes, Hybodontiformes) egg capsules from New Jersey, USA

B394 **J. Liston**, **A.E. Maltese** The Coniacian dating game: Niobrara predatory behaviour and the dangers of swiping right revealed by palaeopathology

B395 **D. Brinkman**, **L.E. Nelson**, **A.M. Murray** Clarifying the taxonomy of North American *Enchodus* species: revisiting the specimens

B396 **A.L. Atwater**, **A.E. Maltese**, **M.J. Everhart** From feeding to fossil feces: connecting enigmatic trace fossils to a likely tracemaker in the Niobrara Formation of Western Kansas

B397 **J.W. Krakora** Shared growth changes in the dentary of *Cyclurus fragosus* and *Melvius thomasi* (Actinopterygii, Amiidae) from the Hell Creek Formation of Southeastern Montana: Evidence for developmental underpinnings of species differences

B398 **R.W. McCune**, **T.G. Kaye**, **B.R. Peecook**, **M. Whitney** A pathological description of a Late Cretaceous teleost vertebra: evidence of spinal trauma reveals Schmorl's node

B399 **J.G. Westgaard**, **H.D. Hanks**, **K. Shimada** Chondrichthyan teeth from Upper Cretaceous Coleraine Formation at the Hill Annex paleontological site in northern Minnesota, USA

B400 **A. Maréchal**, **A.S. Marques**, **M. Polcyn**, **A.S. Schulp**, **L.L. Jacobs** The latest Cretaceous fish fauna from the Mocuio Formation of Bentiaba (Namibe Basin, Angola)

B401 **E. Villalobos-Segura**, **S. Stumpf**, **M. Amadori**, **F.A. López-Romero**, **J. Kriwet** Phylogenetic insights into Mesozoic elasmobranch evolution

B402 **M. Kane**, **T.R. Simoes**, **T.A. Gates** A total evidence phylogeny of Carcharhiniformes sharks since the Cretaceous using dental morphological characters and genomic data

B403 **L.V. Williams**, **C. Pimiento**, **D. Silvestro**, **W. Allen** Are functional traits and tooth shapes conserved along the shark tree of life?

B404 **M. Amadori**, **M.A. Staggl**, **F.H. Mollen**, **E. Villalobos-Segura**, **J. Kriwet** Lines of distinction: morphometric tools for exploring past and present taxonomic diversities of galeomorph sharks

B405 **D.M. Leong**, **D. Kim**, **J. Liu** The cephalic lateral line in gars (Lepisosteidae): unique tubule structures and interspecific variations

B406 **L. Ridolfi**, **G. Marramà**, **G. Carnevale** Anatomy and phylogenetic relationships of two new Eocene species of *Argyropelecus* (Sternoptychidae) from the Pabdeh Formation, Iran

B407 **M. Montalvo**, **M. Friedman**, **E.J. Hilton** Osteology of palaeorhynchids from the Eocene Habib Rahi formation of Pakistan

B408 **PROGRAM ADJUSTMENT**

B409 **J.R. Carr**, **J.T. Deckhut**, **J.A. Case** The yabby crusher, a latest Oligocene, freshwater, durophagous fish from South Australia

B410 **M.P. Weinberg**, **E.Y. Hallett**, **J.N. Cerasoni**, **Y.E. Stuart** Threespine stickleback (*Gasterosteus doryssus*) fossil fish reveal taphonomic factors throughout Miocene time series

B411 **K. Reichmann**, **M. Mahoney**, **D. Long**, **K. Shimada** Body length estimates of the Miocene crocodile shark, *Pseudocarcharias* sp. (Lamniformes: Pseudocarchariidae) based on the extant crocodile shark, *P. kamoharai*

B412 **K. Shimada**, **M. Elstrup**, **H. Lauridsen**, **T. Sørensen**, **M. Siversson** The rediscovery of 'Bendix-Almgreen's' gigantic vertebral specimen of the extinct megatooth shark, *Otodus megalodon* (Lamniformes: Otodontidae), from the Upper Miocene Gram Formation in Denmark

B413 **E. Furman**, **A. Bush**, **J. Mead** Quaternary fish diversity in the southern Black Hills of South Dakota

Euarchontoglires

B414 **J.E. Stone**, **M. Godinot**, **S.L. Toussaint**, **D.M. Boyer** Adapiform (Primates) tarsal assemblage from the Prémontré Eocene fossil locality in France represents multiple species previously only known from dental material

B415 **S.L. Toussaint**, **M. Godinot**, **S. Ladeveze** Reinvestigation of the auditory bulla and postcranium of the *Plesiadapis* genus and its implications for the phylogenetic affinities of plesiadapiforms

B416 **PROGRAM ADJUSTMENT**

B417 **L. Zhang**, **B. Du**, **R. Hu**, **L. Zhao** Molar enamel thickness of late Miocene *Lufengpithecus lufengensis*: dietary adaptations and paleoecological implications

B418 **R. Germano**, **G. Rocha Leite**, **A. V. Araújo**, **M. Dantas**, **A. Liparini**, **J. Fleagle**, **H.I. de Araújo-Júnior**, **T. Rodrigues** Comparative dental microwear texture analyses of fossil, subfossil, and modern platyrrhine monkeys: implications for diet, adaptation, and sexual dimorphism

B419 **K. Suraprasit**, **K. Westaway**, **M. Duval**, **L. Tze Tshen**, **H. Bocherens** A new late middle Pleistocene fauna yielding *Pongo* from Krabi, peninsular Thailand

B420 **G.A. Assance**, **M. Lang**, **M.T. Silcox** Comparative sulcal morphology of Malagasy subfossil lemurs

B421 **H.E. Anderson**, **A.M. Burrows**, **C.J. Law**, **A.J. Lis**, **L. Mulvey**, **K.I. Nekaris**, **K.R. Selig**, **M.T. Silcox**, **S. López-Torres** Exploring interrelationships between fossil and extant lorisids (Strepsirrhini, Primates) and the question of their biogeographic origins

B422 **K. HIirata**, **M.O. Kubo**, **M. Takai** Dental microwear texture analysis revealed intraspecific dietary variation of Japanese macaques (*Macaca fuscata*)

B423 **R. Kumar**, **R. Patnaik**, **M. Bansal** The biogeographical history of Murinae: insights from fossils and extant diversity

B424 **D. Choudhary**, **C.C. Gilbert**, **D.J. Peppe**, **C. Campisano**, **R. Patnaik** Refining Miocene primate timelines: new insights from rodent biochronology and magnetostratigraphy of the Miocene Siwaliks at Ramnagar, India

B425 **M. Bilgin**, **P. Joniak**, **F. Goktas**, **P. Pelaez-Campomanes**, **L.W. van den Hoek Ostende**, **S. Mayda** Belenyenice, a key section for understanding biodiversity shifts in the Early Miocene small mammal fauna of Anatolia

B426 **J. López-García**, **E. Meseguer-Despons**, **J. Oliva-Simó**, **A. Canals-Salomó**, **B. Martínez-Navarro**, **L. Rook**, **J. Madurell-Malapeira** Biochronological insights from a new Early Pleistocene karstic site complex in eastern Iberia: the rodent assemblages from *Els Saldonets* (Vilanova d'Alcolea, Castellón, Spain)

B427 **E. Guyonneau**, **H. Gomes Rodrigues**, **G. Billet** Evolution of a highly convergent dental trait: how to quantify and analyse the multiple independent acquisitions of hypsodonty in rodents?

B428 **C. Pfaff**, **I. Ruf**, **A. LeMaître** Back to the past: the middle and inner ear of selected extinct and extant rodents and its morpho-functional implications

B429 **J.H. Clonce**, **J.X. Samuels** Ecomorphological analysis of lagomorph postcrania reveals locomotor habits of extinct species

B430 **P. Morris**, **R.C. Terry** Out of the frying pan, into the fire: actualistic taphonomy of heat-induced bone damage and implications for Quaternary assemblages

Saturday Morning, November 15, 2025
Technical Session XIV: Mammalian Phylogeny & Function
Meeting Room Hall 1
Moderators: Robin Beck and Julia Schultz

8:00 **O.A. Goodchild**, **A.M. Jukar** Taxonomy and evolution of North American Gomphotheriinae (Mammalia, Proboscidea): a reassessment of proposed holotypes housed at the American Museum of Natural History and preliminary phylogenetic analysis

8:15 **K. Le Verger**, **F. Allione**, **B. Wang**, **B. Weisse**, **A. Ijspeert**, **M.R. Sánchez-Villagra**, **T.M. Scheyer**, **A. Jusufi** The devastating tail strikes in glyptodonts in the light of phylogeny and paleorobotics

8:30 **T.J. Gaudin**, **D.A. Iurino**, **F. Costanzo**, **N. Vega**, **G. Tirao**, **I. Soto**, **A. Boscaini** Endocranial cavity in extant and extinct anteaters (Xenarthra, Vermilingua)

8:45 **D. de Vries**, **J. Cadby**, **A. Hall**, **L. Smith**, **A. Gao**, **D.A. Croft**, **R. Engelman**, **R.M. Beck** Dietary reconstructions and disparity through time of South American fossil metatherians using dental topography

9:00 **L. Meade**, **E. Panciroli**, **S. Walsh**, **R. Butler**, **R.B. Benson** A climbing carnivorous eutriconodont mammal exceptionally preserved from the Middle Jurassic of Skye, Scotland

9:15 **A.L. Wisniewski**, **K.R. Selig**, **D.K. Anderson**, **B. Rodwell**, **L.N. Weaver** Evolvability, evolutionary currencies, and the decline of multituberculates in North America

9:30 **A. Knapp**, **R. Marek**, **D. Nganga**, **R. Felice** Sociality and ecology drive three dimensional brain shape evolution in mammals

9:45 **V. Weisbecker**, **R. Mitchell** Comparative finite element analysis of differently sized mammalian crania reveals substantial mechanical impact of size variation on absolute biomechanical performance

10:00 Coffee Break

10:15 **H.Z. Fulghum**, **D. Grossnickle**, **S.M. Smith**, **P. Polly** Many-to-one relationships of tribosphenic molar morphology and diet in mammals

10:30 **J.A. Schultz**, **L.N. Weaver**, **K. Jäger**, **D. Grossnickle** An evolutionary conundrum: the mammalian medial pterygoid muscle

10:45 **K. Walls**, **L. DeSantis** Mammalian functional diversity and functional rarity in North America throughout the Cenozoic

11:00 **Y.U. Braumuller**, **L. Zel**, **R. Vries**, **S. Dullaart**, **J. Miller**, **L.W. van den Hoek Ostende** Bringing the past into the present, ecometric approaches to reconstruct the paleoenvironments of the Greco-Iranian bioprovince

11:15 **A. Alfsen**, **C. de Muizon**, **G. Bianucci**, **O. Lambert**, **R.M. Salas-Gismondi**, **M. Urbina**, **A. Kaffler**, **M. McCurry**, **O. Hampe**, **E. Amson** Broadening the semi-aquatic scene: first quantification of the diversity of microanatomical patterns in pinnipeds and its relevance for early cetaceans

11:30 **M. Qi**, **X. Lu**, **Y. Li**, **J.N. Keating**, **D. Pisani**, **P. Donoghue** The identification of Cretaceous crown placentals is hindered by incomplete fossil records and substantial morphological similarity

11:45 **S. Brusatte**, **R.M. Beck**, **O.C. Bertrand**, **F.A. Perini**, **H. Püschel**, **E. Rossi**, **S.L. Shelley**, **J.R. Wible**, **T. Williamson**, **S.P. Zack** Resolving early placental mammal relationships with morphological and molecular data

12:00 **R.M. Beck** 'Difficult' nodes in placental mammal phylogeny and the timescale of mammal evolution

Saturday Morning, November 15, 2025
Technical Session XV: Reptile'O'Rama
Meeting Room Hall 4
Moderators: Urmi Chakraborty and Gabriel Mestriner

8:00 **T. Maho**, **J. Bevitt**, **R. Reisz** Captorhinid premaxillary dentition reveals the pathological phenomenon of tooth socket closure

8:15 **P.L. Knaus**, **J. Fröbisch** Orbit and scleral ring dimensions suggest nocturnality at the origin of amniotes and early diversification of diel activity patterns

8:30 **A. Rebillard**, **A. Jannel**, **L. Marchetti**, **M. MacDougall**, **C. Hamann**, **J.S. Steyer**, **G. Townsend**, **J. Fröbisch** Tetrapod feeding remains: the first bromalites from Bromacker (early Permian, Germany)

8:45 **M. MacDougall**, **J. Ponstein**, **J. Fröbisch** Computed tomography (CT) data reveals new insights into the evolution of herbivory in bolosaurian reptiles

9:00 **J. Yi**, **J. Liu**, **L. Xie** The Chinese pareiasaurs revised: taxonomical validity and phylogenetic framework of late Permian pareiasaurs

9:15 **V. Buffa**, **J. Kibii**, **S. Ngui**, **J. Benoit** A newly discovered fossil reptile fauna with preserved skin impressions from the Permo–Triassic Maji ya Chumvi Formation, southeastern Kenya

9:30 **I. Pugh**, **M.P. Sodano**, **S.J. Nesbitt** We found the rest in the cabinet: reassessing the holotype of the Late Triassic drepanosauromorph *Dolabrosaurus aquatilis* reveals additional elements and unexpected hook-and-pull digging adaptations

9:45 **G. Mestriner**, **A. LeBlanc**, **G.F. Funston**, **D. Evans**, **D. Casali**, **S.J. Nesbitt**, **A.A. Rytel**, **S. Herter**, **J. Marsola**, **M.C. Langer** Evolutionary history of tooth attachment systems in Archosauromorpha: understanding the origin and ontogeny of archosaurian thecodonty

10:00 Coffee Break

10:15 **W. Wang**, **N. Fraser**, **S. Spiekman**, **C. Li** A Middle Triassic marine tanysaurian with soft tissue preservation from Yunnan, China

10:30 **D.R. Pittinger**, **A. Marsh**, **B.T. Kligman**, **Y. Haridy** Caudal autotomy in tanystropheids (Reptilia, Tanysauria): the first known occurrence of tail shedding in archosauromorphs

10:45 **M. Whitney**, **T.I. Prause**, **C.H. Woolley**, **N.D. Smith**, **P. Makovicky**, **C.A. Sidor** Long bone histology of Early Triassic Antarctic reptiles reveals ectothermic adaptations to polar environments

11:00 **U. Chakraborty**, **D. Mukherjee**, **S. Ray** Neural anatomy and ontogenetic trajectories of rhynchosaurian braincase from the Upper Triassic of India

11:15 **S. Sen**, **S. Ray** Assessing the diverse avemetatarsalian (Diapsida, Archosauria) record from the Upper Triassic of India

11:30 **S. Wills**, **S.T. Poon** AI and deep learning in taxonomy

11:45 **M.O. Kubo**, **K. Usami** Mechanical insights into microwear formation: puncture experiments with alligator teeth using foods of varying hardness

12:00 **S.K. Drumheller**, **H.M. Maddox**, **O.J. Singleton**, **C.A. Boyd**, **M.L. Householder**, **C. Woodruff**, **J. McHugh**, **H. Noel**, **J. DeBruyn** Rethinking dinosaur ‘mummies’: insights from a long-term study of reptilian decomposition

Saturday Morning, November 15, 2025
Technical Session XVI: Dinosauria II: Aves
Meeting Room Hall 8
Moderators: Beatriz Caraza del Hoyo and Olivia Plateau

8:00 **A.H. Crane** Novel insights from modern birds inform non-destructive criteria for identifying sex-specific bone tissue in fossil avemetatarsalians

8:15 **R. Marek**, **R. Felice** The emergence of the surrogate forelimb: correlated evolution of the neck and forelimb across the theropod-bird transition

8:30 **J.N. Tang**, **S. Lautenschlager**, **D.J. Field**, **T. Stubbs** Bird-like orbits originated in maniraptoriform dinosaurs

8:45 **J. O’Connor**, **H. Hu**, **A. Clark**, **P. Kuo**, **M. Fabbri**, **H. Zhang**, **A. Shinya**, **C. Van Beek**, **M. Wang**, **J. Lu** CT-derived morphological data reveals early musculoskeletal adaptations in *Archaeopteryx*

9:00 **P.E. Nixon-Hermansen**, **C. Sullivan** Trunk anatomy of American white pelican (*Pelecanus erythrorhynchos*) suggests exhalatory function of unusual sternal rib flange in the long-tailed Early Cretaceous bird *Jeholornis prima*

9:15 **O.E. Demuth, J. Benito, K.E. Widrig, J. O’Connor, G. Kinney-Broderick, S.E. Warner, J.R. Hutchinson, D.J. Field** Flight of early birds—insights from joint mobility

9:30 **B. Walters**, **Y. Liu**, **E. Rayfield**, **P. Donoghue** Theoretical morphospace shows most flying vertebrates evolve suboptimal wing shapes for flight style

9:45 **L.N. Wilson**, **Z.S. Morris**, **A. Kalmbach**, **J. Botelho**, **C. Griffin** The evolution of palatal development in the common ancestor of living birds

10:00 Coffee Break

10:15 **O. Plateau**, **G. Navalon**, **J. Benito**, **D.J. Field** Revisiting the pterygoid-palatine complex: ontogenetic and ecological insights into evolution of the crown bird palate

10:30 **J. Benito**, **E. Steell**, **M. Fabbri**, **K.E. Widrig**, **B.S. Bhullar**, **D.J. Field** A phylogenetic plesiomorphy zone obscures the early evolutionary history of crown birds

10:45 **D.J. Field**, **J. Lee** Macroevolutionary analysis of developmental mode illuminates underpinnings of the neoavian radiation

11:00 **S.N. Somogyi**, **J. Lee**, **G.S. Bever**, **D.J. Field** Hemiplasy helps explain high rates of apparent morphological convergence in neoavian birds

11:15 **G. Navalon**, **S.W. Evers**, **E. Hughes**, **A. Bjarnason**, **L.M. Chiappe**, **D.J. Field**, **R.B. Benson** Evolution of avian vestibular apparatus morphology is highly controlled by foramen magnum orientation

11:30 **J.W. Oyston**, **M. May**, **R. Felice** Brain size dependent speciation and extinction rates in birds and the cognitive buffer hypothesis

11:45 **K.A. Beguesse**, **E. Hyland**, **L.E. Zanno** Effects of select temperature, chemical, and sample pre-treatment processes on stable and clumped isotope compositions of extant avian bone

12:00 **B. Carazo del Hoyo**, **D. Cirtina**, **A. Quigley**, **H. Bean**, **V. Rossi**, **S. Ito**, **K. Wakamatsu**, **S.M. Webb**, **M.E. McNamara** Understanding the functional evolution of melanin in birds and mammals using dual chemical approaches

Saturday Afternoon, November 15, 2025
Symposium: Multidisciplinary Approaches to Skull Function & Evolution
Meeting Room Hall 1
Moderators: Stephan Lautenschlager and Laura Porro

1:45 **R. Dearden**, **A. Lanzetti**, **S. Giles**, **Z. Johanson**, **L. Schnetz**, **A.S. Jones**, **S. Lautenschlager**, **K. Dollman**, **V. Fernandez**, **I.J. Sansom** Building the earliest vertebrate skull—microtomography sheds light on endoskeletal cranial construction in the Ordovician vertebrate *Eriptychius americanus*

2:00 **J.D. Fortner**, **K. Middleton**, **C. Holliday** Finite element modeling reveals effect of jaw muscles on intramandibular joint flexibility and strain in taxa with differently built mandibles

2:15 **A. Ballell**, **H. Dutel**, **M. Fabbri**, **C. Hammond**, **A. Herrel**, **E. Rayfield** Innovation in jaw musculature drives the evolution of temporal fenestration patterns of the amniote skull

2:30 **T.I. Pollock**, **P. Milla Carmona**, **C. Caldicott**, **A. Ballell**, **E. Rayfield**, **P. Donoghue**, **A.R. Evans** The point of it all: exploring constraints on pointed tooth form in tetrapods

2:45 **K. Garland**, **E.M. Hay**, **D.J. Field**, **A.S. Mohamed**, **T.L. Green**, **P.M. Gignac**, **M.R. Sánchez-Villagra**, **K.L. Buchanan**, **A.R. Evans** Uncovering the evolutionary origins and developmental foundations of beak shape in theropods using a universal rule of growth

3:00 **J. Bright**, **P.J. Morris**, **V. Raju**, **A. Wood-Bailey**, **P. Watson** Computational modelling of cranial kinesis in birds: risks and rewards

3:15 **A.S. Tucker**, **S. Johnston**, **M. Renfree**, **N. Anthwal** Developmental biology shedding light on evolution of the mammalian ear

3:30 **H. Higashiyama** A tale of two premaxillae: from ancestral jaw tip to mammalian nose

3:45 **A.C. Sharp**, **A. Wood-Bailey**, **P.G. Cox** Multidisciplinary approaches to the study of evolution and function of unique cranial morphology in Lagomorpha

4:00 **Y. Pommery**, **D. Koyabu**, **F. Meguro**, **V. Tu**, **T. Ngamprasertwong**, **T. Wannaprasert**, **T. Nojiri**, **B. Moison**, **A. Sadier**, **L.A. Wilson** Can the evolution and origins of laryngeal echolocation in bats be revealed by examining cranial growth rate?

Saturday Afternoon, November 15, 2025
Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha
Meeting Room Hall 4
Moderators: Stephanie Lechki and Qi Zhao

1:45 **Y. Ke**, **M.W. Ferguson**, **A. LeBlanc** When the tooth clock stops ticking: ontogenetic changes in dentine production skew replacement rate estimates in Archosauria

2:00 **S.C. Lechki**, **R.B. Benson** The explanatory power of energetic fitness models across living amniotes and extinct non-avian dinosaurs

2:15 **P.M. Barrett, S. Maidment** Solving the enigma of small-bodied ornithischian dinosaur diversity in the Morrison Formation (Upper Jurassic) of the western USA

2:30 **P. Upchurch**, **J.E. Hall**, **P.D. Mannion**, **S. Bilbey** A new *Haplocanthosaurus*-like sauropod dinosaur from the Morrison Formation of Utah, and its implications for the origin of Diplodocoidea

2:45 **T. Sethapanichsakul**, **S. Manitkoon**, **S. Khansubha**, **R. Hanta**, **P.D. Mannion**, **P. Upchurch** First sauropod dinosaur from the Lower Cretaceous Khok Kruat Formation of Thailand: expanding the diversity of somphospondylan titanosauriforms in Southeast Asia

3:00 **A.A. Chiarenza**, **L.E. Zanno**, **C. Tsogtbaatar**, **V. Díez Díaz**, **B. Mainbayar**, **H. Saegusa**, **P. Upchurch**, **P.D. Mannion** Integrative redescription of the Mongolian titanosaur *Opisthocoelicaudia skarzynskii* clarifies titanosaurian evolution, dispersal, and ecological responses to Cretaceous hyperthermal events

3:15 **S.L. Arriscorreta**, **M.T. Hiltunen**, **I. Huffaker**, **R. Scheetz**, **B. Britt** The first dinosaur eggs from the Yellow Cat Member, Cedar Mountain Formation (Early Cretaceous, Barremian), Utah, USA

3:30 **B.W. Griffin**, **T.L. Prescott**, **P.L. Falkingham** Track robusticity: subsurface layers consistently capture motion irrespective of substrate properties

3:45 **Q. Zhao**, **T. Guo**, **M. Hao** Wedl tunnels in dinosaur and extant vertebrates: reevaluating fungal bioerosion in paleohistology

4:00 **P. Kaskes**, **S. Goderis**, **A.S. Schulp**, **P. Godefroit**, **P. Claeys** Blasting dinosaurs in Brussels: tracing the taphonomic history of Cretaceous bonebeds using μXRF and LA-ICP-MS

Saturday Afternoon, November 15, 2025
Technical Session XVIII: Early Tetrapoda & Lissamphibia
Meeting Room Hall 8
Moderators: Per Ahlberg and Nadia Fröbisch

1:45 **P.E. Ahlberg** A rich new tetrapod locality from the latest Devonian of Greenland

2:00 **M. Coates**, **B. Otoo**, **A. Caron**, **K. Tietjen**, **M. Ruta** Amniote traits and terrestriality in an early amphibian

2:15 **T.R. Smithson**, **M. Ruta**, **B. Otoo**, **L.B. Porro** A new diminutive tetrapod from the Tournaisian of Burnmouth, Scotland, revealed by microcomputed tomography

2:30 **C. So**, **M.E. Montgomery**, **N.I. Cookson**, **J. Pardo**, **H.C. Maddin**, **H. Sues**, **A. Mann** Taxonomic diversity and development of Late Carboniferous amphibamiforms from the Mazon Creek Lagerstätte

2:45 **N.B. Fröbisch**, **C.M. Perez-Ben**, **F. Witzmann**, **V. Bothe** Evolutionary history of limb regeneration in lissamphibians: new evidence from two paleozoic stem-group species

3:00 **P.I. Heise**, **J.K. Lungmus** Forelimb disparity in Late Paleozoic tetrapods: a geometric morphometric approach

3:15 **T. Brewington**, **R. Blob**, **R. Wunderlich**, **M. Iijima**, **D. Munteanu**, **S. Swisher**, **A. Kellerhal** Polydactyl precursors: insights into early tetrapod terrestrial locomotion from polydactyl alligator

3:30 **D. Konietzko-Meier**, **N. Klein**, **F. Witzmann**, **N.B. Fröbisch**, **E. Griebeler**, **E. Amson**, **E. Mujal**, **D. Schwarz**, **R.R. Schoch** Forever young: larval fish-like bone matrix in the long bones of Permian temnospondyls *Sclerocephalus* and *Apateon*

3:45 **R. Moreno** Bioapatite geochemistry reveals paleoenvironmental conditions in Lower Keuper (Middle Triassic) fossil sites of Baden-Württemberg, Germany

4:00 **A. Quigley**, **B. Carazo del Hoyo**, **D. Cirtina**, **V. Rossi**, **C. McCarney**, **J. Brennan**, **S. Ziapour Razlighli**, **M.E. McNamara** Decoupled evolution of melanosome geometry and chemistry in amphibians and reptiles

Saturday Afternoon, November 15, 2025
Regular Poster Session IV
Meeting Room Hall 3
Authors must be present from 4:30 – 6:30 p.m. on Saturday, November 15

Mammalian Phylogeny & Function

B431 **L. Hautier**, **R. Tabuce**, **K.E. Kassegne**, **Y.Z. Amoudji**, **G. Guinot** Unexpected proboscidean diversity in the middle Eocene phosphate deposits of Togo

B432 **T.G. Bedane**, **H. Mackaye**, **J. Boisserie** New data on morphological evolution and dietary adaptations of *Elephas recki* from the Plio-Pleistocene Shungura Formation (Lower Omo Valley, Ethiopia)

B433 **H. Zhang**, **A. Lister**, **M.P. Ferretti**, **J. Saarinen**, **J. Madurell-Malapeira** The latest well-dated occurrence of *Mammuthus meridionalis* in Western Eurasia: insights from the Vallparadís Section

B434 **D. Biswas**, **C. Tsai** A lost giant and its diet: body mass and paleoecology of *Palaeoloxodon* from the Pleistocene of Taiwan

B435 **R. Bobe**, **J. d'Oliveira Coelho**, **M. Doyle Boyd**, **E. Lourenço**, **L. Balate**, **S. Tagir**, **P. Jena**, **W.J. Sanders**, **M. Bamford**, **S. Carvalho** The coastal forests of eastern Africa as an evolutionary hotspot: hypotheses and new data

B436 **P.M. Mbatha**, **L.N. Leakey**, **J. Saarinen**, **J. Jernvall**, **W.J. Sanders**, **C. Feibel**, **A. Kaakinen**, **A. Lister**, **E. Muoki**, **S. Ngui** Proboscidean postcranial morphometrics and ecomorphology and their utility in reconstructing past environments: the case of the Koobi Fora Area 123 *Elephas atavus* skeleton

B437 **R.L. Anemone**, **R. Bobe**, **J.D. Coelho**, **T. Püschel**, **M. Sier**, **C. Mendes**, **W. Archer**, **D. Presnyakova**, **E. Paixão**, **S. Carvalho** A new giant fossil hyracoid (Mammalia, Afrotheria) from the southern East African Rift in Gorongosa National Park, Mozambique

B438 **M. Losco**, **T. Martin** Tooth function and mastication in Paleogene Hyracoidea

B439 **G. Aguirre-Fernández**, **K. Kissling**, **K. Le Verger**, **L. Costeur**, **L. Hautier** Shape and allometry of the sirenian brain and inner ear, with emphasis on Steller's sea cow (*Hydrodamalis gigas*)

B440 **J.J. Hooker** A new specimen of the enigmatic mammal *Lessnessina* from the early Eocene of Abbey Wood, UK, shares important characters with stem members of the superorder Paenungulata

B441 **E. Webb**, **J. Codd**, **K. Jones** Impact of axial patterning on ribcage composition and regionalization in Xenartha

B442 **R.E. Narducci** Evaluating the contributions of phylogeny and substrate preference on intracranial morphology in extant and extinct Xenarthra

B443 **H.G. McDonald**, **R. Nieto** Recent discovery of a skeleton of the Pan-American sloth, *Eremotherium laurillardi*, in Honduras: new insights into its distribution and paleoecology

B444 **J.A. Case**, **G.W. Rougier**, **Z. Luo**, **M. Lamanna**, **N.R. Chimento** The evolution of enamel structure and diet in the Monotremata (Mammalia)

B445 **J.L. Scharpf**, **J.A. Case** Early diversification and coexistence of macropods in the late Oligocene, Etadunna Formation, South Australia

B446 **E. Chenal**, **H.J. Diependaal**, **J. Hakkens**, **E.A. Mulder**, **J.W. Reumer**, **I.R. Van der Beek**, **A. Van de Weerd** Avillers (Vosges, France): a new locality with Late Triassic Mammaliaformes

B447 **A.L. Waller**, **L.N. Weaver**, **B.M. Davis** A new multituberculate skull from the Upper Jurassic Morrison Formation of Utah: implications for the taxonomic validity of the genus *Glirodon*

B448 **A. Khatavkar**, **A. Goswami**, **G. Prasad** First mammal (Gondwanatheria) from the Upper Cretaceous Kallamedu Formation of the Cauvery Basin, South India

B449 **G.P. Wilson Mantilla**, **I.R. Newbins**, **D.E. Fastovsky**, **Y. Zhang**, **M. Montellano Ballesteros**, **D. García Alcántara**, **M. Chen** Cranial and postcranial remains of a new species of *Cimolodon* (Mammalia, Multituberculata, Cimolodontidae) from the Upper Cretaceous (Campanian) El Gallo Formation of Baja California, México

B450 **A.S. Schulp**, **Y.U. Braumuller**, **L.W. van den Hoek Ostende**, **E. Kruidenier** Between sauropod toes: a microvertebrate survey of fine-grained deposits from the Upper Jurassic Morrison Formation (northern Wyoming, USA)

B451 **C.K. Siemann**, **K. Beard**, **M.F. Jones** A description of *Pararyctes pattersoni* and *Palaeoryctes* sp. nov. (Mammalia: Palaeoryctidae) from the late Paleocene Fort Union Formation of Wyoming, USA

B452 **B. Burger**, **L. Jolley** Skeletal convergence between the Middle Eocene *Pantolestes* and modern river otters (*Lontra*): insights from a new skeleton from the Washakie Formation

B453 **F.A. Perini**, **S. Lages**, **L.D. Carneiro**, **L.C. Andrade**, **R.C. da Silva** A new ichnospecies of *Nihilichnus* from the Paleogene of South America: trace makers and ichnological and paleobiological implications

B454 **H.O. Berks**, **E. Rayfield**, **P. Donoghue** High functional optimality in mammalian jaws reflects an evolutionary trade-off between strength and speed

B455 **H. Williams** Correlating masticatory muscle and skull morphology across mammals

B456 **M. Camaiti**, **Y. He**, **A. Goswami** Macroevolutionary patterns of 3D skull suture complexity across the mammalian radiation

B457 **A. Gardiner**, **R.J. Asher** Variation, ecology, and anterior rostral anatomy in small, 'insectivoran' mammals.

B458 **H. Gomes Rodrigues** Evolution of dental eruption patterns in placental mammals

B459 **B. Figueirido**, **A. Perez Ramos**, **M. García-Sarmiento**, **J. Moulaye**, **J. Pastor**, **J.A. Pérez-Claros**, **A. Martin-Serra** Vertebral column evolution in Sirenia (Mammalia, Afrotheria)

B460 **S. Leedham**, **K. Jones**, **N. Cooper**, **J. Charles**, **K.T. Bates** Locomotor specialization drives patterns of evolutionary allometry in the mammalian spine

B461 **A. Gillet**, **S.E. Pierce**, **K. Jones** 'Back' to the sea: backbone evolution in secondarily aquatic mammals

B462 **R.J. Asher** How reliable are fossilizable data in phylogeny reconstruction?

Reptile'O'Rama

B463 **D. Rowe**, **R. Reisz** Examination and reconstruction of locomotory patterns for *Captorhinus* sp. and *Mesenosaurus efremovi* using digital modeling methodology

B464 **M. Malone**, **K. Nicholas**, **S.S. Sumida** New information on the postcranial skeleton of *Rhodotheratus parvus*, supporting the interpretation that it is a miniaturized adult and smallest adult member of the basal eureptilian family Captorhinidae

B465 **A. Sanchez** Ontogenetic data for the early Permian basal captorhinid eureptile *Labidosaurus*: comparative anatomy and possible behavioral implications

B466 **D. Marjanović** The origin and early evolution of amniotes in phylogenetic context: step 2

B467 **A. Jannel**, **C. Clemente**, **J.A. Nyakatura**, **J. Fröbisch** Reconstructing 3D locomotor capabilities and hindlimb musculature in the early Permian reptile *Eudibamus cursoris*: Implication for the origin of bipedalism

B468 **R.C. Benjamin** Expanding the rhynchosaur sample in the CoArTreeP: implications for hyperodapedontine relationships and the monophyly of *Hyperodapedon*

B469 **J. Zariwala**, **I. Stott**, **M. Ruta**, **M. Hayden**, **C. Venditti**, **A. Meade**, **G. Sutton**, **M. Sakamoto** Evolution of the antorbital fenestra in Archosauriformes: insights from craniofacial morphometrics

Dinosauria II: Aves

B470 **L.S. Freisem**, **D. Meyer**, **B.S. Bhullar** Tracking archosaurian brain evolution through early embryonic development

B471 **D.C. D'Amore**, **C. Yox**, **A. Wilken**, **C. Holliday** Temporal muscle orientation correlates with tooth reduction and loss in paravian dinosaurs

B472 **WITHDRAWN**

B473 **A. Colesmith**, **B. Arnaout**, **D.J. Field** Boneless wings: the evolution and distribution of manual claws in avialans

B474 **M. Burton**, **J. Benito**, **D.J. Field** The evolution of postcranial pneumaticity in crownward stem birds

B475 **G. Kinney-Broderick**, **G. Navalon**, **D.J. Field** Using µCT scanning to reinvestigate the appendicular skeletal morphology of *Confuciusornis sanctus*

B476 **M. Serio**, **H. Hu** New bohaiornithid-like bird from the Lower Cretaceous of China with well-preserved gastric pellet

B477 **R. Palmgren**, **K. Harrington**, **E. Bamforth**, **C. Sullivan** A hesperornithiform bird from the Campanian Dinosaur Park Formation of western Saskatchewan, Canada, and the diversity of small mid-grade hesperornithiforms in Late Cretaceous North America

B478 **C. Sullivan**, **J. O'Connor**, **J. Mandseth**, **R.L. Sissons**, **N. Campione**, **P.R. Bell**, **M. Vavrek**, **F. Fanti**, **E. Bamforth** A diminutive hesperornithiform bird from the Upper Cretaceous Wapiti Formation of northern Alberta, Canada, and the form of the hesperornithiform carpometacarpus

B479 **Z. Risley-Smyth**, **E. Bamforth**, **C. Sullivan** A partially fused juvenile hesperornithiform (Avialae, Ornithuromorpha) metatarsus from the Albian–Cenomanian (Cretaceous) of northern Alberta, Canada

B480 **H.J. Scudder**, **Z. Boles**, **K. Lacovara** Preliminary evidence of osteosclerosis as indication of diving behavior in a fragmentary K/Pg fossil ornithurine from New Jersey

B481 **J.C. Terol**, **M. Costa-Pérez**, **F.J. Serrano** Variation in humeral disparity across avian evolution

B482 **H. Bean**, **N.P. Edwards**, **S.M. Webb**, **D.J. Field**, **M.E. McNamara** A new framework for quantitative prediction of fossil feather color using melanosome geometry, metal chemistry and reflectance spectrophotometry

B483 **P.J. Morris**, **A. Wood-Bailey**, **P. Watson**, **J. Bright** The functional morphology and evolution of the avian cranial kinetic 'hinge' apparatus

B484 **H. Hu**, **R.B. Benson** Phalangeal shape variation and its ecological correlates in birds

B485 **A.J. Shepherd**, **R. Nudds** A new application of OpenSim to study fossil bird biomechanics

B486 **C. Mehling** First feather inclusions digitally extracted from a coprolite

B487 **T.L. Prescott**, **B.W. Griffin**, **P.L. Falkingham** Footprints beneath the surface: visualizing foot-substrate interactions using μCT

B488 **J.T. Deckhut**, **J.A. Case** Modern avian polar section modulus plots predict the lifestyle of the latest Cretaceous fossil avians *Antarcticavis capelambensis* and *Vegavis iaai*

B489 **K.E. Samonds**, **J. Hansford**, **L. Ranivoharimanana**, **N. Rasolofomanana** Head to toe: the latest in Aepyornithidae research using exceptional cranial remains

B490 **A.J. Tennyson**, **P. Lubbe**, **A. Adams**, **L. Shepherd**, **T. Cole**, **M. Knapp**, **B. Llamas**, **J. Wood**, **K. Mitchell**, **N. Rawlence** Morphometrics and ancient DNA reveal a new species of extinct insular shelduck (Anatidae, *Tadorna*) from Rekohu Chatham Islands

B491 **K.J. Doron**, **E.V. Griffith**, **J.D. Weckstein** Evidence of repeated evolution of wing spurs in Anseriformes based on X-rays of study skins

B492 **K.M. Gregory**, **R. Felice**, **R. Marek**, **A. Knapp** The role of trade-offs in shaping cranial morphological variation in domestic chickens

B493 **A. Chen**, **D.J. Field** On the origin of nightjars (Caprimulgidae): perspectives from the fossil record

B494 **K. Matts**, **E. Fordyce** A brief history of the penguins of Zealandia, focus on late Oligocene *Platydyptes* new phylogenetic position and fourth species

B495 **C. Du Toit**, **A. Bond**, **S. Cunningham**, **S. Portugal**, **R.M. Salas-Gismondi**, **D.J. Field** Tactile bill-tip organs in extant and Paleogene seabirds suggest conservation of a deep avian symplesiomorphy

B496 **C.R. Cope**, **I.J. Rivera-Molina**, **A.W. Peng** An unusually complete specimen of *Bubo virginianus* (Aves, Strigiformes, Strigidae) from the Pleistocene of Kansas and the use of skeletal proportions in the identification of fossil owls

B497 **U. Göhlich**, **G. Putzgruber**, **R. Roetzel** A new avifauna from the Lower Miocene of Austria

B498 **M.F. Chavez-Hoffmeister**, **A. Solorzano**, **A. Encinas**, **G. Carrasco** Fossil birds from the Cura-Mallín Formation: new clues about continental birds from the Neogene in southern Chile

B499 **G.B. Davies**, **B.T. Fuller**, **J. Southon**, **R. Dunn**, **E. Lindsey**, **K.E. Campbell**, **M.R. Waters** Chronology of avian extinction, survival, and turnover in the terminal Pleistocene at Rancho La Brea, California

Symposium: Multidisciplinary Approaches to Skull Function & Evolution

B500 **G.S. Ferreira** Theoretical adaptive landscapes suggest that bite efficiency and opening speed—but not strength—shape the mandibles of turtles

B501 **J.C. Silva**, **A. Ballell**, **T.I. Pollock**, **E. Rayfield** Finite element analysis and puncture testing reveal diverse dental mechanics among early dinosaurs

B502 **S. Lautenschlager**, **V. Díez Díaz**, **G.S. Ferreira**, **R.A. Bilbee**, **M. Tumelty**, **L.B. Porro**, **A. Gidna** Ontogenetic functional and dietary niche shifts in the basal iguanodontian *Dysalotosaurus lettowvorbecki*

B503 **C.D. Hill**, **P.J. Morris**, **P. Watson**, **J. Bright** Evolutionary changes in the suborbital arch of parrots

B504 **S. Pollard**, **P.J. Morris**, **S. Lautenschlager**, **P. Watson**, **J. Bright** Elucidation of functional morphology in the avian rhamphotheca using finite element analysis

B505 **F.J. Weston**, **S. Lautenschlager** Modelling the functional effects of changing canine tooth length in sabertoothed predators

B506 **A. Coste**, **C. Loch** Morphometrics and functional implications of tusk-like teeth in fossil waipatiids: peculiar cranial and dental evolution in early odontocetes

Dinosauria III: Macroevolution & Sauropodomorpha

B507 **G.G. Barbosa**, **F. Montefeltro**, **J. Silva Júnior**, **Q. Zhang** Comparative cranial biomechanics in Sauropodomorpha: morphological and functional evolution of feeding strategies

B508 **L.S. Jackson**, **A.N. Rountrey**, **J.A. Wilson Mantilla** Tooth imbrication evolution and function in sauropodomorph dinosaurs

B509 **R. Lefebvre**, **C. Aubry**, **H. Mallison**, **A. Houssaye** Evolution of the sauropodomorph astragalus: implication for key phylogenetic characters and critical appraisal of evolutionary rates associated to the evolution of sauropod's bauplan and gigantism

B510 **S. Beeston**, **D. Schwarz**, **P. Upchurch**, **P.M. Barrett**, **P. Asbach**, **P.D. Mannion** Postcranial skeletal pneumaticity in Late Triassic sauropodomorph dinosaurs

B511 **J. Schaeffer**, **R. Lefebvre**, **R.R. Schoch** Analyses of the early sauropodomorph dinosaur *Plateosaurus trossingensis* using 3D geometric morphometrics

B512 **X. Chen**, **Y. Wang**, **Q. Zhang**, **H. You** A new non-sauropodan sauropodomorph from the Lower Jurassic Zhangjiaao Member of Lufeng Formation, Yunnan, Southwestern China

B513 **R.J. Zhao**, **X. Chen**, **H. You** Skeletal reconstruction and locomotor mode of *Xingxiulong yueorum*, a sauropodomorph dinosaur from Lower Jurassic Lufeng Formation, China

B514 **J. Órfão**, **A. de Celis**, **F. Ortega**, **P. Mocho** The Morrison Fm. (Late Jurassic, USA) Sauropoda diversity: a blink into the (global) past

B515 **J.N. Cattedra**, **C. Woodruff**, **J.R. Horner**, **J. Scannella** A multi-taxic assemblage of immature sauropods from the Upper Jurassic Morrison Formation of southwestern Montana, USA

B516 **T. van der Linden**, **G.T. Bivens**, **R. Hunter**, **T. Stecko**, **R. Wilhite**, **C. Woodruff**, **B. Curtice** A fracture in the 'whip' of a *Barosaurus* tail provides possible evidence of combat use in flagellicaudatan sauropods

B517 **S. Liu**, **S. Beeston**, **X. Xu**, **P. Upchurch**, **P.D. Mannion** The external and internal anatomy of the cervical vertebrae of the sauropod dinosaur *Lingwulong shenqi* and its implications for pneumaticity in Diplodocoidea

B518 **P. Mocho**, **F. Escaso**, **J.M. Gasulla**, **B. Maggia**, **E. Malafaia**, **F. Marcos-Fernández**, **I. Narváez**, **J. Órfão**, **F. Ortega** Walking with giant dinosaurs: new brachiosaurid fossil sites from the Upper Jurassic of Pombal (Portugal)

B519 **A. Gigliotti**, **F. Schäfer**, **J.A. Nyakatura**, **V. Díez Díaz** Testing the effect of different rotation centers in procoelous caudal vertebrae on the ranges of motion (RoM) of two sauropod tails from the Late Jurassic of Tendaguru (Tanzania)

B520 **D. Schwarz**, **V. Díez Díaz**, **A. Campbell**, **W. Jilala Viscent**, **P.M. Bushozi** Sauropod diversity in the Middle and Upper Dinosaur Member of the Late Jurassic Tendaguru Formation in Tanzania

B521 **K. Eiamla-or**, **S. Suteethorn**, **P. Chantasit**, **V. Suteethorn**, **K. Suraprasit** Structural and pneumatic characteristics of the cervical vertebrae of sauropods from the Lower Cretaceous Sao Khua Formation, Thailand

B522 **C. Christensen**, **S. LeBaron**, **B. Britt**, **R. Scheetz** A cluster of gastroliths and minute plant fossils associated with *Moabosaurus* provide the first evidence of the diet of sauropods

B523 **L. Matteoni**, **F. Bellardini**, **M. Romano** Uncovering Los Bastos: new titanosaur specimens and paleoecological insights from the Santonian of Argentina

B524 **D. Vidal**, **P.C. Sereno** Tangled titanosaur trees from character, taxon, and specimen discordances

B525 **F. Sanguino**, **A. de Celis**, **R. de la Horra**, **F. Ortega** *Litosoolithus poyosi*, a new fusioolithid ootaxon from the Upper Cretaceous of Spain, and its implications for titanosaur reproductive diversity

B526 **K. Edgar**, **R. Butler**, **E. Nicholls**, **D. Murdock**, **L. Meade**, **P.L. Falkingham**, **J. Lallensack**, **T.M. Beard** Thirty years of discovery at the UK's largest dinosaur track site: Ardley and Dewar's Farm Quarries in north Oxfordshire

B527 **G. Hartmann**, **P. dePolo**, **T. Blakesley**, **S. Brusatte** Identifying variation in dinosaur footprints and classifying problematic specimens via unbiased unsupervised machine learning

B528 **K. Yamaguchi**, **T. Kubo**, **M.O. Kubo** The difference in locomotor style between two saurischian clades, theropod and sauropodomorph, inferred from trackways

B529 **P. dePolo**, **S. Brusatte**, **M. Wilkinson**, **N. Clark**, **G.F. Funston**, **D. Foffa**, **T.L. Prescott**, **A. Thomas**, **D. Ross** The vertebrate fauna of the Isle of Muck, Scotland, UK, including a new dinosaur tracksite

B530 **S. Kim**, **Y. Lee**, **Y. Gihm** Trotting ornithopod trackway and flood-driven taphofacies in the Lower Cretaceous Hasandong Formation of Juji Island, Korea

B531 **A. Páramo** Computer-aided dinosaur footprint detection of the Era del Peladillo tracksites (Igea, La Rioja): state of the art

B532 **S. Choi**, **I. Paik**, **H. Kim**, **Y. Kim**, **S. Zhang**, **Y. Park**, **S. Lee** Cenomanian (Upper Cretaceous) dinosaur eggs from Busan, Korea: microstructural preservation and paleobiogeographical implications

B533 **B. Munkh-Ochir**, **T. Bayarmagnai**, **B. Minjin** New information on dinosaur diversity in Mongolia's Nemegt Basin based on isolated teeth

B534 **E.K. Koenig**, **D.W. Larson**, **V. Arbour** A high latitude Turonian dinosaur tooth assemblage from the Kaskapau Formation of northeastern British Columbia, Canada

B535 **R.J. Gay**, **A. Milner**, **J. McHugh** A new dinosaur body fossil from the Navajo Sandstone of Utah (USA) represents the northernmost body fossil yet recovered from the Navajo erg

B536 **J. McHugh**, **S.K. Drumheller** Fossil deformation and alteration as seasonality and residence time indicators in the Upper Jurassic Morrison Formation

B537 **E.A. Larsen**, **E. Warner-Cowgill**, **J.I. Kirkland** Dinosaur fauna from a quarry in the Cedar Mountain Formation of southeastern Utah, and implications for faunal turnovers in the Lower Yellow Cat Member

B538 **T. Luckau**, **C.H. Ummel**, **J. Frewin**, **R. Scheetz**, **B. Britt** The taphonomy of a nodosaur bonebed in the Yellow Cat Member of the Cedar Mountain Formation (Barremian), south-eastern Utah

B539 **J.J. Ramirez**, **J. Botha**, **A. Moopen**, **E. Twala**, **J. Choiniere**, **D.E. Barta**, **K. Curry Rogers**, **K. Chapelle**, **R.B. Benson**, **Z.T. Kulik** A quantitative approach to understanding variation in early dinosaur growth patterns

B540 **B.W. Perkins**, **S.J. Nesbitt** Characterizing the braincase anatomy of early dinosauriforms: the braincase of *Asilisaurus kongwe* and its implications for dinosauriform evolution

B541 **E. Puetz**, **D.J. Morgan**, **A. Balanoff** Macroevolutionary dynamics of the dinosaur cerebrum

B542 **D.D. Cashmore**, **S. Lautenschlager** Evolution and adaptation of the dinosaur naris

B543 **A.K. Hunt**, **S. Brusatte**, **D.J. Field** Investigating the anatomy and evolution of basipterygoid processes across Dinosauria

B544 **T.M. Beard**, **S. Lautenschlager** Changes in supratemporal fenestra morphology as a result of dietary specialization in herbivorous dinosaurs

B545 **T.P. Ducrey**, **S. Lautenschlager** Investigating niche competition in Mesozoic ornithischian, maniraptoriform and sauropodomorph dinosaurs

B546 **L.N. Weaver**, **T. Tobin**, **C. Sprain**, **P. Wilson Deibel**, **V. Korasidis**, **M. Carvalho**, **P. Kaskes**, **I. Fendley** Dinosaurs as ecosystem engineers: evidence from facies changes at the K–Pg boundary

B547 **B. Slibeck**, **P.E. Olsen** A synoptic view of life and death in the Newark Basin—new perspectives from the ETE and beyond

B548 **A.V. Moore**, **E. Hyland**, **T.A. Gates**, **C.R. Congreve**, **L.E. Zanno** The role of climatic constraints on dinosaurian faunal transitions during the mid-Cretaceous in the Western Interior Basin of Utah

B549 **K. Schroeder**, **P. Hull** Some like it hot: examining thermal tolerance at extreme body size

B550 **Z. Ji**, **F. Fang**, **K.L. Atkins-Weltman**, **E. Snively** Precise estimation of turning inertia (Lyy) in Late Cretaceous dinosaurs under varying postures and its biomechanical and ecological implications

B551 **F. Therrien**, **J.T. Voris**, **K. Tanaka**, **D.K. Zelenitsky** Life-and-death situation in the Late Cretaceous: comparison of dinosaur cursorial adaptations in the ecosystems of the Dinosaur Park, Hell Creek, and Nemegt formations

B552 **C.J. Brazee**, **J.R. Horner**, **J. Scannella** Counting terrible lizards: new information on the dinosaur assemblage of the 3B-1 Lag Deposit in the Hell Creek Formation, Montana, USA

B553 **R.B. Cooper**, **D. Silvestro** Revisiting Cretaceous dinosaur diversity dynamics using deep learning

Early Tetrapoda & Lissamphibia

B554 **B. Otoo** Turnover means your turn's over: biogeography, paleobiology, and the differing fates of Mississippian tetrapod clades

B555 **A.F. Osterling Arias**, **J. Bevitt**, **R. Reisz** Taxonomy versus ontogeny—variation in the snout morphology of Early Permian trematopids at Richards Spur, Oklahoma

B556 **L. Schmitz**, **M. MacDougall**, **A. Jannel**, **J. Fröbisch** New insights into the anatomy of the early Permian trematopid *Rotaryus gothae* (Temnospondyli, Dissorophoidea) using CT data and re-evaluation of its phylogenetic position

B557 **L.J. Hart** Mandibular evidence for suction feeding in the Cretaceous temnospondyl *Koolasuchus cleelandi*

B558 **D. Adhami**, **R.B. Benson**, **J.W. Streicher**, **S. Evans**, **M.E. Jones** An investigation of ilium shape among salamanders (Lissamphibia) using 3D geometric morphometric analysis shows significant phylogenetic signal

B559 **M.E. Jones**, **R.B. Benson**, **P. Skutschas**, **S. Evans** Middle Jurassic fossils from Kirtlington, England, UK, document small terrestrial salamander

B560 **J. Jia**, **W. Wu**, **J. Song**, **Y. Wang**, **K. Gao** A Late Cretaceous salamander from Songliao Basin, China, and evolutionary patterns of the cervical vertebra in lissamphibians

B561 **M. Nohomovich**, **S.J. Nesbitt**, **Y. Haridy**, **N. Shubin**, **M.R. Stocker** The anatomical evolution of the urostyle, a novel structure formed from caudal vertebrae in anurans

B562 **J.S. Ramirez Moreno**, **M.C. Langer**, **L. Barcelos** First Quaternary record of *Rhinella* from Bahia, Brazil: osteological description and taxonomic implications

B563 **S.A. Woodard**, **S.J. Nesbitt**, **D. Foffa**, **M.R. Stocker** A new occurrence of a caecilian (Lissamphibia: Gymnophiona) from the Upper Triassic Tecovas Formation of Texas, reveals that caecilians were widespread in the western USA

B564 **A. Ó Gogáin** 3D rendering of the aïstopod *Dolichosomatites emersoni* from the Jarrow Coal Seam (Bashkirian, Pennsylvanian) of Ireland.

B565 **J.M. Young**, **T. Maho**, **R. Reisz** Direct evidence of scavenging on a large Paleozoic terrestrial herbivore

NOTE: Some abstracts have author affiliations where superscripts are not presented in numerical order. Unfortunately, our abstract publishing partner was unable to resolve the issue, and we apologize for any confusion.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

An investigation of ilium shape among salamanders (Lissamphibia) using 3D geometric morphometric analysis shows significant phylogenetic signal

Adhami, Darcy[1], Benson, Roger B.[2], Streicher, Jeffrey W.[1], Evans, Susan[3], Jones, Marc E.[1,3]

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Salamanders (Caudata) are a diverse clade within Lissamphibia that includes over 820 extant species. The earliest crown group salamanders (Urodela) are likely Early Cretaceous in age but stem-salamanders are known from the Triassic and Jurassic. Salamanders vary in size, life history, and locomotion (i.e., swimming, crawling, climbing, burrowing). Although salamanders are often used as models to investigate early tetrapod locomotion, and frog ilia have been studied extensively, salamander ilia have yet to be systematically surveyed or analyzed. Here we use 3D geometric morphometrics with Procrustes alignment to characterize and quantify iliac variation among Caudata. We use six sliding semi-landmark lines, one each along the proximal and distal edges, one along the upper edge of the acetabulum and three along the lateral edges (anterolateral, anteromedial and posterior). We use a sample of 74 salamanders, including representatives of all families with ilia, and one Jurassic fossil stem-salamander (*Marmorerpeton*), and two extant frogs (outgroups). Results show substantial variation in ilium shape involving the shape, length, and orientation of the shaft as well as the shape and size of the acetabulum. This variation has notable phylogenetic signal with significant differentiation between the major families (MANOVA P <0.001***) (e.g., Plethodontidae, Ambystomatidae). Nevertheless, there is also significant association with habit (MANOVA P <0.001***): aquatic, semiaquatic, terrestrial, arboreal, fossorial. In general, aquatic taxa have ilia that are tall with relatively small acetabula, terrestrial taxa have ilia that are short with relatively large acetabula, and arboreal taxa have ilia that tend to be sigmoid with large acetabula. There are multiple ilium shapes associated with fossorial perhaps highlighting that there are different ways to burrow. *Marmorerpeton* has an ilium shape consistent with semi-aquatic habit. In conclusion, the salamander ilium clearly shows promise for further phylogenetic and functional analyses and for taxonomic and ecological assignment of isolated ilia from Cenozoic microvertebrate sites (e.g., from the Eocene of Hordle, UK).

Funding Sources Leverhulme Research Project Grant RPG-2018-381 (Pro.550474; no.178055 to S.E.E. and R.B.J.B.)

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Locomotor diversity of giant otters from Plio-Pleistocene hominin sites in Africa

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Enhydriodon is a genus of lutrine mustelid carnivoran known from the Neogene of Africa and Asia. It is a primitive member of the enigmatic Enhydriodontini lineage, which includes the extant sea otter *Enhydra lutris*. Species of *Enhydriodon* from the Plio-Pleistocene of eastern Africa have received attention because they were speciose and frequent components of the large carnivoran paleoguilds at hominin sites. Some of these species reached conspicuously large sizes, exceeding the mass of a modern male lion. Recent research has questioned the dietary ecology of *Enhydriodon*, which was previously thought to have been a molluscivore. Previous research revealed evidence of locomotor diversity in postcranial morphology for several *Enhydriodon* species, suggesting a less aquatic

locomotor repertoire. The current study describes a geometric morphometric analysis of *Enhydriodon* fossil femora to revisit locomotor function of this material with a different methodology. Geometric morphometric techniques using 2D landmarks were applied to published femora of *Enhydriodon omoensis* from the Omo Formation (Fm.) and *E. dikikae* from the Hadar Fm. at Dikika, as well as unpublished *Enhydriodon* femoral material from Woranso-Mille, and compared with a modern sample of mustelid postcrania.

Results are consistent with previous evidence of locomotor diversity in *Enhydriodon* femora. In a principal components analysis (PCA), the complete femur of *E. omoensis* from the Omo Fm. was most similar to modern terrestrial and semi-fossorial mustelids (e.g., *Gulo* and *Taxidea*) and the most terrestrial lutrines (i.e., *Aonyx* spp.). A linear discriminant analysis (LDA) classified *E. omoensis* as semi-fossorial with a high cross-validation score. In a PCA of proximal femoral specimens, *Enhydriodon dikikae* and *Enhydriodon* sp. from Woranso-Mille were most similar to modern lutrines. An LDA of these specimens classified *E. dikikae* as semi-fossorial and *Enhydriodon* sp. as terrestrial, but this result is interpreted cautiously due to the incomplete state of the fossils, known homoplasy among semi-aquatic and semi-fossorial forms in modern mustelids, and a paucity of lutrine axial material in the fossil record. These findings suggest that Enhydriodontines may have differed from previous locomotor expectations of aquatic adaptation based on extant otters and support hypotheses of more terrestrial behavior, possibly involving different gaits, postures, and/or swimming modes compared to extant taxa.

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Body elongation in Osteoglossomorpha (Teleostei): evolutionary patterns revealed by fossil taxa

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Osteoglossomorpha (bony tongues) is a morphologically diverse clade of actinopterygian fishes with fossil and living representatives occurring in a variety of habitats and on six continents. With seven families, more than 250 extant species, and with known fossil representatives in nearly all families, the taxonomic diversity of bony tongues is well documented. In contrast to stem osteoglossomorphs (e.g., *Lycoptera*, *Wilsonichthys*) that have short median fins and fusiform or deep bodies, most extant bony tongues have elongated bodies with long median fins. A simple interpretation of the evolution of body elongation in bony tongues would suggest a single independent origin of related traits. However, non-elongated fossil species nested within the major groups indicate a different scenario. We investigated the evolution of body elongation in Osteoglossomorpha through the optimization of quantitative characters on the most recent phylogeny of extinct and extant taxa. An increase in the head length and a decrease in the caudal peduncle length occurred in the total group of osteoglossids (which dates from the Early to Late Cretaceous), including short, deep-bodied fossil taxa (e.g., *Phareoides* and *Phareodus*). However, other traits related to body elongation, as the increase of vertebral centra and median-fin rays, occurred later in crown osteoglossids. Additionally, traits such as the number of anal-fin rays gradually increase from more inclusive to more restrictive groups, but with a sudden increase occurring in apical nodes (e.g., notopterids). Our results suggest that characters related to body elongation (i.e., addition of vertebral centra and median-fin rays,

as well as body proportions) have evolved multiple times throughout the evolutionary history of the group. These evolutionary changes have occurred gradually along more inclusive (e.g., Mormyriformes + Osteoglossiformes) to less inclusive clades (e.g., Osteoglossinae + Arapaiminae), as well as rapidly in more apical clades (e.g., Notopteridae and Gymnarchidae). Rapid evolutionary changes, though, might indicate gaps in the fossil record. This study indicates that incorporating extinct, non-elongated taxa into the analysis clarifies the evolution of body elongation by providing a more complete scenario of character state changing. This facilitates the interpretation of synapomorphies within topologies across the span of geological time, thereby allowing the identification of evolutionary patterns.

Funding Sources VIMS 2024 Student Research Grant; Sara E. and Bruce B. Collette Fellowship.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Measuring ornithischian tooth complexity using patch count rotated analysis

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Ornithischian dinosaurs are notable for the repeated evolution of complex craniodental characters, indicating independent acquisitions of specialized forms of herbivory within each major ornithischian clade. Previous studies have proposed linked increases in tooth surface complexity and bite efficiency through ornithischian lineages, resulting in greater processing ability of the feeding apparatus. However, this idea has yet to be tested. Here, we quantify tooth complexity among a sample of Jurassic and Cretaceous ornithischians using rotated orientation patch counts (OPCRs), which are known to significantly distinguish herbivory from non-herbivory in extant taxa, but have yet to be systematically compared across Ornithischia. We found that in our sample, Jurassic ornithopods and ceratopsians have lower toothrow complexity than later occurring species, while thyreophorans have a more complicated pattern. The first two groups increased toothrow surface complexity by increasing jaw tooth number. Thyreophorans increased toothrow surface complexity while decreasing jaw tooth number from the Early Jurassic to Late Jurassic, before decreasing toothrow complexity in the Cretaceous. Our study suggests that these three ornithischian clades independently evolved towards higher than average toothrow complexity regardless of trends in tooth number. This may reflect a shift from omnivory to more specialized herbivory, underpinned by more complex tooth surfaces permitting more efficient processing of vegetation. Measurements of surface complexity from ceratopsians and other ornithischian clades should document evolutionary shifts in tooth surface complexity, quantify its relationship with bite performance, and explain patterns of dietary adaptation across Ornithischia.

Funding Sources The Bob Savage Memorial Fund (University of Bristol; 2023, 2025), Student Research Grant (Paleontological Society; 2024), The Jurassic Foundation Grant (2024).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Shape and allometry of the sirenian brain and inner ear, with emphasis on Steller's sea cow (*Hydrodamalis gigas*)

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Sea cows (Sirenia) are obligate aquatic mammals with a rich fossil record extending back to the Eocene. In proportion to body size, their brains are among the smallest and smoothest (lowest gyrification) of all extant mammals. Within Sirenia, the recently extinct Steller's sea cow (*Hydrodamalis gigas*) stands out due to its massive size and unique habitat, diet, and social structure. We hypothesized that brain and inner ear size and shape are correlated with these distinctive traits. To test this hypothesis, we produced cranial and inner ear endocasts of *Hydrodamalis gigas* and other extant and extinct sirenians (n = 17) through 3D segmentation derived from computer-tomography scans. We found that brain and inner ear shapes are broadly explained by phylogeny: trichechid brains are globular, whereas dungongid brains are elongated. *Hydrodamalis gigas*, a dudongid, exhibited a globular brain shape which is probably linked to the milder flexion of the rostrum in comparison to other members of the clade (in turn, likely related to the unusual diet of *Hydrodamalis gigas* among dudongids). The inner ear shape of *Hydrodamalis gigas* was more akin to its relatives, with a minor variation in the lateral canal. In terms of allometry, our results show that size has an influence on brain and inner ear shape. These findings highlight the intricate relationships of neuroanatomy and ecology.

Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

A rich new tetrapod locality from the latest Devonian of Greenland

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Although the majority of Devonian tetrapods are described in the literature as of Late Devonian (late Famennian) age, they do not date to the latest Famennian but to a slightly earlier time window, about 2–3 million years before the Devonian/Carboniferous boundary. This applies to *Ichthyostega*, *Acanthostega*, *Ymeria*, *Brittagnathus*, *Ventastega*, *Densignathus,* and *Hynerpeton*; only *Tulerpeton* from Russia is thought to be younger. As a result, they are not necessarily informative about tetrapod faunas on the eve of the end-Devonian mass extinction. Here we present the first securely dated end-Devonian tetrapod assemblage, from the Latest Famennian Stensiö Bjerg Formation of Ymer Island, Greenland. The locality lies about 20 m below the Devonian-Carboniferous boundary, at least 500 m above strata bearing *Ichthyostega* and other previously known Greenland tetrapods. It yields a rich assemblage comprising hundreds of bones of at least 5 tetrapod taxa, all of them new to science, but no fish remains. Associated non-vertebrate fossils include large scorpion fragments, a diverse assemblage of arthropod tracks and burrows, and a range of land plants. There are also numerous non-spiral vertebrate coprolites, presumably produced by the tetrapods, as well as tetrapod footprints and a few body impressions. Thus, this is the earliest pure tetrapod vertebrate assemblage and the earliest tetrapod coprolite assemblage in the known fossil record. The tetrapod body fossils range from isolated bones to partly articulated bodies, and include some areas of soft tissue preservation. Most of the material studied so far belongs to '*Ichthyostega*-sized' animals, representing at least three distinct taxa, probably approaching 1 m in total length. However, there are also at least two much smaller tetrapods present, indicative of a range of niches occupied by tetrapods from this site. Surprisingly, the large tetrapods all appear to be closely related to each other and to the enigmatic, unnamed humerus ANSP 21350 from the late (but not terminal) Famennian of the Catskill Formation, Pennsylvania. This points to the existence of a previously unrecognized clade of Late Devonian stem tetrapods. The specimens are all being studied by means of synchrotron microtomography at ESRF (Grenoble, France), allowing us to digitally dissect structures such as articulated middle ears, articulated sacra, and partly preserved belly skin with gastralia and scales.

Funding Sources ERC Advanced Grant 101019613 'Tetrapod Origin'

Wallenberg Scholarship, Knut & Alice Wallenberg Foundation

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Not like other hadrosaurids: a review of growth rates and age segregation in *Edmontosaurus regalis* (Dinosauria: Hadrosauridae)

Alexander, Janet, Currie, Philip J., Koppelhus, Eva B.

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Monodominant hadrosaurid bonebeds are common in the Upper Cretaceous of North America, and have provided the basis for many studies of behavior, growth dynamics and paleoecology. Based on abundant data, a widely accepted definition of hadrosaurid life stages has been developed, combining evidence from size-frequency distributions and osteohistology. A "juvenile" is considered to be <50% of maximum adult size (defined by the largest known articulated adult of the species). An individual that is half of adult size is equivalent to ~2 years of age and has distinct histological characteristics.

The Danek Bonebed (DB) is a monodominant *Edmontosaurus regalis* site found in the Horseshoe Canyon Formation in Edmonton, Alberta. Osteohistologic evidence and size-frequency distribution data from this site suggest this definition may not be applicable at this locality. Limb bones from the DB appear to be proportionally larger than in other species at the "late juvenile" stage of osteological maturity, at approximately 65% of adult size (defined by CMN 2289, paratype of *E. regalis*). This suggests that increasing the size limit of juveniles to <65% may more accurately reflect the life stage distribution of *E. regalis* in the DB.

These findings may indicate a faster growth rate than in other hadrosaurids, and by extension a higher level of interspecific variation than has been assumed. However, they may also be a result of the rarity of known articulated specimens of this species, given the reliance on such specimens for defining maximum adult size. Some ~11.3% of the limb bones found in the DB exceed 100% of adult size as defined by CMN 2289 (n = 8/71). Regardless, these findings have implications for *E. regalis* bonebed interpretation.

These results also have implications for the hypothesis of intraspecific age segregation, which has arisen from the minimal overlap in element size among hadrosaurid bonebeds. Based on the present analysis, ~28% of limb bones found in the DB belonged to individuals aged two years and younger. However, the smallest specimens are 40–45% of adult size, meaning the nestling life stage is missing. This suggests that if age segregation was occurring in *E. regalis* at this locality, it would have been only for their first year of life, unlike what has been proposed for other hadrosaurids. Further research is needed to investigate variability of growth rates among hadrosaurids and its impact on the interpretation of age distribution in bonebeds.

Colbert Prize Session

Pioneering snakes: reconstructing the early arrival of colubroids in South America

Alfonso Rojas, Andres F.[1], Salas-Gismondi, Rodolfo M.[2,3], Schmaltz Hsiou, Annie[4], Bloch, Jonathan I.[5], Antoine, Pierre-Oliver[6], Head, Jason[1]

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Snakes are a hyperdiverse terrestrial vertebrate clade. One-third of global snake species richness is concentrated in tropical South and Central America following immigration of colubroids and elapoids from Asia through North America. The timing and factors driving and permitting their adaptive radiation in this region remain poorly understood. Recent molecular and biogeographical studies suggest that colubroids arrived in South America during the late Eocene to Oligocene, likely through multiple migration events during the Cenozoic.

Fossil evidence for the arrival of colubroids in South America remains scarce. Unambiguous occurrences in northern South America date to the middle Miocene with some record to the late Miocene of Brazilian Amazon. However, older records have not been previously documented. We describe multiple colubroid fossils from the upper Oligocene Chambira and middle Miocene Pebas Formations in Peru, the lower Miocene Cucaracha Formation in Panama, and the middle Miocene Villa Vieja Formation in Colombia. These records consist of isolated precloacal vertebrae, which are assignable to Colubroides based on the variable preservation of elongate and narrow centra, circular cotyle and condyle articular surfaces that are narrower in diameter than the neural canal, well-developed paracotylar ventrolateral processes, elongate neural spines that are uniformly wide transversely along their length, and well-developed, laterally oriented prezygapophyseal accessory processes. Additionally, vertebral morphology is consistent with Colubrinae sensu lato based on well-developed, flattened haemal keels. No specimens can be referred to other extant South American lineages, including Elapidae and Dipsadinae.

Vertebrate immigration into South America during the late Paleogene has been proposed via three primary routes: dispersal from North America through Central America or the Caribbean and overseas rafting from Africa. The lack of African clades in the Oligocene–Miocene Colubroides record does not support Atlantic rafting. Conversely taxonomic similarities between the New World late Paleogene and Miocene records supports Southward dispersal. However, the absence of a terrestrial connection between Central and South America requires overwater dispersal or conduits that are currently unknown.

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Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Broadening the semi-aquatic scene: first quantification of the diversity of microanatomical patterns in pinnipeds and its relevance for early cetaceans

Alfsen, Apolline[1,2], de Muizon, Christian[3], Bianucci, Giovanni[4], Lambert, Olivier[5], Salas-Gismondi, Rodolfo M.[6], Urbina, Mario[6], Kaffler, Antonia[1], McCurry, Matthew[7], Hampe, Oliver[1], Amson, Eli[2]

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The aquatic lifestyle has emerged multiple times in mammals, and the cetacean fossil record offers a unique window into its past diversity.

During the early–middle Eocene, semi-aquatic whales diversified from Indo-Pakistan to South America. They shared aquatic adaptations, including hind limb reduction, an elongated tail and high bone compactness, yet they had varying degrees of these traits, with only some able to bear weight on their hind limbs. Unlike mustelids, pinnipeds, that have diverse amphibious behaviors, never had their microanatomy systematically investigated quantitatively. Including both clades in a comparative analysis makes the ideal framework for studying the spectrum of aquatic adaptation.

Here, we analyzed the microstructure of four-legged cetaceans using µCT and compared it to the humeri and femora of extant semiaquatic carnivorans. We sampled ~60% of pinniped species, complemented by semiaquatic and generalist mustelids, to build a reference for the amphibious lifestyle. We quantified global compactness, medullary cavity proportion and the type of medullocortical transition (MCT) via variation profile along bone shaft. We then contrasted these results with Eocene whales for a functional interpretation.

Statistical analyses showed that comparisons away from the growth center significantly distinguished species with non-weight-bearing hind limbs from those with all-limb bearing weight. *Andrewsiphius sloani* (Pakistan) had the most compact femur, a medullary cavity occupying less than half of the bone section and a very gradual MCT, this profile was similar to those of otariids—agile predators capable of high swimming speeds. *Peregocetus pacificus* (Peru) and *Rodhocetus balochistanensis* (Pakistan) had compact femora, a medullary cavity exceeding half the bone section and a gradual MCT—a profile between a fur seal and the sea otter. *Ambulocetus natans* (Pakistan) had a less compact femur with three quarter of the bone occupied by the medullary cavity and a very gradual MCT—a pattern resembling some phocids that spend most of their life in water. Lastly, certain monachine seals exhibited extremely spongious bones with a medullary cavity occupying 94% of the bone section and filled with trabeculae, strongly reminiscent of modern cetaceans. This new comparative dataset of extant carnivorans widens the spectrum of microanatomical patterns linked to an amphibious lifestyle and reveals a broader diversity of semiaquatic behaviors in early cetaceans.

Funding Sources Deutsche Forschungsgemeinschaft (DFG) - Project number 495352270

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Lines of distinction: morphometric tools for exploring past and present taxonomic diversities of galeomorph sharks

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Body measurements are fundamental components in the description of living and fossil sharks, often reported in taxonomic studies, and traditionally used as valuable tools for recognizing and comparing taxa. Traditional morphometric approaches offer a promising framework to quantify morphological variations, support taxonomic identifications, and explore diversity patterns, especially in deep time. Although increasingly used, this approach is increasingly used nowadays, but it undoubtedly raises methodological challenges and controversies. This study evaluates the reliability of morphometric data derived from various sources (e.g., physical specimens, photographs and line drawings) and assess the potential taxonomic significance of selected body proportions in both living and fossil sharks. The superorder Galeomorphii, which is one of the most diverse groups of modern sharks and includes some of the best-documented taxa (e.g., the white shark, the whale shark, and the hammerhead shark), was chosen as the study

group. Standardized measurements, normalized by total length, were taken from lateral-view images of extant taxa to establish a robust reference dataset. Measurements from well-preserved fossil specimens were subsequently integrated into this framework. In the first analytical phase, we tested for inter-source consistency and applied correction factors as needed. In a second phase, we evaluated which body proportions most effectively discriminate taxa at the order, family, and genus levels. Our first outcomes indicate that although morphometric data from different sources are generally congruent at higher taxonomic levels, discrepancies emerge at finer resolutions. Additional results based on a more complete data set revealed that at least some body proportions offer significant discriminatory power for recognizing galeomorph sharks. However, taxonomically informative proportions may not always be consistent across different clades. These results highlight the potential of traditional morphometry in shark systematics and emphasize the need for standardized, empirically supported protocols to improve reproducibility. Beyond a mere methodological assessment of the morphological diversity in living sharks, the integration of fossil data also demonstrates the method's value in enhancing their past taxonomic resolution, promoting effective tools for both biodiversity and macroevolutionary investigations.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Using Finite Element Analysis to determine combative evolutionary drivers of ceratopsid horns.

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Ceratopsid dinosaurs are best known for their extravagant headgear, including elaborate neck frills and varied nasal and supraorbital horns, providing an excellent case-study in which to investigate morphological diversity patterns through deep time. While ceratopsid frills are generally interpreted as display structures, the horns are hypothesized to have played a role in intraspecific combat, evidenced by pathologies in some taxa. However, while the morphological diversity of ceratopsid horns is well-understood, the evolutionary drivers of this diversity is less clear. One possibility is that the evolution of different horn shapes was driven by variance in combat styles, as observed in some extant animal groups. Here, we test this hypothesis through Finite Element Analysis (FEA) of the skulls of five ceratopsid taxa (*Psittacosaurus*, *Protoceratops*, *Centrosaurus*, *Spiclypeus*, and *Triceratops*) to quantitatively compare biomechanical performance under simulated combat behaviors observed in extant analogues, including stabbing, fencing, ramming, and wrestling. Results indicate that the basal *Psittacosaurus* and *Protoceratops* skulls can accommodate surprisingly high stresses for their size but lack any obvious adaptations for specialized combat. The nasal horn of *Centrosaurus* was well-suited for taking vertical and longitudinal stresses while being weaker under mediolateral loads. The supraorbital horns of the chasmosaurines *Spiclypeus* and *Triceratops* exhibit low functionally-induced stresses under most loading scenarios, suggesting they were well-suited for accommodating a range of combat behaviors. These results suggest a complex interplay of potential drivers of ceratopsid skull evolution. A mechanically strong skull was ancestral for the clade, but divergences in horn morphology between centrosaurines and chasmosaurines may have been driven by distinct combat styles, with centrosaurines being more specialized stabbers and chasmosaurines being more generalized wrestlers. This study helps ascertain the effectiveness of cranial weaponry in ceratopsids for intraspecific combat and fills a notable knowledge gap in our understanding of these famous dinosaurs. Future work and increased sampling will further help to illuminate the evolutionary drivers of the extreme cranial morphologies observed within this clade.

Funding Sources University of Bristol, Department of Earth Sciences, Palaeobiology MSc program.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

The endocranial anatomy of protocetids: implications for early whale bone mass increase and paleoneurology

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The exceptional fossil record of cetaceans provides a unique opportunity to understand major lifestyle transitions. The paraphyletic protocetids represent a key stage in early cetacean evolution during the middle Eocene, when these mammals were most likely capable of locomotion both on land and in water. This amphibious lifestyle imposed specific constraints on both the locomotor and sensory apparatus. Bone mass increase (BMI) – a typical adaptation of shallow-diving tetrapods associated with buoyancy and trim regulation – has been documented in the postcranial skeleton of several protocetids, emphasizing that such a trait was under selection in this lineage. However, no study has hitherto assessed whether the skull of these animals was also affected by BMI. More generally, protocetid endocranial anatomy has only been documented in a few studies. This hampers our ability to clarify crucial aspects of early cetacean evolution, such as the timing of encephalization increase or the relative size of the olfactory apparatus, which is often argued to undergo relative reduction in aquatic amniotes.

Here we present high-resolution CT scans of the skull of *Protocetus atavus*, the type species of the family, from a middle Lutetian member of the Mokattam Formation (northern Egypt). We compare it to a contemporaneous protocetid, *Aegyptocetus tarfa*, which complements the preserved endocranial anatomy of *Protocetus*. We further incorporate these new data into large comparative datasets to better understand how the encephalization quotient (EQ), relative size of the olfactory apparatus, and skull roof thickness and compactness evolved in early cetaceans.

We found that early cetaceans such as *Protocetus* likely exhibited an increased EQ and retained a relatively large olfactory apparatus, suggesting limited selective pressure resulting in olfactory reduction at this stage. Additionally, we found that BMI also affects the skull of *Protocetus*, which features relatively thick and compact skull bones, roughly intermediate between those of the pygmy hippopotamus and manatees. Combined with previous postcranial observations, these results give further credit to the hypothesis that BMI is an adaptation that can affect aquatic amniotes systemically. More generally, this emphasizes that endocranial microanatomy is an understudied avenue that can shed further light on lifestyle transitions.

Funding Sources Deutsche Forschungsgemeinschaft (AM 517/4-1); Alexander von Humboldt-Stiftung (1222365);

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Exploring interrelationships between fossil and extant lorisids (Strepsirrhini, Primates) and the question of their biogeographic origins

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Extant lorisids are distributed across equatorial Africa (pottos and angwantibos) and Southeast Asia (slow, pygmy and slender lorises), and this notable degree of geographic separation suggests a complicated evolutionary history. Molecular phylogenetic analyses have addressed interrelationships among extant lorisids and generally agree with the family being divided into two monophyletic clades: the African Perodicticinae and Asian Lorisinae. However, how modern lorisids relate to their extinct kin is poorly understood. Here, we created a data matrix of 191 morphological characters for 17 extant lorisoids (14 lorisids and 3 galagids) and 13 fossil lorisoids to test their interrelationships, making it the most comprehensive phylogenetic study for this primate group. Molecular sequence data were included for 14 of the extant taxa, and a Bayesian Total Evidence analysis performed. *Karinisia*, a late Eocene stem lorisoid, was used as the outgroup.

A summary tree from the posterior distribution of trees is consistent with previous molecular phylogenies that separate monophyletic Perodicticinae and Lorisinae. The Pliocene *Laetolia* is resolved as sister to modern galagids, and the other stem Galagidae are composed of several species of Miocene *Komba*. This is consistent with previous hypotheses for fossil galago interrelationships.

Concerning lorisids, the late Miocene *Nycticeboides* from Pakistan appears more closely related to modern *Loris* from Asia. However, another known lorisid from Pakistan falls within African Perodicticinae, suggesting complex migrations between Africa and Asia. The hypothesis that all *Mioeuoticus* species form their own subfamily, Mioeuoticinae, at the stem of Lorisidae is not supported. *Mioeuoticus kichotoi* is well nested within Perodicticinae, and more closely related to the angwantibos (*Arctocebus*). *Mioeuoticus shipmani* falls at the stem of Lorisoidea – more basal than previously hypothesised. The enigmatic Fort Ternan lorisid (Kenya) is not resolved as a lorisid and may belong to a more basal radiation of lorisoids. Finally, the oldest alleged lorisid, *Namaloris* from the Oligocene of Namibia, appears as the most basal galagid instead, putting its ascription to Lorisidae in doubt.

This tree is more consistent with an African, as opposed to Asian, origin of the family Lorisidae. This result would agree with previous inferences that lorisids may have used the *Gomphoterium* Landbridge to reach Asia from Africa during the Middle Miocene.

Funding Sources Funding provided by a National Science Centre (Cracow, Poland) grant (Nr. 2022/45/NZ8/03585) to S. López-Torres.

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Tooth patterning in the earliest osteichthyan

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An elaborate mosaic of toothed dermal bones comprises the dentition of osteichthyans and sets it apart from that of other modern and extinct jawed vertebrates. In the earliest known osteichthyans from the Silurian, the inner series of jaw bones can feature specialised dome- (cushions) and spiral- (whorls) shaped elements with a fibrous or weakly mineralised connection to the jaw endoskeleton. These are commonly found as isolated remains and their position in the dentition has been inferred from attachment surfaces and processes in articulated specimens. Tomography data from the dental elements of the oldest osteichthyan from the lower Silurian (439 Mya), Rongxi Formation of China reveal growth-related fusion of tooth cushions that can possess two or more distinct attachment areas. The tooth curvature of these compound cushions indicates that they were arranged transversely to the jaw rami in a manner similar to the tooth families of modern chondrichthyans. This points to a different arrangement of the inner dental series of the Rongxi osteichthyan in relation to the stem osteichthyans *Lophosteus* and *Andreolepis.* In these taxa, tooth cushions possess a single concave area for contact with jaw processes that are assumed to be distributed in a longitudinal series. The capacity of the Rongxi osteichthyan to integrate discrete toothed elements into larger units has the consequence of producing ontogenetic and/or positional changes in the morphology of the dentition. These results challenge the view of tooth cushions as developmentally conserved units and suggest an early evolutionary experimentation with latera/lingual expansion of the inner dentition in osteichthyans.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The second species of *Dimorphodon*

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Dimorphodon macronyx is the second valid species of pterosaur to be erected, and the first to be discovered outside of the Solnhofen Formation of Germany (by Mary Anning), becoming the oldest known pterosaur for almost a century and a half and extending the range of pterosaurs to the Lower Jurassic of England. As such, *Dimorphodon* has had a profound influence on our understanding of pterosaur biology, evolution, and function. What is not usually appreciated is that there is a second species of *Dimorphodon*, *Dimorphodon weintraubi* from the Middle Jurassic of Tamaulipas, Mexico. It was erected in 1998 as part of an analysis of foot posture and locomotion in pterosaurs, but was not completely described at the time. To address this, the holotype and only specimen was restudied and analyzed. The holoytpe is well preserved, and includes the posterior portion of the skull (including endocast), four cervical vertebrae, pectoral girdles, partial left and nearly complete right wing, and the right ankle and foot. Unusual for pterosaurs, it is three-dimensionally preserved with robust sturdy bones. In addition to highlighting the morphology of basal pterosaurs otherwise seen only in two-dimensions, it provides insight into the early evolution of the pterosaurs. *Dimorphodon weintraubi* has been proposed to be a dimorphodontid, sister group to the

Anurognathidae, or sister group to all pterosaurs but the Dimorphodontia. Phylogenetic analysis confirms that *D. weintraubi* is a later-branching member of an expanded Dimorphodontia with six Late Triassic to Middle Jurassic species: *Parapsicephalus purdoni*, *D. macronyx* and *weintraubi*, *Rhamphinion jenkinsi*, *Allkaruen koi*, and *Caelestiventus hanseni*. Because *D. macronyx* is an early-branching member of the Dimorphodontia, *Dimorphodon* could currently be considered to either have five species or be polyphyletic if the other genera are retained. The Dimorphodontia is the second basal-most pterosaur group and one of only two clades to survive the end-Triassic extinctions. It thrived during the Early Jurassic achieving global distribution, before tapering off in the Middle Jurassic with the rise of the breviquartossan pterosaurs. The Dimorphodontia was the most successful group to navigate the Early Jurassic when pterosaurs came closest to extinction.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

LIVE from the field: paleontological fieldwork livestreams as impactful outreach

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While paleontological fieldwork is a vital component of fossil science, it is also a subject of fascination for the general public—which presents the paleontologist with an opportunity for impactful science communication. Paleontological public outreach can be challenging, and traditional modes of outreach (such as written accounts, documentary films, and television shows) have inherent shortcomings which can limit their effectiveness in educating and inspiring the public. Livestreaming (the broadcasting of audio and video in real time to audiences over the internet) is still a practice which remains underutilized within paleontology. By showcasing how paleontologists gather data and collect fossils, fieldwork livestreams can help dispel public misconceptions about paleontological fieldwork and build more direct connections between fossil science and the public at large.

Here, we outline the necessary equipment and logistical requirements for livestreaming from remote field sites, provide examples of productive interaction between paleontologists in the field and viewers at home, as well as offer guidance on best practices for lessening the risk of site vandalism and fossil poaching when fieldwork is publicly broadcasted. Furthermore, we describe how we have successfully employed livestreaming to raise substantial funds for fieldwork and fossil preparation in the laboratory. Survey responses from livestream viewers emphasize how these livestreams can provide a compelling window into the fieldwork process for members of the public who might lack the ability to volunteer on a field crew due to geographical, financial, or disability reasons. Finally, we make the case that recent advances in technology and the emergence of affordable satellite internet have now made livestreaming far more accessible to paleontologists in the field.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new giant fossil hyracoid (Mammalia, Afrotheria) from the southern East African Rift in Gorongosa National Park, Mozambique

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Paleontological surveys of the Urema Rift in the Gorongosa National Park (GNP) of central Mozambique, the southern-most extent of the East African Rift System (EARS), have yielded a unique sample of marine and terrestrial vertebrate fossils from a coastal forested paleoenvironment. Dating these fossil remains is challenging due to the lack of volcanics in the southern Rift and the limited and dispersed nature of outcrops of sedimentary deposits within the modern woodland-savannah mosaic habitats of Gorongosa. Geological work places our fossil localities in the lower member of the Mazamba formation, and preliminary dating using a cosmogenic nuclide dating method based on isotopes of beryllium (Be^{10}/Be^{9}) suggests an early Miocene age for the vertebrate bearing deposits of GNP. The presence of intermingled marine vertebrates (tiger sharks of the genus *Galeocerdo* and batoid rays), as well as turtles (Testudines), crocodiles (Crocodylia) and terrestrial Afrotheres (Hyracoidea, Embrithopoda) is consistent with the geological and paleobotanical evidence suggesting that the GNP fossil localities sample a coastal or estuarine paleoenvironment. Several new and as-yet unnamed hyracoid taxa are present at the GLP-12 fossil locality, including a large species with an estimated body mass of 125–150 kg and one or possibly two smaller taxa. The large hyracoid from GNP is represented by a single individual with a complete left hemi-mandible with all lower tooth positions present and the entire right-side post-canine dentition preserved except for the first molar. The cheek teeth are strongly lophodont, bearing transverse crests that link buccal and lingual cusps in the trigonid (protocristid) and the talonid (hypocristid). Strong wear along these crests exposes dentine as enamel wears to create sharp and elongate crests well adapted for an herbivorous, possibly folivorous diet. The distal end of the lower third molar includes an elongated hypoconulid lobe with sharp crests running along its lingual, buccal, and distal borders. Uniquely among fossil hyracoids, both the protocristid and the hypocristid are extended lingually by the addition of crests (metacristid and entocristid) that run from the metaconid and entoconid to lingually placed metastylid and entostylid. *Titanohyrax* from the Fayum shares a similar metastylid and metacristid, but the entocristid and entostylid described here are novel features among currently described fossil hyracoids.

Funding Sources The National Geographic Society NGS-111654R-24, The Leakey Foundation S202410549, and The Palaeontological Scientific Trust (PAST).

Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

Morphological complexity, reduction, and loss of the postfrontal bone of Permian dicynodonts (Therapsida, Anomodontia)

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Like other therapsids, dicynodonts ancestrally retain a postfrontal, but it is reduced or lost in multiple dicynodont lineages. Its presence or absence is a frequent character used in phylogenetic analyses. The postfrontal is visible on the skull roof as a sub-triangular element wedged between the frontal, postorbital, and parietal, and it makes a small contribution to the posterior margin of the orbit. X-ray μCT data reveal that the internal structure of the postfrontal is more complex than expected given its external appearance. In basal dicynodonts, like the endothiodont *Abajudon,* the postfrontal is broadly exposed anteriorly on the dorsal and

ventral surfaces of the skull and contacts the frontal and postorbital along simple scarf joints. Moving posteriorly, the dorsal surface narrows more rapidly than the ventral, so that a narrow process projects dorsally from the wider internal portion of the element. Bidentalian dicynodonts with wide anterior exposures of the postfrontal, like *Oudenodon*, show a similar morphology, but the lateral and medial surfaces of the bone complexly interdigitate with the frontal and postorbital. Many Permian bidentalians, such as *Aulacephalodon kapoliwacela* and *Madumabisa opainion*, have an extremely narrow dorsal exposure of the postfrontal. These taxa retain a substantial internal portion of the element, with only a blade-like dorsal process extending between the frontal and postorbital; the complexity of its contacts with the latter elements is variable. These observations also suggest that ontogenetic loss of the postfrontal in taxa such as *A. bainii* likely stems from overgrowth of the narrow dorsal portion of the postfrontal by the postorbital and frontal, with a distinct postfrontal still present internally, instead of a complete co-ossification of the elements. Postfrontals also are lost in some Permian emydopoids, such as kingoriids and cistecephalids. Observations of *Dicynodontoides* and *Kembawacela* imply a different method of loss than in bidentalians. In these taxa, there is no internal or external manifestation of the postfrontal, suggesting that the element never forms or co-ossifies with the frontal or postorbital very early in ontogeny. These data show that a more refined treatment of the postfrontal than simple presence/absence is warranted in phylogenetic datasets, and that characters describing the element's internal morphological variation may be feasible as the CT datasets available for the clade grow.

Funding Sources Field Museum of Natural History

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A new Pan-Chelidae (Testudines, Pleurodira) from the Early Cretaceous of the northern margin of Gondwana (Lebanon)

Anquetin, Jérémy[1,2], Bouchema, Nicolas[3], Vallée-Gillette, Nathan[4], Roch, Renaud[1,2], Olive, Sébastien[4,5], Robin, Ninon[3], Godefroit, Pascal[4], Cavin, Lionel[6], Maksoud, Sibelle[7,8], Azar, Dany[7,8]

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The evolutionary history of side-necked turtles (Pleurodira) is intrinsically linked to that of Gondwana. Pleurodires are restricted to southern continents (South America, Africa, Australasia), and the clade probably originated in Gondwana during the Late Jurassic or Early Cretaceous. Early on, they split into two main clades. While the Pan-Pelomedusoides diversified greatly during the Cretaceous and Paleogene and reached a widespread distribution including the northern hemisphere, the Pan-Chelidae apparently remained restricted to South America and Australasia. The earliest pan-pelomedusoid dates from the late Barremian of Brazil, whereas, until now, the oldest pan-chelid is *Prochelidella cerrobarcinae* from the Aptian-Albian of Argentina.

In this study, we describe new pleurodiran material, including a sub-complete specimen, from the lower Barremian dysodiles of Jdaydet Bkassine (Lebanon). The presence of a cervical scale and a finely vermiculated surface ornamentation on the shell confirm an attribution to pan-chelids. The presence of a large retropterygoid foramen (also called chelid canal) on the cranium recalls the condition in *Prochelidella* spp. The phylogeny of Pan-Chelidae is far from being either resolved or

stable. Nonetheless, we tested the phylogenetic relationships of our new turtle in several recent matrices. The new Lebanese pan-chelid usually groups with the South American extinct short-necked chelids (an eclectic group of mainly Cretaceous forms), but the position of these turtles is somewhat unstable. This instability is inherent to the matrices used and is not related to the inclusion of our new material.

The new Lebanese material therefore represents the earliest unambiguous Pan-Chelidae and the first known outside of South America and Australasia. This is also one of the oldest and best-preserved crown-group pleurodires. Its northern gondwanan origin and early age open new questions regarding the initial distribution and center of origin of pan-chelids in particular and pleurodires in general. However, we must not forget that according to molecular-clock dating pleurodires originated during the Late Jurassic, which leaves a 20–30 Ma temporal gap during which the early history of the clade is still obscure.

Funding Sources Swiss National Science Foundation (SNSF IC00I0-227983) to JA; Swiss European Mobility Programme, University of Fribourg to NB.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Virtual taphonomy: examining preservational megabias in a simulated world

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While the fossil record is teeming with new species, ecological interactions, and past environmental signals, data continually remains overshadowed by one major megabias: only terrestrial organisms that live, disperse, or deposit within actively filling, net-depositional sedimentary basins may potentially preserve. It is imperative, therefore, that we gain an understanding of how greatly this bias can impact our ability to accurately represent species traits, phylogenetic relationships, and overall ecosystem structures. By adapting a virtual world model simulating global conditions (including fluctuating precipitation and temperature) across the past 120,000 years, we can assess some of these patterns. Virtual species within this model were seeded into grid cells and allowed to expand their geographic range based on assigned environmental niche breadth and dispersal ability. Although prior investigations have utilized this model primarily for delineating macroevolutionary patterns (e.g., latitudinal diversity gradients), we examine the impact and extent of the basin-only preservational megabias on phylogenetic relationships and overall species diversity within terrestrial species in simulated North and South America. The positions of all sedimentary basins active within the past 120,000 years were added post-hoc to simulation results, with 12 10,000-year time slices designated. Species were removed from the analysis if they did not fall within these basins in any given time slice to simulate non-preservation. Calculated species' diversity and phylogenetic reconstructions of simulated species were examined within each time bin and compared to their 'real' record (the entire model). We then considered how species' traits (combinations of niche breadth and dispersal capacity) were associated with likelihood of basin preservation, as well as the influence of basin characteristics themselves (e.g., basin size, location, etc.). This subsetting was repeated again, this time with basin positions randomized to assess whether current basin configuration had any impact on pattern of biasing. Preliminary results demonstrate that while the basin-only preservational megabias

does affect simulated paleoecological interpretations, this impact is minimal beyond overall record reduction, giving confidence in our interpretation of the terrestrial vertebrate record.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Fossil vertebrate diversity and paleoecological implications of a new fossiliferous horizon from the Upper Cretaceous Smoky Hill Chalk, Logan County, Kansas

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The Smoky Hill Chalk Member is a sedimentary rock unit deposited under the Late Cretaceous Western Interior Seaway in North America and represents deposition during a regressive phase of the NioDebrara Cyclothem. Fossil invertebrates are well known from the Smoky Hill Chalk, but the taxonomic composition of its vertebrate fauna is less understood, particularly smaller taxa. Although vertebrate fossils are generally distributed sparsely in the Smoky Hill Chalk, a stratigraphic horizon rich in vertebrate remains was discovered near the uppermost part of the stratigraphic member, approximately 5 m below the contact with the overlying Pierre Shale, in Logan County, Kansas. Recovered fossil taxa include two identifiable chondrichthyans, at least 7 osteichthyan fishes, and three tetrapods. The most abundant taxonomically identifiable vertebrate fossils collected in our study are teeth and palatine bones of *Enchodus petrosus*. The collection also includes small phosphatic pebbles interpreted to be coprolites of uncertain origins, some of which contain fragmentary bones of small teleosts as inclusions. The present fossil record is sufficient to indicate this assemblage encompassed a wide range of trophic regimes, including small pelagic bony fishes with small sharp teeth suited for catching smaller fishes and soft-bodied invertebrates (e.g., *Pachyrhizodus*, *Cimolichthys*, and *Enchodus*), a durophagous benthic fish (*Rhinobatos*), a shark known as an opportunist or scavenger (*Squalicorax*), and two examples of predatory marine reptiles (mosasaur and plesiosaur). This study is significant because it represents the first collective study of fossil vertebrates from a single stratigraphic horizon within the uppermost part of the Smoky Hill Chalk.

Funding Sources DePaul University College of Science and Health; DePaul University Department of Biological Sciences

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Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Endless snakes most beautiful: searching for the drivers of cranial evolution across Constrictores

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The anatomical blueprint for snake cranial osteology is distinct from all other tetrapods. Within alethinophidian snakes we observe a level of functional separation between cranial units that is unseen in other vertebrates. This has likely facilitated the high level of cranial disparity across modern snake taxa. New fossil discoveries continue to highlight novel forms and expand the range of anatomical morphospace occupied by alethinophidians.

Our research questions whether this anatomical skeletal disparity is driven solely by adaptive factors, and test the influence of phylogenetic signal and allometry on the cranial anatomy of extant and fossil taxa. Booidae and Pythonidae (modern boas and pythons) provide an ideal natural framework for testing evolutionary drivers. These two morphologically and ecologically diverse alethinophidian clades

contain taxa which are posited to be morphologically convergent and have independently evolved complex sensory systems and similar soft tissue phenotypes. We quantify skeletal morphological variation across the palatomaxillary arch complex in a sample of over 50 constrictores species using geometric morphometrics (GMM). Preliminary analyses and results suggest that whilst phylogeny plays a strong influence on palatomaxillary arch evolution, the ecological factor of diet can drive the evolution of form within specific clades. Convergence of cranial anatomy is frequently seen co-occurrent with fossorial habits, and these taxa show differing rates of evolution to either arboreal and terrestrial taxa suggestive of divergent evolutionary processes driving the entry to new habitat occupation.

Funding Sources Yale Institute for Biospheric Studies (YIBs) Late Grant

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Microvertebrate assemblage from a Late Triassic bonebed in Arizona shows faunal diversity at the Adamanian–Revueltian boundary

Armour Smith, Elliott[1], Kligman, Ben T.[2], Marsh, Adam[3]

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The Upper Triassic Chinle Formation of the southwestern United States preserves well-known assemblages of large-bodied tetrapods, but we are now only beginning to understand the magnitude of the biodiversity of smaller-bodied tetrapods and fish. We collected vertebrate microfossils from PFV 410, known as the Kaye Quarry, a multitaxic bonebed with abundant shuvosaurid pseudosuchians in the Sonsela Member of the Chinle Formation of Petrified Forest National Park, Arizona. Constrained to a middle Norian age of approximately 214–216 Ma, PFV 410 fills a stratigraphic gap near the temporal transition from the Adamanian to Revueltian biozones, which demarcates a biotic turnover coincident with both an increase of regional aridity on the Colorado Plateau and the Manicouagan bolide impact event. PFV 410 is by definition in the base of the Revueltian, as the site occurs 1 m above an occurrence of the phytosaur *Machaeroprosopus*. The bonebed represents crevasse-splay deposits and possesses two distinct facies that were sampled for vertebrate microfossils. We implemented screenwashing and microfossil sorting procedures to search for small fossils under magnification. A total of 20 diagnosable vertebrate taxa are identified from the site, including: metoposaurid temnospondyls, drepanosauromorphs, lepidosauromorphs, tanystropheid, trilophosaurid, and malerisaurine archosauromorphs, *Vancleavea campi*, a lagerpetid pterosauromorph, a silesaurid dinosauromorph, saurischian dinosaurs from the *Chindesaurus+Tawa* clade, and coelophysoid neotheropods. A preliminary assessment of the non-tetrapod assemblage includes *Reticulodus* (a hybodont shark known from other Revueltian deposits), semionotiforms, redfieldiforms and coelacanthiforms. Comparisons of the PFV 410 assemblage among both older Adamanian sites and younger Revueltian sites has the potential to elucidate the timing and selectivity of the Adamanian-Revueltian faunal turnover event, and may serve to untangle what drove these patterns of faunal change.

Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

The first dinosaur eggs from the Yellow Cat Member, Cedar Mountain Formation (Early Cretaceous, Barremian), Utah, USA

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Newly excavated dinosaur eggs near Moab, Utah, are the geologically oldest Early Cretaceous eggs found in western North America and the first eggs from the Yellow Cat Member of the Cedar Mountain Formation. Eggs have long been known from the Cedar Mountain Formation but were limited to the Cenomanian-age Mussentuchit Member. The eggs from the Yellow Cat Member (Barremian) are about 25 million years older, providing insights into an earlier stage of the Cretaceous.

Two egg clutches and shell fragments were found at the same stratigraphic horizon, 325 m apart. They occur in a dull green, silty mudstone with chert granules, and rare mudstone clasts. The mudstone is massive with no apparent sedimentary structures. The structureless texture of the unit is attributed to extensive bioturbation, relics of which are represented by uncommon invertebrate burrows recognizable only by the frass being a different color than the matrix, and rare root casts. Fluvial sandstone channels are closely associated with the fossiliferous mudstone. The fossil-bearing horizon is interpreted as a floodplain deposit.

The egg clutches consist of a minimum of four crushed eggs, primarily consisting of the lower portions of the eggs, some retaining portions of the upper, and all of the lower curvature forming a lenticular shape due to sediment compaction. The eggs are estimated to be at least 8 cm in diameter. The eggshell is 1035–1050 µm thick. Observed eggshell is bioeroded on the inner surface due to resorption of calcium by the developing embryo, indicating that the eggs had hatched or were near hatching.

The eggshell has the following characters: dinosauroid ultrastructure, prolatospherulithic shell units, prolatocanaliculate pores, and sagenotuberculate ornamentation. This combination is diagnostic of the oofamily Spheroolithidae and the oogenus *Spheroolithus*. These ootaxa were formerly associated with hadrosaurid dinosaurs, but it has been argued that they likely pertain to ornithopod dinosaurs. Screening of matrix associated with the eggs failed to produce bones or other fossils.

The egg clutches represent nests and argue against hydraulic transportation. The uniformity and structureless nature of the matrix surrounding the nests obfuscates evidence of the nature of the nests. These nests indicate one of the many ornithopods in the member favored floodplains for nesting.

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Hoyo Negro: an amazing deposit for Pleistocene fauna

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Hoyo Negro is a large collapse feature within the submerged Sac Actun Cave System, Tulum, Quintana Roo, Mexico. This collapse feature episodically supported a pool of water and served as a depositional setting for animals during the late Pleistocene and early Holocene. The site was found in 2007 by cave divers, most of which have continued providing their high-level of expertise for the ongoing project. Almost 500 bones have been collected at this

point, which record 61 individuals from 23 species, including 15 extant species (29 individuals), and 8 extinct ones (32 individuals). Among these are two ground sloths that are new to science (*Nohochichak xibalbahkah* and an unnamed mylodont), and two carnivorans previously only known from South America, the short-faced bear *Arctotherium wingei* and canid *Protocyon troglodytes*. Other outstanding finds include an almost-complete human skeleton (one of the earliest humans from the Americas), sabertooth cat, gomphothere, and two other ground sloth species. As for the extant fauna, Hoyo Negro records multiple species that currently occur in the Yucatán, suggesting they may have existed within their current ranges for thousands of years. This includes carnivorans (puma, ocelot, margay, coati, hog-nosed skunk, spotted skunk), rodents (porcupine and mouse), bats (2 species), tapir, opossum (1 species), collared peccary, and snake (*Boa*). A series of AMS radiocarbon dates have been secured, with an age range between ~10,000 cal BP for a coati, and ~39,000cal BP for a ground sloth of the genus *Xibalbaonyx*. Taphonomic studies have focused on how the bones were deposited within the collapse feature. Based on this evidence, the current hypothesis is that the large Pleistocene animals fell into the pit while traveling through the cave when sea level was lower, upper passages were not submerged, and the floor of the pit held water. Hoyo Negro continues to increase our knowledge of the faunal communities at the end of the Pleistocene in southern North America.

Funding Sources Center of Excellence in Paleontology at East Tennessee State University
Instituto Nacional de Antropología e Historia
National Geographic Society

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Evolution of cranial joints in jawed vertebrates: insights from paleontological and evo-devo perspectives

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In the evolution of jawed vertebrates, cranial skeletons became divided into several movable units by interlocking joints, which enable delicate manipulation and rapid movement of jaws during feeding and ventilation. With the acquisition of the jaw, the jaw suspension was established to support the upper jaw (palatoquadrate) against the neurocranium. The suspensory joints of some extant lineages perform important functions in the cranial kinesis. The evolutionary processes of cranial joints have been discussed, but recent advances in phylogeny of jawed vertebrates prompt a reevaluation of the evolution of suspension modes and cranial articulations. During embryonic development, the cranial joints are formed at the interface between two different cell lineages, namely the neurocranial and pharyngeal arch elements, unlike postcranial synovial joints that develop within contiguous cartilage primordia. However, the developmental processes and molecular mechanisms of cranial joints have remained almost unexplored. To solve these problems, this study aims at understanding the homology and evolutionary process of cranial joints through analyses of the fossil record and at unveiling the developmental mechanisms of cranial joints. Comparative analysis of fossil morphologies showed that the suspensory joints, including the basal joint seen in extant osteichthyans, were established in the stem jawed vertebrates (placoderms) and that their positional relationship with the surrounding structures remained unchanged in the evolution of jawed vertebrates. On the other hand, detailed histological observations of the basal joint in the selected taxa in the actinopterygians, lissamphibians, squamates, and palaeognath and neognath birds showed the unexpected diversity in the developmental process of the basipterygoid processes and articular cartilages. We also revealed, through *in situ* hybridization of *Gdf5*, which codes a transcriptional factor involved in the formation of synovial joints, *Gdf5* is likely involved in the development of the basal joint in the tetrapods, as in the postcranial and jaw synovial joints. These lines of evidence suggest that the conservation of

position and the diversity of developmental processes in the evolution of cranial joints have been governed by the functional importance and underlying developmental constraints of joints, and possibly by developmental system drift.

Funding Sources JSPS KAKENHI Grant nos. 22H01341, 24KJ0649 and 25H01422.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

You should look a gift horse in the mouth: using 2D occlusal cheek tooth morphology to study the evolution of molarization in hoofed mammals

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Cheek teeth are filled to the cusp with information about mammalian evolution. Studying the evolution of mammalian cheek tooth crown complexity has benefited our understanding of mammalian evolution in developmental, morphological, and ecological contexts. Most work is focused on individual cheek tooth loci as opposed to considering the premolars and molars as serial homologues. This focus on individual tooth loci has left the exploration of inter-regional phenomena behind. One such phenomenon is the molarization of premolars across hoofed mammals; some have simple unicuspid premolars while others have premolar crowns that are equal in complexity to their molars. We investigated if 2D occlusal morphology across the upper and lower premolar–molar boundary in artiodactyl and perissodactyl taxa could be utilized to study the evolution of molarization in hoofed mammals. We developed a landmarking scheme for the upper and lower premolar–molar boundaries to capture the morphology across this important identity boundary. Shape data were analyzed through phylogenetically informed modularity analyses to understand the covariation structure at the upper and lower premolar–molar boundaries. *A priori* modularity hypotheses were proposed to provide alternative pathways to molarization considering the serial developmental homology between the premolars and molars. Hypotheses evaluated include mesial, distal, buccal, lingual, and independence modularity hypotheses that will be expanded on during this presentation. Both artiodactyl and perissodactyl results showed support for modularity across the upper and lower premolar–molar boundary but showed more variation in the upper premolar–molar boundary. Artiodactyls and perissodactyls differ in the modular strength of *a priori* modularity hypotheses between the upper and lower dentition—artiodactyls show consistency in support of modularity hypotheses between upper and lower premolar–molar boundaries where perissodactyls show significant differences in support for modularity hypotheses between upper and lower premolar–molar boundaries. Our results lead us to hypothesize that phylogenetically informed pathways to molarization are canalized through functional constraint, but variation still exists that may be important to understand the process behind the evolution of molarization in artiodactyls and perissodactyls.

Funding Sources Alberta graduate student excellence scholarship (AGES) and an NSERC Discovery Grant awarded to JMT (RGPIN/03433–2023).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Excavating and recording dinosaur dominated tracksites of Dinosaur Provincial Park, Alberta, Canada: including The Skyline Tracksite

Ashby, Sarah[1], Boult, Vicky[1], Bell, Phil R.[3], Walker, Issy[4,1], Brown, Caleb M.[2], Pickles,

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Dinosaur Provincial Park (DPP) in Alberta, Canada, is a site of global importance to palaeontologists due to its Konzentrat-Lagerstatte deposit, which contains a high abundance of diverse, high quality body fossils. The Park also has over a century of specimen collecting, which makes it an exemplary study system for Late Cretaceous ecosystems.

During the summer of 2024, a new tracksite was uncovered, named The Skyline Tracksite for its high elevation. This site contains evidence of multiple ceratopsians and at least one ankylosaur moving in the same direction, two tyrannosaurids walking parallel to each other and a small bird-like theropod. Additionally, there are a series of unidentified crescent marks which are expected to pertain to pterosaur, potentially *Cryodrakon boreas*, as this is the species all Albertan pterosaur material is referred to.

Before the discovery of the Skyline Tracksite only a small number of tridactyl concretionary prints had been recorded from DPP, making this site significant as it preserves the first multi-taxic dinosaur trackways in the Park that are comprised of natural moulds. Six new localities with trackways have since been discovered with this new search image. Being able to utilise both body fossils and ichnites at DPP provides researchers with the opportunity to gain a more complete picture of the local ecosystem, community structure, and behaviours contemporary to sediment deformation.

The 2025 field season will concentrate on further excavation and documentation of the Skyline Tracksite (a first paper is already in print) as well as prospecting for and recording new sites. Due to the friable nature of these ichnites, it is essential that as much information as possible is collected in a timely manner and that they are digitally preserved. Fully georeferenced, photogrammetry 3-D models will be made for each site, culminating in a guide to the ichnology of Dinosaur Provincial Park. This work will ensure these essential resources remain accessible to researchers for present and future studies.

Funding Sources The Dinosaur Research Institute student project grant.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

How reliable are fossilizable data in phylogeny reconstruction?

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DNA and soft tissues are unknown for most fossil taxa. To infer where fossils belong on the Tree of Life, vertebrate paleontologists generally have to use what is available: bones and teeth. Here, I examined the assumption that such fossilizable data contain phylogenetic signal. Using an anatomical matrix focusing on lipotyphlan mammals, I tested if congruence with an independent, well-corroborated tree increases with ever increasing samples of osteological and dental data. I treated recent species (or subjects) with well-supported phylogenetic affinities as though they were fossils, deleting non-fossilizable data and retaining only those anatomical characters present in a fossil (or template). I explored every subject-template combination (excluding the root), retaining only anatomical characters present in the respective fossil template and using the character states of the recent subject. This analysis differs from previous applications

of artificial extinction in that I randomly selected not just one, but two, four, eight, 16, or 32 subjects to treat as artificial fossils simultaneously in a given phylogenetic analysis. Retained characters were all based on the same template, first with the recent subjects' real states and again with random binary states. To generate topologies across the nearly 12000 artificial-extinction analyses, I used implied-weights parsimony in TNT. I measured congruence of a strict consensus from each analysis with a well-corroborated topology of recent taxa based on a DNA alignment plus phylogenies derived from genomic data in the literature. I measured congruence with this tree using shared splits and shared quartets. Results show that congruence with an independent tree increases with the addition of fossilizable data. This finding is true for analyses artificially fossilizing one or many taxa at a time; indeed, the slope of improving congruence with fossil completeness increases when multiple subjects are fossilized, although overall similarity to the well-corroborated tree decreases as more subjects are treated as artificial fossils. I therefore conclude that, for this dataset, morphological characters available in fossils contribute positively to accurate phylogeny reconstruction.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Comparative sulcal morphology of Malagasy subfossil lemurs

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The large-bodied subfossil lemurs of Madagascar exhibited vastly different locomotor repertoires compared to extant lemurs, including families that have been likened to Afroeurasian monkeys (Archaeolemuridae), sloths (Paleopropithecidae) and koalas (Megaladapidae). The inferred contrasts in behavior between extant and subfossil lemurs undoubtedly required differences in how the latter were processing information. To explore this, we interpret the sulcal impressions on the endocasts of five large-bodied subfossil lemur taxa, including two monkey lemurs (*Archaeolemur*, *Hadropithecus*), two sloth lemurs (*Babakotia*, *Mesopropithecus*), and the koala lemur (*Megaladapis*). We compare the subfossil lemur endocasts to a sample of extant lemurs and anthropoids to identify major anatomical regions and relative positioning of sulci. In general, we find the sulcal pattern characteristic of extant lemuroids to be highly conserved in subfossil lemurs. The sulcal pattern of the sloth lemurs and *Megaladapis* are similar to extant lemurs in their simple pattern of long, primarily longitudinal sulci. In monkey lemurs, the positioning and shape of principal sulci resembles the sulcal pattern of extant lemurs caudally while becoming significantly more complex in the frontal lobe. This contrast is most notable in the form of the lateral sulcus, which descends into the frontal lobe transversely, converging in position with the anthropoid central sulcus. The conservation of the extant lemur sulcal pattern in sloth and koala subfossil lemur taxa suggests that these taxa did not fundamentally differ in broad-scale patterns of cognition from living taxa. However, the combination of complex sulcal patterning and cercopithecoid-like inferred locomotion in monkey lemurs suggests these taxa may have been more cercopithecoid-like in aspects of its cognition. Overall, these data provide a novel window into the biology of the extinct members of the lemur adaptive radiation that may help us to understand additional complexities of their behaviour and ultimate extinction.

Funding Sources Supported by NSERC discovery grants to MTS. GAA supported by funding from Beausoleil First Nation.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

From feeding to fossil feces: connecting enigmatic trace fossils to a likely tracemaker in the Niobrara Formation of Western Kansas

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Paleontological exploration of the Smoky Hill member of the Niobrara Formation has occurred continuously since E. D. Cope's 1870 expedition. Hattin's 1982 description of the Smoky Hill Chalk marker units established useful stratigraphic references based on lithology, addressing complaints of the lack of stratigraphic data collected with vertebrate macrofossils. The description of trace fossils has lagged behind, with few mentions in the literature. Here we describe a new ichnofossil with implications for paleoecology and biostratigraphy.

Unique trace fossils composed of angular crushed bivalve fragments have been found between Hattin's marker units 4 and 6. This brief interval of deposition closes with the disappearance of the inoceramid Volviceramus involutus and the end of the Coniacian stage (~86.5 Ma). These trace fossils, here interpreted as coprolites, are strictly found in association with the rare and poorly known ram-snouted fish *Martinichthys ziphoides*. These fish, primarily found as robust isolated rostra, only occur in this interval. We interpret the coprolites as traces of *Martinichthys* feeding activity.

CT scans and thin sections of the coprolites were analyzed to study their composition. These analyses indicate they are the result of a durophagous feeding strategy. *Martinichthys*, restricted here to *M. ziphoides*, likely preyed on *Pseudoperna congesta* oyster communities anchored to hardgrounds on the soft seafloor. These include large inoceramids *Volviceramis involutus*, *Platyceramus platinus*, the rudist *Durania maxima* and encrusting fauna on sunken driftwood. Individually variable beveled rostral tips are interpreted as wear facets from feeding. We hypothesize a face-ramming behaviour for *M. ziphoides* that smashes encrusting oysters against the hardground, enabling a fish that completely lacks crushing dentition to exploit a hard-shelled prey. The relative abundance of coprolites compared to body fossils highlights their potential as biostratigraphic proxies for *Martinichthys*. Other durophagus Cretaceous fish were evaluated as a tracemaker; however, they have broader geographic and stratigraphic ranges and no co-occurrence with crushed shell coprolites. This research enhances our understanding of Late Cretaceous paleoecology, revealing a highly specialized trophic niche in the Niobrara. By describing these coprolites and assigning them to *Martinichthys*, this study highlights paleoecology significance and biostratigraphic value.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New material of the rhabdodontid *Transylvanosaurus platycephalus* (Dinosauria: Ornithischia) from the uppermost Cretaceous of the Hateg Basin (western Romania)

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The continental uppermost Cretaceous deposits of Transylvania (western Romania) yielded one of the richest and most diverse vertebrate assemblages from the entire European Upper Cretaceous, with fishes, amphibians, multituberculates, squamates, crocodyliforms, pterosaurs and various dinosaurs. Especially the dinosaur fauna has become famous, as it lived on an island during the latest Cretaceous and some members supposedly underwent island

dwarfism. However, despite the abundance of these Transylvanian dinosaur fossils, most specimens recovered thus far are very incomplete, hindering a detailed understanding of their anatomy and phylogenetic relationships. This is well exemplified by one of the most recently named dinosaurs from Hateg Island, *Transylvanosaurus platycephalus*, which was described in 2022. The holotype of this taxon consists of an articulated basicranium (basioccipital, exoccipital-opisthotic complexes, basisphenoid-parasphenoid complex, prootic, laterosphenoid) found associated with the articulated frontals. The fragmentary nature of the holotype hampered a detailed comparison with other taxa (due to a lack of overlapping material) and a precise assessment of its relationships (due to incomplete scorings in phylogenetic analyses). Recently, new associated cranial material (housed in the Palaeontology Collection, University of Bucharest) was recovered from the type locality of *Transylvanosaurus*, the Maastrichtian 'Pui Beds' (southeastern Hateg Basin). This new disarticulated partial skull includes a right frontal, a left maxilla (without teeth), and a partial left dentary with in situ teeth. The new material can be confidently assigned to *Transylvanosaurus*, as it exhibits two autapomorphies of this taxon—proportionately wide frontals, and a well-developed, anteriorly placed and transversely extending frontal crest. Aside from the frontal, the new skull preserves elements that were hitherto unknown for *Transylvanosaurus*, and thus offers additional insights into the cranial anatomy of this poorly known dinosaur. In addition, these elements are known in several other, supposedly closely related taxa (such as the sympatric *Zalmoxes*), allowing for more extensive comparisons, in particular in the case of the dentary, which represents the holotype of six of the ten currently recognized rhabdodontid taxa (including both *Zalmoxes* species). Finally, the new elements will permit a more confident placement of the genus in future phylogenetic analyses.

Funding Sources Deutsche Forschungsgemeinschaft (DFG, German Research Foundation)—Projektnummer (grant number) 533750820 (F.J.A.)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Evaluating targeted hemoglobin extraction from extant and diagenetically altered bone

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The application of molecular techniques has increasingly revealed the preservation of endogenous proteins in fossils across diverse taxa and geological timeframes. In typical protein extraction assays of bone, collagen I is readily recovered, as it comprises the bulk of the protein content in bone tissue. However, the sheer abundance of collagen I in extraction supernatants can potentially obscure the detection of non-collagenous proteins that are also present, such as hemoglobin (Hb). Additionally, previous research has suggested that standard extraction methods are especially poor at solubilizing Hb from bone tissue. Here, we evaluate the effectiveness of multiple protocols in targeting hemoglobin for extraction from modern chicken bones and a diagenetically altered (~1,000-year-old) moa (Dinornithiformes) bone that has been previously shown to preserve non-collagenous proteins, including Hb. Four extraction approaches were conducted: (1) an extraction using a single-phase, non-demineralizing buffer (400 mM ammonium phosphate diabasic, 200 mM ammonium bicarbonate, and 4M guanidine HCl; 400/200/4), (2) three extractions utilizing a two-buffer approach consisting of a demineralization phase (either hydrochloric acid or disodium ethylenediaminetetraacetic) and a subsequent solubilization phase (either a 8M urea-based solution or 2% SDS). The relative abundance of Hb and collagen I obtained by each extraction was quantified via enzyme-linked immunosorbent assay (ELISA). To separate moa proteins from coextracted,

diagenetic humic substances, moa supernatants were concentrated and digested through a modified filter-aided sample preparation (FASP) workflow. In chicken samples, urea-based solubilization yielded greater hemoglobin recovery while minimizing collagen extraction. In the moa, the non-demineralizing 400/200/4 and the urea-based solubilization phases recovered collagen effectively but did not yield a positive result for Hb. Further experimentation is needed to determine if the disparity between extant and diagenetically altered bone derives from the extraction protocol, the diagenetic alteration of the fossil, or the preservation state of Hb in the fossil. Our results illustrate the potential for the development of extraction protocols refined for the recovery of Hb and other non-collagenous proteins in fossilized material. Optimization of these methods will enable more targeted downstream proteomic analyses and broaden our access to extinct proteomes.

Funding Sources NC State University Department of Biological Sciences

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Colbert Prize Session

Were areas of higher ecological uniqueness consolidated as centres of recovery after the end-Cretaceous extinction?

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The end-Cretaceous mass extinction is the focus of extensive research, with increasing attention being paid to the palaeoecology of faunas before and after it. It is well known that non-avian dinosaurs succumbed to extinction, followed by the expansive diversification and radiation of surviving mammalian lineages in the Paleogene, but the effects of the extinction were far broader. Late Cretaceous ecological differences between dinosaurs, mammals and freshwater taxa may have affected what perished and survived and the subsequent establishment of new ecosystems. Untangling this involves using ecological models applied to study extant ecosystems, such as ecological uniqueness measures, to determine spatiotemporal links between species distributions and the abiotic environment.

We tested whether highly unique late Cretaceous vertebrate faunas (i.e., areas notably different from other coeval assemblages) corresponded to centres of post-extinction recovery in the early Palaeogene (i.e., areas with highly unique faunal compositions). We compared pre- and post-extinction uniqueness measures of Laramidian terrestrial and fluviolacustrine faunas from the latest Cretaceous (Campanian–Maastrichtian) to the earliest Paleogene (Danian). Our calculations were based on a comprehensive fossil occurrence database sourced from the Palaeobiology Database, taking into account environmental conditions from climate model outputs and fossil record biases.

Overall, we found that high pre-extinction ecological uniqueness values do not correspond to high post-extinction values in the same areas, indicating that ecologically unique areas in the latest Cretaceous were not preferential centres of recovery post-extinction. Freshwater guilds and mammals appear to have responded differently to the extinction, evidenced by freshwater taxa contributing more to overall beta diversity than mammals in the Danian, meaning that freshwater ecosystems were likely affected differently by the event than terrestrial ones, potentially recovering more rapidly. There is little correlation between biotic and abiotic uniqueness, implying that abiotic conditions did not exert consistent controls on spatiotemporal variation of biotic uniqueness.

In conclusion, pre-extinction ecological uniqueness did not determine faunal recovery patterns in the earliest Paleogene. Recovery to latest Cretaceous regional beta diversity levels was driven by freshwater taxa, despite the appearance of novel mammalian clades.

Technical Session II: Paleozoic Fishes
(Wednesday, November 12, 2025, 8:00 AM)

A redescription of the holotype of the eugeneodontid *Sarcoprion edax* using CT scanning and 3D modeling to examine jaw morphology and function

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Known for their midline tooth spirals, eugeneodontiformes are some of the most unique chondrichthyans to ever evolve. While most of this unusual group is only known from teeth, *Sarcoprion edax* is one of the most complete eugeneodontids ever discovered, with the holotype specimen containing almost the entire anterior third of the head. Despite this, it has not been the subject of any research since its description in 1952 by Dr Eigil Nielsen. Advances in CT scanning and 3D modeling have allowed for a reexamination of *Sarcoprion'*s holotype, which reveals a suite of novel adaptations for tooth stability and feeding.

The holotype specimen consists of the upper jaw, lower jaw, upper and lower symphyseal tooth series, part of the basihyal, and hundreds of disarticulated small lateral teeth and scales. The upper jaw is made from 4 cartilage plates, the lateral two of which may be the palatoquadrates. The basihyal is more complete than previously thought and is a poorly preserved puck-shaped piece of cartilage that lies behind the symphysis. The lower jaw consists of the left and right meckle's cartilages and a long symphyseal portion, which the lower symphyseal tooth series overlies.

The lower tooth series is extremely worn on both the lateral and apical surfaces. This wear increases anteriorly, which is due to either occlusion with the lateral teeth and the upper tooth series or feeding. The upper tooth series is dislodged but likely rested in the ventral concavity of the upper jaw. Both the upper and lower tooth series possess large posterior root extensions which interlocked with the surrounding teeth, providing significant support to each tooth during life. Both tooth series would have been shed.

The elongate snout with robust teeth well-suited for grabbing indicates that *Sarcoprion* was a large active predator of large fish and other chondrichthyans. *Sarcoprion* likely evolved this morphology to avoid competition with the other two durophagous eugeneodontids it lived alongside. *Sarcoprion's* jaw morphology is completely unique to chondrichthyans and is most comparable to toothed whales.

Within eugeneodontiformes, *Sarcoprion* represents a transitional morphology between the durophagous caseodontids and the spiral-toothed helicoprionids (such as *Helicoprion*). This is evidenced by a jaw morphology most similar to caseodontids, teeth that are most similar to helicoprionids, and similar growth patterns of the lower tooth series to that of *Karpinskyprion,* a helicoprionid.

Funding Sources Jeff Geslin Geosciences Research Fund.

Technical Session XIII: Euarchontoglires
(Friday, November 14, 2025, 1:45 PM)

Of mice and mountains: small-mammal diversity and mountain building past and present

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Mountainous regions are biodiversity hotspots around the world today, especially for small mammals (<1 kg). We report here findings from a long-term collaboration between paleontologists, mammalogists, and Earth scientists, supported by the U.S. National Science Foundation and informally named NARLEE (North American Rodents—Landscapes, Ecology, and Evolution). The central inquiry was which tectonic and climatic processes and conditions influence the richness and diversification history of small mammals over time. Our investigations focused on western North America over the past 30 million years, but the topic has relevance to other regions and time intervals as well. Through workshops, field trips, multi-institution online lab meetings, and research working groups, we formulated and tackled questions that require reciprocal illumination between past and present information and between Earth scientists and (paleo)biologists.

The evidence that we gathered resulted in the following findings. (1) Both compressional and extensional regimes of mountain-building promote species richness but result in different regional geographic richness gradients, based on evidence from the fossil record and modern ecosystems. (2) Few montane fossil records are preserved long term, but mountain-proximal basin areas record a substantial proportion of montane mammal diversity, based on evidence from the fossil record, modern richness gradients, and modeling. (3) Rates of change in the landscape are equally or more important than static attributes in the generation of diversity, based on the fossil and geological records and modeling. (4) The topographic richness gradient between lowlands and uplands is greatest during intervals of global warming, based on evidence from modern ecosystems and the fossil record from the Miocene Climatic Optimum. (5) Geomorphic aspects of canyon topography are strong predictors of elevational richness gradients, based on studies of modern canyon profiles and mammal surveys in the Basin and Range. (6) Since montane regions host increased species richness during warm intervals, they are regions of exceptionally high conservation priority. These findings arose from collaboration and would not have been realized by any one of us working in isolation.

Funding Sources The Research Coordination Network Program of the U.S. National Science Foundation supported our activities (grant no 1655720).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Description of large theropod dental material (Dinosauria, Theropoda) from the Campanian (Upper Cretaceous) of the El Gallo Formation, Baja California, Mexico

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Non-avian theropods were one of the most globally diverse groups of dinosaurs, originating approximately 235 million years ago during the Late Triassic and going extinct at the K–Pg boundary 66 million years ago. Throughout their evolutionary history, they occupied a wide range of ecological niches. Among the most abundant fossil evidence of large theropods, teeth are particularly common due to their continuous replacement and resistance to diagenesis.

Consequently, numerous studies have explored the taxonomic information that can be obtained from these structures. In Mexico, the fossil record of large theropods mainly consists of fragmentary and/or isolated remains, with documented evidence in the states of Coahuila, Chihuahua, Sonora, Michoacán, and Baja California. This study presents preliminary results of the taxonomic identification of 25 large theropod teeth (with crown sizes greater than 2 cm) recovered from sediments of the upper Campanian El Gallo Formation in northwestern Baja California. Identifications were made from morphological comparisons with existing literature and phylogenetic analysis using maximum parsimony. The analysis followed the methodology proposed by previous authors, focusing exclusively on crown-related characters and applying the monophyly proposed previously. A total of 91 crown characters were employed in both the morphological descriptions and phylogenetic analyses. These characters included denticle shape, crown base ratio (CBR), enamel texture, and denticle density per 5 mm in the apical, central, and basal portions of each tooth on both mesial and distal carinas, among other characteristics. Each tooth was treated as an operational taxonomic unit (OTU).

The results suggest a close relationship with taxa within the Campanian Tyrannosauridae clade of North America, including genera such as *Gorgosaurus* and *Daspletosaurus*, because they exhibit shared characteristics with these genera, such as denticle shape, crown width, and mesial chain elongation, among others. Additionally, this pattern is consistent with what has been observed across Laramidia for the Campanian regarding the diversity of large theropods.

Funding Sources Funding from Grants to MMB (PAPIIT IN100913, PAPIIT IN103616, PAPIIT IN111209) made possible the field work, collection and preparation of the study material.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

A diverse perissodactyl fauna from the early Eocene of southern China

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Perissodactyls first appeared at the beginning of the early Eocene, and soon diverged into four major groups. However, early Eocene perissodactyls are often preserved either by abundant materials from the same population or by fragmentary specimens in a relatively high diversity, which is controversial and obscures the early evolutionary history of perissodactyls. Furthermore, although southern China has been considered as one of the potential areas where perissodactyls originated, the early Eocene perissodactyls are very rare in this region. Here we report a highly diverse perissodactyl fauna from the early Eocene Huayong Formation in the Sanshui Basin of Guangdong Province, China. The preliminary analysis shows that the perissodactyl fauna is composed of three major groups, including ceratomorphs, chalicotheres, and brontotheres, and is mainly preserved by the maxillae and lower jaws from both adult and juvenile individuals. The ceratomorphs are the most diverse in the fauna and represented by a new derived isectolophid, a new helaletid, and three closely related species of a new lophialetid, which are probably related to *Kalakotia* from the middle Eocene of the Indian subcontinent. The chalicothere is represented by a new eomoropid which is similar to *Protomoropus* in the lack of mesostyle on the upper molars. The brontothere is represented by a new species of *Danjiangia*, which shows mosaic characters of both *Lambdotherium* and *Danjingia*, but is more similar to the latter by the well-developed ‘metastylid’ on the lower molars. The importances of the perissodactyl fauna from the Sanshui Basin lie in three aspects. First, it is a rare early Eocene locality that preserves highly diverse perissodactyls with relatively abundant materials. Second, its high diversity indicates that the divergence of Ceratomopha at familiar level occurred as early as the early Eocene, probably equivalent to the

Heptodon interval zone of Bumbanian. Finally, the new lophialetids close to *Kalakotia* suggest a faunal exchange between the East Asia and India subcontinent during the early Eocene. The perissodactyl fauna from the Sanshui Basin indicates that southern China is a pivotal area for the origin and early radiation of perissodactyls.

Funding Sources National Key Research and Development Project of China (2024YFF0807603);
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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Tracing the formation of the North American hot deserts since the Miocene via mammalian paleoecology and body size distribution

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The Neogene was a period of dramatic global climate change. On the one hand, the period was marked by a warm climatic optimum followed by dramatic cooling and drying that resulted in changes in vegetation coverage across North America—the mid-late Miocene was marked by the spread of C4 grasses and the Pliocene by the advent of glacial cycles.

Much of the research on the paleoecology of mammals in this period has focused on the spread of grasslands, particularly in the inner continent, with a major focus on the concomitant changes in locomotion and diet, particularly the shift from browsing to grazing forms in well-known ungulate groups. Surprisingly little attention, however, has been given to the formation of North America's major hot deserts—the Chihuahuan, the Sonoran, and the Mojave—and the adaptive changes in the region's fauna through the Neogene.

Indeed, there is no consesus among paleo-desert studies on the timing of the formation of deserts and their expansion in the southwestern continent. Little research has incorporated Neogene faunal and faunal changes within the context of these paleoecological data. Here I address this gap by using mammalian paleoecology to model past climate and make paleoenvironmental inferences in the regions of the southwest where Miocene–Pliocene formations are exposed today.

Here I test the reliability of trait assemblages in ecological communities to model paleoenvironmental variables such as temperature, precipitation, and vegetation coverage in the context of desert formation in the North American Neogene. I ask when and where these models first predict desert-type drying and warming in Miocene North America, and what is the timing of the development of the three deserts (e.g., are they synchronous)? And finally, what (and where) are the community changes that occur as desertification progresses?

I apply a method of mammalian community composition analyses through a generalized linear latent variable model that reconstructs paleoenvironment using ecological variables (such as body mass, presence/absence, diet, etc.) and contemporary analogous community assemblages to model past climate via a maximum likelihood approach. The ecological data come largely from fossil databases (such as NOW, MIOMAP, and the Paleobiology Database) and paleoclimate databases (such as MOD44B and WorldClim/Eco-ISEA3H), with current natural ranges predicted by the Phylacine database.

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Early career researcher needs, challenges, & opportunities in ethical open science

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Paleodata is complex: it spans time, scientific disciplines, and data types. As big data has revolutionized science, the FAIR (findable, accessible, interoperable, reusable) data principles and acceleration towards Open Science practices have become the new standard. Arguably, much of the work implementing and adopting these principles through practices has been undertaken by early career researchers (ECRs: graduate students, postdocs, and pre-tenure academics). This has included database development, creating and running workshops and protocols for FAIR tools and workflows, and designing course materials. The evolution of clearer ethical standards for Indigenous Data Governance (e.g., CARE principles: collective benefit, authority to control, responsibility and ethics) has again put ECRs at the intersection of principles and practice in the sciences. ECRs must contend with gaps between principles and practice within their fields of study, traditions of data management, sharing, and publication within their fields of study, as well as their own academic vulnerability. We present results from discussions with ECRs in paleodata fields at various career stages, with differing interactions with FAIR and CARE principles and Open Science practice. These discussions explore the needs and challenges that inhibit the uptake of these principles and engagement with ethical Open Science as linked to Indigenous Data Governance. We show how shifts in power structures, allocation of resources, and cross-disciplinary education are needed to transform how we practice more ethical Open Science in current and future research. These changes are most needed to bring awareness to data extracted from Indigenous communities that are made accessible in community-curated data resources. Our work identifies opportunities for progress to increase support for ECRs in paleodata disciplines as we re-envision ethical Open Science practice through FAIR and CARE principles.

Funding Sources NSF FAIR OS RCN, Disciplinary Improvements for Past Global Change Research: Connecting Data Systems and Practitioners [#s: 2347014, 2245082, 2226373, 2226370].

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

Innovation in jaw musculature drives the evolution of temporal fenestration patterns of the amniote skull

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Evolutionary innovation in the musculoskeletal system is behind some of the major body plan transformations in vertebrate history. The temporal region of the skull is central in the macroevolution of amniotes, since major clades (e.g., anapsids, synapsids, diapsids) are traditionally defined by the number of temporal bars and fenestrae. Temporal fenestration first evolved in early amniotes, possibly associated with the diversification of feeding mechanics and dietary habits on land. The diversity of fenestration patterns seen in extant and extinct amniote clades is thought to reflect variation in muscle attachment, size, orientation and physiology, since the temporal region houses the jaw adductor musculature, although this has been scarcely explored. Lepidosaurs showcase outstanding variation in the structure of the temporal region and the arrangement of jaw musculature, representing an ideal case to test these hypotheses. Here, we quantitatively explore the evolutionary relationship between temporal region morphology and jaw muscle anatomy and physiology using 3D geometric morphometrics and phylogenetic comparative methods in a sample of 149 lepidosaurs, and

musculoskeletal modelling of the skull in 13 species spanning our morphospace. We find significant co-variation and correlation signals between jaw muscle properties (mass, fibre length and PCSA) and skull and temporal shape. Accelerated evolutionary rates in muscle properties are found in clades that show more structural variation in their temporal region. Loss of temporal bars is associated with expanded external adductors, less vertical fibre orientation and relatively shorter in-levers. Our findings suggest that the evolution of temporal fenestration patterns is driven by innovation in jaw musculature arrangement and function, associated with diversification of feeding mechanics and diets. Thus, the remarkable disparity of temporal morphotypes showcased by amniotes, including several extinct lineages, reflects evolutionary experimentation in the skull musculoskeletal system through deep time.

Funding Sources Biotechnology and Biological Sciences Research Council (BB/W00867X/1).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

'Big Sam': a new large skull of *Pachyrhinosaurus lakustai* from the Campanian (72 Ma) Wapiti Formation of northwest Alberta, Canada, with implications for intraspecies variation

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Located in northwest Alberta, Canada, the Pipestone Creek Bonebed (PCB) is one of the densest dinosaur deposits in North America. The PCB represents a mega-herd of the endemic centrosaurine ceratopsian species *Pachyrhinosaurus lakustai*, which likely died in a single catastrophic event. This huge sample size of individuals from a single dinosaur community, including individuals of all ages, makes the PCB invaluable in the study of ceratopsian morphology, ontogeny, ecology, intraspecies variation, and social structure. The PCB has yielded more than a dozen complete and partially complete adult skulls of *P. lakustai.* However, due to extensive taphonomic crushing and warping, the scientific significance of many of these specimens is compromised. In 2024, a team from the Philip J. Currie Dinosaur Museum extracted a very large, complete adult skull from the PCB, the first to be found in over a decade. The excavation of this specimen (PCB.2024.666), nicknamed 'Big Sam', took five months to complete with a subsequent field jacket weighing over 453 kg (1,000 lbs). The skull consists of a complete cranium, including the occipital condyle and braincase, an articulated left squamosal, and an articulated parietal bar. Though dorsoventrally compressed, 'Big Sam' is among the largest skulls collected from the PCB to date, measuring 138 cm in length and with a massive nasal boss measuring 43 cm in diameter. While all other known *P. lakustai* skulls were preserved on their sides, the 'Big Sam' skull was preserved ventral-side up. As a result, this is the first *P. lakustai* specimen, and one of few known centrosaurine skulls, to have a complete palatal and rostral region free of lateral crushing or warping. While still in preparation, the 'Big Sam' skull has already yielded some intriguing features. An autapomorphy of *P. lakustai* is the parietal 'unicorn' spike(s) on the parietal bar, which can vary in number from one to three. Despite its size, 'Big Sam' appears to have an extremely reduced or absent parietal spike, with no evidence of pathology. This calls into question both the use of the parietal spike(s) as a diagnostic feature of the species, and the theory that these cranial adornments were display features in the oldest and most mature animals. Subsequent preparation work and study of this specimen is likely to yield interesting insights in the morphology, intraspecies variation, and ecology of *P. lakustai* specifically, and ceratopsians in general.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

From paddles to *Pachyrhinosaurus:* a novel public program provides a river raft-based fossil experience in northwest Alberta, Canada

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When visitors come to a dinosaur museum, they typically encounter the 'end product' of the paleontological process, the result of years of fossil collection, excavation, preparation, research, and curation. The Philip J. Currie Dinosaur Museum's (PJCDM), located in northwest Alberta, Canada, offers a unique program that takes visitors right to the beginning of the paleontology process, to the point of fossil discovery. Launched in 2023 and called 'Secrets of the Wapiti', this program is a four-hour, 23 km (15 mi) float down the Wapiti River in a guided raft, taking participants alongside deposits of the late Cretaceous (74–72 Ma) dinosaur-bearing Wapiti Formation. Along the river, they stop at three of the PJCDM's fossil sites accessible from the water. These include a dinosaur fossil site called Cucumber Point, a paleofloral site called Spring Creek, and a set of hadrosaur footprints called Jessy's Toes. The inspiration for this program was taken, in part, from the fact that fossil hunting in this forested region of the province was traditionally done by boat. One of the objectives of this program is to help the public understand why fossils are found in certain types of rocks, and how paleontologists know where to look for them. Led by a paleontological guide, participants learn that the sandstone cliffs surrounding them were formed by Cretaceous rivers, very similar to the river they are currently floating down. Participants see that features found in the modern river, such as wave-rippled sand and plant debris, can also be observed in lithified form in the Cretaceous sandstone. At each of the three fossil stops, participants may touch *in situ* fossils, and learn about their preservation, fossilization, discovery, and significance. The Secrets of the Wapiti program is formally evaluated with feedback forms distributed to participants before and after the experience. Of 115 post-experience surveys returned in 2024, 98 (94%) responded to the question "How satisfied were you with the experience?" with a 9 or 10 out of 10. All participants reported they had learnt something new, and that the amount of content delivered was 'just right'. The Secrets of the Wapiti program is suitable for adults and older children and provides a unique opportunity for participants to experience field-based science in real time. It is also a creative way to showcase the remarkable and unique ecosystems, past and present, of northern Alberta.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Unravelling possible extinction drivers for Australia's Quaternary giants: using stable isotope analysis to reconstruct community level ecology of Late Pleistocene mammals from Naracoorte, South Australia

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Investigating palaeoecology on a community scale can help elucidate individual life habits and the association of species with their environments, which can help understand the drivers of species decline and extinction. Stable isotope analysis of carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$), derived from mammalian tooth enamel, has become a globally recognized proxy for obtaining semi-quantitative results of past mammalian dietary preferences and their drinking behaviours. Within the extensive karst system in the southeast of South Australia, pristine fossil deposits have given insight into

the paleoecology of Quaternary faunas and community responses to changes in climate over the last 500 thousand years. Komatsu Cave, in the Naracoorte region, covers a relatively brief window of time, dating to approximately 61 ka. It preserves a diverse faunal assemblage spanning megafauna to rodents. We analyzed stable isotopes of carbon and oxygen from the bioapatite of fossilized enamel representing a suite of extinct and extant large- and small-bodied mammal species including: extinct megafaunal species (*Procoptodon gilli, Zygomaturus trilobus* and *Thylacoleo carnifex*), macropods (*Notamacropus greyi, Notamacropus rufogriseus,* and *Macropus fuliginosus/giganteus*), koalas and wombats (*Phascolarctos cinereus* and *Lasiorhinus* spp.), bandicoots (*Isoodon obesulus* and *Perameles gunnii*), potoroids (*Potorous* spp. and *Bettongia lesueur*), and rodents (*Mastacomys fuscus, Pseudomys auritus,* and *Pseudomys shortridgei*). Our aim was to use these data to reconstruct past ecology and community dynamics of the Komatsu Cave faunal assemblage to gain information on the drivers of species decline and extinction. The broad range of $\delta^{13}C$ values indicates diverse resource use and species level niche partitioning, while relatively narrow ranges in $\delta^{18}O$ values indicates water source. This study, when compared to previous stable isotope studies, shows consistent dietary preferences and drinking sources and behaviours, while elucidating new palaeoecological records. The use of stable isotopes paired with the temporally constrained assemblage captured by Komatsu Cave, has advanced understanding of community level niche partitioning at Naracoorte. This in turn, aids elucidation of possible extinction drivers for some Australian megafauna species, and provides insight into the palaeoecology and life habits of these animals in a way that has yet been explored at Naracoorte and comparable sites in Australia.

Funding Sources Australian Research Council Linkage project LP160101249.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Digital reconstruction of the endocranial anatomy of species of the Cenozoic European crocodylian *Diplocynodon*

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With the exception of *Alligator sinensis* in eastern China, extant members of Alligatoroidea are restricted to the Americas. However, the fossil record indicates a broader distribution that includes at least Europe. The latter is mostly based on *Diplocynodon*, which is typically recovered as one of the earliest diverging alligatoroids. It was seemingly endemic to Europe, and also the last known alligatoroid taxon to have inhabited the continent, with dozens of occurrences representing eleven currently recognized species, spanning the late Paleocene to the middle Miocene. Specimens of *Diplocynodon* have usually been recovered from freshwater environments, but remains of at least one species have been collected from a marine environment. This potentially indicates a capability for salt tolerance, contrasting with extant alligatoroids, that might have been key to the dispersal of early members of the clade. However, some phylogenetic analyses have recently cast doubt on the monophyly of these species and have even suggested that *Diplocynodon* might instead lie outside of crown-group Crocodylia. One possible avenue to address these phylogenetic and ecological questions is to evaluate the endocranial anatomy of *Diplocynodon*, which can potentially shed light on osteological correlates for oceanic capability, as well as provide a source of currently neglected anatomical features that can be incorporated into phylogenetic analysis. Here we present preliminary results based on CT scans of specimens referable to two different species, *D. ratelii* from the Miocene of France, and *D. hantoniensis* from the late Eocene of the UK. The high level of preservation of the fossils

of both species has permitted a detailed description of their endocranial anatomy, providing information that can help infer their ecology and phylogeny. Based on a series of specimens of *D. hantoniensis*, representing three ontogenetic stages, we have been able to reconstruct how endocranial anatomy changes with ontogeny in a fossil crocodylian for the first time. Our study of *D. ratelii* has also facilitated the first analysis of the inner ear of a *Diplocynodon* species, with its morphology showing no clear evidence of a possible pelagic adaptation, at least for this species. Equivalent study of additional specimens of *Diplocynodon* will be critical in determining whether such features vary interspecifically.

Funding Sources The Royal Society, UK.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Comparative cranial biomechanics in Sauropodomorpha: morphological and functional evolution of feeding strategies

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Sauropodomorpha represents a diverse clade of herbivorous dinosaurs that exhibited broad morphological and ecological disparity throughout the Mesozoic. Variations in cranio-mandibular anatomy are frequently associated with dietary specializations, but the biomechanical consequences of these adaptations remain insufficiently investigated. Finite element analysis (FEA) is employed as a robust tool to investigate the biomechanical performance of skeletal structures in extinct vertebrates, enabling inferences about feeding strategies and ecological adaptations. We applied FEA to compare the biomechanical performance of the skull and mandible in four sauropodomorph representative of different sauropodomorph lineages: *Camarasaurus*, *Diplodocus*, *Sarmientosaurus*, and *Yizhousaurus*. Digital three-dimensional models of skulls and mandibles were subjected to morphofunctional scenarios of two different types. In the intrinsic scenarios, we modelled the muscles of the adductor chamber to estimate bite force, while extrinsic scenarios to simulate three distinct feeding load scenarios: dorsoventral (top-down), ventrodorsal (bottom-up), and anterior horizontal, replicating forces generated during different feeding behaviors. The results indicate that *Camarasaurus* exhibited low stress levels (Bottom-up 0,68MPa), suggesting a versatile cranio-mandibular apparatus. *Diplodocus* showed lower stress under horizontal loading (4,22MPa), supporting the low-browsing feeding hypothesis. *Sarmientosaurus* displayed overall low and stable stress values (2.01 MPa), indicating a robust structure and a potentially intermediate feeding strategy. *Yizhousaurus* presented the highest stress levels across all scenarios, especially in vertical mandibular loading (Bottom-up 19,90MPa), which may reflect functional limitations associated with its more basal morphology and phylogenetic position. The evolution of feeding strategies in Sauropodomorpha entailed both morphological and functional adaptations, with biomechanical specializations reducing stress during specific feeding behaviors. *Camarasaurus* and *Sarmientosaurus* exhibited high biomechanical performance and versatility across multiple feeding directions. In contrast, *Diplodocus* and *Yizhousaurus* showed directional functional constraints, likely reflecting dietary preferences and ecological niches. These findings highlight biomechanics as key to understanding sauropodomorph ecology, feeding, and diversification under herbivorous gigantism.

Funding Sources FAPESP process: 2023/08493-8; FAPESP process: 2022/14694-3

Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Hamular cartilage is a conserved feature from the dawn of mammals

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Throughout their evolution from synapsid ancestors, mammals have acquired a range of traits supporting their unique reproductive biology. Among these, lactation stands out as a defining feature, enabling mothers to nourish their young with milk. Today, extant mammals are divided into three major clades: monotremes, marsupials, and placentals. All three clades produce milk, however, only therian mammals possess nipples, while monotremes deliver milk via specialized patches on the mother's abdomen. To enable efficient suckling, therians evolved a distinctive feature known as the medial pterygoid plate, a paired structure at the base of the sphenoid bone. This plate bears a posterior projection called the pterygoid hamulus, which serves as a pulley for the tensor veli palatini (TVP) muscle. The hamulus assists in stiffening the soft palate, creating a seal against the posterior tongue to facilitate suckling. In contrast, monotremes have a pterygoid and ectopterygoid, the homologies of which are unclear. Despite its functional importance, the pterygoid has rarely been studied in a developmental or evolutionary context. Using *Mus musculus* as a model, we examined the development of the medial pterygoid process from E13.5 to E17.5 using immunofluorescence for Sox9, Runx2, and 12-101, and lineage tracing via *Wnt1Cre;tdTomato* and *Mesp1Cre;tdTomato*. We show that the medial pterygoid is a composite element formed from a dorsal membranous and a ventral endochondral ossification center. At its posterior tip lies the hamular cartilage. All components of the pterygoid complex, including the hamular cartilage, are neural crest-derived. To assess evolutionary conservation, we compared cranial development in *Monodelphis domestica*, *Tachyglossus aculeatus* (short-beaked echidna), and *Ornithorhynchus anatinus* (platypus). In *Monodelphis*, the pterygoid developed similarly to the mouse, with a discrete hamular cartilage. In echidna and platypus, the two medial pterygoid elements formed but did not fuse, creating the pterygoid (homologous to the dorsal membranous region) and ectopterygoid (homologous to the ventral endochondral region). In echidna no hamular cartilage formed, while in platypus a clear hamular cartilage was evident from histology. These findings confirm the homology of the monotreme pterygoid and demonstrate that the hamular cartilage is not a therian novelty but a primitive mammalian feature with secondary loss in the echidna linked to their feeding mode.

Funding Sources LB is supported by a PhD Studentship from the Anatomical Society awarded to Abigail S Tucker.

Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

Solving the enigma of small-bodied ornithischian dinosaur diversity in the Morrison Formation (Upper Jurassic) of the western USA

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The Morrison Formation (Upper Jurassic, USA) has yielded a diverse dinosaur fauna. Although many of these taxa have been monographed and incorporated into broader studies of dinosaur evolution, the small-bodied ornithischians have received comparatively little attention. These taxa represent various non-thyreophoran, non-ornithopod ornithischians and include many historical species erected by Marsh, such as *Nanosaurus agilis* and *Othnielosaurus* (= *Laosaurus*) *consors*, which are based on incomplete or difficult to interpret type specimens. Previous workers have revised these

taxa, creating an intricate web of synonymies and referrals. This has led to confusion regarding the hypodigms of these taxa, undermining their inclusion in larger-scale studies of ornithischian evolution.

We examined the holotypes of *N. agilis, N. rex*, *L. celer*, *L. gracilis*, and *O. consors* firsthand, and evaluated published descriptions of *Drinker nisti*. Using an autapomorphy-based approach, we assessed their taxonomic validity and the status of referred material. None of the holotypes possess autapomorphies or unique character combinations that adequately diagnose them, nor could we identify clear features that supported the retention of referred specimens in these taxa. We regard all these species as nomina dubia and suggest that all previous referrals are spurious. Due to incompleteness, it was not possible to analyze the phylogenetic positions of these taxa: however, their anatomy is consistent with positions near the base of Neornithischia (e.g., '*N. rex*') or referral to the ornithopod *Dryosaurus* (e.g., referred specimens of '*O. consors*'). Surprisingly, some cranial and dental features of '*Drinker*' hint at pachycephalosaurian affinities, although this conclusion is tentative given the limited information available.

It is unfortunate that none of these historic names survive, but this revision clears the way for reinterpreting other important specimens from the Morrison Formation that were previously shoehorned into these taxa. One of these (NHMUK PV R39000) consists of a partial postcranial skeleton that possesses unique features of the vertebrae and limbs that allow us to recognise it as a new species, which is recovered as the sister-taxon of the Chinese taxon *Yandusaurus*. It is hoped that this taxonomic work sets the stage for reevaluating other Morrison 'nanosaur' specimens, leading to better understanding of their diversity, ecology, and phylogenetic significance.

Funding Sources Science Investment Fund (Natural History Museum, London); Bennett Lowell Ltd

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Drivers of morphological variation in the mandible of alethinophidian snakes

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Snakes exhibit pronounced cranial and mandibular kinesis, allowing for extremely large gapes (macrostomy) and the consumption of whole prey much larger than their resting head diameter. This is facilitated by key anatomical traits of the mandible: an intramandibular hinge (IMH), connecting the dentary to the compound bone, a liberated mandibular symphysis, and a highly flexible suspensorium enabling a range of swift and coordinated mandibular movements. Jaw gape size and the biomechanics of bite force have been previously explored in specific species of snakes and lizards. Whereas the morphological variation of mandibles across snakes culminated from a singular event earlier in its evolutionary history, the evolutionary drivers of jaw form and function in specialized feeding across snakes is currently under-explored. Here, using 3D imaging, landmark-based morphometric analysis, and evolutionary modelling, we investigate variation in mandibular shape across 264 species of snakes belonging to the infraorder Alethinophidia, spanning various types of prey subjugation (constriction vs. venom) and ecological niches. Principal components analysis demonstrates that principal component (PC) axis 1 characterizes the curvature and thickness of the mandible, the ratio between dentary and compound length, the interlocking shape of the IMH, and the distance between the suspensorium joint and jaw muscle attachment sites. PC axis 2 characterizes the height of the jaw muscle attachment sites and the dorsal/ventral symmetry of the IMH, thus also the length of the teeth row. Notably,

constrictors (Boidae, Pythonidae) and the fossorial Uropeltidae share a plesiomorphic jaw morphology that occupy a distinct region in phylomorphospace: a thicker mandible with relatively equal dentary/compound length ratio, and a socketed IMH. Mandibular shape is significantly correlated to venom utilization (p=0.031) and ecological niche (p=0.001). We also quantified linear jaw measurements to test whether mandibular morphology is associated with bite mechanical advantage. Mandibular shape is significantly correlated to mechanical advantage regarding jaw adduction (p=0.001) and jaw depression (p=0.012). Together, these findings demonstrate that in snakes, jaw morphology is driven by prey acquisition and the ecological niche the species inhabits. These factors define jaw movement, speed, and force across the lineage, therefore shaping specific forms of the snake mandible through deep time.

Funding Sources Biotechnology and Biosciences Research Council (BBSRC) through the London Interdisciplinary Doctoral Training Programme (LIDo DTP) (grant no. BB/ M009513/ 1).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The life and death of mosasaur 'Carlo', an unusual globidensine mosasaur from the upper Maastrichtian Gulpen Formation of the Maastrichtian type area (southeast Netherlands, northeast Belgium)

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Globidensine mosasaurs were a diverse clade of marine reptiles that thrived and diversified during the latest Cretaceous, occupying a wide range of (feeding) ecological niches, including durophagy, piscivory and macropredation. Here we report on a new discovery of a globidensine mosasaur (NHMM 2012072) from the type Maastrichtian of the Netherlands that highlights the clade's evolutionary success.

Previously noted for cranial pathologies and tentatively assigned to *Prognathodon sectorius* at the time, NHMM 2012072 was recovered from the Lixhe 3 member of the Gulpen Formation—an uncommon source of mosasaur remains. The nearly disarticulated skeleton shows poor preservation, and pyrite- and marcasite-related gypsum encrustation. Recovered elements include cranial fragments (e.g., premaxilla, maxillae, dentaries, pterygoids, braincase), dorsal to caudal vertebrae, ribs, and isolated teeth.

It is assigned to the Mosasaurinae based on several synapomorphies and plesiomorphies, including a raised tooth row of the pterygoid; the shape of the basisphenoid pterygoid process, the long parallel basioccipital tubera; and the height of the dentary medial parapet. It shares features with most "*Prognathodon*-type" mosasaurs, for example the presence of a short but distinct premaxillary rostrum; reduced dentary tooth count and an extreme medial inflection of the retroarticular process. However, NHMM 2012072 can be distinguished from other *Prognathodon* species by a combination of cranial and dental characters such as elongated and rugose basioccipital tubera, and faceted tooth crowns lacking posterior inflation. Details from the axial skeleton may help further narrow down its phylogenetic placement within the *Prognathodon* clade sensu lato, as affinities with *P. kianda, P. solvayi* and *P. saturator* are suggested.

Prominent cranial pathologies indicate possible intraspecific aggression or predation, and subsequent infections associated with reparative bone formation provides insights in the last months of its life. Associated micro- and macrofaunal biota coupled with poor bone surface preservation and feeding traces, indicate prolonged seafloor exposure and potential scavenging of the mosasaur carcass by neoselachians, in a similar fashion as modern whale falls.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new framework for quantitative prediction of fossil feather color using melanosome geometry, metal chemistry and reflectance spectrophotometry

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Melanin pigments, contained within melanosomes, underpin visual communication in feathers either by producing colors directly or by serving as a backing pigment for structural colors. Melanosome geometry has long been associated with feather color and has been used to predict the color of fossil feathers, albeit with low accuracy (<60%). We aim to create a model for predicted feather color with improved accuracy using a fully quantitative approach based on spectral data for feather color coupled with data on melanosome geometry and metal chemistry. Our dataset comprises 293 feathers from representatives of all 44 extant avian orders. Spectral data supports the division of the feathers into seven color categories: black, brown, grey, dark rufous, light rufous, iridescent and non-iridescent structural color. Analysis of the geometry of more than 25,000 melanosomes reveals clear statistical variation in melanosome shape between and within color categories, while preliminary synchrotron-XRF data also indicates differences in elemental chemistry between color categories. Multivariate analysis of geometry and chemistry data for feathers allows the quantitative prediction of color spectra, thus providing a new framework for predicting fossil feather color.

Funding Sources Irish Research Council Postgraduate Scholarship GOIPG/2022/1231 (H.B.)

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Changes in supratemporal fenestra morphology as a result of dietary specialization in herbivorous dinosaurs

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The cranial fenestration of vertebrate skulls is an important feature for higher-order taxonomic classification but also plays a significant role in the biomechanical behavior of the skull with implications for its function. The distribution (position, presence/absence) and morphology (shape, size) vary greatly between different vertebrate groups but also within specific groups, such as dinosaurs. In particular, the supratemporal fenestra, located on the top of the skull and housing several jaw muscles, has been associated with jaw mechanics and bite force. However, the morphology of the supratemporal fenestra and its correlation with diet, phylogenetic affinity, and jaw function have not been quantified.

Here, we used a combination of two-dimensional geometric morphometric analyses and biomechanical modelling to characterize the morphology of the supratemporal fenestra of different dinosaur clades and to evaluate the functional significance of different morphologies. A major variation across Dinosauria was observed, particularly in the herbivorous dinosaurs, and distinct fenestra morphologies were identified, with Ornithopoda and Sauropoda demonstrating opposing

supratemporal fenestra morphologies (in particular in the extent of anteroposterior vs mediolateral elongation). Theropoda show a recurring morphology of teardrop and arrowhead shapes with variation in the orientation of the fenestra tip. We found that supratemporal fenestra shape may be indicative of different feeding styles in herbivores; notably, there are differences in the extensive processing of plant matter in the jaws in many ornithopods compared to rake-/bulk-feeding and gut processing in sauropods. A similar trend is not observable in theropods, which may be due to the lack of variation in feeding styles in carnivores more generally.

Our results further demonstrate that the change in supratemporal fenestra morphology across Dinosauria impacts the size and arrangement (i.e. orientation, length) of the jaw adductor musculature, underpinning the different feeding styles. Fenestrae with a predominantly mediolateral orientation were found to allow for a larger jaw gape than other morphologies, thereby maximizing the intake of vegetation in the studied herbivorous groups.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

'Difficult' nodes in placental mammal phylogeny and the timescale of mammal evolution

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The higher level phylogeny of extant placental mammals was largely resolved with comparatively small molecular datasets over 20 years ago. However, branching patterns at several supraordinal nodes (e.g., Euarchontoglires, Scrotifera, Paeungulata) have proved remarkably difficult to resolve, even with very large 'phylogenomic' datasets, and the timescale of placental evolution remains controversial, particularly in relation to the K–Pg boundary. Using two existing large molecular datasets (3787 and 15431 gene trees respectively) and coalescence-based methods, I show that these 'difficult' nodes are largely the result of incomplete lineage sorting rather than hybridization, and that they are characterized by large increases in estimated effective population sizes, both of which are suggestive of ecological release. Analysis of a large (130 taxa, 422 characters) morphological matrix of eutherians using improved phylogenetic methods (including character ordering, molecular-informed homoplasy partitioning, and Bayesian skyline tip-dating) confirms that no Cretaceous eutherian is supported as a member of crown-group Placentalia. Multivariate analysis and ancestral state reconstruction also indicate that Cretaceous eutherians fall outside the morphospace defined by extant placental supraordinal clades and their predicted ancestors. Based on this combined molecular and morphological evidence, I argue that these 'difficult' nodes are evidence of ecological release in the aftermath of the K–Pg mass extinction, supporting the 'soft explosive' model of placental origins. Furthermore, because these nodes can be directly associated with the K–Pg boundary, I suggest that they are uniquely suitable to act as calibration points in molecular clock analyses of mammals. I show that use of these calibrations results in overall improved precision in posterior estimates of molecular divergence dates, and a revised (somewhat younger) timescale for mammal evolution: notably, Placentalia is dated to the latest Cretaceous, crown-clade Mammalia to the Middle–Late Jurassic, and Theria to the middle Cretaceous. Other clades appear amenable to this general approach, most obviously birds.

Funding Sources NERC Standard Grant 'Rise of the continent of the monkeys' (NE/T000341/1).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

New data on morphological evolution and dietary adaptations of *Elephas recki* from the

Plio-Pleistocene Shungura Formation (Lower Omo Valley, Ethiopia)

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The abundant and diverse proboscideans are essential terrestrial megaherbivores for studying morphological adaptations and reconstructing paleoenvironments in Africa. This new study of the lineage of *Elephas recki* from the Plio-Pleistocene deposits of the Shungura Formation aimed at investigating further the interplay between morphological and behavioral adaptations within proboscideans. For this, we used the most complete and well-preserved third molars of the series for characterizing morphological changes, while describing dietary behavior by applying mesowear angle analysis to all identifiable cheek teeth. Biometric character changes indicated that evolutionary change was not a gradual, progressive trend through the Shungura sequence deposition. Rather, we observed a complex trend involving sudden changes. The mesowear angle analysis suggested that *Elephas recki* from the Shungura Formation had consistently grazing dietary habits throughout its evolution, except for some slight tendencies of mixed browse/graze diet in certain time intervals. We therefore did not observe any correlation between morphological change and feeding preferences over two million years. This delay between the acquisition of the observed diet and purportedly consequent morphological changes questions the classical interpretations of factors at play in this evolutionary sequence.

Funding Sources Funding: This research was funded by the MEFA, the NRA, the Région Nouvelle-Aquitaine, CNRS INEE, PALEVOPRIM, the Fyssen Foundation, & the School of Earth Sciences, AAU.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Postcranial skeletal pneumaticity in Late Triassic sauropodomorph dinosaurs

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Within Archosauria, postcranial skeletal pneumaticity (PSP) occurs in pterosaurs, as well as theropod (including extant Aves) and sauropod dinosaurs. The evolutionary origins of PSP in the latter group remain largely unknown, with few studies assessing early-branching sauropodomorphs. Furthermore, most proposed identifications of PSP in early-branching sauropodomorphs relate to external indicators of internal pneumaticity, e.g., subfossae. To address this, we CT scanned representative elements from the vertebral columns of the early-branching sauropodomorphs *Thecodontosaurus antiquus*, *Pantydraco caducus*, *Ruehleia bedheimensis* and *Plateosaurus longiceps*. These were compared with other early-branching sauropodomorphs with published vertebral CT scan data, namely, *Buriolestes schultzi*, *Pampadromaeus barberenai,* and *Macrocollum itaquii*. Based on the sampled vertebrae, PSP is absent in *Buriolestes*, *Pampadromaeus*, *Pantydraco* and probably *Thecodontosaurus*. The neural arches of the posterior cervical vertebrae of *Thecodontosaurus* possibly possess PSP, but this can only be interpreted from broken transverse cross-sections. The posterior cervical vertebrae of *Ruehleia* possess PSP in the neural arches; their corresponding centra, and the centra and neural arches of the anterior–middle dorsal vertebrae, are apneumatic. *Plateosaurus* possesses PSP in the neural arches

of the middle cervical–middle dorsal vertebrae, and the centra of the presacral vertebrae are apneumatic. Where present, pneumatic internal chambers are neither exclusively camerate nor camellate, nor do they align with the 'protocamerate' tissue type previously described in the posterior cervical–anterior dorsal vertebrae of *Macrocollum*. From external indicators, PSP might be present in the sacral neural arches of *Ruehleia* and *Plateosaurus* but is absent in the caudal vertebrae. However, our results reveal that PSP cannot be unequivocally determined from external indicators; subfossae do not always communicate with internal chambers, and internal chambers communicate with undivided fossae. PSP in early-branching sauropodomorphs probably evolved first in the posterior cervical vertebrae, expanding anteriorly and posteriorly along the vertebral column. The distribution of PSP in early-branching sauropodomorphs does not appear to be correlated with body size trends. Instead, our preliminary results suggest that PSP shows a broad phylogenetic signal, with increased development in later sauropodomorphs.

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Effects of select temperature, chemical, and sample pre-treatment processes on stable and clumped isotope compositions of extant avian bone

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Paleopathology studies of extant and extinct archosaurs can provide valuable information about disease evolution and associated physiological responses. Data derived from these studies are critical to testing macroevolutionary models of bone disease, trauma, and repair. Standard methods used to analyze fossil bone pathologies can be confounded by taphonomic processes that distort, obscure, or prevent identification and differentiation of pathologic (PB) and normal (NB) bone. This is especially true in isolated and fragmentary specimens. Hence, there exists a need for verified techniques that can confidently discriminate PB from NB.

Clumped (Δ_{47}) isotope analysis offers the potential to discriminate NB from PB in fossil and osteological collections based on differential formational temperatures and isotopic composition. Clumped isotope values are solely dependent on precipitation temperature of the carbonate mineral, thus allowing for direct measurement of formational temperature with an accuracy of ±2°C. However, potential effects of low-heat diagenesis during fossilization, and/or common practices used in natural history museums and veterinary diagnostic labs on bones during storage and skeletonization processes have not yet been tested as a possible source of error.

We performed stable ($\delta^{13}C$, $\delta^{18}O$) and clumped (Δ_{47}) isotope analyses on extant avian bone subjected to a variety of standard treatments (freezing, boiling, formalin, hydrogen peroxide (HP), ammonium hydroxide, and two degreasers) to test potential diagenetic and common treatment effects that might limit the utility of this technique. Additionally, we tested the effects of two chemical pre-treatments commonly used to remove organic material [HP and sodium hypochlorite (SH)]. Results demonstrate most treatments have no impact on bone formational temperature values, except boiled bone has consistently more depleted $\delta^{18}O$ and lower Δ_{47}, a predictable trend that follows known principles of isotope kinetics and carbonate heating. Additionally, the SH pre-treatment group has consistently lower $\delta^{13}C$ values than the HP group, suggesting a difference in organic carbon removal between these two pre-treatment methods. Overall, our results are within known ranges of avian body temperatures and indicate osteological

collections can reliably be used for these analyses in future studies. Heating is a factor that should be considered as a potential source of error in isotopic characterizations of fossil bone.

Funding Sources This material is based upon work supported by the Triangle Center for Evolutionary Medicine (TriCEM) and American Ornithological Society (AOS).

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

^{14}C dating of naturally occurring bones in two modern river systems: implications for time-averaging and taphonomy of vertebrate remains in paleochannel deposits

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A large proportion of vertebrate fossils occur in fluvial channel deposits, and there are continuing questions about the spatial and temporal resolution of co-occurring taxa. Transport can entrain skeletal remains from large areas of landscape, combining taxa from different habitats, affecting the spatial resolution of paleocommunity reconstruction, and potentially inflating species richness for any given place and time. Time-averaging in fluvial systems is also important and may combine taxa from different habitats and time periods. To test temporal resolution, we ^{14}C dated naturally occurring, unfossilized bones from the East Fork River, Wyoming (N = 8) and the South Platte River, northeastern Colorado (N = 13). Specimens were selected from assemblages of surface bones collected along segments of the rivers from 1983 to 1986. Results show that time-averaging ranges from modern (50 years or less) to 1835 + 20 years for East Fork samples and modern to 20,330 + 50 yrs for South Platte samples. In the East Fork, bison (N = 4) form the older component (1500–2000 yrs) and co-occur with modern (domestic) horse (N = 4). In the South Platte, extinct camel (N = 4) form the oldest component (11,000–22,000 yrs), bison (N = 6) are next oldest (900–1800 yrs), and horse and cow (N = 3) are modern. In both of these river systems, sedimentary processes mixed bones from different time periods, and species that did not co-occur in the living community are preserved in the same channel deposits. This indicates that temporal resolution of similar fossiliferous fluvial deposits in the vertebrate record can be on the order of 10^3–10^4 yrs. Abrasion is often assumed to indicate the amount of transport prior to final burial. We scored the degree of abrasion using standard sedimentary rounding categories on ^{14}C dating samples (various skeletal elements) to test for correlation with age. One camel M_2 (^{14}C age = 20,435 + 40 yrs) is virtually unabraded (angular), but other elements vary from sub-angular to rounded. There is no correlation between rounding and age. The East Fork is a meandering system that reworks bones from overbank deposits as well as its channel, whereas the South Platte is a braided system that mainly reworks mid-channel bars. Our results suggest that braided fluvial systems may have longer periods of time-averaging than meandering ones—a hypothesis that will require further research.

Funding Sources Smithsonian National Museum of Natural History CORE Grant 2024-2025.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Ontogenetic and intraspecific variation in the Campanian baenid turtle *Plesiobaena antiqua*

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Baenids are fresh water paracryptodiran turtles with a fossil record ranging from the Lower Cretaceous to the Eocene, thus surviving the mass extinction event at the K/Pg boundary. The group is found across North America, with the highest diverstiy during the Maastrichtian (Upper Cretaceous). Among them, *Plesiobaena antiqua* is the most common turtle in the Campanian (Upper Cretaceous) deposits of the Judith River in Canada, but it remains comparatively poorly described. The relative abundance of well-preserved material allows an assessment of variation within the species, specifically to test if previous speculation about ontogenetic fusion of the epipterygoid in baenids is indeed supported. We used micro-computed tomography scanning technology (µ-CT scanning) on a sample of four crania and three mandibles representing different size classes. Bone-by-bone segmentation of the available material allowed us to notice some ontogenetic related variation: 1) the jugal is progressively included into the orbital margin; 2) the angular height and the robusticity of the mandible increase; 3) the adductor fossa gets more accentuated. Contrary to expectation, the epipterygoid fusion is intraspecifically variable, and does not happen ontogenetically. Our result show that some phylogenetically important topological information (jugal exclusion from the orbit; fusion of epipterygoid) show intraspecific variation, whilst ontogenetic changes in the mandibles may be indicative of dietary change to a higher proportion of durophagy in adults. Durophagy in baenids may have contributed to their selective K/Pg survival, as has been hypothesized for marine turtles. The documentation of this variation alongside the detailed description of *Plesiobaena antiqua* provides new insights into the cranial evolution, ontogenetic trends, and phylogeny of baenid turtles.

Funding Sources This project was funded by a grant from the Swiss National Science Foundation to WGJ (SNF 200021_207377).

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

A phylogenetic plesiomorphy zone obscures the early evolutionary history of crown birds

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Neornithes (the bird crown group) originated during the Late Cretaceous, yet their fossil record predating the end-Cretaceous mass extinction is extremely scarce. A large number of fragmentary Late Cretaceous avian remains have been suggested to exhibit affinities to Galloanserae (waterfowl + landfowl), and the only two well-supported Cretaceous neornithines are thought to belong to this clade. Similarly, total group Anseriformes (waterfowl) are amongst the most diverse and abundant early Cenozoic neornithines. Recent insights on the ancestral crown bird palate suggest that a galloanseran-like palate may be ancestral for Neornithes. Yet, the plesiomorphic condition of numerous additional aspects of the neornithine postcranial skeleton remains uncertain. Here, we re-evaluate a crownward stem bird specimen from North America and reveal that its skeleton combines features of early Cenozoic Anseriformes, such as *Presbyornis,* stem members of Palaeognathae (ostriches and kin), like *Lithornis*, and Neoaves (all other birds), clades that span the deepest divergences within Neornithes. Phylogenetic analyses under multiple optimality criteria and incorporating character partitions recover a highly variable phylogenetic position, including stem Palaeognathae, stem Neognathae (Galloanserae + Neoaves), and stem Anseriformes. Principal

Coordinate analyses from discrete phylogenetic discrete morphological characters show a large overlap of morphologies across taxa spanning the stem-to-crown bird transition and the earliest divergences within Neornithes, but excluding most extant taxa. These results are suggestive of a 'Plesiomorphy Zone,' where crownward stem birds and stem representatives of major extant neornithine bird lineages are found to be more similar to each other than to their extant relatives, obscuring major evolutionary transitions leading to the origin of the bird crown group. These results may force reconsideration of the purported galloanseran and neornithine affinities of several Cretaceous and early Cenozoic fossil birds, with potential implications for assessing the age of the deepest divergences among Neornithes in the Cretaceous. Furthermore, the postcranial similarities of crownward stem birds and early representatives of major neornithine lineages may hint at the ecology of the earliest crown birds and its potential impact on the survival of the clade through the end-Cretaceous mass extinction.

Funding Sources PalAss Research Grant (J.B.); UKRI Future Leaders Fellowship MR/X015130/1 (D.J.F.)

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Expanding the rhynchosaur sample in the CoArTreeP: implications for hyperodapedontine relationships and the monophyly of *Hyperodapedon*

Benjamin, Ryan C.

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Rhynchosaurs were an incredibly successful and widespread group of basal archosauromorphs that were particularly prominent during the Carnian Age of the Upper Triassic. However, two new taxa, *Oryctorhynchus bairdi* and *Beesiiwo cooowuse*, raise new questions about the evolutionary relationships, and most prominently, how many species truly belong in the genus *Hyperodapedon*. The authors describing these two taxa used a relatively small rhynchosaur-focused matrix for their phylogenetic analysis, and recovered *Hyperodapedon* as a polyphyletic group that they suggest may warrant the splitting of several former *Hyperodapedon* species into distinct genera. This research aims to test those conclusions in a much larger matrix that samples nearly all extinct non-archosaur archosauromorphs. Specifically, I used the most recent version of the CoArTreeP (Complete Archosauromorph Tree Project) matrix. Despite its name, this matrix is far from complete, because it is missing several described rhynchosaur taxa. To remedy this, I scored five additional OTUs to test rhynchosaur affinities and the effects on the internal topology of Rhynchosauria: *Supradapedon stockleyi*, *Hyperodapedon tikiensis, Beesiiwo cooowuse, Oryctorhynchus bairdi*, and an unnamed rhynchosaur from Zimbabwe.

Preliminary results of the phylogenetic analysis strongly support the classification of all five added taxa as hyperodapedontine rhynchosaurs, with little to no effect on the relationships of taxa outside that clade. The resulting trees also place *Hyperodapedon tikiensis* and the Zimbabwe rhynchosaur as early-branching hyperodapedontines outside the *Hyperodapedon* hypodigm. They may need to be split into new genera if further work supports this conclusion. *Beesiiwo*, *Oryctorhynchus*, and *Supradapedon* are recovered as more derived, with *Beesiiwo* and *Oryctorhynchus* as sister taxa to each other. *Supradapedon* is sister taxon to *Hyperodapedon*, which here includes five species: *H. gordoni, H. huenei, H. huxleyi, H. mariensis,* and *H. sanjuanensis*. This indicates that contrary to recent papers, *Hyperodapedon* is a monophyletic group that includes at least 5 distinct species from Europe, India, and South America, and that it is most closely related to taxa from Africa and North America.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

Niche partitioning in the odontocete fauna from the Early Miocene Chilcatay Formation of Peru

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The Early Miocene was an important time in the evolution of echolocating toothed cetaceans (odontocetes) as it saw the extinction of archaic groups and the radiation of early members of various modern lineages. The Chilcatay Formation (East Pisco Basin, Peru) dates to this time period and is known for its extremely diverse and disparate odontocete fauna. As well as being taxonomically diverse, the Chilcatay odontocetes also display a range of body sizes and skull morphologies, including variation between closely related taxa. Recent stratigraphic work has found that these fossils were all deposited within a narrow time interval (Burdigalian; 19–18.7 Ma), providing a unique opportunity to investigate the ecology of Early Miocene odontocetes at the ecosystem level. Coexistence of such a rich sympatric odontocete fauna would only be possible if the species occupied different niches within the ecosystem, a phenomenon well documented in modern communities of odontocetes. We investigated dietary niche partitioning in this fossil assemblage and how it related to the range of body sizes seen within the odontocete fauna. A series of ecologically and functionally relevant ratios and discrete characters were taken from the skulls, both directly from the specimens and from the 3D models. The data were subjected to clustering methods (cluster dendrograms) and ordination techniques (Principal Coordinate Analyses [PCoA], and Non-metric Multi-Dimensional Scaling [NMDS]) in R to visualise variation in skull morphology and feeding strategy between the taxa. Values were calculated for total body length and mapped onto the cluster dendograms and morphospaces produced by the methods outlined above. Our results show widespread partitioning of dietary niches. Some taxa (e.g. the hyper-longirostrine *Ensidelphis riveroi* and the large and robust *Macrosqualodelphis ukupachai*) show distinct cranial ecomorphology and likely prey choice and capture techniques. Other taxa may have come into competition with each other, most notably a cluster consisting of the physeteroid *Rhaphicetus valenciae*, the early homodont dolphin *Chilcacetus* spp., and the squalodelphinid *Huaridelphis raimondii*. The significant difference in body size between these taxa likely contributed to their partitioning of ecological niches, alongside subtle differences in snout ecomorphology. Future work will expand on these results and compare the Chilcatay odontocetes with those from coeval and modern ecosystems.

Funding Sources The Palaeontological Association (Stan Wood Award, to RB)
The European Union (NextGenerationEU, project title: BIOVERTICES, to GB, AC and FN)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The paleoneurology of *Lystrosaurus* (Therapsida, Dicynodontia) through the end-Permian Mass Extinction

Benoit, Julien[1], Legendre, Lucas[5], Araújo, Ricardo[2], Abdala, Fernando[3], Angielczyk, Kenneth D.[4]

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As we enter a 6th mass extinction event, the fossil record of past biological crises offers a gateway to study how animals survived them, and insight into better anticipating the effects of the upcoming biodiversity loss. The dicynodont genus *Lystrosaurus* is famous for surviving the end-Permian mass extinction. The South African Karoo fossil record chronicles the occurrence of this genus as it lived before, survived through, and after the extinction, offering a unique opportunity to study changes in *Lystrosaurus* paleoneurology across this event. The brain is an energy-expensive organ, which puts a high selective pressure on it when resources become scarce; yet, it is also the seat of cognition, and may help to adapt to a rapidly changing environment behaviourally. Encephalization may also be affected by changes in body mass (for example, due to the Lilliput Effect). As such, relative brain size may decrease or increase depending on the evolutionary response to mass extinction events. Here, we document the evolution of the relative size and morphology of the brain endocast in *Lystrosaurus* through the end-Permian mass extinction using synchrotron scanning. We find that the neuroanatomy of the different species of the genus remains relatively conservative across the extinction event, and that the Synapsid Encephalization Quotient does not vary significantly. These observations are consistent with those made in other therapsid lineages that crossed the end-Permian extinction, thus supporting that competition was low at the cognitive level during this biological crisis. Elevated reproduction rates likely put a hard cap on brain size evolution in *Lystrosaurus*.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A northeastern Arizona bonebed of the Late Triassic archosaur *Typothorax coccinarum* provides an opportunity to test for ontogenetic and social dynamics

Ben-Salahuddin, Adé, Weinbaum, Jonathan

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Typothorax coccinarum is one of the earliest named members of Aetosauria, a clade of armored pseudosuchian archosaurs that were among the predominant land tetrapods of the Late Triassic and are particularly common in the southwestern United States. The Jeffers Ranch site in northeastern Arizona falls within the Sonsela Member of the Upper Triassic Chinle Formation, and ongoing excavation and preparation work by Southern Connecticut State University's paleontology program has revealed a treasure trove of fossils. These include multiple partial osteoderms of large specimens of *Typothorax* and a highly productive bonebed that contains well-preserved articulated remains of at least four smaller individuals averaging two meters long.

This wealth of new material provides a unique opportunity to assess the ontogeny of *Typothorax* using histological sampling to determine the relative growth rates, ontogenetic stages, and minimal absolute ages of the individuals present at Jeffers Ranch. Prior histological studies examining the count and spacing of lines of arrested growth (LAGs) in isolated *Typothorax* osteoderms suggest that heavy internal remodeling somewhat obscures their LAG counts, preventing accurate absolute age estimates. We aim to build on this work with our well-preserved sample size to determine if a correlative relationship exists between osteoderm and long bone LAG counts. With multiple individuals of varying sizes preserved at and collected from Jeffers Ranch, these findings could have implications for understanding the growth and potential social structure of *Typothorax*.

Funding Sources Connecticut State University System, Southern Connecticut State University

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

High functional optimality in mammalian jaws reflects an evolutionary trade-off between strength and speed

Berks, Harry O., Rayfield, Emily, Donoghue, Philip

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The vertebrate lower jaw provides an ideal system to test the evolutionary relationships between form and function. It offers rich sampling across extant and fossil taxa and plays a key role in feeding biomechanics. Furthermore, the jaw can be modelled as a simple lever system, presenting a well-established functional trade-off between strength and speed, which tend to be negatively correlated. Here, we aim to quantify jaw shape diversity across Mammalia and evaluate how functional trade-offs between strength and speed have shaped mandibular evolution in this key vertebrate clade.

Using Elliptical Fourier analysis (EFA) we quantified variance in lateral jaw shape in 2,063 extant and extinct mammal species, representing all 27 extant orders and 25 extinct orders. Substantial morphological overlap of major clades shows how convergent evolution has occurred throughout mammals at high taxonomic ranks. Phylogenetically distant taxa with similar ecologies can also be found to cluster near each other; myrmecophagous taxa such as pangolins, echidnas, and anteaters occupy similar regions of morphospace, suggesting shared functional demands.

To investigate how functional properties of jaws vary through the morphospace we produced a landscape of theoretical jaw morphologies derived from the EFA of empirical jaws. These theoretical jaws were evaluated for mechanical performance quantifying their rotational efficiency (as a proxy for speed) and median von Mises stress during a bite-muscle load simulation (as a proxy for strength). This in turn allowed us to produce functional landscapes showing how speed and strength properties vary across our morphospace. Two major mammal clades, Laurasiatheria and Euarchontoglires, do exhibit morphological differentiation, and our functional analyses reveal how the latter clade trends towards stronger jaws compared to the former.

Finally, by combining functional landscapes in a Pareto optimality ranking, we reveal that mammals exhibit high optimality in the trade-off between strength and speed. Extreme morphologies linked to specialized ecologies, such as filter-feeding in whales, deviate from this pattern, suggesting that the trade-off may be relaxed or overridden in these groups. Our findings showcase the importance of biomechanical trade-offs in morphological evolution, revealing how mammalian jaws have evolved to balance competing demands of strength and speed to achieve high functional performance across a great range of ecologies.

Funding Sources John Templeton Foundation Grant 62574 to EJR and PCJD; opinions expressed here are the author's and do not necessarily reflect the views of the John Templeton Foundation

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Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Unlocking dark data in historic collections to address key scientific questions: a case study of the Chalk fish from Southern England

Bernard, Emma L.[1], Fogerty, Thomas[1], Gallagher, Liam[3], Tangunan, Deborah[2], Witts, James[1], Bown, Paul[2], Twitchett, Richard[1]

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The Natural History Museum, London (NHMUK), houses one of the most important collections of Late Cretaceous fish worldwide, containing substantial archives of potential data. Unfortunately, many of the specimens from the

UK Chalk Group were collected over 150 years ago and often have sparse stratigraphic data associated with them, limiting their usefulness.

To address this, we sampled ~1000 fossil fish specimens, removing <0.05g of Chalk matrix from each specimen and examined calcareous nannofossils to improve the precision and accuracy of the stratigraphic ages and provenance of the specimens. As this involved altering the original specimen, a sampling and documentation policy was developed. This involves individually assessing each specimen, producing a condition report, imaging the specimen before and after sampling, recording the process on our collection management system, and ensuring links are made between the specimen, the sample, and the nannofossil slide for posterity.

New nannofossil biostratigraphy revealed that most museum specimens with original biozone information were correctly dated to at least stage level, although not all of them. Specimens that lacked stratigraphic control were, in most cases, successfully assigned to a specific calcareous nannofossil biozone, which significantly enhanced their stratigraphic resolution. We found discrepancies between the label data, nannofossil data and locality data for some specimens, which could be due to a variety of reasons explored in this presentation.

This is a major step in unlocking the Museum's fossil archive to address key scientific questions, such as how fish responded to periods of rapid environmental change and to better constrain evolutionary rates and the timing of the origins of modern groups. This study is an example of curators and researchers working together, using new techniques and historic specimens to expand our collective knowledge about the Earth whilst addressing key societal issues such as climate change, as well as illustrating the ongoing importance of historic museum collections.

Funding Sources CFIND: funded by NHM (Departmental Investment Fund) to RJT
ChaSE: funded by NERC grants NE/X015300/1 to RJT (lead), NE/X015386/1 to PB

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

Assessing the degree of decessity for parental care in the hadrosaurid dinosaur *Maiasaura* based on its neonatal metabolic rate estimates

Bert, Hugo[2], N. Woodward, Holly[1], Rinder, Nicolas[2], Amiot, Romain[2], Horner, John R.[3], Lécuyer, Christophe[2], Sena, Mariana[4], Cubo, Jorge[4]

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Perinate morphology and histology of the hadrosaurid dinosaur *Maiasaura peeblesorum* supports the hypothesis that hatchlings required parental care. We tested this hypothesis by investigating the locomotor/motor activity of *Maiasaura* neonates. We compared the difference between maximum (MMR) and minimum (RMR) rates of oxygen consumption, referred to as aerobic scope and denoted as ΔMR. In extant endotherms, ΔMR enables a quantitative estimation of the neonatal state with a ΔMR value of 0 $mL_{O2}/h/g^{0.67}$ characterizing altricial species, and an elevated ΔMR value (for example 10-30 $mL_{O2}/h/g^{0.67}$) characterizing precocial species.

We made neonatal metabolic inferences (both RMR and MMR) for *Maiasaura* based on a model built on extant tetrapods (amphibian [newt], reptiles including birds, and mammals). In extant tetrapod juveniles, RMR is primarily correlated with bone growth rate, which is characterized by vascularization during mineralization represented by Relative Primary Osteon Area (RPOA). We consequently used RPOA and a selected set of phylogenetic eigenvectors based on the Holm-Sidak correction to infer the RMR value of two *Maiasaura* neonates.

Femoral blood flow is correlated with MMR because it is related to bone oxygen supply for bone remodeling due to stresses of locomotion and vary similarly to the oxygen consumption of animals running on treadmills. We consequently used blood flow and a selected set of phylogenetic eigenvectors to infer the neonatal MMR value of *Maiasaura*. *Maiasaura* neonatal blood flow was estimated using the neonatal femoral circumference based on an equation calibrated from 19 *Maiasaura* specimens including embryos, neonates, and older specimens.

An inferred neonatal RMR value of $5.2_{(2->12)}$ $mL_{O2}/h/g^{0.67}$ for *Maiasaura* is similar to those of present-day fast-growing endotherms. We calculated a neonatal ΔMR value of $0_{(0->9)}$ $mL_{O2}/h/g^{0.67}$, which suggests altriciality when compared to the neonatal ΔMR values observed in modern birds and mammals. This result also suggests that *Maiasaura* needed intensive parental care similar to present-day altricial species. *Maiasaura* provides a useful ecological baseline from which to infer neonatal states in other hadrosaurs of similar adult size.

Funding Sources This study was supported by the French CNRS INSU grant INTERRVIE and the European Research Executive Agency through the Marie Sklodowska-Curie Actions to M. Sena.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

'You get the thumb': the role and function of the spike-like pollex in *Iguanodon bernissartensis* (Dinosauria, Ornithopoda) via biomechanics approaches

Bertozzo, Filippo[1,2], Lautenschlager, Stephan[3], Mallet, Christophe[4,1]

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Since the earliest reconstructions of the Early Cretaceous ornithopod *Iguanodon* by Gideon Mantell and Benjamin Waterhouse Hawkins during the 19th century, one of the most discussed features was the putative 'nasal horn,' a conical structure placed on the snout of this animal. The "horn" was correctly identified as the ungual of the first manual digit ('thumb') by Louis Dollo thanks to the several complete *Iguanodon* skeletons found in the Bernissart Sinkhole in Belgium in 1878. The spike-like thumb was speculated to have an active role, either as a defensive weapon or an intraspecific display apparatus. However, this hypothesis, which led to many speculations about *Iguanodon'*s behavior, was never quantitatively tested biomechanically. Here, we applied Finite Element Analysis and Range of Motion tests to identify the mechanical resistance of the thumb and the movement of the arm to measure force and speed during a strike. The right thumb of RBINS Vert-5144-1657 was scanned using a microtomographic scanner (microCT), segmented in the software Avizo and meshed for FEA in Hypermesh and Abaqus using standard bone properties. The pectoral girdle and the forelimb elements were digitized from the holotype RBINS R51, imported in Blender and muscles were reconstructed as bars following published muscular reconstructions. Results of the analyses tested with and without a keratinous sheath (estimated to overlap the bone by ca. 20%) show that the thumb could resist an impact force of up to 5,000 N, with peak stresses restricted to a small apical region. The conical shape helps to dissipate the forces along the longitudinal axis. The results were further validated against the talon of a rooster (*Gallus lafayetii*) due to the similar functional structure of the claw and the analogous swinging movement of the limb. Our preliminary results suggest that the spike-like thumb of *Iguanodon* could be used as a weapon, either for intraspecific sparring or defense against a predator, or both. However, this assumption needs to take into account the disparity of thumb dimensions across the other iguanodontian taxa (e.g. *Ouranosaurus, Mantellisaurus, Bolong*), which imply that the structure might have been under different ecological pressures.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Functional morphology of pterosaurs and avialans and the impact of non-adults in facilitating competitive exclusion between these two volant clades in the Mesozoic

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In the Mesozoic, powered flight evolved twice; in pterosaurs and avialans (i.e., 'birds'). Contentious hypotheses disagree on whether these clades competed for resources and on the impacts they had on each other's evolutionary history. Prior investigations often assume that the morphology of anatomical structures is directly linked to its hypothesized function (which may not be true). Furthermore, they rarely include non-adult individuals, which can contribute to the functional diversity of a species and clade. Here, we use multivariate analysis of biomechanical and functional characters of the skull and wingspans to investigate pterosaur and avialan functional morphology and assess the potential for competition. We used a dataset that comprised specimens of all life-history stages and an 'adults only' dataset to explore impacts of non-adults on functional diversity and competition likelihoods. We find pterosaurs and avialans exhibited very different functional morphologies, and thus high degrees of competitive exclusion, via a 'speed–power' trade-off. In general, pterosaurs exhibit traits that facilitate faster, weaker bites and avialans exhibit traits that facilitate slower, stronger bites. Both clades also exhibit greater functional diversity in the Cretaceous than the Jurassic. Moreover, pterosaurs and avialans from the Middle Jurassic and Early Cretaceous Yanliao and Jehol biotas of China, respectively, exhibit different functional morphologies and pterosaurs exhibit greater functional disparity in each biota. This indicates that interspecific competition between closely related taxa was more likely than interclade competition. Furthermore, the 'adults only' dataset found lower degrees of competitive exclusion in both taxonomic and stratigraphic contexts, suggesting that non-adults more likely engaged in intraspecific and/or interspecific competition than interclade competition. Placing the data in phylogenetic contexts finds that both clades originated with similar functional morphologies and diverged over evolutionary time. The first avialans in the Middle–Late Jurassic therefore did not competitively displace pterosaurs but rather filled functional niches that pterosaurs were vacating. Pterosaurs may have thus somewhat limited avialan functional diversity and the extinction of pterosaurs and non-avian avialans at the end of the Cretaceous may have enabled crown birds to functionally radiate.

Funding Sources SNSF Swiss Postdoctoral Fellowship TMPFP2_217001.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Understanding the paleoecology and extinction dynamics of the Cuban crocodile (*Crocodylus rhombifer*) across the Holocene Caribbean

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The Cuban crocodile (*Crocodylus rhombifer*) is today one of the most critically endangered and range-restricted extant crocodylian species. Its present endemism belies a Quaternary history that saw its populations span the Greater Antilles and the Lucayan Archipelago. Despite a rich fossil record, the chronology and causes of the species' decline over the course of the Holocene remain largely unknown. Using a holistic approach, building on primary data from over 400 specimens from 11 sites across the Western Caribbean and incorporating past archives into MaxEnt species distribution models, we disentangle the compounding factors that drove

a formerly widespread species to the brink of extinction. Extinction chronology mapping strongly implicates anthropogenic drivers of extinction, suggesting extinction events correlating with the spread of Taíno peoples over the past millennium and accelerating following the arrival of Europeans in the late 15th century. With exceptions, the observed pattern of range collapse is generally consistent with the theory of island biogeography, with larger and less-isolated landmasses providing the most enduring refugia. Estimates of body sizes from Holocene specimens suggest patterns of evolution driven by insular biogeography, with smaller landmasses generally associated with smaller morphologies. New estimates for the upper limits of *C. rhombifer* body sizes, derived from measurements of 52 specimens from 4 distinct islands and representing a minimum of 42 individuals, suggest the necessity of a revision of our understanding of the species' paleoecology. Evidence from past archives and differences in body sizes between islands imply a far broader paleoecological niche relative to the species' present ecology, indicative of a high degree of phenotypic and ecological plasticity in response to the differing requirements presented by an array of distinct insular habitats. A longer-term approach to assessing threats to species survival can track extinction events and anthropogenic forces across much longer timescales than are usually considered in conservation, contributing novel baselines for species status, an increased understanding of extinction dynamics, and a more robust assessment of species vulnerability and resilience to human pressures.

Funding Sources London NERC Doctoral Training Partnership.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Growth dynamics and histological variation of *Alligator mississippiensis*: implications for archosaur physiology

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The bone histology of alligators offers crucial insights into the growth dynamics, functional morphology, and physiological strategies of archosaurs, both extinct and extant. This study presents a comparative histological analysis of limb bones (humerus, femur and fibula) and multiple ribs across multiple individuals of different ontogenetic stages. We document differences in primary bone tissue types, vascularization patterns, and remodelling intensity between these skeletal elements. Limb bones in early ontogeny predominantly exhibit fibrolamellar bone, characterized by woven-fibered matrix mixed with dense, longitudinal to reticular vascular canals, indicating rapid periosteal bone deposition. As individuals age, these elements show a progressive shift toward parallel-fibered, with increasingly organized vascular canals and the appearance of cyclical growth markers. In contrast, ribs exhibit a slower and more consistent growth pattern. Primary bone tissue in ribs remains largely parallel-fibered throughout ontogeny, with limited and restricted vascularization, often dominated by longitudinal canals along with sporadic radial canals. Growth marks are consistently present but are more closely spaced and less distinct than those in limb bones. Secondary remodelling in ribs is minimal, restricted primarily to the endosteal region, and does not significantly encroach upon the primary cortex. The observed histological differences reflect both functional and developmental divergence between skeletal elements. Limb bones, subjected to higher mechanical stresses and supporting locomotor activity, undergo rapid early growth followed by extensive structural reinforcement. Ribs, functioning primarily in respiration and body wall support, maintain a more gradual and consistent growth trajectory. This element-specific variation in bone histology

represents the first systematic assessment of intra-skeletal and intra-specific variation in alligators using both ribs and limb elements, and underscores the importance of using multiple skeletal regions when reconstructing growth rates, ontogeny, and metabolic parameters in both living reptiles and their extinct relatives, including non-avian dinosaurs and early archosaurs. These results also provide comparative baseline data for assessing the efficacy of skeletochronological data from ribs in extinct reptiles.

Funding Sources This work is supported through project grants to TMC and postdoctoral support to MSB from Auburn University.

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Evolution, development and function of tubular enamel in monophyodont reptiles

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Enamel is the hardest tissue in the vertebrate body and typically contains less than 3% organic material by weight. However, in rare cases some amniotes have evolved a form of enamel containing networks of organic tubules. Tubular enamel is present in extant marsupials and early fossil mammals, suggesting that its development and evolution are associated with the origins of enamel prisms.

Tubular enamel is also present in *Priosphenodon avelasi*, a derived herbivorous rhynchocephalian from the Cretaceous of Argentina that also independently evolved prismatic enamel. Beyond this case, however, the prevalence of tubular enamel across Rhynchocephalia, its possible function, and its association with the evolution of enamel prisms in reptiles has not been tested.

We investigate the association between enamel prisms and tubule evolution by testing their order of appearance in a sample of early rhynchocephalians. We examined histological sections and synchrotron tomographic scans of enamel tubules in *Clevosaurus* and *Planocephalosaurus* from the Late Triassic of England. Our results show that both early rhynchocephalians possessed tubular enamel, but did not possess enamel prisms, demonstrating that the development and evolution of tubules and prisms are not correlated.

We further tested two potential functions of tubular enamel in reptiles: tooth wear mitigation, and increased tooth sensitivity. We used the extant acrodont squamate *Uromastyx*, which independently evolved enamel tubules, to mechanically test the enamel using microindentation. Enamel tubules do not apparently affect the bulk mechanical hardness of the enamel, given that *Uromastyx* enamel possesses similar microhardness values to other extant amniotes. We then tested the sensitivity hypothesis in *Clevosaurus* and *Planocephalosaurus* by tracing tubule pathways through the enamel, into the dentine, and ultimately the pulp. The scans of the tubules in fossil rhynchocephalians coupled with electron microscopy and soft tissue histology of the tubules in the extant *Uromastyx* reveal consistent results: tubular enamel in these reptiles may have evolved to increase the sensitivity of the teeth, either to increase the response of the dentine to tooth wear or to increase mechanoreception during occlusion.

This study highlights key adaptations in early rhynchocephalian dental evolution and suggests that the transition to monophyodonty in reptiles involved significant changes to enamel structure and development.

Funding Sources Leverhume Trust research project grant no. RPG-2024-053

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

PALEONILE: A new window onto the Mid–Late Pleistocene of Northeast Africa

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Despite the Nile River's prominence in discussions of human and faunal evolution, its Pleistocene vertebrate record remains poorly known. The PALEONILE project addresses this gap through fieldwork and legacy collections research in Sudan and Egypt. Five seasons of fieldwork (2018–2022) along the middle Atbara River (eastern Sudan) revealed a fossil-rich fluvial sequence (dated to 240–17 ka using luminescence) with diverse fauna, including *Ceratotherium simum*, *Eurygnathohippus*, *Palaeoloxodon*, *Loxodonta*, *Potamochoerus*, *Beatragus hunteri*, *Syncerus antiquus*, *Bos primigenius*, a new *Crocodylus* species, *Macaca* (the first from sub-Saharan Africa), cranial and postcranial *Homo* remains with archaic traits, and Acheulean artifacts.

Fieldwork along the Blue Nile in 2023 relocated and sampled the fossil sites of Singa and Abu Hugar. Abu Hugar, newly dated by luminescence to >210–120 ka, yielded *Loxodonta*, *Hippopotamus*, *Giraffa*, *Oryx*, cf. *Kobus megaceros* (possibly the first fossil record of Nile lechwe), *Hystrix*, *Varanus*, and cf. *Eurygnathohippus*. At Singa, now dated to ~40–10 ka using luminescence and radiocarbon, a small fauna includes *Homo sapiens*, *Syncerus antiquus*, *Equus*, and likely *Hippopotamus* and white rhino. Our work shows that these faunas, previously assumed to be contemporary, are of different ages, and supports a complex chronology for Blue Nile deposits.

We also revised key museum collections. At Soleb (northern Sudan), fossils collected in the 1960s include *Homo sapiens*, *Syncerus*, *Nanger*, *Giraffa*, *Phacochoerus*, *Equus*, and *Hippopotamus*, possibly from a Middle Stone Age context. Qau (Middle Egypt) yielded *Alcelaphus buselaphus buselaphus*, *Palaeoloxodon*, *Sus*, *Equus*, *Canis*, *Hippopotamus*, *Homo* postcrania, Nile perch, and crocodiles, all from ancient tombs and likely representing mixed temporal contexts. Chalouf (Suez), excavated during the 19th-century canal works, yielded *Bos primigenius*, *Hippopotamus*, a reduncin bovid, a large carnivore, and possible prehistoric butchery marks.

Together, these findings provide the first integrated synthesis of Pleistocene faunas along the Nile, revealing new taxonomic occurrences, regional ecological variation, and suggesting that the Nile's role during the late Quaternary—as a dispersal corridor or a zone of endemism—likely varied by taxon.

Funding Sources European Research Council (Horizon Europe, ERC Consolidator Grant PALEONILE, grant 101045217). German Research Foundation (DFG) project 282995372.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

I'm just here for the fossils: Academic responsibility, political injustice, and the paleontologist as public intellectual

Bibi, Faysal

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Paleontology is often imagined as an objective science—an exploratory and neutral profession removed from the messy entanglements of politics and power. Yet our field, long intertwined with colonial extraction and the marginalization of Indigenous voices, is not exempt from the political forces shaping academia and society today. Under conditions of growing state repression, academic silencing,

and ongoing realities of genocide and colonial violence, the illusion of scientific detachment becomes ethically untenable.

This talk challenges the myth of scientific neutrality and considers the ethical responsibilities of paleontologists not only as scientists but as public intellectuals. Drawing on Edward Said's conception of the intellectual and on critiques of dominant Western historical narratives, I argue that paleontologists—like all scholars—are embedded in, and contribute to, systems of power, memory, and meaning. Whether in the field or the lab, the questions we choose to ask, the collaborations we pursue, and the interpretive frameworks we adopt all play a role in sustaining or challenging an often violent status quo.

At the same time, paleontology's deep-time evolutionary perspective offers a powerful counterpoint. It invites us to cultivate what Michael Rothberg calls multidirectional memory—an approach that recognizes overlapping and entangled histories of suffering, resilience, and transformation. Moving fluidly across spatial and temporal scales, this perspective reveals the futility of borders, the impermanence of dominance, and the hollowness of supremacist narratives.

By embracing a broader intellectual role, paleontologists can become active participants in defending academic freedom, amplifying marginalized perspectives, and resisting complicity in systemic injustice and crimes against humanity. This presentation draws on insights from critical theory, memory studies, and the philosophy of science to propose a more engaged ethical framework for our discipline—one that reimagines paleontologists as not just technicians of ancient data, but as advocates of a long-view humanism capable of confronting the injustices of the present.

Funding Sources European Research Council (Horizon Europe, ERC Consolidator Grant PALEONILE, grant 101045217).

Colbert Prize Session

An embolomerid humerus inside out: life history traits of a non-amniote tetrapod revealed by synchrotron microtomography

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Embolomeres are an extinct group of non-amniote tetrapods that lived during the late Palaeozoic. Histological analysis of their bones could contain clues to understand their growth and life history traits. One L-shaped humerus (RM 20.6707, Redpath Museum, Canada) from the early Tournaisian of Nova Scotia, Canada, was studied using synchrotron X-ray phase-contrast microtomography at beamline ID19 at the ESRF in Grenoble. This analysis will shed light on the bone microanatomy and microstructure, including growth marks, vascularisation, and cell distribution. Its outer morphology, a bone compactness analysis, a secondarily enlarged medullary cavity filled with spongy bone, and a thin cortex point to a (secondarily) aquatic lifestyle. A high degree of bone remodelling and longitudinal vascular canals suggest an active metabolism. Nine lines of arrested growth suggest that the animal was at least nine years old, and the slower depositional rate in the peripheral cortex from the 5th growth mark suggests the onset of sexual maturity at 5 years of life. The absence of calcified cartilage and the intense bone remodelling in the metaphysis confirm an advanced ontogenetic stage. Numerous bundles of Sharpey's fibers, as well as intense local vascularisation, indicate that major muscles attaching to the shaft of the humerus were stretched enough to stress the bone microstructure at this location. These features suggest that this embolomere had an extremely different growth strategy from slow-growing Devonian stem tetrapods (such as *Acanthostega*), and more resembled other Carboniferous tetrapods like *Whatcheeria*. The complete analysis of this humerus allowed us to reconstruct the life history traits of this

embolomere and sheds light on tetrapod growth strategies during the Palaeozoic.

Funding Sources VR (2019-04595), ERC (LimbEvolution - 101126181)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Holistic grassroot outreach methods in India and their effectiveness in paleontological education

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Paleontological education and outreach are the backbone of continuing conservation efforts and fostering academic interest in the next generation of geoscientists. Globally, education and outreach are carried out and sustained by taking museum specimens or specialists to the public – especially where specimens and academicians are commonplace. However, in countries that lack resources and academic support within paleontology, public outreach is often a grassroots project that is taken up by individuals rather than a sole institution. One such example of this is within India where field sites, museums, and schools or universities are separated by hours of travel. Furthermore, a rigid educational system, deficient educational specimens, and inadequate formal support for the recognition of paleontology as an academic discipline hinder generating interest among the public. To surpass these hurdles, paleontological clubs form partnerships with educational institutions or organizations to reach future students at the national and international levels. An example of this within India is the partnership between the Fossils Forever Club (FFC) and the International Geoscience Education Organisation (IGEO) wherein FFC provides local leadership among schools under the guidance of professors. The strategies put forth by these partnerships utilize school lectures, fossil samples, and field trips to teach paleontological principles as well as demonstrate field methods to students. These opportunities, given in either English or Tamil, are designed with students in mind to foster interest and growth of paleontology as an academic subject over the coming years. In doing so, clubs like FFC develop paleontological education resources at the local level and build support for students, particularly among underserved or rural communities. FFC has also utilized digital outreach to garner interest from an international community, too. By combining digital media, responsibly resourced fossils, and Indian culture, student members of FFC have demonstrated their dedication to paleontological conservation and education in international media such as the Paleontological Society's 2023 Palaeovision contest. By combining methodologies at the school and university levels, nearly 40,000 students have been educated globally on the significance of paleontology within India and have demonstrated the dedication of its younger generation to the conservation of fossil resources.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Belenyenice, a key section for understanding biodiversity shifts in the Early Miocene small mammal fauna of Anatolia

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In central and western Europe, the late Early Miocene is marked by a profound reorganization of small mammal communities, transitioning from eomyid and glirid dominated faunas to assemblages increasingly dominated by cricetids. However, the relationship of this faunal turnover to the Anatolian fossil record remains unclear, as cricetids had already

established dominance in the region much earlier. The fossil evidence from the Belenyenice section in western Türkiye now offers an essential window into this period, revealing a compositionally distinct shift within Anatolian small mammal faunas. The section from western Anatolia comprises 19 fossiliferous layers from which over 2,000 identifiable small mammal teeth were recovered, including taxa representing lagomorphs, insectivores, bats, and especially rodents. Preliminary taxonomic work reveals major changes in composition and diversity across the stratigraphy.

The only taxon recovered from every layer is *Democricetodon*, highlighting its ecological flexibility. By contrast, *Eumyarion* is present exclusively in the basal and uppermost layers. In the lowermost layer, *Eumyarion* dominates the assemblage, indicating swampy/forested conditions, and this horizon represents the youngest known Early Miocene fauna in Anatolia where *Eumyarion* remains the dominant cricetid. It is entirely absent in the intermediate layers, which are marked by low diversity and a predominance of open-environment indicators, including simplified glirid morphotypes. The low-abundance reappearance of *Eumyarion* in the uppermost layer may indicate a brief recolonization facilitated by locally improved environmental conditions, and potentially reflects a broader biogeographic signal associated with the genus's expansion across Europe during the MN3–MN4 transition.

These faunal dynamics point to a significant phase of environmental transformation affecting the regional landscape. The disappearance of swamp-dependent taxa, reduction in diversity, and rise of open-habitat indicators shows increasing aridification and habitat restructuring during the deposition of the middle layers. Previous studies indicate that prior to the late Early Miocene, *Eumyarion* was the dominant cricetid in Anatolia. The Belenyenice sequence thus provides one of the most detailed records of how small mammal communities in western Anatolia responded to regional ecological shifts during this key phase of the late Early Miocene.

Funding Sources This work was funded by the EU NextGeneration EU through the Recovery and Resilience Plan for Slovakia under the project No.09I03-03-V04-00025.

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

Unlocking phylogenetic signal: a remarkable network of diploic veins in pangolin and carnivoran crania

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A fundamental challenge in paleontology lies in the reliable phylogenetic placement of extinct taxa in the Tree of Life. The well-documented discordance between morphology-based and molecular phylogenies in placental mammals highlights the complexities involved, often attributed to rapid cladogenesis and correlated homoplasy. However, we posit that the incomplete utilization of potentially informative morphological data, particularly internal structures traditionally inaccessible without destructive methods, may also be involved. Diploic veins, a complex vascular network hidden within cranial bones, exemplify these neglected anatomical systems, whose diversity

and phylogenetic signal remain largely uncharacterized across most placental lineages. Using μCT scans and histology, we investigate the morphological variation of the diploic venous system across a broad range of placental species (68 spp.—46 extant and 22 extinct). Our analysis confirms that, in most placentals, the venous drainage of the cerebral hemispheres is mainly endocranial and usually associated with modest development of the diploic veins. We show that pangolins deviate remarkably from this pattern, displaying a network of diploic venous channels throughout their cranial vault, which is exceptionally dense. Furthermore, we observe a similar, albeit less pronounced, pattern in carnivorans and their extinct carnivoramorphan relatives. These discoveries establish diploic veins as a potentially powerful phylogenetic marker, providing a distinctive signature for Pholidota and adding another long-sought anatomical synapomorphy for the molecularly supported Ferae clade. We show that it also represents a promising approach to clarifying the uncertain placement of extinct Ferae relatives (e.g., Palaeanodonta†, Hyaenodonta†). Finally, the discovery of this extensive diploic venous network offers new insights into the potential functional importance of diploic veins for cerebral drainage. We suggest that this network provides an alternative drainage pathway for the cerebral hemispheres, which in pangolins echoes human cases with hypoplasia of the superior sagittal sinus.

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Colbert Prize Session

A well-preserved specimen from the Lower Jurassic (Toarcian) of Whitby provides insights into caudal morphology in the genus *Stenopterygius*

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The fossil record of Toarcian ichthyosaurs is heavily biased, with the majority of complete, well-preserved specimens originating from the Posidonienschiefer Formation Lagerstätte of southwestern Germany. *Stenopterygius*, a small to mid-sized ichthyosaur, is the most abundant genus from this formation, represented by three species. These are differentiated primarily based on body proportions, including cranial and postcranial elements. The need for relatively complete skeletons creates difficulties in reconstructing Toarcian ichthyosaur diversity and abundance at coeval localities characterized by less complete material. Here, we examine this problem in relation to one of the best-preserved and previously unreported *Stenopterygius* specimens from the Toarcian Whitby Mudstone Formation (Alum Shale Member) collected from near Whitby, Yorkshire, England. This specimen is preserved lacking the pelvic girdle and hind limb, hindering its determination at the species level. To address this problem, we developed additional criteria that may help to differentiate species in the genus *Stenopterygius* based on firsthand comparisons of 51 specimens including adults and juveniles. The first two concern differences in the length of the tailstock between *S. quadriscissus* and *S. triscissus*: the former species has a lower number of tailstock vertebrae, and a proportionately shorter tailstock relative to the fluke. The third character concerns differences in the relative lengths of the radial and ulnar facets of the intermedium, which appear to differ between all three early Toarcian species of *Stenopterygius*.

These new postcranial metrics identify the Whitby specimen as *S. quadriscissus*, making this the first definitive occurrence of this species

from the Whitby coastline. The individual is also the youngest specimen referable to the species, extending the temporal range to 4.6 +/- 0.4 Ma (183.7–179.1 +/- 0.4 Ma) and the geographical range from southwestern Germany north to the Cleveland Basin. The new metrics assist in revising the taxonomy of historical *Stenopterygius* specimens for which the classical determination methods were not applicable. Comparison of the Toarcian ichthyosaur fauna between Yorkshire and southwestern Germany reveal that preferential quarrying of diachronous strata are largely responsible for the observed slight faunal differences between localities; ichthyosaur species generally exhibit a ubiquitous distribution across Europe in the Early Jurassic.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A lost giant and its diet: body mass and paleoecology of *Palaeoloxodon* from the Pleistocene of Taiwan

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The Pleistocene of Taiwan includes a distinct faunal assemblage that harbored multiple megaherbivore clades, including *Palaeoloxodon*—one of the largest known terrestrial vertebrates in Earth's history. Despite their abundance among the fossils recovered from the sea bottom of the Taiwan Strait, much remains unknown about these behemoths. Considering the important role played by proboscideans as 'ecosystem engineers,' it is essential to understand the biology, ecology, and habitat of these megaherbivores. In this research, we assess the body mass of *Palaeoloxodon* specimens from Taiwan using established allometric scaling equations derived from both extinct and extant proboscideans. To further investigate the diet and paleohabitat for harboring these giant proboscideans, we performed stable carbon and oxygen isotope analysis of structural carbonate on serial enamel samples from three mandibles representing different ontogenetic stages. Our body size estimates show that the largest *Palaeoloxodon* individual from Taiwan exceeded 13 tonnes in body mass, with a mean of 9.32 tonnes. It was comparable in size to the Eurasian *Palaeoloxodon antiquus*, while being significantly smaller than the largest species within the genus, *Palaeoloxodon namadicus*. Furthermore, the $\delta^{13}C$ values obtained for *Palaeoloxodon* from Taiwan suggest that these proboscideans relied heavily on a C_4 diet. They exploited a dietary niche distinct from the Eurasian *P. antiquus* but similar to the predominantly C_4-grazing species *P. namadicus*. The specimens exhibit depleted $\delta^{18}O$ values, indicative of obligate drinking and reliance on running water sources, such as monsoon-fed rivers. Additionally, ontogenetic variation in stable isotope values is observed in the studied specimens, with the juvenile specimen showing isotopic signals indicative of weaning, providing novel insights into the life history and weaning age of *Palaeoloxodon*. Our results highlight the first evidence of a vast and unique paleohabitat from the Pleistocene of Taiwan, represented by C_4 grasslands and a paleo-river system where herds of *Palaeoloxodon* thrived. Furthermore, our results provide crucial insights into the diverse paleo-ecosystem that persisted in Taiwan during the Pleistocene. Future fossil collecting and analyses promise to reveal how and why megaherbivores like *Palaeoloxodon* went extinct along the easternmost margin of Eurasia.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New palaeoecological investigations and post-glacial re-colonization process of the British

Isles based on herpetofauna at the Hoxnian East Farm Barnham site (UK)

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The Pleistocene is well known for its high climatic variability, with the alternance of cold glacial periods with warmer interglacial periods, affecting flora and fauna on lands, including humans. The glacial period known as Marine Isotope Stage [MIS] 12 (ca. 480–425 thousand years ago [ka]) culminated in the largest Pleistocene ice volume expansion in the Northern Hemisphere. In Europe, MIS 12 corresponds to the most extensive recorded glaciation in eastern Germany, Poland, and England (the ice reaching as far as London). The British and Scandinavian ice sheets coalesced for the first time in the central North Sea, redirecting fluvial systems southwards and creating a massive proglacial lake bounded in the south by the Weald-Artois anticline barrier. Overspill of the proglacial lake led to a catastrophic breach of the structural barrier in the so-called Channel Megaflood that formed the Dover Strait, with its effects documented on the seafloor of the English Channel. Following this major glaciation, the Hoxnian interglacial stage (MIS 11e) took place. This interglacial stage is one of the longest and warmest periods of the last 800,000 years; at this time conditions were suitable for southern species to colonise as far North as Britain, which was still connected to the continental mainland. In this global context is placed the stratigraphical sequence of the Lower Palaeolithic site at East Farm, Barnham (UK). As it is located east of London, it was under the ice sheet during the MIS 12. The fossiliferous deposits are assigned to the early part of the Hoxnian interglacial stage, at ca. 425-390 Kyr BP. The sediments preserve a vertebrate assemblage that includes one of the richest collections of Pleistocene amphibians and reptiles known from northern Europe. A verification of osteological attributions of the palaeoherpetofaunal material (1989–1994 excavations) done by J. A. Holman has been undertaken in 2022 and 2023, as well as analysing the taphonomy of the accumulation. The Mutual Ecogeographic Range method has been applied to estimate temperature and rainfall for the Hoxnian. The results provide the basis for new palaeoenvironmental and palaeoclimatic reconstructions and establish a more secure basis for understanding the ecological context of the human occupation at the site but also provide interesting data on the re-colonization process by amphibians and reptiles of the British Isles after a glaciation.

Funding Sources This study is part of the projects PID2021-122533NB- I00, funded by MCIN/AEI/10.13039/501100011033/ and by ERDF, 2021SGR-1238 (AGAUR-GenCat) and 2023PFR- URV-01238 (URV).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A new Hebridean morphotype series in the Middle Jurassic Valtos Sandstone and Kilmaluag Formations on the Isle of Skye, Scotland

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The Middle Jurassic was an important time in the evolution of dinosaurs and yet remains a

poorly sampled time interval due to globally scarce deposits. On the Isle of Skye, Scotland, an abundance of dinosaur tracks continues to provide insights into the distribution, behaviour, and paleoenvironmental preferences of these trackmakers. In our investigation, we described and grouped 185 theropod tracks from the Bathonian aged Valtos Sandstone and Kilmaluag Formations into four newly devised morphotypes within a Hebridean series. The tracks were examined using photogrammetric techniques and revealed that smaller morphotypes occurred in greater abundance in the freshwater, closed-lagoonal Kilmaluag Formation at Lùb Score compared to larger equivalents in the freshwater-brackish fluviodeltaic Valtos Sandstone Formation at Valtos. We suggest that the proximity to, or suitability of, the paleoenvironment for particular trackmakers may have influenced these differences in assemblage composition. Furthermore, specimens with multiple tracks provide an indication of potential behaviours exhibited by trackmakers in respective paleoenvironments, including post-hatchling care at Lùb Score and foraging at Valtos. The tracks were most likely impressed by a large megalosaurid and smaller-bodied basal or non-coelurosaurian (e.g., Ceratosauria, Megalosauroidea, Allosauroidea) theropods. Collectively, these scarce track assemblages provide evidence of several small-to-mid-sized theropod trackmakers on Skye during the Middle Jurassic, and documentation of these trackmakers and their behaviors enrich our understanding of the dinosaur fauna during this poorly known time.

Funding Sources National Geographic Society (GEFNE185-16) and a Philip Leverhulme Prize to Stephen L. Brusatte.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The price of preservation: commercial fossil purchasing, and the longevity of paleontological museums

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Paleontological museums often commercially purchase specimens in hopes of increasing their visitor engagement, but they must adhere to strict acquisition policies and international trade and exportation laws, which aren't always as explicit. As demand increases, the commercial fossil market is constantly evolving; more fossils are entering the commercial market, and it is becoming increasingly common to encounter stolen or falsified specimens. This study determines the return on engagement and significance of notable commercial purchases within UK museums, assessing their ethical implications, and the impacts they may have on the commercial market. Commercial purchases made by the Natural History Museum (NHM) London, the University of Manchester (UoM) Museum and the Lapworth Museum of Geology (LMoG) in Birmingham were studied, concluding that visitor engagement is highest at smaller museums such as the LMoG, whereas larger museums, particularly the NHM London, benefit most from revenue generation and scientific research related to their commercial purchase. Overall, incorporating large commercial purchases (specifically vertebrate specimens) into museum exhibits can help increase visitor engagement, but the longevity of paleontological museums may be ultimately dependent on the commercial fossil market. Increased exposure to commercially available specimens and lack of barriers for the purchase of illegal fossils media could risk a decline in visitor numbers. Likewise, Influential figures (such as museums and celebrities) may be glamourising commercial purchasing and causing a surge in purchasing, falsification, and theft, but more research is needed to confirm this. The ambiguity of intentional trade laws and fossil exportation laws is undoubtedly responsible for loopholes being exploited and

henceforth clarification and wider publication of laws should be prioritised. Museums need to ensure that the commercial purchases they do make are ethical, economically-beneficial, and are engaging visitors in multiple ways.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Oldest known New World river otter from North America coincident with high-latitude intercontinental mammalian dispersal event in the latest Miocene

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Extant otters (lutrines) are a moderately diverse radiation of semiaquatic mustelid carnivores that include eight species in Africa and Eurasia, five species in the Americas, and the sea otter *Enhydra lutris* distributed across the North Pacific. New World river otters (*Lontra*) are mostly from South and Central America (3 species), with a single extant North American species *Lontra canadensis*. Results from published whole-genome analyses suggest that *Lontra* diverged from Old World otters ~8.8 Ma and that *L. canadensis* diverged from the three Neotropical species ~3.7 Ma coinciding with the formation of the Isthmus of Panama and the Great American Biotic Interchange. Until now, the oldest fossil record of New World River otters in North America has been largely restricted to Pleistocene occurrences of *L. canadensis* from the late Blancan/early Irvingtonian, with the exception being *Lontra weiri* from the Pliocene-aged Hagerman Fossil Beds of Idaho (~3.8 Ma). Here we describe the oldest unambiguous occurrence of *Lontra* in North America, recovered from a latest Miocene river deposit in Levy County, Florida. The Montbrook Site has been dated using strontium isotopes preserved in fossil shark teeth to 5.86 Ma, consistent with a latest Hemphillian (Hh4) correlation based on contemporary land mammals. Fossils referred to *Lontra* collected from the Montbrook Site (n = 52) include a partial maxilla with C1-P4, a partial dentary with c1–m1, vertebrae, long bones of forelimbs and hind limbs, and a few wrist and ankle bones representing several individuals (MNI = 3) of what is likely to be a single undescribed species. Comparison of these fossils to those of *Lontra weiri* from the Pliocene of Idaho, and to those collected from the Pleistocene of Florida, including a remarkably complete undescribed skull from the earliest Pleistocene (late Blancan; 2.2–1.9 Ma), provide new insight into the evolution of New World river otters. Discovery of a 5.86-million-year-old *Lontra* in Florida is consistent with previous studies that suggested global climate change in the late Miocene led to northward expansion of humid climate zones with the intensification of the Asian Monsoon which reached the Artic by Hh4, providing a high latitude corridor for dispersal of east Asian species, including river otters, into North America.

Funding Sources Montbrook excavations funded by NSF award 1645530 and the Felburn Foundation; NSF grant 1756306 provided funding for specimen curation and preparation.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The coastal forests of eastern Africa as an evolutionary hotspot: hypotheses and new data

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The geographic distribution of modern plants and animals in Africa indicates that the coastal forests of eastern Africa (CFEA) have played a key role in generating the extraordinary biodiversity of the continent. In fact, for some taxa including ungulates and afrotheres the peak of continental species richness is in the eastern regions near the Indian Ocean. Hypothetically, climatic change during the Cenozoic along with the emergence of the East African Rift System beginning in the Oligocene led to the fragmentation of the pan-African forests into the current Guineo-Congolian realm and the CFEA, creating biogeographic barriers and opportunities for speciation. Here we aim to answer the question, what role did the coastal forests and woodlands play in the evolution of African mammals? Until now there have been no fossil sites to assess the role played by these forests, but new paleontological sites in Gorongosa National Park, Mozambique, have opened the first opportunity to directly study plants and animals that lived in the ancient coastal forests. The Gorongosa fossil record derives from the Mazamba Formation, exposed on the Cheringoma plateau. Some 2000 fossil specimens have been excavated and catalogued so far. The geochronology of the sites is currently under study, but preliminary atmospheric beryllium analyses suggest a Miocene date for the sites, although earlier dates are also possible. Ongoing geochronological efforts include Ar-Ar dates of igneous intrusions, U-Pb on calcites, and magnetostratigraphy. The Gorongosa fossil record includes a sequence with abundant fossil wood, with *Entandrophragmoxylon* (African mahogany) as the most abundant taxon. Other localities have produced well-preserved mandibles and teeth of a giant hyracoid (a new species), skull, dental and postcranial remains of embrithopods, as well as marine invertebrates and vertebrates like sharks of the genus *Galeocerdo*. Here we present taxonomic and phylogenetic analyses of the hyracoids, embrithopods, and sharks, and provide a paleoenvironmental reconstruction of these sites that are unique in eastern Africa. The fossil record still emerging from Gorongosa is providing a picture of a rich coastal ecosystem, with new species of mammals and unique faunal associations. This new evidence may transform our understanding of how Africa's biodiversity originated and evolved during the Cenozoic.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A second species of non-crocodyliform crocodylomorph from the Late Triassic fissure deposits of southwestern UK

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The Late Triassic–Early Jurassic fissure deposits of the Bristol Channel area (southwest England and south Wales) are renowned for their diverse vertebrate faunas. These assemblages have yielded an array of predominantly small-bodied forms that are crucial to our understanding of the early evolution of several major tetrapod clades. Although their dating remains contentious, these deposits represent a valuable insight into biodiversity at a key time in Earth history, as they span the end-Triassic mass extinction event. Known from around 200 specimens, *Terrestrisuchus gracilis* represents one of the

most completely preserved early crocodylomorphs. Recent phylogenetic analyses have assigned it to Saltoposuchidae, a group of small-bodied, highly gracile, cursorial non-crocodyliform crocodylomorphs. *Terrestrisuchus* is known exclusively from Pant-y-Ffynnon Quarry, whereas only generically indeterminate crocodylomorph remains have been recorded from the other fissure deposits in the Bristol Channel area to date. Here we present a detailed anatomical description of specimen NHMUK PV R 10002, the semi-articulated partial postcranial remains of a non-crocodyliform crocodylomorph from the fissure deposits of Cromhall Quarry. We scored NHMUK PV R 10002 in a pre-existing data matrix comprising 138 morphological characters, enabling us to assess its phylogenetic position alongside 39 other operational taxonomic units. Our phylogenetic analyses recover NHMUK PV R 10002 as the sister taxon to *Terrestrisuchus* within Saltoposuchidae. Although NHMUK PV R 10002 exhibits a high degree of morphological similarity to *Terrestrisuchus*, key differences are identified in its limb proportions and carpal morphology. Anatomical features that differentiate NHMUK PV R 10002 from *Terrestrisuchus* as a new species include: (i) a humerus that is shorter than the radius and ulna; (ii) a tibia that is shorter than the femur; (iii) shorter and more robust radiale and ulnare; and (iv) the presence of well-developed medial and posterolateral longitudinal ridges that demarcate a concavity extending along the length of the posterior surface of the radiale. We explore how these anatomical differences may reflect varying locomotory specialisations within early crocodylomorphs. In particular, differences in anatomical features previously associated with cursoriality suggest that the new species represented by NHMUK PV R 10002 may have differed functionally from *Terrestrisuchus*.

Funding Sources London NERC DTP

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Revision of the longirostrine crocodilian *Thoracosaurus isorhynchus* from the Maastrichtian–Danian of northwestern Europe

Boerman, Sophie A.[1,2], Vellekoop, Johan[1,2], Jouve, Stéphane[3], Rabi, Marton[4,5], Vallée-Gillette, Nathan[2], Oudoire, Thierry[6], Smith, Thierry[2]

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"Thoracosaurs" are a group of longirostrine eusuchians known from Upper Cretaceous–lower Paleogene coastal deposits of Europe and North America. Their phylogenetic position is highly debated and varies from one study to the next, ranging from inclusion within Gavialoidea—implying ghost lineages of up to 100 million years—to exclusion from Crocodylia altogether. Despite these issues, many "thoracosaur" taxa have been understudied, suffering from incomplete or outdated descriptions and questionable taxonomic assignment. We present a comprehensive revision of *Thoracosaurus isorhynchus*, the most common European "thoracosaur." Here, we redescribe the lectotype and paralectotypes of the species from the Maastrichtian of Mont-Aimé, France, and a skull from the Maastricht type area, The Netherlands. We also add new, previously undescribed cranial and extensive postcranial material from Mont-Aimé. Moreover, comparison with the type material of *Thoracosaurus "scanicus"* of the Danian of southern Sweden indicates that the latter is a junior synonym of *T. isorhynchus*, confirming the persistence of this species across the Cretaceous–Paleogene boundary. An array of phylogenetic analyses points to a close relationship between *T. isorhynchus* and the

Cenomanian *Portugalosuchus azenhae*. This implicates an early emergence of "thoracosaurs" within Gavialoidea, highlighting the stratigraphic inconsistency of this group and a need for up to date descriptions of species belonging to this group.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A new record of the fur seal *Pithanotaria starri* (Mammalia: Otariidae) from the uppermost Miocene Purisima Formation of northern California reveals cryptic diversity in late Neogene pinniped assemblages from the eastern North Pacific

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Fur seals and sea lions (family Otariidae) include fifteen extant species inhabiting the North Pacific and Southern Ocean. Early otariids such as *Eotaria* and *Pithanotaria* were small-bodied 'fur seal' ecomorphs from the late Burdigalian–Tortonian of California, indicating an approximate middle Miocene origin for the clade in the eastern North Pacific. *Pithanotaria starri* is a diminutive form (CBL ~160 mm, body length = 1.2–1.5 m) with double-rooted cheek teeth lacking lingual cingulum and accessory cusps, and occasionally retaining m2. Previous discoveries of *P. starri* are chiefly known from Tortonian-correlative strata including the Monterey Formation (7.7–9.4 Ma) and Santa Margarita Sandstone (9–10 Ma). The holotype, CAS 13665, is a poorly preserved impression of a nearly complete juvenile skeleton in diatomite, and most subsequently identified specimens of *Pithanotaria* have not been described in detail. *Pithanotaria starri* thus awaits modern reassessment. A new specimen from the base of the Purisima Formation, UCMP 296821, consists of associated left and right dentaries preserving canines, left p2–3, and right p3–4. Previously, otariid fossils from the base of the Purisima Formation have been identified as *Thalassoleon macnallyae*, though UCMP 296821 is considerably smaller (115 mm mandible length, ~60% of mandible size of *Thalassoleon*) and critically lacks lingual cingulum and accessory cusps, consistent with identification as *P. starri*. Further, robust canines suggest that this specimen is a male and not simply identifiable as a female of *Thalassoleon*. Identification of this specimen as *Pithanotaria starri* resulted in a reappraisal of several postcranial specimens previously identified as female *Thalassoleon macnallyae*, including a cervical vertebra (UCMP 219408), left femur (UCMP 219409), associated vertebra and calcaneum (UCMP 219426), and partial hind limb (UCMP 219482), which now seem to be referable to *Pithanotaria* (and too small to represent female *Thalassoleon*). Previously, only a single fossil otariid was evident in any late Neogene fossil assemblage from the eastern North Pacific. This new material, however, indicates that *Pithanotaria* survived into the Messinian (latest Miocene) and coexisted with a larger otariid, *Thalassoleon*, hinting at previously unappreciated and cryptic diversity of late Neogene otariid faunas. Careful assessment of diagnostic craniodental material and potentially nondiagnostic postcrania is needed moving forward.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

High bite forces reveal divergent ecological drivers in pinniped evolution

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Pinnipeds are a diverse group occupying a broad array of niches and exhibiting significant variety in life histories and morphologies. Their complex evolution incorporates multi-stage, distinct subclade aquatic transitions. Despite occupying multiple aquatic niches, minimal quantitative analysis has been performed on jaw strength or the evolutionary pressures behind pinniped skull morphology, both of which are key aspects to their lifestyles and ecology. Here, we perform quantitative analysis of the jaw musculature using the physiological cross-sectional area (PCSA) of key jaw adductor muscles, namely the temporalis, masseter, and medial pterygoid, using anatomical correlates present in the skulls of Steller's sea lion (*Eumetopias jubatus*), crabeater seal (*Lobodon carcinophaga*), Weddell seal (*Leptonychotes weddellii*), and two leopard seals (*Hydrurga leptonyx*). These data were combined with literature figures to calculate bite forces. Our results reveal jaw musculature in the male sea lion capable of generating 2500 N, with leopard seals generating forces from 1700N–2400N. Crabeater and Weddell seals were found to have bite forces of 500N and 300N, respectively. Our results suggest that the presence of sagittal and nuchal crests enabled large physiological cross-section areas, which in turn enabled powerful bite forces in leopard seals and Steller's sea lions. Despite convergence between sea lions and leopard seals, evolutionary drivers of exceptional bite forces are hypothesized to be different. We find the most likely reason for the strong bite force of male Steller's sea lions is intraspecific competition for mating rights because females lack specialized traits for strong biting and diets do not vary between the sexes. Conversely, leopard seals' high bite forces are linked to diet. Compared to other lobodontini, leopard seals specialize in macroraptorial predation, using high bite forces to both dispatch and hold onto prey during processing. High bite forces potentially arose independently within phocids and otariids for different reasons. Our study reveals how the independent emergence of high bite forces in separate lineages of otariids and phocids occurred and highlights how different pressures have driven parallel evolution in pinnipeds. This work contributes to knowledge on pinnipeds, illustrating how functional morphology and lifestyle are linked in pinniped evolution and exploring new links between functional morphology and pinniped biology.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The Late Eocene record of amphisbaenians (Reptilia, Squamata) from Hampshire Basin (UK)

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Amphisbaenians are fossorial squamates with a good fossil record in Europe, where *Blanus* (Blanidae) is the only extant representative of the group. Regarding the Paleogene record, most known specimens come from localities in France, Spain, Portugal, Switzerland, and Germany, but a formal description of available material from the UK is lacking. Our survey of the squamate material housed at the Natural History Museum UK of the Eocene-Oligocene Hampshire Basin in Southern England has revealed new material that complements specimens described in an unpublished PhD thesis completed in the late 1990s. The new material comprises several partial jaws, numerous vertebrae, and, most importantly, a partial frontal, representing up to three kinds of amphisbaenian. Two of the dentary morphotypes differ in tooth, sub-dental shelf, and symphysis morphology, but both have low tooth counts and are reminiscent of European Eocene genera

referred to Blanidae. A third dentary morphotype, if genuinely amphisbaenian, had a higher, likely plesiomorphic, tooth count of ten or more. An almost complete maxilla compares well with that of blanids but, again, has an unusual high tooth count. Finally, the available partial frontal is interesting in that this element is rarely preserved and enables a new line of comparison to extant amphisbaenians. Our results invalidate previous records of Amphisbaenidae, which were based on the now-outdated view that this subclade included *Blanus*, and are not supported by characters observed in the material. The presence of two blanids similar to those described from continental Europe suggests a certain homogeneity between European and British amphisbaenian assemblages, something supported by the shared composition of squamate assemblages as a whole. The few Hampshire Basin localities that have yielded squamate material after the Eocene-Oligocene boundary do not record amphisbaenians. Although the scarcity of squamate material in the earliest Oligocene localities from the Hampshire Basin may have hampered the chances of recovering rare taxa, it is possible that the Grande Coupure marks the final extirpation of the Amphisbaenia in the UK, because no younger records are known. This study forms part of a wider project that aims to compare the understudied Eocene assemblages of lizards and amphisbaenians from the UK with those of the rest of Europe.

Funding Sources CERCA Programme, CLT0009_22_000022, 2021SGR01188 (Generalitat de Catalunya), RYC2022-037745-I (MCIN/AEI and FSE), AL\221010, AL\231048 and AL\24100054 (Royal Society).

Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Growth strategy did not influence the survival of sauropodomorph dinosaurs through the end-Triassic extinction

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Sauropodomorph dinosaurs, the largest terrestrial animals in Earth's history, reached body masses over 50 tonnes. The earliest sauropodomorphs, first appearing in the Carnian stage of the Late Triassic, were small, bipedal forms that evolved multi-tonne sizes by the end of the Triassic. These dinosaurs survived the end-Triassic mass extinction with little evidence of size-based selective pressure, and by the Middle Jurassic, they had produced species larger than any other land animal. A major focus in sauropodomorph evolution concerns the shift from the ancestral condition of annual, interrupted growth to a derived pattern of rapid, sustained growth throughout most of development. Recent osteohistological studies have begun to clarify this transition using Upper Triassic fossils. In this study, we combine previously published data with new osteohistological samples from Upper Triassic sauropodomorphs in South Africa, producing the largest dataset to date for analyzing their growth evolution. Our findings confirm earlier observations that both basal sauropodomorphs and more derived sauropodiforms displayed interrupted growth early in life. We also detect allometric differences in growth rate, particularly among the small-bodied Massospondylidae, as well as diversity in growth strategies within Lessemsauridae—close to the evolutionary transition to sauropods. Importantly, we find no significant changes in

sauropodomorph growth patterns before or after the end-Triassic extinction. When compared with studies on other Late Triassic vertebrates, especially crocodylomorphs, our results show that alternative growth strategies emerged in the Triassic and continued beyond the extinction event. These patterns contradict hypotheses that link survival through the extinction to macroevolutionary shifts in growth rate, suggesting instead that multiple growth strategies coexisted and were evolutionarily stable across this boundary.

Funding Sources GENUS, National Research Foundation, Palaeontological Scientific Trust

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Fossil evidence of advanced nasal echolocation in late Eocene Hipposideridae (Chiroptera, Yinpterochiroptera) from Quercy, France

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Hipposideridae, also known as Old World leaf-nosed bats, are today restricted to the tropical regions of Africa and Asia and are characterized by a leaf-shaped rhinarium. They use nasal echolocation, meaning they emit high frequency sound waves through their nostrils to echolocate, a method particularly effective in complex environments such as dark habitats or dense forests. Bats that echolocate nasally show several distinctive cranial features: ventral rotation of the basicranium relative to the cervical axis, depression of the rostrum below the basicranial axis, tilting of the lateral semicircular canals to maintain their horizontal orientation during flight, and modification of the premaxilla to enhance the emission and direction of ultrasonic signals. Additional differences are observed in the turbinal bones, cochlea, and cranial shape setting them apart from oral emitter bats. All these traits are well documented in extant representatives of Hipposideridae.

However, three dimensional skulls are rarely present in the fossil record, and the delicate structures of the rhinarium (especially the premaxillae and the turbinal bones) are rarely preserved, making it difficult to determine the echolocation mode of extinct bats.

The konservat Lagerstätten of the Quercy phosphorite area in France yielded exceptionally well-preserved cranium of Hipposideridae dated from the late Eocene. These specimens show remarkable preservation of the bony part of the rhinarium, including the premaxilla and the turbinal bones.

In the studied fossil species, the morphology of these bones, especially of the premaxillary, is very similar to extant hipposiderids, with a typical absence of the nasal process. The turbinate bones also show similarities with extant species, showing a vertical lamina horizontalis and a high number of ethmoturbinates (at least three). The studied extinct species first occur in the fossil record during the MP 16, which indicates that Hipposideridae were already capable of complex nasal echolocation as early as the middle Eocene, at the origination of the family. The striking morphological similarity between these late Eocene bats and living species suggests that this mode of echolocation was already fully functional at the emergence of Hipposideridae.

Funding Sources This project received financial support from the CNRS through the interdisciplinary programs of the MITI through its exploratory research program.

Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

Intraspecific variation of the maxillary canal in a sample of green iguanas (*Iguana iguana*): preliminary implications for the reconstruction of fossil neurovasculature.

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The maxillary nerve innervates the midface in all vertebrate taxa. In non-mammalian amniotes, this nerve enters the maxilla through an osseous tube called the maxillary canal, which courses parallel to the alveolar margin and sends out branches that terminate in foramina on the bone's lateral surface. Maxillary canal morphology has been used to support phylogenetic, behavioral, and soft tissue inferences across a variety of extinct amniote taxa. Within the synapsid clade, canal morphology has provided insight into the evolution of mammalian soft tissue traits such as vibrissae and facial musculature. Though previous research relied on qualitative observations to substantiate these inferences, recent papers have begun to implement a more quantitative approach. Unfortunately, these studies often rely on a single specimen (and sometimes on only a single canal) to represent a broader taxonomic group. To begin to assess the amount of variability present in a maxillary canal, and thus if limited samples can act as an accurate representation of a species, we collected quantitative data from the computed tomography (CT) scans of a small sample of green iguana (*Iguana iguana*) skulls available on Morphosource. For each specimen, the left and right maxillary canals were segmented and three measurements were taken from each canal reconstruction: 1) canal cross-sectional area; 2) canal length; and 3) number of canal branches that terminate in external foramina. Measurements of skull size, such as maximum cranial width and maximum cranial length, were also collected from the CT data. Our preliminary results suggest a moderate amount of variation in the iguana's maxillary canal morphology, both in terms of intraspecific variation and contralateral variation within a single individual. As such, future research should be cautious when making paleobiological inferences based on quantitative data from a single maxillary canal. By investigating the extent of intraspecific variation in canal morphology, we aim to support a more thorough understanding of how tactile sensitivity evolved in the earliest mammalian ancestors.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Bringing the past into the present, ecometric approaches to reconstruct the paleoenvironments of the Greco-Iranian bioprovince

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Paleoecological studies shed light on how past environments shaped biodiversity and the mechanisms behind migration, extinction, and evolution. Traditional methods based on taxonomic compositions are vulnerable to uncertainties in classification and incomplete fossil assemblages. By contrast, ecometric ('taxon-free') methods circumvent these issues by linking community-level functional traits to specific climatic variables.

During the Late Miocene, declining precipitation and increased seasonality transformed much of Eurasia from humid forests into more open, drier landscapes. This shift coincided with the extinction of many forest-adapted taxa, including the last European hominids.

South of the Parathethys, the Greco-Iranian bioprovince (GRIP) extended from the Balkans to Iran and Afghanistan. It has traditionally been viewed as a relatively homogeneous open woodland to savannah-like landscape, home to a distinct mammal community known as the Pikermian Biome. Its strategic position likely facilitated dispersals between Eurasia and Africa.

However, this presumed environmental uniformity may oversimplify the region's ecological complexity. In this study, we re-examine the GRIP to assess whether local habitat variation existed within the broader biome. Such variation could explain patterns of survival, extinction, and migration in the Late Miocene.

We compare two ecometric approaches for reconstructing climate based on fossil mammal assemblages. The first uses Functional Crown Types (FCT) of herbivorous mammals, correlating FCT scores from extant communities with bioclimatic variables via a machine learning algorithm (Least Angle Regression), and applying the model to fossil sites. The second approach uses niche-exploitation profiles (NEP), based on the normalized proportions of dietary and locomotory niches. Clustering modern communities by these profiles allows the prediction of environmental conditions at fossil localities.

Preliminary FCT results suggest wetter conditions, placing sites in temperate forest or rainforest biomes, while NEP results point to tropical seasonal forest/savanna. The NEP method currently shows a large error margin, which we aim to reduce by expanding the modern reference dataset. While FCT results hint at greater habitat diversity in the GRIP, the NEP results do not, though improved resolution is needed before drawing conclusions from the latter. The analyses yield valuable insights, pending improved resolution for full clarity.

Funding Sources NWO Mozaïek 2.0

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Evolution of the gnathostome head: jaws and girdles from a paleontological perspective

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The vast morphological gap between jawless and jawed vertebrates heads has long posed an obstacle to a coherent theory of the origins of the jawed vertebrate head. The void has been filled with theories, often informed by developmental biology. However, these theories fail to resolve the outstanding problems of gnathostome evolution: what (if anything) are the homologues of jaws (and potentially paired fins) in jawless fishes? Secondly, what are the adaptive intermediate states between jawless and jawed conditions? The heavy emphasis on abstract theories is a byproduct of a lack of clear fossil intermediates between the earliest jawed vertebrates and their nearest fossil jawless relatives such as osteostracans and galeaspids. Here, we present new data that may allow us to address key elements of the morphofunctional origin of jaws. We demonstrate that a complex exoskeleton was present in the last common ancestor of all known jawed vertebrates, including bones associated with active buccal ventilation. We review two competing models of osteostracan and galeaspid head shield currently in the literature in light of two competing theories of vertebrate (jawed and jawless) pharyngeal morphology. We use new morphological data from placoderm fishes to address a longstanding debate on the anatomy of the hyoid arch in placoderms. This is new data highlights the presence of multiple endoskeletal 'layers' to the gnathostome pharyngeal skeleton, recalling the extrabranchial cartilages of chondrichthyans. The reconciliation of these competing theories has concrete implications for the origins of jaws and pectoral girdle, highlighting whether existing fossils may yield tangible evidence of the precursors of jaws. We combine these concepts with new insights into the evolution of the jawed vertebrate exoskeleton to provide a holistic functional and comparative anatomical picture of the origin of jaws and pectoral girdle.

Funding Sources NERC UK

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Counting terrible lizards: new information on the dinosaur assemblage of the 3B-1 Lag Deposit in the Hell Creek Formation, Montana, USA

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The Hell Creek Formation (HCF) of Montana and surrounding regions provides a record of ecosystem dynamics during the terminal Cretaceous. Throughout the HCF, fluvial channel deposits are interspersed between overbank and floodplain mudstones. In 2002, Museum of the Rockies (MOR) field crews discovered a large channel lag deposit at the base of the middle unit of the HCF in Garfield County, Montana. This site ("3B-1 Lag," MOR Locality no. HC-312) yielded hundreds of vertebrate fossils and was included in an extensive census of HCF dinosaurs that reported abundant *Tyrannosaurus*. The current study reassesses fossils collected from this locality, and includes previously undescribed material, increasing the identified sample from 70 to 113 dinosaur elements.

The diversity of non-avian dinosaurs recovered from the locality spans from small theropods to herbivorous megafauna such as *Edmontosaurus*. Relatively small-bodied taxa including *Thescelosaurus*, *Ornithomimus*, *Leptoceratops*, and cf. *Acheroraptor* make up approximately 23.8% of the assemblage. Previously, the ceratopsid *Triceratops* was found to be the most abundant dinosaur at the 3B-1 Lag site (31% of identified material). This updated census finds *Tyrannosaurus* fossils are the most abundant at the site (29.5% of identified bones), with the megaherbivores *Edmontosaurus* (24.8%) and *Triceratops* (21.9%) also being very common. Further, smaller genera comprise a larger proportion of the assemblage than previously determined. We note that the site yields non-dinosaur microvertebrates (n >50), including *Myledaphus* and *Basilemys* material. Preservation of these microvertebrates suggests that the larger abundance of *Tyrannosaurus* relative to smaller theropods at the site is not taphonomic in nature. Assessment of ontogenetic stages of newly identified material are consistent with the finding that very old and very young individuals are relatively rare. Ongoing study of the 3B-1 Lag continues to enhance this window onto ecosystem dynamics of the latest Cretaceous.

Funding Sources Donors to the Hell Creek Project

Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

Polydactyl precursors: insights into early tetrapod terrestrial locomotion from polydactyl alligator

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Several of the earliest taxa of tetrapod vertebrates exhibited polydactyl hands and feet, with seven or eight digits rather than the typical five or fewer seen in extant lineages. While preserved fossil footprints provide evidence of external foot morphologies, clarity on functional use is required due to potential sedimentary variables which impact footprint formation. How such digit arrangements might have been used during terrestrial locomotion is unclear, given the dearth of living models. However, polydactyly occasionally appears in natural

populations of American alligators (*Alligator mississippiensis*), animals with body plans that broadly resemble those of early tetrapods from the Devonian. To test how polydactyly, like that seen in early tetrapods, might have functioned on land, we used high-speed video and an EMED-ST pressure mat to measure the limb movements and foot pressures of three polydactyl alligators (~1.5 m in length) during walking. Our data did not indicate significant pressures from supernumerary digits in many cases, but a few trials showed their limited use. This indicates that polydactyly might not contribute substantially to terrestrial propulsion, providing context for the evolutionary loss of these structures as tetrapods became more terrestrial and potentially helping to explain the lack of examples of polydactyly in fossil trackways. Our results also imply that extra digit usage does not directly impede terrestrial locomotion. Thus, polydactyl digits might not be strongly selected against, potentially enabling the occasional reappearance of this trait in extant populations.

Funding Sources JSPS Grant-in-Aid for Scientific Research [19J00701 to M.I.] and Clemson University Creative Inquiry Program (Project #479).

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

Computational modelling of cranial kinesis in birds: risks and rewards

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The evolution of cranial kinesis in birds is one of the key transitions away from their dinosaurian ancestors, and is widely thought to be an important factor in the radiation of neornithes. Unfortunately, a paucity of fossil material from the palate during this transition, and difficulties in conducting comparative studies on the small, structurally complex palates of modern birds, makes the evolutionary story of cranial kinesis difficult to untangle. At first glance, computational biomechanical techniques such as finite element analysis provide a straightforward way to explore the functional consequences of cranial kinesis, for example, by adding or removing different fenestrae and cranial bars, or otherwise 'locking' certain bones from movement. However, the static model approaches typically employed by paleontologists are inappropriate for bird skulls, where the rigid body motion of multiple moving parts, and the high strains seen in cranial flexion zones, violate several criteria of linear, isotropic, homogenous models. Further challenges arise in imaging and meshing birds' thin cortical bone and fine trabeculae, the latter of which may be precisely orientated to accommodate stresses. Here, we present the first validation attempt of prokinetic bird skulls, using specimen-specific boundary conditions and time-stepped, contact finite element modelling. This is compared with digital volume correlation to experimentally measure motion and 3D strain directly within the CT scanner. We show how the approaches previously used to model bird skulls with finite elements fail to correctly capture displacement of the skull, and in particular cause elevated stress in the delicate bones of the interorbital septum and braincase. In comparison, dynamic models that capture rigid body motion concentrate stress in the relatively robust and densely ossified bones of the kinetic linkage: the jugal bar and palate. We also show how muscular details and different levels of mineralization among avian cranial bones contribute to both feeding performance and model sensitivity. Overall we highlight the risks, but also the potential, for multidisciplinary computational modelling of complex functional evolutionary questions. In particular, we caution the use of these approaches in both extant and stem birds without thorough consideration of the validity of the models.

Funding Sources BBSRC BB/X014479/1

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Clarifying the taxonomy of North American *Enchodus* species: revisiting the specimens

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Enchodus is a genus of marine teleost fishes, which were globally abundant throughout the Late Cretaceous. The multitude of *Enchodus* species, lack of strong characters, and widespread distribution of the genus have confounded species diagnoses. *Enchodus* taxonomy in Canada and the USA is additionally complicated by poor quality type specimens, which were designated in the 1800s. Subsequent reviews of the American and Canadian species have clarified aspects of their character suites, but the holotypes were often not revisited. This has resulted in the propagation of some inaccuracies in later publications. To remedy this problem, we redescribe the holotypes and important referred specimens, to construct a revised character matrix.

Enchodus ferox Leidy, 1855 was erected based on an isolated dermopalatine tooth, along with a series of paratypes. Review of Leidy's paratypes reveals that one of the specimens belongs to a different taxon, *Enchodus petrosus*. Referred material to *Enchodus ferox* must clearly demonstrate the unique character suite seen in the type series, which is not the case for some recently referred material. A more complete specimen from the species, which includes a partial mandible, is described here for the first time.

Enchodus dirus Leidy, 1857 was named from a partial dentary, which is split down its centre, is missing the majority of its teeth, lacks a counterpart, and lacks locality information. Recent authors have sourced our knowledge of *Enchodus dirus* from a referred skull (KUVP 817), which differs from the holotype in dental characteristics. To clarify this discordance, we propose that KUVP 817 should serve as the holotype of a new species, and that *Enchodus dirus* should be treated as a nomen dubium. We clarify characteristics of KUVP 817 that differ from previous descriptions, modifying the phylogenetic position of the new taxon. We refer several specimens to the new species.

We revisit referred specimens of *Enchodus petrosus* Cope, 1874, and *Enchodus gladiolus* Cope, 1872, two species which have received significant study due to their abundance. We describe differences between the braincases and skull roofs of the two species.

This work builds upon contributions from previous workers and clarifies points of confusion, which should highlight future research opportunities. To move forward in *Enchodus taxonomy*, we must understand the line of preceding literature and consult the holotypes.

Funding Sources NSERC CGS-M, NSERC Discovery Grant.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Lucy's peril: a Pliocene crocodile from the Hadar Formation (Afar Regional State, Ethiopia) and its importance to understanding the phylogeny and biogeography of *Crocodylus* in the Cradle of Humanity

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Most prior work on the paleofauna of the Plio–Pleistocene Hadar Formation—famed for hominin fossils such as the skeleton of *Australopithecus afarensis* known as 'Lucy'—has focused on mammals, but a new species of crocodile can also be recognized. It was a generalized form outwardly resembling most modern species of *Crocodylus*, and the largest specimens suggest it reached total lengths of between 4 and 5 m and 300 to 600 kg, making it the largest predator in its ecosystem. Unlike deposits of similar age in the Turkana Basin with three crocodylian species, this appears to be the only crocodile in the Hadar Formation.

One mandible preserves pathological structures consistent with injuries sustained during intraspecific combat. They reinforce the similarity of crocodile feeding traces with the kinds of markings left by primitive stone tools on bone.

The new species shares a combination of plesiomorphic and derived states with extinct forms of *Crocodylus* from the Plio–Pleistocene of southern Ethiopia, Kenya, and Tanzania (Paleoafrican *Crocodylus*), but it also shares a midline boss on the rostrum similar to those of modern Neotropical crocodiles and late Miocene crocodiles from Libya and Kenya. Some specimens also have a more substantial prenarial rostrum than other Paleoafrican *Crocodylus*, though not to the same extent as in extant *Crocodylus*, and its expression is variable. A phylogenetic analysis supports a placement of the new species within Paleoafrican *Crocodylus*. A close relationship with Neoafrican *Crocodylus* (extant *C. niloticus* and *C. suchus*) is rejected, reinforcing a comparatively recent arrival for Neoafrican *Crocodylus* in East Africa. However, the phylogenetic placement of the Paleoafrican clade depends on how one codes certain potentially polymorphic characters, and positions outside crown *Crocodylus* or close to the Neotropical clade can be equally optimal.

Funding Sources US National Science Foundation (NSF DEB 1257786 to C.A.B.); Leakey Foundation (to C.A.B. and S.K.D.)

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Pterosaur neuroanatomy converged with that of bird precursors but did not follow the avian path

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Pterosaurs, the first vertebrates to achieve powered flight, and dinosaurs share a non-volant common ancestor. Following their divergence approximately 245 million years ago, their evolutionary trajectories converged around 80 million years later with the emergence of powered flight among paravian dinosaurs closely related to birds. While pterosaurs and birds evolved distinct morphological adaptations for flight, they are thought to share neuroanatomical features associated with aerial locomotion. However, this hypothesis has been based on limited specimens and insufficient comparisons with closely related non-volant taxa. To address this, we analyzed digital brain endocasts from four pterosaurs, one lagerpetid (the closest relatives of pterosaurs), eight pseudosuchians (seven extinct, one extant), ten extant birds, and eleven non-avian dinosaurs including four early dinosaurs, four non-paravian theropods, and three early paravians. The first complete braincase of a lagerpetid, that of *Ixalerpeton polesinensis*, reveals features that are also present in pterosaurs, such as a relatively enlarged and ventrally positioned optic lobe, suggesting that these changes predate the origin of flight and may reflect visual

adaptations potentially linked to the arboreal habits hypothesized for lagerpetids. Principal component analysis and euclidean shape distances show that pterosaur brain shape closely resembles that of avian precursors, such as troodontids and *Archaeopteryx lithographica*, characterized by an expanded forebrain and a more globular morphology—though less pronounced than in living birds. To assess relative brain size, we used phylogenetic regressions of 'log10 endocast centroid size against log10 femoral length.' The results indicate that pterosaur brain size is comparable to that of lagerpetids and non-volant dinosaurs, suggesting that, as in birds, the advent of flight in pterosaurs did not necessitate an increase in brain size. Together, our findings support convergent evolution in brain shape between pterosaurs and paravian dinosaurs, without the acquisition of the derived neuroanatomical features characteristic of crown birds.

Funding Sources Alexander von Humboldt Foundation.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

An examination of the enigmatic *Tragelaphus pricei*, an extinct bushbuck from South Africa

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The extinct bovid species *Tragelaphus pricei* was named based on a holotype hemimandible alongside three paratype hemimandibles and a single paratype horn core from the Plio-Pleistocene site of Makapansgat, South Africa. The species was initially placed in the genus *Cephalophus* but later transferred to *Tragelaphus* based on the morphology of the dentition, though no species-specific evaluation of the dentition of *T. pricei* was provided. Although *T. pricei* is considered to be the ancestor of the extant bushbuck *T. scriptus*, the absence of a species-level diagnosis of its dentition has led to uncertainty in differentiating the two taxa and in recognizing possible representatives of *T. pricei* at other fossil localities. In this study we investigate whether the maxillary and mandibular first through third molars of *T. pricei* and *T. scriptus* differ morphologically by comparing the size, shape, and form (size and shape) of the occlusal surface. We test for differences in size using the classic 2-sample Student's t-test. We test for differences in shape and form using two different testing frameworks: 1) a distance based method, and 2) the Hotelling t-test with derived features. Our results indicate a statistically significant difference exists between the two species in nearly all of the tests conducted across the six different molar types and three different characterizations of the occlusal surface. We conclude that the occlusal surfaces of the molars of *T. pricei* can be reliably distinguished from those of *T. scriptus*. Additionally, we tested two fossil specimens identified as *T. scriptus* from the sites of Malapa and Swartkrans in South Africa, both of which appear more similar to *T. pricei* than to *T. scriptus*. The ability to reliably distinguish *T. pricei* from *T. scriptus* will provide significant insight in our broader investigation into the evolutionary history of the bushbuck lineage.

Funding Sources National Science Foundation #2015236

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Specimens as intellectual property: implications for preparation, collections management, and authorship

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Fossils in museum collections often undergo mechanical or chemical preparation prior to research or display. This involves removing fossilized remains from a rock matrix, as well as repair and reconstruction to approximate the original anatomy. Depending on the complexity of the project this can take just hours, or several years. Fossils are also commonly reproduced both mechanically and digitally, using traditional molding and casting methods or 3D scanning and printing. The purposes of these replicas include teaching, research, trade, exhibition, and sale.

Museums may partner with exhibit companies to facilitate reproduction and distribution of casts for sale through licensing agreements that generate income through fees, royalties, and other benefits to the museum. A recent review of casting contracts and royalty distribution at The University of Texas at Austin (UT) and the opinion of lawyers with UT's licensing office intellectual property team provided new insights into the generation of intellectual property (IP) in paleontology. Although fossils in situ are natural works and not subject to copyright, the prepared museum specimens represent a series of decisions and interpretations made by laboratory and collections staff based on their domain expertise, which, in the opinion of our legal department, constitute IP.

There has been debate in recent years within the preparation community about the role that preparators play in the process of knowledge generation in paleontology and the ethics of how those members of the research team should be recognized. Preparators are typically identified in a publication's acknowledgements or materials and methods sections. It is exceedingly rare for preparators to be included as co-authors on research projects to which they have contributed, in some cases representing hundreds or thousands of hours of work. Determination of authorship can be fraught in any research project, and some labs employ rubrics, authorship contracts, and other policies to help navigate these decisions. When preparators are included as co-authors, it is generally for expertise contributed that is more conventionally thought of as academic (i.e., research or writing), and not for the act of preparation itself. However, the IP framework provides another avenue for weighing contributions and re-evaluating who may be an author of ideas in science, which might include laboratory or collections staff who help shape and determine fossil data.

Funding Sources Jackson School of Geosciences Geology Foundation.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Resolving early placental mammal relationships with morphological and molecular data

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Placental mammals include over 6000 extant species, ranging from rodents and bats to whales and humans. Their phylogenetic relationships

are well established via molecular data, but much of their early history is shrouded in mystery, and there is long-standing debate as to whether placentals originated and diversified beginning in the Cretaceous or mostly (or entirely) after the end-Cretaceous extinction. Underpinning these issues is that so-called 'archaic' placentals from the Paleocene, the first 10 million years after the extinction, have been challenging to study, and their relationships to each other and extant placentals are uncertain. It is unclear whether some were early members of modern placental orders, extinct dead-ends of placental history, and/or even crown placentals at all. Our team has been building a total evidence dataset of molecular, morphological, and temporal data for a suite of placentals and outgroups. We finalized a dataset of 2520 morphological characters scored for 191 taxa (44 extant, 147 extinct), with 26 nuclear genes, 14 mitochondrial genes, and two amino acid sequences scored for the extant taxa and, in rare cases, fossil species. We first performed maximum parsimony, traditional Bayesian, and tip-dated Bayesian analyses on the morphological dataset, with a molecular scaffold. For Bayesian analyses, we used a dissimilarity-based method to identify and remove putatively non-independent characters, and partitioned characters by homoplasy based on their parsimonious fit to the extant molecular scaffold. Our preferred topology recovers Xenarthra and Afrotheria in an Atlantogenata clade sister to Laurasiatheria + Euarchontoglires. The vast majority of 'archaic' placentals are within Laurasiatheria, including taxa traditionally referred to as 'condylarths,' pantodonts, tillodonts, and taeniodonts, and most form a series of outgroups in a grade basal to Artiodactyla + Perissodactyla. Most South American Native Ungulates are within Perissodactyla. No Cretaceous taxa are found within crown Placentalia, and the sister group to placentals is a small cluster centered on *Leptictis*. Tip dating, however, indicates that many placental lineages diverged in the Cretaceous, although the fossils of these forebears are still elusive. Our findings reconcile discordance between morphological and molecular evidence, suggesting that placentals originated in the Cretaceous, but underwent their ecological and morphological radiation in the Paleocene.

Funding Sources European Research Council (ERC) Starting Grant 756226; Philip Leverhulme Prize; NSF DEB 1654952, DEB 1654949.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The high bite force of *Tupandactylus navigans* (Pterodactyloidea: Tapejaridae) and implications for frugivory

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Pterosaurs present many variations in skull morphology, which reveal differences in foraging habits among lineages. In particular, differences in the shape and length of the rostrum and mandible may give clues to their probable diet. In this sense, the use of biomechanical analyses has the potential to test previously proposed morpho-functional inferences. Here, we aimed to determine the bite force of a toothless pterosaur and relate it to its inferred diet.

We used CT scans of the skull and mandible of *Tupandactylus navigans* (GP/2E 9266), from the Crato Formation (Aptian, Lower Cretaceous), Santana Group, Araripe Basin. The locations of muscle attachments were determined from the literature. We quantified the forces produced by these muscles as the average of the attachment area multiplied by the isometric muscle tension equivalent to 25 N/cm^2. We then determined the bite force using finite element analysis.

Results indicated that the force generated during jaw closure would not exceed 70 N. Additionally, the greatest stress was concentrated from the mid-length to near the jaw joint. The proportionally high bite force is consistent with the frugivory previously inferred for the pterosaur, although a generalist diet has

also been previously proposed. The revealed bite capacity is related to the short rostrum of tapejarids, which favors an herbivorous habit. Stresses concentrated in the caudal half of the mandible suggest a greater capacity for strain tolerance in this region, which demonstrates a relationship with durophagy. Therefore, the biomechanical analysis of the inferred musculature agrees with the frugivorous diet and habits previously recognized for *Tupandactylus navigans*.

Funding Sources Conselho Nacional de Desenvolvimento Científico e Tecnológico (314260/2021-8, 406902/2022-4, 178965/2024-3).

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

A newly discovered fossil reptile fauna with preserved skin impressions from the Permo–Triassic Maji ya Chumvi Formation, southeastern Kenya

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The Maji ya Chumvi Formation of the Duruma Basin of southeastern Kenya is arguably one of the least studied, yet most scientifically relevant fossiliferous deposits in Africa. Pioneer palynostratigraphic studies suggest that this formation records the Permo–Triassic transition, a critical interval that witnessed the most severe biological crisis in the history of Life, the Permo–Triassic Mass Extinction. The study of the Maji ya Chumvi Formation fauna could thus cast light on the evolution of amniotes on land across this pivotal event. Previously, only a single partial skeleton had been described, almost fifty years ago, from the Maji ya Chumvi Formation: the holotype of the neodiapsid reptile *Kenyasaurus mariakaniensis*. Fortunately, recent discoveries from the Maji ya Chumvi Formation in Lunga Lunga (southeastern Kenya) have revealed exceptionally preserved complete articulated fossil reptile skeletons, some including soft tissue preservation. As revealed by their anatomical and phylogenetic study, the new fossils from Lunga Lunga document the first occurrence of a procolophonoid in Kenya and provide unprecedented details on the anatomy of the neodiapsid *K. mariakaniensis*, including three subcomplete skulls, the first cranial material known for this taxon. The presence of extensive skin impression on one of these specimens also documents the first evidence of scale morphology in stem-saurian neodiapsids. Additionally, the preliminary stratigraphic assessment of the Lunga Lunga locality suggests that these outcrops correspond to lacustrine shale and mudrock deposits typical of the Middle Maji ya Chumvi Formation, likely correlated to the earliest Triassic (Induan). These new discoveries in southeastern Kenya thus provide not only critical evidence regarding the evolution of Permo–Triassic reptiles, but might also represent an exceptional window onto the recovery of terrestrial ecosystems in the aftermath of the Permo–Triassic Mass Extinction.

Funding Sources National Research Foundation of South Africa (Grant AOP240418214774), Palaeontological Scientific Trust (PAST), University of the Witwatersrand (URC fellowship)

Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Composition, trophic interactions, and community structure of a diverse Upper Triassic microvertebrate assemblage from the Chinle Formation of northeastern Arizona, USA

Burch, Helen E.[1], Stocker, Michelle R.[2], Dineen, Ashley[3], Foffa, Davide[9], Kryder, Sofia[4], Keeble,

Emily[5], Kligman, Ben T.[6], Marsh, Adam[7], Parker, William G.[8], Nesbitt, Sterling J.[1]

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The Late Triassic was a crucial time for life on land and witnessed climatic fluctuations, faunal transitions, and key evolutionary events, such as the rise of early dinosaurs within complex trophic networks. The Chinle Formation of the Southwestern United States spans much of the Late Triassic and captures a detailed record of the taxonomic and ecological changes leading up to the end-Triassic extinction. For the first time, we document the Green Layer Locality, an incredibly diverse assemblage deposited in a fluvial environment dated just after the Adamanian-Revueltian biotic turnover event (~216 Ma) in the Jim Camp Wash beds of the Sonsela Member (mid-Norian). The exceptional preservation of macro- and microvertebrates at this locality makes it a key assemblage for interpreting faunal composition, ecological interactions, and community turnover yet to be explored in the Late Triassic. The macrofauna at the site includes large-bodied vertebrates typical of Late Triassic faunas, primarily phytosaurs, aetosaurs, temnospondyls, and archosauromorphs. The microfauna reveals greater taxonomic diversity in crania, postcrania, and isolated teeth attributable to these animals as well as actinopterygians, hybodontid sharks, coelacanths, salientians, and lepidosauromorphs, including numerous undescribed species. We applied ecological trait modeling and trophic network analysis by integrating phylogenetic bracketing, anatomical comparisons, and new methods linking tooth crown height to body mass. These approaches allowed us to assign functional traits (diet, body mass, motility, and growth stage) to each species or morphotype and categorize them into guilds, and constructed a trophic network based on group-level interactions. Our analysis reveals an unexpectedly diverse and complex multi-tiered trophic network in which the majority of dietary diversity exists among the smallest body mass groups, importantly indicating that incorporating microvertebrates allows us to build more realistic and complete trophic networks. This study marks the first application of these methods to a terrestrial Late Triassic locality, and we aim to expand this approach across a broader temporal framework in the southwestern U.S. to explore long-term patterns of ecological change. By adapting approaches used for extant and invertebrate systems to fossil vertebrate communities, we gain a powerful tool for reconstructing past ecosystems and comparing community structures in deep time.

Funding Sources NSF EAR 1943286.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Skeletal convergence between the Middle Eocene *Pantolestes* and modern river otters (*Lontra*): insights from a new skeleton from the Washakie Formation

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In this study we compare a newly collected skeleton of *Pantolestes natans*, a Middle Eocene pantolestid from the Bridgerian-aged Washakie Formation of Wyoming, with the modern river otter (*Lontra* sp.) to evaluate the degree of skeletal convergence linked to semi-aquatic

locomotion. The fossil is preserved in three dimensions, allowing direct comparison of joint surfaces with those of a modern otter. Although *Pantolestes* has been considered morphologically similar to otters in terms of locomotor adaptations, it belongs to the extinct order Cimolesta—phylogenetically distant from Carnivora. Its dentition also indicates distinct dietary adaptations, highlighting its independent evolutionary history. Despite this distance, its postcranial skeleton exhibits many traits that parallel those of modern otters. The humerus is similar in proportion, though its shaft is straighter and proximal and distal articular surfaces appear to be less extensive, suggesting a more limited forelimb range of motion. The glenoid fossa of the scapula is narrower. The olecranon process of the ulna is longer, indicating a larger triceps brachii moment arm. The distal radius is more gracile, with fewer muscle attachment sites. The femur is robust and comparable in size, but the distal articular surfaces are less expanded. The patella is broad and the femoral-patellar groove is wide. The tibia is more curved and slender, and the tibia and fibula are fused distally, indicating reduced ankle mobility, though this trait varies within Pantolestidae. Cranial and axial differences are also notable. *Pantolestes* possesses a large occipital crest and robust vertebral centra, especially in the anterior caudal region, suggesting well-developed neck, back, and tail musculature. These features imply greater reliance on axial movements during swimming. In contrast, modern otters use powerful forelimb propulsion and exhibit a broader range of limb motion. This distinction highlights a few key functional differences in the locomotor strategy between these two semi-aquatic mammals, despite their ecological convergence.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Strengthening the paleontological network: the case for sister museum partnerships between large and small institutions

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Small and local museums are critical yet underrecognized contributors to paleontology, acting as vital hubs for scientific literacy, community engagement, and the preservation of regionally significant specimens. This proposal introduces the Sister Museum Connections initiative, a framework designed to encourage formal partnerships between major paleontological institutions and smaller, often rural, museums. Notable examples underscore the scientific value of small institutions: the Puntledge River Elasmosaurus (BC's provincial fossil) housed in the Courtenay and District Museum, the baby dinosaur fossils displayed at the Montana Dinosaur Center, and the 300 plus dinosaur tracks in situ at the Heritage Museum of the Texas Hill Country. These institutions not only house specimens of global significance, but serve as primary access points to science for their communities—such as the Carter County Museum in Carter County, Montana, which has fewer than 1,600 residents.

We argue that fostering partnerships allows for enhanced curation and collaborative outreach, while addressing common challenges such as exhibit retirement and storage constraints in large institutions. A sister museum network could redirect deaccessioned exhibits from larger institutions to smaller partners, extending their educational lifespan and boosting public engagement in underserved areas. Preliminary survey tools and outreach materials have been developed and distributed assessing community engagement and will be used to inform the initiatives future development.

This proposal seeks to elevate the visibility and capacity of small museums, create new channels for fossil stewardship, and provide an environmentally and economically sustainable

model for exhibit redistribution. By doing so, we aim to reinforce the broader paleontological community's commitment to accessibility, stewardship, and scientific collaboration. Data from participating institutions, including visitorship, interviews of museum staff, and case studies of successful partnerships (e.g., MOR and Carter County Museum), is used to support the initiative's future scalability and demonstrate its efficacy. The project ultimately aspires to form an internationally recognized network of Sister Museums to democratize access to paleontology, reinforce the discipline's connection to local communities, and to encourage all those served to participate in vertebrate paleontology's public trust.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

The internal cranial anatomy of Gavialoidea reveals profound implications for crocodylian evolutionary history

Burke, Paul M.

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The crown group Crocodylia comprises ~ 25 extant species of alligators, caimans, crocodiles, and gavialoids. Gavialoids are represented by two extant species, *Gavialis gangeticus* and *Tomistoma schlegelii*, which are characterised by their longirostrine skull morphology and restriction to freshwater environments in Asia. By contrast, their fossil record displays a cosmopolitan distribution, with sister taxa separated by vast oceanic barriers. With greater taxon sampling and a revised approach to character formulation and scoring, recent morphological phylogenetic analyses have mirrored results from molecular analyses, with *Gavialis* and *Tomistoma* more closely related to one another than to any other extant crocodylian. Nevertheless, a temporal incongruence remains, wherein several stratigraphically early fossil species are recovered within crown-group Gavialoidea, and it remains difficult to reconcile the distribution of the group without evoking transoceanic dispersal. One fundamental aspect of the group that has been neglected from phylogenetic analyses and considerations of its biogeographic reconstructions pertains to their internal cranial anatomy. Using computed tomography, the internal anatomy of 46 crocodylians, including 20 gavialoids, was reconstructed with 53 new morphological characters formulated and incorporated into a phylogenetic analysis under Maximum Parsimony; however, the temporal incongruence remains. Using Bayesian inference, the total character matrix (384 characters) was subsequently partitioned into endocranial and non-endocranial characters. Results show that the endocranial anatomy evolves twice as rapidly as the remainder of the skull, with faster evolutionary rates resulting in a weakened phylogenetic signal, which is herein interpreted as endocranial changes primarily reflecting ecology. Evaluation of the internal cranial anatomy also reveals concave depressions on the internal surface of the prefrontals in many extinct gavialoids, which are osteological correlates for salt glands in extant marine iguanas and turtles. These depressions might indicate that these extinct gavialoid species were saltwater-tolerant, which could explain their once global distribution via the capability for transoceanic dispersal. These results highlight the importance of the evaluation of internal anatomy, with new insights into the evolutionary history of Crocodylia and how the group's internal morphology influences its ecology and distribution.

Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Proteomic and phenotypic variation in rodent dentition from a feeding experiment

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University, Stony Brook, New York, United States

Rapid advancement in paleoproteomic methods will allow for measures of protein expression levels from fossils of mammalian teeth. Determining the expected relationship between commonly collected phenotypic measures and proteomic data under different conditions is important for future studies of paleontological populations. Here, we present associated patterns of protein expression and phenotypic variation in the first molars of laboratory mice from a controlled feeding experiment. Prior studies indicated that reduction of dietary protein can perturb tooth development via alteration of developmental pathways, (e.g., Insulin-Like Growth Factor [IGF] pathway), resulting in smaller molars.

Pregnant and nursing C57BL6/J mice were fed a 20% raw protein diet (control) or 10% raw protein diet (treatment). We hypothesized that reducing dietary protein during early development would significantly reduce overall molar size and modify expression patterns for proteins involved in tooth formation and mineralization. We collected eight litters (four from each group) of 28-day-old specimens. We sampled an upper first molar from each litter (n = 8) for proteomic measures and utilized an outline-based morphometric approach to quantify the size of the lower first molar of all specimens (n = 49).

We found significant reduction in m1 size and significant differential expression of 120 proteins. Changes in protein expression included alteration of proteins in the IGF pathway. We found significantly decreased expression of enamel and tooth forming proteins (e.g., Amelogenin X, Integrin alpha-V, Collagen alpha-1) and increased expression of dentin forming proteins (Dentin matrix acidic phosphotprotein 1 and Dentin sialophosphoprotein). We also recovered significantly increased expression of immune-system proteins within the Neutrophil Degranulation pathway.

Our results demonstrate that changes in dietary protein can substantially reduce tooth size and alter developmental pathways. Our results provide a baseline upon which to formulate hypotheses for phenotypic and proteomic responses to major environmental changes in paleontological samples of rodent teeth, which are exceptionally common in the recent fossil record. As paleoproteomic methods advance, we anticipate being able to detect alterations to developmental pathways preserved within mineralized systems and thus test for correlated responses of developmental processes and tooth phenotype to environmental changes.

Funding Sources National Institute of General Medical Sciences of the National Institutes of Health: K12GM102778

Stony Brook University Startup Funds

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The evolution of postcranial pneumaticity in crownward stem birds

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Birds represent the only extant tetrapod group to exhibit postcranial skeletal pneumaticity (PSP)—the intraosseous invasion of the respiratory system into skeletal elements. Among crown group birds, the degree of PSP can be variable across the skeleton, yet the most commonly pneumatized bones include portions of the axial skeleton and proximal appendicular elements. Reductions and expansions of this pattern are highly influenced by ecology and locomotor strategies, even between very closely related taxa. PSP arose along the bird stem lineage; however, stem birds—including both avialan and non-avialan saurischian dinosaurs—exhibit comparatively reduced degrees of PSP, with pneumatization almost universally constrained to axial portions of the skeleton. The

evolution towards the expansive PSP condition observed in crown birds is poorly understood due to a lack of representative fossils, and the limited preservation of diagnostic pneumatic features (e.g., common pneumatic foramina locations). The crownward ornithurine *Janavis finalidens* constitutes one of the few Mesozoic avialans reported to exhibit extensive PSP. This interpretation was based on the presence of numerous remarkably large pneumatic foramina in the centra of its thoracic vertebrae. Intriguingly, these are notably absent in the thoracic vertebrae of *Ichthyornis*, a close relative of *Janavis*, whose postcranial morphology is otherwise extremely similar. Many of the pneumatic structures in the thoracic vertebrae of *Janavis* are unlike those observed in any other Mesozoic bird. Here we re-examine the postcranial skeleton of *Janavis* to better characterise its patterns of PSP, providing unprecedented data from a stem bird close to the origin of the avian crown group. We quantify air space proportion (ASP) of the pneumatic postcranial elements in *Janavis* and compare them with those of other fossil and extant birds and qualitatively assess the extreme PSP-influenced morphology of its thoracic vertebrae. Preliminary results suggest that the pneumatic elements of *Janavis* exhibit crown bird-like levels of ASP. The expansive PSP of *Janavis* compared to *Ichthyornis* suggests that PSP in crownward stem birds was subject to relatively rapid adaptive evolution, similar to observations from crown birds. Regardless, unambiguous evidence of PSP in the appendicular skeleton of *Janavis* remains elusive, suggesting PSP may have remained constrained to the axial skeleton even among the most crownward-known stem birds.

Funding Sources Natural Environment Research Council grant number NE/S007164/1 and the University of Cambridge Harding Distinguished Postgraduate Scholars Programme.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

From small to surprising: rethinking the Late Cretaceous island-dwelling ankylosaur *Struthiosaurus*

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The ankylosaurian dinosaur *Struthiosaurus* was a widespread inhabitant of the late Cretaceous European archipelago, ranging from the Campanian to the Maastrichtian. Traditionally assigned to Nodosauridae and comprising three species, *Struthiosaurus* is widely regarded as one of the smallest known ankylosaurs, with an estimated adult body mass of about 130 kg. Its type species, *S. austriacus* from the lower Campanian of Muthmannsdorf, Austria, has had a complex taxonomic history since its erection in the 19th century. Originally described from a partial braincase, *S. austriacus* is now widely accepted to include both cranial and postcranial remains from at least three individuals of varying sizes. Notably, minor morphological differences among overlapping elements, previously attributed to preservation or ontogenetic variation, may instead reflect inter- rather than intraspecific variation, raising the possibility of two sympatric ankylosaurian species in the Muthmannsdorf assemblage. This may explain the presence of comparatively large, albeit fragmentary limb bones that reveal some individuals exceeded previous body mass estimates. To help resolve this conundrum, we conducted a histological analysis of limb bones attributed to *S. austriacus*, representing different sizes, in order to determine their ontogenetic stages. Primary bone is restricted to the outermost cortex and patches between secondary osteons in almost all sampled specimens. Vascularisation is low to moderate, predominantly consisting of longitudinal vascular canals. Most samples show alternating layers of lamellar and woven bone, with advanced bone remodeling indicated by secondary osteons. Lines of arrested growth are

rare in most samples, but common in smaller bones. The presence of multiple generations of secondary osteons suggests sustained rapid growth until late ontogeny, with extensive remodeling beginning as individuals approached skeletal maturity. These findings support the interpretation that the material represents different ontogenetic stages of a single species. Consequently, previous adult body mass estimates for *Struthiosaurus* were likely based on ontogenetically immature material, and *S. austriacus* may have reached a substantially larger adult body size than previously assumed, challenging its status as a potential island dwarf and offering a new perspective on late Cretaceous island-dwelling ankylosaurs.

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

The Kilmaluag Formation of the Isle of Skye: a site of exceptional vertebrate preservation in the Middle Jurassic

Butler, Richard[1], Panciroli, Elsa[2,1], Walsh, Stig[2], Meade, Luke[1], Evans, Susan[3], Jones, Marc E.[4], Maidment, Susannah[4,1], Benson, Roger B.[5]

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The Middle Jurassic was a critical time for terrestrial faunas, witnessing key stages in the early evolution and diversification of modern tetrapod groups (squamates, mammals, birds, amphibians), as well as the origins of numerous major groups of dinosaurs and pterosaurs. Frustratingly, the Middle Jurassic is extremely poorly sampled globally, obscuring our understanding of phylogeny, body plan construction, timings of origins, and biogeographic history. Over the last decade, our team has intensively sampled the tetrapod fauna of the Kilmaluag Formation (Bathonian) of the Strathaird Peninsula of the Isle of Skye, Scotland, which is globally unique in preserving numerous three-dimensionally preserved, associated partial to complete skeletons of small tetrapods. These fossils are challenging to prepare because of their preservation in highly resistant carbonates. To address this, we have developed an approach of iterative imaging using cabinet and synchrotron X-ray micro-computed tomography combined with the removal of unfossiliferous matrix using precision wire saws, allowing us to obtain exceptional anatomical data. Here, we describe our recent field discoveries from the Kilmaluag and their evolutionary and ecological significance. Among amphibians, a relatively complete skull of an albanerpetontid represents the stratigraphically oldest associated specimen of this enigmatic group, while a remarkable specimen preserving three complete, articulated skeletons of the stem-salamander *Marmorerpeton* entangled with one another may represent social behaviour within a burrow. Synapsid specimens include the first complete skull of the tritylodontid *Stereognathus* and three of the most complete mammaliaform skeletons known from the UK Mesozoic, including stomach contents that yield novel ecological inferences. New choristodere specimens represent much of the skull and postcranial skeleton and may represent a new species. Only a few archosaur fossils have previously been documented from the Kilmaluag Formation: our recent discoveries include a partial skeleton of a medium-sized dinosaur, likely an ornithopod, two tiny dinosaur specimens that suggest a previously hidden diversity, and multiple new partial skeletons of pterosaurs. In the wider context, we argue that the exceptional preservation of the Kilmaluag Formation means that we should consider it as a Konservat-Lagerstätte and perhaps the most important active vertebrate palaeontological site in the UK.

Funding Sources Supported by the Leverhulme Trust (RPG-2024-352). We thank the European Synchrotron Radiation Facility (BM18) and the Diamond Light Source (I12) for beamtime.

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

The evolution of tesselated calcified cartilage in fossil chondrichthyans

Byrne, Hannah M.[1], Pedersen, Emilie[1], Dearden, Richard[3,1], Johanson, Zerina[6], Leyhr, Jake[7,4], Dollman, Kathleen[2], Dean, Mason[5], Haitina, Tatjana[4], Sanchez, Sophie J.[4], Rücklin, Martin[1]

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Chondrichthyans (elasmobranchs and holocephalans) have developed a distinctive array of cartilaginous tissues that fulfil the structural role typically served by bone, with Tessellated Calcified Cartilage (TCC) playing a central role. TCC is composed of small mineralised blocks (tesserae) that form a thin layer over the uncalcified core of the skeleton, offering an effective combination of stiffness, flexibility, and reduced weight. Despite its importance, our understanding of calcified cartilage in chondrichthyans remains limited compared to our knowledge of bone in osteichthyans. This hinders deeper insights into the process of cartilage calcification, its links to bone ossification, and the broader evolution of hard tissues in vertebrates. Fossil evidence, based on 2D data, has provided some insight into TCC and its precursors in stem-group and crown-group chondrichthyans. However, the two-dimensional nature of this data imposes significant limitations on interpreting mineralised cartilage structure. Advances in high-resolution imaging have enabled 3D visualisation of TCC ultrastructure, yet these methods have been applied to only a small number of extant chondrichthyan taxa. In this study, we use propagation phase-contrast synchrotron microtomography (PPC-SRμCT) to study the 3D structure of TCC and its precursors in fossil chondrichthyans for the first time. The cartilage of the lower jaw in a total of 14 taxa (5 stem chondrichthyans and 9 crown-group chondrichthyans) was imaged at the European Synchrotron Radiation Facility (ESRF). Our tomographic scans present exceptionally detailed data on the preserved hard tissues. Preliminary findings show a diverse suite of hard tissues within stem-chondrichthyans, suggesting a non-linear transition from bone to calcified cartilage. Among stem-elasmobranchs, multiple layers of TCC in *Tristychius* might represent reinforcement structures linked to increased mechanical stresses. Multiple struts of calcified cartilage (trabeculae) inside the jaw of *Hybodus* might fulfil a similar function. For the stem-holocephalans, *Akmonistion* and *Chondrenchelys*, the shape of tesserae differs greatly, with polygonal tesserae in *Akmonistion*, as seen in elasmobranchs, whereas amorphous-shaped tesserae in *Chondrenchelys* are akin to the extant holocephalan condition. Our future work includes examining the different calcified layers within the tesserae in our scans of extinct and extant chondrichthyans.

Funding Sources This project has received funding from the European Union's Horizon 2023 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 5135002.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Can bone-volume thickness detect bone pneumatized by pulmonary diverticula in extant and extinct archosaurs?

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Birds exhibit copious non-ventilatory pulmonary diverticula that branch off the gas-exchanging lungs and compliant air sacs to directly pneumatize skeletal tissues and extend around organs and joints. Despite similar patterns of bone pneumatization in non-avian dinosaurs, determining the presence of pulmonary diverticula in fossils is challenging due to the rarity of soft-tissue preservation. Furthermore, the only reliable method for detecting pulmonary tissue attachment in fossils is through histology, which is destructive to the sample. We ask: can the ratio between cortical and trabecular bone thickness (Ch.Th.: Tb. Th.) reliably identify pneumatized bone? We tested this by creating volume fraction scalar maps to measure Ch.Th.: Tb.Th. using a μCT dataset of 13 extant birds, 4 extant reptiles, 8 extant mammals, and 4 fossil archosauromorphs. Six vertical sections of bone were serially measured through the posterior cervical and anterior dorsal vertebrae from each sample to ensure regional variations in thickness would not bias the results. Because pneumatization of bone has direct effects on cortical and trabecular thickness (i.e., thinner and thicker, respectively), we propose that this method can be used as an alternative to BV/TV, which can prove erroneous due to large internal cavities that appear to be pneumatic, but are filled with bone marrow. We find that pneumatized bone exhibits a Ch.Th.: Tb.Th. of ≤2.05, while non-pneumatized bone exhibits higher values (i.e., ≤5.86). For our fossil samples, histologic sectioning was paired with μCT data to ground truth results obtained by the volumetric models. All fossil samples did not display pneumosteum, nor did they exhibit Ch.Th.:Tb.Th. values lower than 2.05. Interestingly, we find relatively low Cb.Th.: Tb.Th. values in extant crocodilians (i.e., 1.8, 2.8) and an extinct shuvosaurid pseudosuchian (i.e., 2.27). Despite having non-pneumatic vertebrae, this may suggest that crocodilian-line archosaurs have trabecular and cortical bone morphology more closely resembling birds than mammals and other reptiles. These new data enhance our understanding of the evolution and function of bone mesostructure in crocodile-line and bird-line archosaurs and can provide a new method to investigate the presence of pulmonary diverticula in the fossil record.

Funding Sources University of Southern California Department of Earth Sciences Student Research Grant

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Microvertebrate assemblage from the Upper Cretaceous site Lo Hueco (Cuenca, Spain).

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The Konzentrat-Lagerstätte site ‘Lo Hueco’, Central Spain, represents extremely rich and diverse late Campanian-early Maastrichtian fossil assemblages with more than 10,000 fossil remains. Because of this, it is considered one of the most relevant paleontological sites for the study of continental vertebrate faunas from the Upper Cretaceous of Europe. Its stratigraphic succession is characterized by an alternation of green, gray and red marly mudstone separated by gradual boundaries and punctually altered by sandy channel structures and sulphate intervals. The microvertebrate sample was obtained from the screenwashing and sorting of 200 kg of sediments that belonged to one of the gray mudstone beds (G2). This bed is the richest lithosome in terms of microvertebrate fossil abundance and diversity from the site. Among the fossil material, the most common are attributed to fishes, especially the conical teeth and ganoid scales of Lepisosteidae. To a lesser degree, there are lanceolate teeth of Amiidae? and molariform teeth of Pycnodontiformes and Paralbulinae. The Lissamphibia material is represented by appendicular elements assigned to Anura, where two of the three recovered humeri can be assigned to Discoglossinae and Palaeobatrachidae. A small fragment with a

pleurodont tooth indicates the presence of a scincomorph lizard. Crocodylomorpha remains correspond to at least six tooth morphotypes assigned tentatively to Allodaposuchidae (bulbous to elongated conical teeth) and 'atoposaurid' (triangular labiolingually compressed teeth). Theropod tooth specimens constitute an important part of the diversity reported here. It includes two dromaeosaurid tooth morphotypes, the cf. Dromeosaurinae specimens with small chisel-like denticles and the cf. Velociraptorinae specimens with hooked distal denticles. A small triangular shaped tooth with very small denticle is attributed to *Richardoestesia* sp. Apex teeth fragments with both mesial and distal large hooked denticles are tentatively assigned to Troodontidae, but this identification should be taken with caution. This microvertebrate assemblage is consistent with other upper Campanian-lower Maastrichtian Iberian Peninsula localities with coastal or freshwater with marine influence environments. Additionally, the presence of pycnodontid, atoposaurid, and the absence of albanepertontids and hylaeochampsids provide a unique set of fauna that distinguishes it from other contemporary Iberian Peninsula localities.

Funding Sources Projects PID2023-148083NB-100 and Consolidación Investigadora CNS2023-144950.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Late Miocene insectivores as environmental indicators: an introduction to the North Pannonian eulipotyphlan metacommunities

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Recent advances in the taxonomic study of late Miocene small mammal assemblages from central Europe enable a detailed investigation of faunal pattern and environmental changes centered on the previously underexplored Eulipotyphla mammal order.

Based on an updated faunal dataset, we confirm previous observations that central Europe corresponds to the area of highest insectivore diversity in Europe. We additionally identified environmentally driven spatial fluctuations of this area during the late Miocene. Species richness, abundance, and association indicate a temporal succession of four Late Miocene metacommunities in the northern part of the Pannonian realm. These North Pannonian eulipotyphlan metacommunities (NPEM) represent regional phases that constitute strong temporal markers. NPEM are also observed in faunal subsets from regions such as the Iberian Peninsula, where peninsular effect and environmental parameters limited the occurrence of stenotopic taxa.

Each NPEM is partly defined by the paleoecological and dietary reconstructions of its representative taxa (based on actualism, spatial and temporal distribution, and biomechanical interpretation), making the system a robust proxy for both environmental shifts and faunal stability. The succession of the NPEM is primarily driven by change in habitat openness, dryness, and seasonality. Along with orbital forcing and large-scale environmental changes, the early Turolian turnover of the eulipotyphlan fauna in the northern Pannonian realm is explained by the fast change from lacustrine-type and forested wetland environments to riparian environments, following the southern retreat of Lake Pannon and the overall decline of central Paratethys. Habitats fragmentation significantly contributed to the demise of several humidity-dependent families (Plesiosoricidae, Dimylidae, Heterosoricidae) in the early Turolian, resulting in a complete turnover of insectivore paleoecological communities. These findings highlight the critical role of habitat shifts in shaping Neogene insectivore faunas.

Funding Sources This research is funded by the EU NextGenerationEU through the Recovery

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Osteohistologic variability between the femur and tibia of Rocky Mountain elk (*Cervus canadensis*): implications for ontogenetic interpretations in extinct cervids

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Osteohistology is widely used for studying the life history of extinct vertebrates. However, intraskeletal variability in histologic features, which can influence ontogenetic interpretations, is well documented for a variety of extant taxa. In the case of cervids, a group that attained a wide morphological range from the Miocene to present, such information on histoskeletal variability is limited. Here, we compare the femur and tibia osteohistology from six female Rocky Mountain elk (*Cervus canadensis nelsoni*), aged 2 to 9 years old based on tooth cementum analysis. Within the fibrolamellar complex (FLC), bone vascular organization is predominantly laminar to plexiform in femora and tibiae. Haversian remodeling is typically more extensive in the tibia than the femur for a given individual. For the oldest individuals in the sample, a maximum of 5 and 3 cyclical growth marks (CGMs) are observable in the FLC of the femur and tibia, respectively. This finding is consistent with the general timing of skeletal maturity for this species, anywhere from 3 to 7 years of age. As in other taxa, deposition of CGMs in the external fundamental system (EFS) are inconsistent between elements, and total CGM count does not always match the known age of the individual when EFS CGMs are included. By contrast, CGM count more consistently matches age for younger individuals lacking an EFS. Critically, this study empirically supports previous observations that within an individual, intraskeletal maturity is achieved asynchronously. Growth curves reconstructed from CGM spacing show generally similar growth patterns between the femur and tibia although the femur grows over a longer period of time before the EFS is deposited. The longer period of growth in the femur than the tibia is consistent with studies on some extinct and extant cervids. However, it contrasts with others, including the closely related extant red deer (*Cervus elaphus hippelaphus*), where the tibia grows over a greater period of time than the femur before EFS deposition. Taken together, these data highlight the diversity of bone growth duration, both intraskeletally and between closely related species, suggesting that inferred age at skeletal maturity may differ based upon the bone type analyzed. In cases where the growth patterns of a taxon are poorly understood, multiple skeletal elements should be histologically sampled to make more robust interpretations relating to ontogeny and longevity.

Funding Sources Oklahoma State University - Center for Health Sciences

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Macroevolutionary patterns of 3D skull suture complexity across the mammalian radiation

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The skull performs numerous distinct tasks essential to the evolutionary success of vertebrates. In mammals, sutures are often overlooked but key contributors to skull performance. Sutures are fibrous joints that connect cranial bones, acting as agents of both growth and absorption of physical forces that

stem from feeding, fighting, and other biomechanical pressures. Here, we showcase the first ever three-dimensional quantification of suture morphology across mammal lineages both extant and extinct, using 3D meshes generated from microCT scans. As interfaces between bones, sutures lack distinctive homologous structures, making their shapes difficult to both extract and quantify with traditional morphometrics. For this reason, we apply alpha complexity to compare the shapes of sutures across a sample of mammals. We find that transverse sutures are on average more complex than non-transverse sutures, confirming patterns known from two-dimensional analyses of suture morphology. When zooming into individual sutures, the vault and facial sutures of mammals follow highly idiosyncratic patterns of complexity that are largely dependent on which suture is considered. Higher complexity of the transverse vault sutures (i.e., coronal, frontonasal) shows significant correlations with the dietary habits of species. By contrast, sutures on the sagittal plane (interfrontal, sagittal) follow largely lineage-dependent patterns, showing differences associated with developmental mode (altricial vs. precocial). When including extinct lineages of mammals in our analyses, we also find that these tend to largely follow general trends, with some extreme exceptions for clades with odd cranial morphology. Going forward, we plan to extend this novel approach to a broader dataset of living and extinct mammals and their stem relatives to reconstruct the influence of diet, brain size, and locomotion, in addition to life history, on suture complexity and skull shape. Our goal is that of elucidating how cranial sutures supported the incredible ecological diversification of mammals.

Funding Sources Leverhulme Trust

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Testing controversial reports of avian reproductive tissues in the fossil record using a synchrotron-based multidisciplinary approach

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During lay, female birds draw upon the calcium stored in an ephemeral endosteal tissue, i.e. medullary bone (MB), to form the eggshell. Studies have demonstrated that crocodilians rely on different resources to calcify their eggshells. MB is thus hypothesised to have originated within extinct Avemetatarsalia. Identifying MB in the fossil record is essential for tracing its evolutionary history. Yet, it has proven challenging because MB shares microstructural (rapidly deposited matrix) and chemical (keratan sulfate) characteristics with some endosteal bone pathologies (EBP). Recently, significant progress has been made in establishing criteria inherent and unique to MB. Based mostly on 2D histology and micro-CT scanning, studies demonstrated MB is phylogenetically widespread among Neornithes and microstructurally comparable between taxa. In addition, its skeletal distribution pattern is linked to pneumaticity and bone marrow, two factors related to body size and ecology, allowing MB to be differentiated from EBP. We further characterize the trace elemental composition, 3D spatial deposition, and fine 3D microstructure of avian MB and EBP using a combination of synchrotron-based X-ray fluorescence and absorption spectroscopy, as well as propagation phase-contrast synchrotron radiation microtomography. In light of these discoveries, we also reassess, using similar approaches, the nature of all contentious MB-like tissues previously reported in pterosaurs and several non-avian dinosaurs. We find differential distributions of key trace elements, primarily sulfur and zinc, between MB and EPB. Our observations also reveal that most reported endosteal tissues previously identified as MB in

fossils co-occur with pathological bone deposition, raising doubt on a MB identification. Our study adds to the list of criteria available discrimination of MB from EPB and will, ultimately, allow us to better constrain the origin of MB within Avemetatarsalia.

Funding Sources The authors thank the ESRF and SSRL for access to facilities on experiments LS-3386, and S-XV-ST-6732 and 5643, respectively.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

How many characters are needed to reconstruct a phylogeny?

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Despite increased recent attention towards Bayesian phylogenetics and its applications in understanding macroevolutionary processes, it remains unclear how many discrete characters are needed to accurately estimate tree topologies in a Bayesian framework. This could be particularly relevant for morphological datasets used in phylogenetics, including the ones assembled to reconstruct the relationships of extinct organisms, as they usually consist of few dozens to few hundreds of characters—orders of magnitude smaller than most molecular datasets.

I designed a simulation study in the software RevBayes to explore how the number of sampled discrete characters affects accuracy and precision of Bayesian phylogenetic estimates, under various setups differing in number of taxa, average number of state changes per character (i.e., tree length), and number of states per character. Results indicate that sufficiently accurate and precise phylogenetic estimates for as low as 20 tips require between 100 and 500 variable characters, more than a substantial portion of empirical morphological datasets. All other parameters being equal, multistate characters produce slightly more accurate estimates than binary characters, and more labile characters produce more accurate estimates for trees above 50 tips.

The results of this study highlight the continuous need for global research efforts (i.e., funding, hiring, academic training) geared towards the characterization and digitization of interspecific morphological diversity in both extant and extinct taxa, with the specific aim of building larger data matrices for phylogenetic studies. Without this added effort, downstream analyses that use morphological or total-evidence phylogenies to address macroevolutionary questions will often be based on faulty premises.

Funding Sources European Research Council GA 101043187

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Multi-proxy isotope analysis refutes trans-oceanic foraging and reveals dietary complexity in pterosaurs

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Pterosaurs, the first vertebrates to evolve powered flight, remain relatively poorly understood ecologically as a result of their more incomplete fossil record when compared to other clades, such as dinosaurs. Major questions exist concerning the flight patterns and diet in many pterosaur taxa. Previous studies have focused on the biomechanics of pterosaurs, allowing for interpretations of their energy requirements, types of strokes and or types of flying, and potential travel distances. Some groups, such as ornithocheirids, have been compared to albatrosses in terms of their potential long-distance oceanic foraging. To date, isotope methodologies have only been rarely applied to

the pterosaur fossil record and have yet to be used to test hypotheses of flight behaviors. Dietary reconstructions also remain debated and have largely focused on comparative morphology and environmental associations. Here we apply $^{87}Sr/^{86}Sr$ as a proxy for movement to test hypotheses of long-distance oceanic foraging in ornithocheirids from the Cambridge Greensand Formation, Kem Kem Group of Morocco, and $\delta^{44/42}Ca$ as a proxy for diet to test dietary and niche partitioning hypotheses among co-occurring pterosaurs from the Kem Kem Group. Our $^{87}Sr/^{86}Sr$ compositions of ornithocheirids show a lack of open marine compositions and instead support coastal to inland feeding. Kem Kem Group pterosaur taxa preserve a complete terrestrial signal with no indication of any marine habitation. Both patterns differ strongly from the $^{87}Sr/^{86}Sr$ compositions in extant albatrosses, which indicate clear signals of near-exclusive use of marine resources. The $\delta^{44/42}Ca$ compositions of the Kem Kem Group pterosaurs show niche partitioning between ornithocheirid, azhdarchid, and azhdarchoid pterosaurs, and provide additional support for piscivorous feeding in *Coloborhynchus* and durophagous feeding in in *Alanqa saharica*. Our results dispute the albatross model of flight and ecology in large pterosaurs and demonstrates both the further utility of isotopic approaches in understanding the ecology of extinct organisms, but also the need for a broader range of quantitative modern analog assessments of differing flight styles for use in evaluating the potential behaviors of extinct volant organisms.

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Understanding the functional evolution of melanin in birds and mammals using dual chemical approaches

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Melanin is a phylogenetically widespread pigment that is biosynthesized, stored, and transported by intracellular organelles termed melanosomes. Two forms of melanin—eumelanin and phaeomelanin—have been identified in various body tissues in all vertebrates analysed to date. Several functions have been proposed for melanin, including the regulation of redox reactions, enzyme function and metal homeostasis. The functional significance of the metal ions that bind to melanin and its relationship to monomer chemistry, however, is poorly understood, which limits our understanding of melanosome chemistry in fossils. To address this, we assessed melanin chemistry in twelve tissues from eight avian and six mammal species using high-performance liquid chromatography (HPLC; following tissue digestion using alkaline hydrogen peroxide oxidation (AHPO) and hydroiodic acid (HI) hydrolysis) and synchrotron X-ray fluorescence (XRF). HPLC results confirm the presence of phaeomelanin and eumelanin in most internal tissues, with phaeomelanin dominating all internal tissues. Interestingly, specimens with predominantly rufous fur and feathers (i.e., phaeomelanin-based pigmentation) show particularly high concentrations of eumelanin in their internal organs. This suggests a decoupling of melanogenesis in external and internal tissues. Synchrotron-XRF results confirm that the melanosomal metallome is tissue-specific. Critically, however, our preliminary analyses suggest that there is no obvious link between the monomer composition of the melanosome extracts and their metallome. This indicates that potential functions for melanin in regulation of

metals and as an antioxidant are mutually independent. The combination of these results with data from fossil birds and mammals provides a new platform to investigate the evolution of melanin in response to physiological and ecological adaptations in vertebrates.

Funding Sources European Research Council (ERC) Consolidator Grant (H2020-ERC-COG-101003293-PALAEOCHEM) awarded to my supervisor Professor Maria McNamara.

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Chondrostean signal within the early actinopterygian record

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The early diversification of ray-finned fishes (Actinopterygii) remains largely unresolved; morphology-based phylogenies conflict with molecular results and fail to reliably place Paleozoic taxa. This phylogenetic underperformance may stem from incomplete anatomical descriptions, character definitions that fail to accommodate the full range of early morphological diversity, and overreliance on external features (e.g. scales, dermal bones) that are prone to homoplasy.

Recent advances in micro-computed tomography (μCT) imaging have unlocked the endoskeleton as a new source of phylogenetic signal. Delicate articulated structures such as the gill skeleton can now be recovered from fossils, revealing internal anatomy rarely accessible through mechanical or chemical preparation. Endoskeletal morphology appears more conserved and could be more phylogenetically informative across long timescales than the dermal skeleton due to constraints imposed by multiple demands (e.g. respiration, feeding, development) that limit rapid directional selection.

Here we sample four Carboniferous actinopterygians of varying size and body shape (*Trawdenia planti*, *Nematoptychius greenocki*, *Elonichthys robisoni*, and *Chirodus granulosum*) using high-resolution μCT to test for endoskeletal signal. We present three-dimensional morphology of the neurocranium, visceral arches, axial column, and pectoral girdle from each, as well as from extant comparative exemplars (*Polypterus senegalus*, *Acipenser stellatus*, *Polyodon spathula*, *Amia calva*, and *Hiodon tergisus*). We then constructed a novel endoskeletal character matrix inclusive of fossil and extant anatomical diversity.

Exploratory phylogenetic analyses recover *Trawdenia planti* as a stem-chondrostean. The inclusion of *Trawdenia* flips the polarity of some character states and causes several other Paleozoic species to also resolve on the chondrostean stem. The implications of this topology are twofold: first, it suggests a previously unrecognized early chondrostean radiation in the Carboniferous; second, it pushes the actinopterygian crown node back earlier in the geologic record. This result parallels recent temporal revisions in other gnathostome groups: tetrapods and chondrichthyans. The emerging pattern of survivorship through the end-Devonian mass extinction provides insight into cladogenic events preceding the post-Devonian proliferation of these clades throughout Carboniferous aquatic systems.

Funding Sources NSF (EAR) 2218892

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The yabby crusher, a latest Oligocene, freshwater, durophagous fish from South Australia

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A new fish fossil from the latest Oligocene, Etadunna Fm. located in the Lake Eyre Basin of South Australia. The Etadunna Fm. is characterized by green lacustrine claystone, sandstone, mudstone, and dolomitic limestone, indicating deposition in a freshwater lake environment. There are five biostratigraphic zones (A–E) in this formation with Faunal Zone A (25.0–24.6 Ma) being the most basal assemblage. The fauna in this zone includes nine families of marsupials, and assorted birds, crocodiles, turtles and fish. This new durophagous fish fossil was found with scores of unrelated fish fossils, including vertebra and fin spines. A 2 cm long, left edentulous, premaxillary fragment with three alveoli from a new fish based on the bone structure and color of the non-alveolar bone. The anterior end of the specimen is bent medially towards the midline, indicating that this is the transition of the premaxilla from labial to buccal. The premaxilla contains three alveoli, averaging 4.65 mm in diameter. The middle alveolus is both the largest and is also the deepest (2.5 mm) of the three alveoli. The bone in the alveoli is distinctive from the overlying bone of the premaxilla. The alveolar bone is lighter in color (whitish) than the reddish-brown premaxillary bone. The texture of the alveolar bone is composed of thin, dense plates of opaque, cortical-looking bone, while the premaxillary bone is translucent plates and spicules of structurally substantive cancellous bone. This new fish premaxilla and other specimens already in our collections from the Etadunna Fm. can be assigned to the family Scaenidae. The Scaenidae has modern representatives, Mulloways, Jewfish, and Drumfish, in the seas around Australia. The main evidence indicating the fossil material belongs to the Scaenidae is the presence of the thick cancellous skull bones, including in the premaxilla. Modern scaenids can exhibit durophagous characteristics. The thick, dense bone allows for a higher bite force, allowing for a durophagous lifestyle, as crushing a shell or exoskeleton requires more force than to bite a fleshy prey item. Gastropods have been found in the Etadunna Fm. and would be a potential food source for an Etadunna scaenid. Another potential food source would be yabbies (= Australian crayfish). Yabby fossil in Australia go back to the Cretaceous, suggesting they would be present in the Oligocene as they are found in mid-Miocene deposits and in modern Australian lakes and streams.

Funding Sources J.A. Case, Eastern Washington University Faculty Grant for Research and Creative Works 2024 - 2025; J.T. Deckhut Sigma Xi Grants in Aid of Research.

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

Fossil sampling bias, faunal composition, and Miocene climatic events: reassessing the palaeoecology of the La Venta mammal assemblage in tropical South America

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The La Venta site in Colombia hosts one of the richest vertebrate fossil assemblages in tropical South America and offers a key window into how Miocene climatic and environmental changes shaped tropical biodiversity. A century of paleontological research has shown that La Venta preserves an ancient tropical forest ecosystem with a highly diverse fauna. Its mammalian fossil record is so distinctive that it defines the Laventan Age/Stage. However, most paleoenvironmental reconstructions have relied on fossils from a single stratigraphic level—the Monkey Beds (~12 Ma). Recent work by our team demonstrates that the fossil-bearing strata

of La Venta span a broader time interval, from 16 to 10.5 Ma. This expanded temporal framework enables evaluation of faunal and environmental dynamics during key climatic events, including the Miocene Climatic Optimum (MCO) and the Miocene Climatic Transition (MCT). We compiled and analyzed 855 mammal fossil occurrences from published literature (1930–2022) and ongoing fieldwork, and we generated stable carbon and oxygen isotope data from mammal tooth enamel sampled across the Monkey Beds. Our results reveal a strong historical sampling bias as ~30% of all occurrences are from the Monkey Beds, skewing interpretations of diversity and environment. In contrast, the older San Alfonso Beds, spanning the MCO and early MCT, were previously under-sampled (~1%) but now represent ~12% of occurrences, revealing previously unrecognized fossiliferous potential in older strata. Three mammalian clades dominate the assemblage, comprising ~74% of occurrences: Xenarthra (30%), Notoungulata (26%), and Rodentia (18%). Stratigraphic range data show no faunal turnover at the MCO–MCT boundary (~14 Ma) but suggest a turnover near 12 Ma. However, isotopic results ($\delta^{13}C$ and $\delta^{18}O$) from the Monkey Beds indicate a closed-canopy forest dominated by C_3 vegetation, with no major environmental shift at that level. This finding suggests that the apparent turnover may reflect sampling artifacts rather than true ecological change. By extending faunal and isotopic analyses across multiple stratigraphic levels, our study refines the palaeoecological framework for La Venta and highlights the need to address sampling bias in reconstructions. These findings suggest long-term stability of tropical forests across major Miocene climatic transitions.

Funding Sources French National Research Agency grant ANR-24-ERCS-0007-01

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Mountains can preserve ecological community functioning during periods of climate change: evidence from Miocene mammal assemblages of western North America

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Mountains are among the most biodiverse and ecologically important habitats on Earth. However, they are also highly susceptible to climate and environmental perturbations, making it critical to understand how mountain communities have been impacted by past climate changes. The Middle Miocene Climatic Optimum (MMCO; ~17 to 14 Ma) was a notable warming period with temperatures 5–6 °C higher than today, making it a suitable analogue for investigating modern climate change impacts. By combining high-resolution paleoclimate models and fossil assemblage data, our aim was to quantify changes in the biomass, energy use, and species richness of local mammal communities across the MMCO, and to assess differences in these changes between regions of high ('Mountain') versus low ('Plains') topographic complexity in western North America. As indicators of community functioning, assemblage biomass and energy use were respectively scaled up from body mass and metabolic rate estimates obtained for 752 unique species records across 190 well-sampled fossil assemblages dating from 20 to 5 Ma. Together with estimates of species richness, they were contrasted with paleoclimatic data derived from eight 1-Ma model time slices. Total energy use, biomass, and richness is greater on average in the plains than in mountain regions for both large- and small-mammal assemblages. All three

metrics are also consistently higher during the MMCO for both groups and in both regions. For large mammals, changes are largely consistent across mountain and plains assemblages across all three metrics. Thus, there was seemingly little influence of topographic complexity on changes in large mammal communities over the MMCO. Conversely, for small mammals, changes in richness and the energy usage of mountain assemblages were decoupled. While energy use began declining during the MMCO and continued after the Miocene Climatic Transition at 14 Ma, richness did not start declining until after the transition, likely because mountainous regions acted as climate refugia. As a consequence, changes in small mammal community functioning after the MMCO were far less severe in the mountains than on the plains. These results further emphasise the ecological significance of mountain habitats by showing that they can serve as important buffer zones preserving community functioning amidst notable climate changes.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The evolution of enamel structure and diet in the Monotremata (Mammalia)

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Fossil monotremes are uncommon, less than a dozen species ranging from early Aptian (126 Ma) to late Miocene (5 Ma). Most fossil taxa are based on isolated teeth or incomplete jaws. A new latest Cretaceous monotreme from Vega Island, Antarctica, based on an upper 3rd molar, has given us a further look at early monotreme enamel structure.

Enamel structure has been previously studied for the modern platypus, *Ornithorhynchus anatinus,* (only primary or juvenile teeth exist in the platypus and once shed, the loci a covered in heavily keratinized pads with transverse ridges) and a mid-Miocene species of *Obdurondon* from the Riversleigh World Heritage Area fossiliferous limestones. Additionally, the Early Paleocene (63.5 Ma) monotreme *Monotrematum sudamericanum,* Salamanca Fm. of Patagonia, Argentina, has had its enamel structure described, while the latest Cretaceous monotreme, *Patagorhynchus pascuali*, also from Patagonia (Chorrillo Fm.) has only had its enamel thickness measured.

Thicker enamel seems to be a plesiomorphic condition within the Monotremata, as it is seen in all of the latest Cretaceous and early Paleocene monotremes such as the new Antarctic monotreme (105 µm), *Patagorhynchus* (127 µm) from the Maastrichtian of Argentina, also has thick enamel but structure is currently unknown) and the Paleocene *Monotrematum* (100 µm), whereas, all of the late Cenozoic monotremes, the three *Obdurodon* species (*Obdurodon* from Riversleigh = 21 µm) and the juvenile dentition of *Ornithorhynchus* (9.6 µm) have thin enamel resulting in significant exposure of the underlying dentine in the lophs and lophids with wear. The interrod enamel is much thicker and barely separated from the prismatic rod enamel in both the Antarctic monotreme and *Monotrematum* compared to that seen in *Obdurodon* and *Ornithorhynchus* where the interrod enamel is very thin creating a very clear and wide separation between it and where the internal prismatic rod enamel resides.

The faunivorous diet in the platypus and in the similarly shaped skull of *Obdurodon dicksoni* from the mid-Miocene of Riversleigh is composed (or inferred) of aquatic worms and

insect larvae (soft food types). The earlier occurring monotremes in Patagonia and Antarctica, with their thicker and denser enamel suggest a tougher more insectivorous diet (harder food types) composed of terrestrial arthropods, such as beetles, which require greater force during mastication to fracture the chitinous exoskeleton.

Funding Sources J.A. Case research supported by US National Science Foundation grant ANT-0003844. M.C. Lamanna research supported by US National Science Foundation grant ANT-1142129.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Evolution and adaptation of the dinosaur naris

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Olfaction plays a crucial role in the survival and behavior of vertebrate animals. As narial soft tissues are not preserved in fossil vertebrates, we have limited knowledge of dinosaur olfactory capabilities and their evolutionary trajectories. This study investigates the evolution of narial size and shape in dinosaurs across geological time, taxonomic groups, and ecological niches. We hypothesize that dinosaur narial size and shape is partially controlled by environmental parameters. To test this, we quantified the absolute and relative narial opening size for 200 Mesozoic dinosaur species. We recorded 2D linear and area measurements for narial size and used 32 landmarks and geometric morphometric methods to quantify narial shape. Our results find statistically significant differences in relative narial area between herbivorous and both carnivorous and omnivorous dinosaurs, although these differences are not observed during the Triassic. Additionally, we identify that Ceratopsidae exhibits significantly divergent narial variation relative to all other dinosaurian clades. To provide neontological insight into dinosaur narial evolution, we further quantified the naris of 200 extant non-Serpentes squamate species. Squamates are a suitable comparator group for dinosaurs because they are closely related, have ecological proxies, and have generally reminiscent skulls, with elongate rostra, toothed jaws, and laterally positioned nares. Principal components analysis (PCA) was used to map narial shape into a morphospace, which was partitioned by varying ecological categories (e.g., habitat type, annual temperature, seasonality) defined by the squamate naris. Preliminary comparisons between dinosaur and squamate morphospaces are inconclusive; however, MANOVA tests indicate potential ecological signal in dinosaur narial morphology. As an example, ornithomimosaurs exhibit significantly different PCA scores compared to extant squamates inhabiting desert and forest environments, hinting at possible narial adaptation to more wetland-like habitats. Signals from both dinosaur and squamate data may reflect a combination of environmental, biological, and phylogenetic influences. Future work will aim to refine paleo-aridity and habitat proxies for each dinosaur species, integrate inferences of olfactory ability derived from endocasts, and undertake phylogenetic comparative methods.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A multi-taxic assemblage of immature sauropods from the Upper Jurassic Morrison Formation of southwestern Montana, USA

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With their long necks and titanic proportions, sauropods were not only the largest terrestrial vertebrates, but are also among the most famous and iconic dinosaurs. Although well-known for their extreme size, remains of immature sauropods are relatively rare and provide opportunities to explore ontogenetic changes in morphology and behavior. In 1992, a sauropod dominated locality (Museum of the Rockies [MOR] locality M-124, "T&J Site") was discovered in a hard limestone in the Upper Jurassic Morrison Formation of Gallatin County, Montana. Excavations were conducted at the site through 1994 and produced a large sample (n >300) of sauropod bones, including vertebrae and limb elements. All of the recovered elements are relatively small (ulnae range in length from 390–460 mm), and vertebrae exhibit shallow pneumatic fossae and lack neural spine bifurcation, indicating early to late-stage 'juveniles'. Preserved humeri express equally expanded proximal and distal ends with a rounded humeral head, consistent with referral to Diplodocidae. Similarly, the morphology of cervical vertebrae, including the centrum shape and neural spine length, indicate Diplodocidae. However, at least two cervical vertebrae from the site (MOR 714 2021-C-288 and MOR 714 7-13-93-61) express box-shaped diapophyses, alignment of the pre- and postzygapophyses, and a deep cotyle cup. These features characterize Camarasauridae and indicate the presence of at least two sauropod clades at the "T&J Site". Ongoing study continues exploring the paleobiological implications of this association of immature sauropods.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Macroevolutionary dynamics of Odontoceti and the rise of Delphinidae in the Peruvian coast

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Odontoceti are currently the most diverse group of marine mammals, yet their past diversity far exceeded what we observe today. A major taxonomic turnover occurred during the Plio-Pleistocene, when extinction events likely linked to sea-level changes disproportionately impacted coastal odontocetes. This loss of diversity opened ecological niches that facilitated the rapid radiation of the Delphinidae, now the dominant odontocete group.

Here, we present two new Delphinidae fossils from the Sacaco region on the southern coast of Peru (16°S), marking the first South American specimens of this group to be included in a phylogenetic analysis. The fossils, dated to approximately 2.7 and 1.9 million years ago and recovered from the Caracoles and Pongo formations respectively, coincide with the peak of Delphinidae diversification. The specimen from the Caracoles Formation (MUSM 3740) is one of the most complete delphinid fossils to date, including the skull, mandible, ear bones, and most of the postcranium. Phylogenetic analysis places it within the Delphininae, closely related to *Delphinus*, *Stenella*, and *Tursiops*. It shares a high tooth count, elongated rostrum, and dorsolateral premaxilla orientation. In contrast, the Pongo Formation specimen (MUSM 4746) consists of a partial skull and belongs to the Globicephalinae, showing affinities with *Feresa*, *Peponocephala*, and *Globicephala*, characterized by a broad rostrum,

low tooth count, and big alveoli in the 2/3 anterior rostrum.

These findings provide crucial evidence of the diversification of delphinids in the southeastern Pacific and support the hypothesis that extinction-driven ecological opportunity played a key role in shaping modern odontocete diversity.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Documenting the formation and deposition of a theropod dinosaur trackway from the Upper Glen Rose Formation, Hamilton County, Central Texas, USA

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The Lower Cretaceous (Albian) Glen Rose Formation and other similarly aged stratigraphic formations exposed across much of Central Texas are world-renowned for yielding thousands of fossilized tracks of theropod, sauropod, and ornithopod dinosaurs. The sedimentary context of the Glen Rose reflects the initial transgression of a transgressive-regressive (T-R) sequence within the Lower Cretaceous Trinity Group (Aptian–Albian), highlighting sea level fluctuations throughout Early Cretaceous North America. Typically, Glen Rose track sites are found on shallow marine carbonate deposits that formed at sequence boundaries. The Shive Site assemblage, located in Hamilton County in Central Texas, represents a newly documented track site. The Shive Site consists of at least twenty three-toed (tridactyl) tracks exposed along an 18-meter-long limestone shelf, with three apparent trackways identified. Based on their size and shape, the tracks are interpreted to belong to the large theropod dinosaur *Acrocanthosaurus atokensis*. The tracks have varied preservation, ranging from complete preservation of the full tridactyl track to incomplete preservation with only toe marks being observable. Most of the tracks show evidence of soft sediment deformation or mud-collapsing during their formation. The tracks head both northward and southward, but the vast majority (80%) head south–southeast. In one case, a south-heading track is overlain by a northward track, potentially suggesting gregarious behavior and that the trackmakers were moving back and forth along the local coastline. The track-bearing layer is a coarse grainstone riddled with *Thalassinoides* burrows (*Cruziana* ichnofacies), indicating that it was deposited in a shallow marine, lower shoreface setting. The units above the track layer indicate sea level rise, denoted by interbedded and muddy carbonate units containing multiple genera of marine invertebrates, including the biostratigraphically informative echinoid *Loriolia rosana*. Taken together, our geological analyses and documentation of the tracks with variable preservations suggests that the tridactyl tracks at the Shive Site were formed in a short-lived single event along a shoreline during a marginal-marine sequence boundary in the Upper Glen Rose Formation, providing new insights into the paleoecology of theropod dinosaurs in Central Texas during the Albian.

Funding Sources Bryce C. Brown Research Fellowship Program at Baylor University's Mayborn Museum; Dallas Paleontological Society Frank Crane Memorial Scholarship.

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Detecting the effect of past biotic interactions and climate changes on phenotypic evolution

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Understanding the role of biotic interactions in shaping phenotypic evolution over macroevolutionary timescales remains a key challenge. While many verbal hypotheses exist about the influence of interspecific competition on trait evolution and its interplay with abiotic factors like climate, quantitative assessments are still limited. Fossil data, increasingly recognized as essential for reconstructing deep-time evolutionary dynamics, offer critical insights into these processes. Here, we present a new phylogenetic comparative framework designed to detect the influence of interspecific competition on trait evolution, and its potential interaction with climate. Through a simulation framework, we show that including fossil data is necessary to detect part of those effects, especially for the most complex developed models. We use our approach to evaluate the hypothesis that traits linked to resource use are more likely to be shaped by competition over long timescales, whereas other traits like body size evolution would more closely follow climatic trends. To test this, we applied our approach to two datasets containing both extant and fossil species: North American canids and equines, both of which include traits related to diet and body size. Our results show that resource-use traits were more consistently influenced by inter-specific competition, while body size followed different evolutionary patterns—being shaped by competition in canids but evolving as a random walk in equines. Contrary to expectations, we detected no significant effect of past climate on body size evolution in either clade, nor evidence for an interaction between climate and competition on all studied traits. These findings highlight the importance of interspecific competition as a driver of trait evolution at macroevolutionary scales and challenge the prevailing view that long-term climate change is a primary determinant of phenotypic evolution.

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Neural anatomy and ontogenetic trajectories of rhynchosaurian braincase from the Upper Triassic of India

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Neurocrania or braincases provide an excellent tool for understanding the neuroanatomical and paleoneurological aspects of extinct taxa. Neuroanatomical inferences are mainly derived from the examination of naturally preserved or digitally extracted endocasts and/or osteological correlates and their soft tissue reconstruction based on the Extant Phylogenetic Brackets (EPB). Although such studies are plentiful for the archosaurians, there is a paucity within the non-archosaurian archosauromorphs, including those recovered from India.

An isolated, nearly complete braincase was recovered from the Upper Triassic Tiki Formation of the Rewa Gondwana Basin. Several morphological features suggest its early-diverging archosauromorph affinity. Detailed studies on comparative anatomy and phylogeny suggested that the braincase belonged to an adult individual of *Hyperodapedon tikiensis*. X-ray micro-computed tomography and 3D virtual reconstruction of the inner ear revealed that the taxon was equipped with a well-developed vestibular apparatus that aided high auditory capabilities. Ontogenetic changes within neurocrania of *Hyperodapedon tikiensis* included dorsoventral expansion and posterior-widening of the braincase as is evident from several well-preserved basioccipital-parabasisphenoid complexes. The current study thus provides new insights on the neuroanatomy and ontogenetic development of *Hyperodapedon* braincases and contributes to the understanding

of the neurocranial evolution of the early-diverging archosauromorphs.

Funding Sources Council of Scientific and Industrial Research, India (09/0081(13997) /2022-EMR-I), Indian Institute of Technology Kharagpur, India.

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

Ecomorphospace partitioning in Gondwana: testing niche conservatism vs. diversification models in post-Permian Indian temnospondyls

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India's unparalleled continuous Triassic record (Panchet, Panchmahi, Denwa, Maleri Formations) reveals temnospondyl niche dynamics through mass extinction recovery using interdisciplinary modeling approaches. Computational taphonomic modeling (stress-strain analysis) of an Early Triassic (Panchet Formation, deltaic) rhytidosteid skull quantifies microscale brittle-ductile deformation from syndepositional faulting within clay-rich substrates, correcting preservation bias while confirming rare dermal impressions. Miniaturized assemblages exhibit exceptional diversity (trematosaurids [*Aphaneramma*-like and *Wantzosaurus*-*Trematosaurus* intermediates], lyddekkerinids (*Manubrantlia*), capitosaurids, benthosuchids, brachyopids, plagiosaurids) with morphospace clustering indicating niche sharing in environmentally stressed deltaic systems. Evolutionary network modeling integrates phylogenetics and geometric morphometrics to resolve complex Gondwanan biogeographic linkages, positioning India as a dispersal corridor between Madagascar and Antarctica. Middle Triassic (Denwa Formation, fluvio-lacustrine) transitions to gigantism with reduced diversity but high disparity: cladistic network analyses (TNT: 14 MP trees, 50% consensus) identify the youngest global lonchorhynchine (*Aphaneramma*) and a novel brachyopid exhibiting cranial convergence with Laurasian *Hadrokkosaurus* (vaulted palate, enlarged orbits, mandibular fenestrae). Late Triassic (Maleri Fm., fluvio-lacustrine) shows low diversity/disparity but unique trans-Gondwanan biogeography: multivariate trajectory modeling positions metoposaurid *Panthasaurus maleriensis* intermediate between European (*Metoposaurus*) and North American (*Koskinonodon*) taxa in cranial morphospace, while ontogenetic network models using multi-sized cohorts demonstrate *Kuttycephalus* as a juvenile morphotype of *Compsocerops*. India's record rejects niche conservatism, revealing pulsed diversification: Early Triassic miniaturized survivors show high diversity/disparity with niche sharing in unstable habitats, Middle Triassic gigantism drives ecomorphological partitioning in stable fluvial systems via adaptive radiation, and Late Triassic assemblages reflect biogeographic reorganization through incipient Pangean fragmentation. Integrative niche modeling demonstrates basin-scale environmental heterogeneity as the primary driver of Gondwanan recovery pathways.

Funding Sources Staatliches Museum fur Naturkunde,Stuttgart & Indian Statistical Institute (Inst.Nat.Importance.,MoSPI,Govt.India).

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Synchrotron scanning reveals a diversity of small-sized vertebrates in one of the world's oldest known dinosaur nesting sites

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The Early Jurassic Rooidraai nesting site in the upper Elliot Formation (uEF) of South Africa has yielded some of the world's oldest-known dinosaur eggs and embryos. The site preserves diverse small vertebrate fossils, in marked contrast to the large sauropodomorph-dominated collections at other uEF localities. Historical Rooidraai collections have yielded many fossils, but few have been studied due to difficulties preparing small, easily damaged bone from a hard matrix. Using phase-contrast synchrotron radiation X-ray tomography (SRµCT), we reveal a rich vertebrate diversity including theropods, sauropodomorphs, ornithischians, small-bodied cynodonts, and several small-bodied "protosuchian" crocodyliforms. The smallest of these latter specimens (femur length ~31 mm) is less than one-third the size of other currently known uEF crocodyliforms. The overall size range suggests that different ontogenetic stages may be represented. SRµCT based observations show that these crocodyliforms differ in cranial and postcranial features from contemporaneous taxa. The Rooidraai material is more similar to *Protosuchus* than to *Orthosuchus* in having a shallow and anterior tapering dentary with a long mandibular symphysis. Unlike *Protosuchus* and *Orthosuchus*, the material lacks an abrupt lateral expansion of the skull at the orbits and shows no sculpturing on the pterygoids. The scapula is long and gradually expands distally, contrasting the distally very wide scapulae in most protosuchids. The posterior margin of the blade is nearly straight, and the anterior margin is gently concave, as in *Orthosuchus* and crownward taxa (e.g., *Fruitachampsa* and *Shantungosuchus*). The pubis is excluded from the acetabulum as in all crocodyliforms but retains a contact with the pubic peduncle of the ilium. The preacetabular process of the ilium is long and slender and exceeds the anterior margin of the pubic peduncle—likely a unique feature of the Rooidrai crocodyliforms. Crocodyliformes are comparatively rare in the uEF, and our discoveries add to early crocodyliform biodiversity. The newly imaged Rooidraai taxa fall on the far-left tail of the known body size distribution of uEF vertebrates (mean body mass of ~1000 kg), with the crocodyliforms among the smallest specimens ever discovered (~0,25 kg). The site elucidates a previously unknown taxonomic diversity and ecosystem assembly, providing insights into an undersampled and poorly understood post-end Triassic extinction small-bodied fauna.

Funding Sources Stony Brook University; European Scynchrotron Radiation Facility; GENUS (DSI-NRF Centre of Excellence in Palaeosciences); University of the Witwatersrand

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Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

Supertooth: slicing, crushing, and the limits of carnassial design

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Multiple groups of carnivorous mammals independently evolved specialized teeth (carnassials) initially for slicing animal tissues. Today, only one such group remains: the

carnivorans (e.g., bears, cats, otters, hyenas). The carnassial represents a functional trade-off between slicing and crushing, with some taxa optimizing slicing efficiency (e.g., hypercarnivores), whereas others emphasize grinding and crushing (e.g., herbivorous taxa). This repeated evolution of carnassial teeth is a striking example of convergent evolution. Still, the persistence of carnivorans at the expense of all other carnassial-bearing lineages raises a fundamental question: is the carnivoran dentition functionally optimized? To address this question, we investigated the form-function relationship in the lower carnassial of carnivorous mammals to uncover the major drivers of their diversification and decline. We first quantified tooth shape in 250 species of carnivorous mammals using a 3D landmark-based geometric morphometric approach. We then developed an innovative protocol to assess tooth performance, combining slicing experiments using layered medical gelatin with crushing experiments employing 3D printed bone analogs produced from a bone modeling filament. Over 300 physical tests were conducted to construct a functional landscape of the lower carnassial. Our findings reveal that efficient slicing is achieved through a narrow set of morphological solutions whereas efficient crushing allows for greater shape diversity. Strikingly, only two species (both extant feliform carnivorans) achieved a decent trade-off between slicing and crushing, representing less than 1% of our dataset despite the extensive taxonomic coverage. These findings suggest that, despite the evolutionary success of carnassial-bearing predators during the Cenozoic, the ancestral tribosphenic condition might have imposed structural limits that restrict dual performance, canalizing most species to evolve either slicing or crushing specializations.

Funding Sources Belgian American Educational Foundation (BAEF), National Science Foundation (NSF DBI-2128146), and Fonds de la Recherche Scientifique F.R.S.–FNRS (FRIA FC 63999)

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Paleontological assessment of Atacama, Chile: a model for fossil heritage protection

Chavez-Hoffmeister, Martin F.[1,2]

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The Atacama Region in northern Chile is renowned for its fossils, which have revealed a great diversity of organisms, including plants and invertebrates, along with a wide range of vertebrates such as Carboniferous tetrapod tracks, Triassic and Jurassic ichthyosaurs, Cretaceous titanosaurs and pterosaurs, and abundant remains of Miocene sharks, birds, and marine mammals, among others. These findings span more than 360 million years, from the Devonian to the Quaternary, making it one of the few areas in the country with such a broad chronological record. This makes Atacama a key region for understanding the history of life on the western margin of South America. For these reasons, the Atacama Regional Government has established a non-governmental entity dedicated to the study and protection of this vast heritage: the Corporacion de Investigacion y Avance de la Paleontologia e Historia Natural de Atacama (CIAHN Atacama). To fulfill this mission, a paleontological assessment of the region was conducted. Its objective was to create an updated database of fossil sites in the region, aiding in the design of strategies to protect and promote this heritage. The results include the identification of nearly 3,000 fossil occurrences, which were used to generate detailed maps and an analysis of sites most likely to be affected by nearby roadways. Additionally, the available data in the Paleobiology Database was updated, making it the area with the highest data resolution in all of Chile. This information has been shared with local authorities through a technical report and with the public via an educational poster distributed free of charge. These materials have not only aided technical and governmental work but have also served as the foundation for artistic projects and educational products. Furthermore, an outreach book has been produced to highlight and raise awareness of the region's paleontological

heritage. This project marks a milestone as the first systematic effort to compile paleontological information at the scale of an administrative region in Chile. Beyond the maps and compiled documents, this work establishes a foundation for planning future studies and projects focused on the protection, planning, and promotion of paleontology in Atacama. This assessment model could be replicated in other regions of the country, contributing to a broader understanding of Chile's fossil heritage and better tools for its protection.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Fossil birds from the Cura-Mallín Formation: new clues about continental birds from the Neogene in southern Chile

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The Cura-Mallín Formation, dating from the Early to Middle Miocene, consists of a sequence of lacustrine and fluvial sediments widely distributed in southern Chile. This unit contains fossil remains of vertebrates, including terrestrial mammals, bony fish, and the only known record of snakebirds (family Anhingidae) in the country. Recent surveys have led to the discovery of new bird remains from this formation, allowing us to define a new avian fauna for the Neogene of Chile. Most of the specimens found come from the Cerro Rucañanco locality, Araucania Region. This is an assemblage dominated by aquatic birds. Most of the new specimens belong to the snakebird *Macranhinga chilensis*, originally described from the same locality under the genus *Meganhinga*. The new specimens significantly expand our knowledge of the species, adding previously unknown elements and even a partially articulated axial skeleton. Additionally, there are isolated vertebrae, articular ends of scapulae, partial coracoids, multiple humerus fragments, fragmentary ulnas, femurs, and proximal epiphyses of tibiotarsi. These new remains allow for an evaluation of the validity of the genus *Meganhinga* and its relationship with other species in the family, as well as a better estimation of its flight capability. Indeed, the proportions between the leg elements are similar to those of extant species of the genus *Anhinga* and the extinct *Macranhinga paranensis*, while being 45% larger than modern species. However, the elements of the pectoral girdle and humerus are very similar in size to extant species, whereas the ulna is proportionally shorter. This, along with the marked thickening of the bones, suggests a greater specialization in foot-propelled swimming, along with a reduced flight capability. Additionally, a partial humerus and coracoid belonging to a new large aquatic bird have been identified and are currently under study. Additionally, a proximal humerus fragment assignable to a galliform has been found in the Laguna del Laja locality, Biobio Region. This record is significant because, like the case of snakebirds, it belongs to a group that currently has no native representatives in the country. This exemplifies the notable differences in continental bird communities during the Miocene compared to those inhabiting the area today, expanding our limited knowledge of these assemblages west of the Andes during the Neogene.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

On the origin of nightjars (Caprimulgidae): perspectives from the fossil record

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Fossils represent the only direct evidence for the ancestral morphologies, antiquity, and historical geographic distributions of life on Earth. The fossil record of the avian clade Strisores (which includes nightjars, oilbirds, potoos, frogmouths, owlet-nightjars, treeswifts, swifts, and hummingbirds) has been richly documented by avian standards, with well-corroborated stem-group representatives of the oilbird, potoo, frogmouth, swift, and hummingbird lineages all having been identified based on fossils dating to the Paleogene Period (66–23.03 million years ago). However, current understanding of the nightjar fossil record remains limited. Nonetheless, new fossil descriptions and restudy of previously known specimens, together with findings from recent phylogenomic studies, have started to provide insight into nightjar evolutionary history. The Archaeotrogonidae, a group of fossil birds represented by numerous specimens from the Paleogene of Europe, have recently been reinterpreted as stem-group nightjars based primarily on osteological characters of the forelimb. We incorporated the most completely known archaeotrogonid species into a phenotypic phylogenetic matrix targeting interrelationships within Strisores, resulting in a dataset of 117 characters scored for 30 taxa (including 16 fossil members of Strisores). Maximum parsimony analyses with extant taxa constrained to a molecular scaffold recovered some trees in which archaeotrogonids were positioned as stem-group nightjars, but also others in which they were placed on the stem leading to Daedalornithes (owlet-nightjars and apodiforms) or outside of crown-group Strisores. These alternative phylogenetic placements for archaeotrogonids have potential implications for understanding the origins of nightjar morphology (including soft tissue anatomy), ecology, and behavior. Although available fossil material of total-group nightjars tends to be relatively sparse, the integration of fossil data into future studies holds promise for elucidating the evolution, timing of origin, and biogeography of this distinctive and mysterious group of birds.

Funding Sources UKRI grant MR/S032177/1 (D.J.F.)

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

3D visualization of the chondrocytes and osteoblasts repairing the gastralia in the structurally preserved skin of a new Devonian stem tetrapod

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Gastralia is an innovation of tetrapods. However, in extant tetrapods, gastralia are only maintained in crocodilians and tuatara. The evolution and development of gastralia thus remain elusive. Gastralia have been referred to as gastral scales or abdominal ribs, reflecting the debate on their dermal or endochondral origin. A new near-complete Devonian stem tetrapod with soft tissues preserved at the cellular-level fidelity was recently discovered in Greenland. Its skin exhibits multiple cornified layers, resembling amniote skin rather than lissamphibian skin. The fragile scales and the solid gastralia, the ventral ‘floating skeletal elements’, are both kept by the belly skin. The rounded scales resembling modern caecilian scales are superficial to the elongated gastralia. This falsifies the idea that round-oval scales on the flanks of early tetrapods would become elongated at the ventral side of the body and evolve into gastralia. Based on submicron-resolution synchrotron scans, the cell and fiber distribution, orientation, and morphology are visualized in 3D. The digital dissection reveals that a couple of gastralia were fractured in life, which is distinct from the post-mortem and post-fossilization cracking. The fracture is filled with fibrous granulation tissue and covered by a callus. The callus is vascularized with the network derived from the two main blood vessels running parallel along the sides of the fracture. The major area of the

callus is composed of fibrocartilage with isogenous groups of large chondrocyte lacunae between the dense regular bundles of collagen fibers, while some areas are replaced by spongy bone. The central portion of the callus immediately facing the fracture has been resorbed by osteoclasts. To bridge the fracture, osteoblasts produce osteoid contoured to the original external bone surface. This bone healing mechanism is the same as in the endochondral bones. Normal gastralia consist of compact bone with flattened, well-spaced osteocyte lacunae along the lines of arrested growth. But at the core, packed rows of cuboid lacunae appear as those in the fibrocartilage callus. It indicates that gastralia are mineralized via metaplastic ossification, which is known to occur in the formation of reptile osteoderms, rather than dermal or endochondral ossification. The presence of dense connective tissue is the prerequisite for metaplastic bone development, which suggests that stem tetrapods already have a reptile-like dense dermis.

Funding Sources ERC Advanced Grant ERC-2020-ADG 10101963 (PEA), VR Starting Grant 148500371 (DC)

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new non-sauropodan sauropodomorph from the Lower Jurassic Zhangjiaao Member of Lufeng Formation, Yunnan, Southwestern China

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The Early Jurassic Lufeng Formation from Yunnan, China, is a famous stratigraphic unit known for its abundant and diverse vertebrate fossil assemblages, particularly those of non-sauropodan sauropodomorphs. Though more than 10 genera have been named to date, the understanding of these early-branching taxa remains incomplete. Here we describe a new non-sauropodan sauropodomorph dinosaur from the Zhangjiaao Member of Lufeng Formation, discovered near Erzhuanshan, approximately 10 km north of Lufeng City in Yunnan, Southwestern China.

The new specimen LF2015-NO02 consists of an articulated postcranial skeleton preserving eight cervical vertebrae, 14 dorsal vertebrae (with 12 left dorsal ribs), two sacral vertebrae, 13 caudal vertebrae (with seven chevrons), a pair of distal parts of pubic shafts, and both femora—partially preserved left femur and nearly complete right femur.

The specimen is different from other non-sauropod sauropodomorphs by a unique combination of features, including several potential autapomorphies (an asterisk indicates autapomorphies): the distal apron of the pubis is relatively rounded in cross-section with an expanded, sub-spherical distal end; a prominent posteroproximal tubercle is present on the femur, forming a groove with the greater trochanter*; and a well-developed tibiofibular crest that merges seamlessly with the lateral condyle in distal view*.

The femur of LF2015 NO02 measures 970 mm in length, making it one of the largest-bodied non-sauropodan sauropodomorphs recovered from this region. The close affinity with Lessemsauridae and Sauropoda, based on the recent phylogenetic analysis and some morphological characteristics, suggests advanced adaptations possibly related to weight support and locomotion. This discovery provides new insight into the morphological evolution of early sauropodomorphs and highlights a trend towards increasing body size approaching the sauropod condition. It may represent an intermediate form in the evolutionary transition toward true Sauropoda, further emphasizing the significance of the Lufeng Basin as a key region for understanding Early Jurassic dinosaur evolution in Asia.

Funding Sources StrategicPriority Research Programme of the Chinese Academy of Sciences (XDB26000000)

Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

Mitogenomes of the extinct and extant species within the *Nomascus* genus add new insights into gibbon evolution, species identification, and their past movements.

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Gibbons (family *Hylobatidae*) are small-bodied apes that inhabit mainland and insular regions of southern, eastern, and Southeast Asia, serving as crucial models for understanding primate evolution. Within this family, the genus *Nomascus* is of particular evolutionary interest. Endemic to Southeast Asia, *Nomascus* exhibits remarkable traits such as sexual dichromatism and low species diversity, including several taxa driven to extinction in recent centuries or millennia. A vanished gibbon (Junzi *imperialis*) excavated from Lady Xia's tomb (~2,300 kya), who is the grandmother of China's first emperor, was identified as a now-extinct gibbon genus. However, whether these incomplete physical characteristics can well represent the genus features remains uncertain.

Unlike their larger hominoid relatives (e.g., *Pongo*, *Gorilla*, *Pan*), gibbons' highly derived anatomy, lightweight skeletons adapted for ricochetal brachiation, and primary occupation of humid tropical forest habitats have resulted in a highly fragmentary record of diagnostic fossil material, limiting the resolution for parsing the taxonomy of gibbon species and addressing several vital questions, such as identifying and classifying extinct taxa and mapping their historical distribution and demography.

To resolve these questions, we produced genomic data from three ancient specimens from the Late Pleistocene to the Holocene and eleven museum samples, incorporating mitogenomes from more than one hundred extant samples across the gibbon family. Our results redefined the evolutionary position of the Junzi gibbon from Lady Xia's tomb with the other two extinct gibbons from Yemao Cave at Chongqing and Longlin Cave at Chongzuo in southern China. The newly sequenced genetic data from extinct and extant species have clarified the taxonomic status of *Nomascus* species. Moreover, estimating the genetic diversity of gibbon species enlightens us to make more efficient conservative policies for endangered animals. Furthermore, the projection of different climatic factors (e.g., temperature, precipitation) and ancestral geographical reconstruction indicate a southward movement of *Nomascus* species alongside their divergence. This molecular paleobiological approach promises to significantly advance our understanding of gibbon evolution and conservation biology, particularly for this critically endangered genus.

Funding Sources Collaborators provided the museum samples and the ancient gibbon specimens. The National Natural Science Foundation of China supported this work.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Avillers (Vosges, France): a new locality with Late Triassic Mammaliaformes

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The origin of mammals traces back to the Late Triassic, yet the fossil record of early mammaliamorphs in northwestern Europe remains sparse. Rhaetian-aged (Upper Triassic) sediments are exposed along the eastern margin of the Paris Basin. Several fossil-yielding

localities with Mammaliaformes are known from the Rhaetian sandstones of the region, notably Saint-Nicolas-de-Port, Rosières-aux-Salines, and Varangéville. A newly discovered site, the long-abandoned sand quarry of Avillers in the Vosges department of France, now adds to this record. The geological map of the area shows Rhaetian Sandstones (205.7–201.4 Ma), reaching up to 19 m in thickness, overlying the Marnes Irisées and capped by ~8 m of Levallois Clays. We sampled a ~3.5-m-thick interval of friable sand, approximately 1 m above the top of the Marnes Irisées, which contained numerous microfossils. These fossils, embedded within the sand grains, were recovered through laborious picking under a binocular microscope. Fossils from Avillers—like those from other Rhaetian sandstone sites—include both marine and terrestrial forms, suggesting an estuarine depositional setting, though the sedimentology remains inconclusive on this point.

The assemblage is dominated by isolated teeth of actinopterygians (mostly *Saurichthys*) and hybodont chondrichthyans (*Lissodus, Acrodus, Rhomphaiodon*). Less frequent finds include *Ptychoceratodus* sp. tooth plates and unidentified dipnoan (Sarcopterygian) scales, a few archosauriform teeth as well as fragments of lepidosauriform jaws. Of particular interest are the dental remains of several Therapsida/Mammaliaformes. The preliminary identifications include an unidentified cynodont, *Pseudotriconodon* cf. *P. wildi*, a haramiyid, *Kuehneotherium* (probably *K. stanislavi*), cf. *Megazostrodon chenali*, and *Morganucodon peyeri*.

Funding Sources The foundation “Stichting Molengraaff Fonds” supported the fieldwork

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Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

Integrative redescription of the Mongolian titanosaur *Opisthocoelicaudia skarzynskii* clarifies titanosaurian evolution, dispersal, and ecological responses to Cretaceous hyperthermal events

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Understanding dinosaur responses to Mesozoic climatic events provides crucial insight into the long-term dynamics of terrestrial ecosystems. Among sauropods, the latest Cretaceous Mongolian titanosaur *Opisthocoelicaudia skarzynskii* is significant for its rare Northern Hemisphere distribution, in contrast with the largely Gondwanan range of other titanosaurs. Titanosauria reached peak diversification during the Cretaceous, encompassing intervals of substantial climatic fluctuation, including the Selli Event (Aptian, 120.5 Ma), the Cretaceous Thermal Maximum (KTM, Cenomanian–Turonian, 94–91 Ma), and the late Maastrichtian warming (66 Ma). These hyperthermal events imposed strong selective pressures and shaped dispersal routes, likely influencing titanosaur evolution and distribution. We present a detailed redescription of *Opisthocoelicaudia skarzynskii* using advanced surface scanning of the holotype. This enabled clarification of previously ambiguous anatomical features and improved its integration within an expanded morphological dataset covering eusauropods, including new titanosaur discoveries from the past few decades. Revised character coding and phylogenetic analyses using maximum parsimony and Bayesian inference result in a highly resolved phylogeny that reveals new insights into titanosaurian relationships. Building on this phylogenetic framework, we

used BioGeoBEARS for biogeographic analyses to evaluate possible dispersal pathways for Eurasian titanosaurs. *Opisthocoelicaudia* biogeographical history was compared with that of putative close relatives from North America (e.g., *Alamosaurus*), South America (e.g., *Saltasaurus*), and Africa (e.g., *Mansourasaurus*). We tested competing hypotheses on Asian titanosaur origins, including scenarios of Gondwanan dispersal, endemic Eurasian evolution, and potential North American recolonization during the Maastrichtian, integrating biogeographic and palaeoclimatic simulations. Phylogenetic comparative methods and palaeoclimatic data highlight the role of temperature variability during hyperthermals, especially the KTM, as a major driver of titanosaur diversification, body size evolution, and climatic niche shifts. By synthesizing anatomical, phylogenetic, biogeographic, and climatic evidence, our study enhances understanding of how large terrestrial vertebrates responded to rapid warming, providing new perspectives on biotic responses to hyperthermal events in a major group of land-dwelling tetrapods.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Quantifying internal and external bone morphology of *Miracinonyx* and other big cats

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Miracinonyx trumani is an extinct genus of large felids that inhabited North America during the Pleistocene. Its phylogenetic status was uncertain until genetic evidence revealed a closer affinity with the mountain lion (*Puma concolor*). For a long time, it was believed that *M. trumani* had evolved convergently with the modern cheetah (*Acinonyx jubatus*) for high-speed pursuit of prey, based on morphological similarities. While morphological features suggest *M. trumani* was adapted for high-speed locomotion, recent studies indicate that it also possessed traits associated with grappling. Specifically, although it exhibits elongated distal limb elements (i.e., cursorial adaptations), it also had unique wrist bones and a mobile elbow joint, indicating an enhanced ability to grapple prey. In particular the elbow joint shows greater supination compared to that of the cheetah. Despite growing interest in *M. trumani*, its locomotor and behavioral traits remain understudied. This study aims to investigate both internal bone morphology (trabecular bone structure) and external joint size to reconstruct its locomotor behavior. Based on previous findings showing that *M. trumani* shares morphological traits with both *A. jubatus* and *P. concolor*, we predict it would exhibit intermediate characteristics in the traits analyzed. We compared trabecular bone volume fraction (BVF)—an indicator of biomechanical loading—and joint sizes in *M. trumani (n=7)*, *A. jubatus (n=20)*, and *P. concolor (n=17)*. BVF and joint volumes were quantified for the femoral head and distal tibia. Preliminary results show that *M. trumani* has a higher BVF in the femoral head (a proximal joint) than both extant species, while in the distal tibia, a distal element, it exhibits the lowest BVF. In terms of joint size, *M. trumani* appears intermediate, with hip and ankle joints more similar to those of *P. concolor*. These findings have implications for interpreting cursorial adaptations in *M. trumani*. The increased BVF in the proximal joint—when controlled for body size—suggests elevated biomechanical loading, potentially reflecting higher activity levels and greater cursoriality during locomotion. This supports recent research

indicating that *M. trumani* displays a unique combination of cursorial and other unique morphological adaptations in its limbs.

Funding Sources John Deaver Drinko Fellowship

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

New *Alligator* fossils from Taiwan: the oldest record in tropical Asia

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The only two extant species of *Alligator*, *A. mississippiensis* and *A. sinensis*, are geographically well-separated, in eastern North America and East Asia, respectively. The sparse fossil record in East Asia has obscured the details of their evolutionary and paleobiogeographic history in the Far East. Here, we describe eight new *Alligator* specimens (eight mandibles) from the Middle Pleistocene of Tainan, Taiwan. Six mandibles show a unique combination of morphological features different from other known *Alligator* species: the mandibular symphysis extending posteriorly to the level between the fourth and fifth alveoli; a distinct diastema between the seventh and eighth dentary alveoli; and the conical tooth crowns in the middle to posterior region of the dentary. Interestingly, two additional mandibles differ from the previous six specimens in larger size and having the mandibular symphysis extending posteriorly to the fifth alveoli, indicating the co-existence of possibly two *Alligator* species. Previously known fossils of *Alligator* from tropical Asia include *Alligator sinensis* from the Late Pleistocene of Taiwan, and *Alligator munensis* from Thailand (likely dating to late Middle Pleistocene or even Holocene). Our discovery of the Middle Pleistocene *Alligator* from Taiwan thus represents the oldest known *Alligator* in the tropical region of Asia. In addition, the new specimens show a distinct size disparity. Our body size estimation suggests a total length of approximately 145 cm for the smaller six specimens, whereas the two larger dentaries are likely to be about 2 meters in length. This body size disparity may indicate two ontogenetic stages. However, given the size disparity and morphological differences, we hypothesize that *Alligator* invaded tropical Asia multiple times during the Pleistocene glacial cycles, and the smaller specimens then represent insular dwarfism, coexisting with the non-dwarf species. If our interpretation is correct, this body size evolution for the *Alligator* lineage differs from the gigantism of *Toyotamaphimeia* from the same locality. Future discoveries and analyses of crocodylian fossils from Taiwan promise to test the dispersal, body-size evolution, niche partitioning, and extinction of the *Alligator* lineage in tropical Asia.

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Cenomanian (Upper Cretaceous) dinosaur eggs from Busan, Korea: microstructural preservation and paleobiogeographical implications

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Dinosaur eggs were recovered from the Dadaepo Basin in Busan (southeast Korea), which is early Late Cretaceous in age. The Dadaepo Basin is characterised by exceptionally high thermal maturity among the fossil egg-bearing basins in East Asia, providing a research opportunity to test whether thermal maturity has influences on the microstructural preservation. Here, we describe two different types of fossil eggs from the Dadaepo Formation. The first type is identified as *Mosaicoolithus*, an indigenous ootaxon of East Asia. The second type is *Macroelongatoolithus*, which is widely distributed in lower Upper Cretaceous deposits of East Asia as well as those of North America. The microstructural preservation of the Dadaepo Formation eggshells is almost the same as that of less thermally mature basins in East Asia. It indicates that even high thermal maturity has relatively little effect on microstructural preservation. This additionally suggests that fluid-mediated alteration (detectable by microscopic and chemical examination tests) is not enough to screen thermally matured eggshells for clumped isotope analysis. The Dadaepo Basin *Macroelongatoolithus* supports the chronological constraint of the global *Macroelongatoolithus*, which is early Late Cretaceous (most likely Cenomanian–Turonian). It indirectly supports an early Late Cretaceous age for the equivocal age of the Iren Dabasu (or Erlian) Formation (Inner Mongolia, China) from which colossal oviraptorosaur body fossils were recovered. This global age constraint also implies that Cenomanian–Turonian deposits in the Bering Strait appear promising for future discoveries of *Macroelongatoolithus*.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Refining Miocene primate timelines: new insights from rodent biochronology and magnetostratigraphy of the Miocene Siwaliks at Ramnagar, India

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The earliest appearance of *Sivapithecus*, a key Miocene hominoid related to extant Asian great apes, has traditionally been tied to the Potwar Plateau of Pakistan, with its first fossil occurence dated to approximately 12.8 million years ago. In this study, we present new chronostratigraphic data from the Middle to Late Miocene fossil-bearing deposits of Ramnagar, Udhampur District, Jammu & Kashmir, India, that refines this timeline. Here, we present the results of an integrated approach combining high-resolution magnetostratigraphy of a 445-meter Lower to Middle Siwalik section with rodent biochronology, including the recovery of the thryonomyid *Paraulacodus indicus* and previously reported taxa such as *Megacricetodon daamsi*, *Kanisamys indicus*, *Antemus chinjiensis*, and *Megacricetodon cf. sivalensis*. This rodent assemblage allows for a robust correlation with the well-documented Potwar faunal sequence and serves as a biostratigraphic anchor for linking the local polarity zones to the Geomagnetic Polarity Time Scale (GPTS). This integrated approach establishes a revised first appearance datum (FAD) of approximately ~13 million years ago for several key Miocene primates, including *Sivapithecus*, the stem hylobatid *Kapi ramnagarensis*, and the sivaladapid *Ramadapis sahni*. Notably, this shifts the FAD of *Sivapithecus* up to 200,000 years earlier relative to its previously earliest known occurrence in the Potwar Plateau. These findings highlight the importance of the Ramnagar sequence in reconstructing hominoid evolutionary history and underscore the effectiveness of rodent biochronology in enhancing the temporal

resolution of South Asian Neogene deposits, especially in contexts where radiometric dating is not feasible.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A cluster of gastroliths and minute plant fossils associated with *Moabosaurus* provide the first evidence of the diet of sauropods

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The diet of sauropod dinosaurs is a long-standing mystery due to the lack of stomach contents, with previous reports of cololites being rejected. Similarly, the use of gastroliths by sauropods is doubted by many, in part due to the rarity of clusters of stones, even in articulated skeletons. Here, we report the discovery of abraded plant fragments preserved between polished stones in a 1250 mm diameter cluster associated with a pair of sternals, dorsal ribs, and an ulna of *Moabosaurus utahensis*. The plant fossils and stones, here interpreted as gastroliths, provide unrivaled insights into the diet and the utilization of gastroliths by sauropods.

The site is in a silty mudstone within the Early Cretaceous Yellow Cat Member of the Cedar Mountain Formation on SITLA land near Arches National Park, Utah, USA. The gastroliths range from 26–100 mm long. Most remain in matrix and their number remains to be determined. The gastroliths are subrounded, highly polished, chert pebbles. A ridge of the gastrolith clutch extends 150 mm deeper into the underlying sediment than the balance of the clutch. The plant fossils were extracted from between gastroliths in this ridge.

The interstitial materials consist primarily of plant bits. This interpretation is based on patterns of wavy laminar, linear, and ovate structures, and objects in cross-section with one serrated margin and one smooth margin, similar in shape to coping saw blades. The fossils are visible on natural breaks, in bas-relief where the matrix is easily removed, and in petrographic sections. The plant bits range from microscopic to ~13 mm in maximum length. All plant materials are preserved as calcite casts. Smaller plant fragments are angular, representing small fragments of plants. Many of the largest plant fossils appear to be abraded stems, one with a lattice of cell walls covering an area of 1 x 4 mm and several with possible short leaves resembling thick, shallow bowls. The most common objects are symmetrical about their long axis, with a central shaft and radiating ovate objects and/or surficial scales. These 10-mm-long objects may be minute reproductive cones with seeds or sacks.

This find represents the first known stomach contents of a sauropod. The plants suggest the animal's last meal consisted of stems and minute cones of an unidentified plant. Additional preparation, thin sections, and micro-CT imaging will provide further sauropod diet insights.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

First preliminary report on crocodilian remnants from Brahmaputra River Bed, Bangladesh: a key to unveil Holocene fluvial system fauna

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The Brahmaputra-Jamuna river system, part of the lower course of Asia's sixth-largest river, the Brahmaputra, delivers approximately 590 million tons of sediment annually to the eastern Bengal Basin in Bangladesh. Frequent avulsion events create a complex Holocene stratigraphic framework, disrupting lateral continuity and

complicating correlation of sedimentary units. A Holocene sand layer overlies a clay-capped Pleistocene paleosol, with a consolidated basal gravel layer marking a variable-depth boundary. Dredging in eastern Gosainbari Union, Bogura District, exposes mid- to late Holocene sediments, including a mid-Holocene gravelly lag containing rhizoliths and numerous fragmentary vertebrate bones. These allochthonous remains, with subangular to angular morphology indicating limited transport, are heavily oxidized, exhibiting dark brown to earthy tones and often crumbling upon air exposure due to oxidation. Among the riverbed finds, well-preserved crocodilian remains include bone fragments, osteoderms, a tooth, and a possible coprolite which provide insights into the Quaternary vertebrate assemblage. Previous reports from Pleistocene deposits in western Bangladesh document multiple crocodilians, including a possible *Crocodylus palaeindicus*. Tooth morphology and osteoderm pit patterns from the mid-Holocene Brahmaputra-Jamuna deposits suggest a freshwater mugger crocodile (*Crocodylus palustris*), despite concurrent sea-level rise. Ongoing analyses aim to refine taxonomic affinities and taphonomic processes, enhancing reconstructions of South Asian vertebrate faunal diversity during the Holocene.

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

A new insight into the linkage between osteocyte lacunae morphologies and flight behaviors in Paraves revealed by synchrotron X-ray nano-CT

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Bone characteristics play a crucial role in flight abilities in vertebrates; however, the relationship between bone internal microstructures and flight behavior remains unclear. Recent studies of mammalian osteocytes have demonstrated that osteocytes can act as mechanoreceptors, responding to mechanical loads experienced by bones, which suggests that the morphology of osteocytes correlate with locomotion patterns in vertebrates. Based on this perspective, we believe that the flight behavior of birds is also likely to influence the osteocyte morphology.

To precisely analyze the 3D morphology of osteocyte lacunae, we used a synchrotron high-resolution transmission X-ray microscope at Taiwan Light Source (TLS 01B1). With a resolution of 60 nm, this technique enables accurate 3D reconstruction of osteocyte lacunae and avoids errors common in traditional 2D analyses.

This study analyzed extant birds (*Accipiter trivirgatus*, *Bubulcus coromandus*, *Coturnix coturnix*, *Otus lettia*, *Spilornis cheela*, *Struthio camelus*) and fossil specimens (*Microraptor gui*, *Linheraptor exquisitus*, *Sinornithosaurus millenni*, *Zhongjianosaurus yangi*). Longitudinal sections from humeral mid-shafts were sampled to examine osteocyte lacunae morphology.

The results demonstrated that extant birds with varied flight behaviors exhibit differences in the height-to-width (H/W) ratio of osteocyte lacunae, which can be classified into three aerial lifestyle categories: infrequent flier, moderate flier, and frequent flier. This classification aligns with the one based on the hand-wing index (HWI). In summary, a low H/W ratio correlates with a high HWI and frequent flier lifestyle, while a high H/W ratio aligns with a low HWI and infrequent flier lifestyle.

Based on extant bird osteocyte analysis, we inferred the aerial lifestyle of *Microraptor gui* as a demonstration. The findings reveal elongated osteocytes with an H/W ratio consistent with the lifestyles between infrequent to moderate fliers, aligning with flight reconstructions of *Microraptor gui*. Furthermore, our HWI analysis of *Microraptor gui* also corresponds to characteristics between infrequent and moderate fliers. This study highlights that osteocyte lacunae morphology reflects mechanical stress from flight behaviors, offering valuable insights into the flight behaviors of extinct species of Paraves. Other fossil specimen results will be presented at the conference.

Funding Sources National Science and Technology Council (https://www.nstc.gov.tw/?l=en) NSTC-113-2116-M-213-001 and NSTC-113-2116-M-006-001

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Melanosome geometry in fish illuminates light modulation strategies through deep time

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Melanosomes, pigment-containing organelles, play vital roles in the physiology of many vertebrates. Ocular melanosomes in fish function in visual adaptation to ambient light conditions but surprisingly have long been overlooked. The palaeobiological potential of preserved melanosomes in the eyes of fossil fish is thus unclear. To resolve this, we carried out a systematic phylogenetic study of melanosomes in extant fish. We investigated melanosome geometry and distribution in ten tissues from twelve species of extant fish, representing a wide phylogenetic spread of early-diverging vertebrates: jawless fish (Agnatha), cartilaginous fish (Chondrichthyes), ray-finned fish (Actinopterygii), and lobe-finned fish (Sarcopterygii). Statistical analysis of scanning electron microscope images reveals strong phylogenetic signals in our dataset. Ray-finned fish possess long, rod-shaped melanosomes, widely considered to be diagnostic of the vertebrate retinal pigment epithelium. Unexpectedly, however, rod-shaped melanosomes are absent in cartilaginous fish, which instead exhibit large, spheroidal eye melanosomes. This difference indicates divergent optical strategies for modulating photoreceptor exposure, whereby ray-finned fish exhibit greater reliance on melanosome motility via retinomotor adjustments, but sharks and rays depend more heavily on pupillary control. In contrast, melanosomes in internal organs exhibit highly conserved geometry, indicating strong functional constraints during evolution. To investigate the temporal emergence of these features, we tested these phylogenetic trends using fossil representatives of each of the studied taxonomic groups, providing fossil calibration points for shifts in melanosome geometry through deep time. Our data highlight the role of pigment innovations in early vertebrates in shaping sensory evolution and ecological expansion in aquatic environments.

Funding Sources European Research Council

Colbert Prize Session

When ibises acted like kiwis: niche convergence and nocturnality in an extinct Hawaiian ibis

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Evolution on islands often generates specialized sensory ecologies that are rarely seen in continental species. The Hawaiian Islands are among the most isolated on Earth and the human

colonization of the archipelago lead to the extinction of most of its unique endemic vertebrates. Among these is *Apteribis* (Threskiornitidae), a genus of flightless ibises that inhabited Maui, Moloka'i, and Lāna'i. Despite being first described 49 years ago and with a rich paleontological record, there is little information on *Apteribis'* behavior or ecology. We provide a quantitative analysis of its sensory system, combining comparative osteology and micro-CT scanning. Data from its skull, mandibles, nerves, and brain (endocast) anatomy are used to infer its foraging behavior, activity pattern, and lifestyle. While its olfactory and somatosensory systems are comparable in relative size and anatomy to those of other ibises, *Apteribis* has a strikingly reduced visual system. Its orbits, optic nerves and optic lobes are half the size of extant ibises. Such reduction, spread through the visual pathway, strongly suggest a nocturnal lifestyle. This is an unprecedented trait among ibises, which otherwise lack nocturnal or even crepuscular species. Overall, our data suggest that *Apteribis* occupied a niche somewhat similar to that of New Zealand kiwi: a nocturnal, flightless taxon relying on tactile feeding. Interestingly, this convergence is only partial, and does not include the increased olfactory abilities of kiwi. Overall, our data emphasize once again the remarkable diversity of avian ecologies that have been lost due to human impact.

Funding Sources Canada Foundation for Innovation; Canada Research Chairs; NSERC; ARC Centre of Excellence for Australian Biodiversity and Heritage; ARC Future Fellowship.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Comparative neuroanatomy of three ornithopod individuals from the Lower Cretacous of Morella (Castellón, Spain)

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The upper Barremian beds of Morella have yielded multiple partial skeletons of non-hadrosauroid styracosternan ornithopods. These fossils have been identified so far as *Iguanodon bernissartensis* and a new form exclusive to the formation, *Morelladon beltrani*. In recent years, paleontological surveillance of clay-mining activities has brought up several new partial skeletons, three of them with partial skulls, including well-preserved braincases. To evaluate potential neuroanatomical differences, the braincases were scanned, which enabled access to new endocranial anatomical information. A 3D model was generated to virtually reconstruct the morphology of the braincase and its internal cavities.

Specimen 1, referrable to *Iguanodon bernissartensis,* has a complete and well-preserved braincase, allowing to reconstruct a detailed endocast. The olfactory bulbs and tracts, cerebral hemispheres, pituitary body, dural peak, cerebellum and the medulla oblongata were identified and reconstructed. Also, the inner ear and almost all cranial nerves and the internal carotid artery were also preserved.

Two additional specimens don't have a taxonomic identification yet beyond non-hadrosauroid Styracosterna. Specimen 2 didn't preserve frontals, and parietals and the orbitosphenoid are incomplete. The endocast is complete but missing the anterior part of the forebrain. The posterior half of the cerebral hemispheres is preserved as are the pituitary and the internal carotid artery. The mid- and forebrain and all structures associated with them are well preserved as well. Specimen 3 preserves the complete encephalic mass, most of the inner ears, most cranial nerves and main blood vessels like the internal carotid artery or the caudal middle cerebral vein.

These specimens display notable differences among them in the general shape of the encephalic mass, with specimen 1 almost lacking cephalic and pontine flexures, specimen 3 having a very pronounced dural peak (next to both other Morella specimens and also with

other ornithopods) and all three of them having different relative positions of anterior cranial nerves relative to the pituitary and differences in morphology and relative size of the inner ear semicircular canals.

These neuroanatomical differences suggest the specimens from Morella possibly belonged to different taxa and that they might have had noticeable sensory or cognitive differences that could be linked to anatomical or ecological variability of each specimen.

Funding Sources Funding provided by SANTANDER-UNED FPI grant.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

High resolution CT scanning reveals a new macrobaenid turtle from the Cenomanian Blackleaf Formation, Montana

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While turtles are a relatively well-sampled component of the fossil record, the paleobiology of certain fossil turtle groups remains poorly understood. Inferring the phylogeny and even monophyly of Macrobaenidae and Sinemydidae has historically proved challenging, with difficulties surrounding specimen accessibility. This problem may be better understood by the discovery of MOR 14891, a small fossil turtle from the Cenomanian age Vaughn Member of the Blackleaf Formation in southwest Montana. The largest piece of MOR 14891, a 6.0 cm long partial carapace and plastron preserving cranial material in between, underwent x-ray micro-CT scanning to reveal obscured anatomy relevant to its description and identification. However, the number of contacting pieces combined with a heterogeneous internal matrix required a higher contrast synchrotron scan. Image filtering, machine learning, and manual segmentation methods are being utilized in a semi-automated workflow to expedite the segmentation process in Dragonfly instead of the previously used 3DSlicer. This combination of methods has yielded clearer anatomical structures, including a configuration of mandibular foramina only recorded in kinosternids. More broadly, the mandible, basicranium, medial carapace, plastron, disarticulated limbs, and cervical vertebrae have been recovered as digital models. The digitally reconstructed basicranium of MOR 14891 revealed carotid fenestrae, which are found in Macrobaenidae, Sinemydidae, and Xinjiangchelyidae. In MOR 14891, the topology of the elements surrounding these fenestrae most closely resembles *Judithemys,* a proposed macrobaenid from the Late Cretaceous of North America. This improved data will contribute to a final description and digital reconstruction of MOR 14891's skeletal anatomy in life and test its current identification as a macrobaenid. Preliminary Bayesian phylogenetic analyses support this taxonomic assignment. Finally, the extensive ossification between MOR 14891's carapace elements paired with its diminutive size (estimated 10–15 cm) for the group raises questions regarding its ontogenetic age, requiring traditional consumptive histology to be performed on an associated femur shaft. Utilizing this segmentation workflow in Dragonfly may prove useful across many fossil segmentation projects, in turn establishing the identity of the oldest occurring and smallest macrobaenid discovered in North America.

Funding Sources This project was funded by the Undergraduate Scholars Program in the Fall of 2023.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

***Platyognathus* from the Lower Jurassic Lufeng Formation of Yunnan extends the record of gobiosuchid crocodyliforms back 67 million years**

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Gobiosuchids are small, terrestrial crocodyliforms known mainly from the Upper Cretaceous of Mongolia, with a single Lower Cretaceous (late Barremian) record from the Las Hoyas Konservat-Lagerstätte in Spain. Several phylogenetic analyses place them as early-branching crocodyliforms, implying a long ghost lineage back to the Lower Jurassic, but no Jurassic records have previously been reported.

The enigmatic crocodyliform *Platyognathus hsui* from the Lower Jurassic (Sinemurian?) Zhangjiawa Member of the Lufeng Formation has been known previously only by its fragmentary and now lost holotype dentary symphysis and the neotype partial skull and mandible (a specimen in the CUP collection at The Field Museum referred to it was mis-identified). It has never been included in a phylogenetic analysis, but in the description of the neotype it was tentatively hypothesized to be a protosuchid based on its derived characters. A new specimen discovered by Lihua Wang near the neotype locality comprises a nearly complete skull and mandible articulated with 17 vertebrae and associated osteoderms and associated with portions of the forelimb and hind limb. This is by far the most complete crocodyliform fossil from the Lufeng Formation, or from any Lower Jurassic formation in Asia, but unfortunately CT scanning of the skull was unsatisfactory. A phylogenetic analysis of early-branching crocodylomorphs, substantially updated from our previous analysis accompanying our description of *Junggarsuchus*, finds *Platyognathus* as an early member of the gobiosuchid lineage, and we apply the name Gobiosuchoidea to the entire clade. The most distinctive apomorphy of the group is the complete fusion of the dentary symphysis, a feature found in all birds, but nearly unknown among crocodylomorphs. *Platyognathus* lacks many of the distinctive gobiosuchid apomorphies, including a reduced supratemporal fenestra and palpebrals sutured to the frontal. Our analysis does not find a monophyletic Protosuchia, and gobiosuchids are more closely related to all other crocodyliforms than are protosuchids. One feature supporting this is the broader rostrum in gobiosuchoids and non-protosuchid crocodyliforms. *Platyognathus* is the oldest non-protosuchid crocodyliform, and along with the appearance in the Pliensbachian of the putative hsisosuchid *Calsoyasuchus*, the enigmatic *Eopneumatosuchus*, and thalattosuchians indicates the Early Jurassic was an important time of crocodyliform diversification.

Funding Sources NSF Earth Sciences 1636753 to JMC.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Ecomorphological analysis of lagomorph postcrania reveals locomotor habits of extinct species

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Members of the order Lagomorpha have seen success in terrestrial ecosystems across North America since the late Eocene. Despite their relatively conservative body plan and historically low diversity, they have evolved a diverse range of locomotor habits, including saltatorial, cursorial, fossorial, scansorial, and semiaquatic behaviors. The locomotor ecology of extant species is reflected in the morphology of the appendicular skeleton, and ecomorphological studies have been successfully used to infer locomotor habits of extinct animal groups, most notably Rodentia,

sister group to Lagomorpha. Here, an ecomorphological analysis was conducted with the goal of inferring locomotor habits of extinct lagomorphs using a large and ecologically diverse modern sample for comparison. A set of 22 linear measurements were gathered from nine appendicular skeletal elements of extant and extinct lagomorph species, which were transformed into 16 functional indices that reflect limb proportions and lever arms of major muscles. Relationships between these indices and locomotor habits were examined using statistical analyses, including analysis of variance (ANOVA) and discriminant function analysis (DFA). Results reveal significant and reliable indicators of locomotor ecology in the appendicular skeleton of lagomorphs. When applied to extinct lagomorphs, such as *Alilepus* and *Palaeolagus*, inferred ecology generally aligns with qualitative studies of fossil lagomorph locomotor ecology. Findings also indicate diversification of lagomorph locomotor habits coincides with intervals of major climate and habitat changes during the Cenozoic.

Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

Amniote traits and terrestriality in an early amphibian

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Eugyrinus wildi is among the oldest temnospondyl amphibians in the fossil record. Collected from the same Lancashire Coal Measures locality as early actinopterygians with preserved brains, the single *Eugyrinus* specimen was investigated to search for similar instances of exceptional preservation. Results matched expectations, and, once again, traces of neural tissues are preserved. However, discoveries within the conventionally preserved skeleton pushed the project in a different direction. Computed tomography revealed barely disturbed articulated limbs with long, slender, hooked terminal phalanges signaling the likely presence of claws. Furthermore, the limb proportions match those of lepospondyls (putative stem-amniotes), the finely textured dorsal coverage of tiny scales in packed rows is decidedly lizard-like, and yet the skull, as previously reported, bears lateral line pits and grooves. None of these discoveries excludes *Eugyrinus* from the Temnospondyli, but claw presence implies enhanced keratinization, previously considered a marker of amniote affinity. Additionally, this early amphibian also reveals a three-dimensionally preserved eye and diagnosable gut contents. This package of discoveries offers a novel perspective on terrestrially adapted conditions in a near-adult temnospondyl close to the crown-group tetrapod split, and an unusually detailed picture of early tetrapod terrestrial activity and niche occupation in coal swamp habitats. To conclude, we suggest (1) that clawed trackways are not the secure markers of amniote track-makers that they formerly were, (2) that *Eugyrinus* corroborates current and recent hypotheses that integument keratinization was widespread among early crown-group tetrapods, and (3) that the enhanced environmental tolerance conferred by this innovation (emerging within the stem lineage) likely contributed to individual survivorship in water-to-land transitions as well as lineage survivorship through the end Devonian biotic crises.

Funding Sources University of Chicago

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Swimming in early vertebrates: exploring the hydrodynamics of *Sacabambaspis*

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As one of the earliest known vertebrates, the Ordovician jawless fish *Sacabambaspis* represents a rare opportunity to understand life at the dawn of vertebrate evolution. Well-preserved specimens provide critical insights into its morphology but raise key questions about its locomotion. How did *Sacabambaspis* steer and stop while swimming, in the absence of any paired fins? Did its elongated horizontal tail lobe serve as a stabilizer? Could the broad, rounded head shield interact with the benthic substrate to generate ground effect forces, thereby influencing its ecology?

To address these questions, we employed a combination of computational fluid dynamics (CFD) and experimental particle image velocimetry (PIV). A 3D digital reconstruction of *Sacabambaspis* was modeled in a computational fluid domain, where simulations were performed evaluating hydrodynamic parameters across various angles of attack, substrate proximities, and flow velocities. Complementary experiments in a flume tank using a 3D-printed model enabled detailed PIV analysis of flow dynamics around the head shield.

We found that the head shield shape generated less lift at positive angles of attack than in comparable jawless fish, indicating that it was not specialized in the same manner as many osteostracans. Instead, we observed a sharp decrease in lift when *Sacabambaspis* was in close proximity to a benthic substrate, resulting from the inverted airfoil-like shape of the ventral body surface. This likely helped to maintain its position in the turbulent, nearshore environments *Sacabambaspis* occupied. The hydrodynamic implications of the unusual tail shape were explored, with the elongate lobe acting to increase the thrust-generating capabilities of the tail fin webs.

This study represents the first investigation into the locomotion of *Sacabambaspis*, offering significant insights into ancestral swimming patterns and biomechanics of early vertebrates.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Boneless wings: the evolution and distribution of manual claws in avialans

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Tree-climbing and wing claws are both plesiomorphic traits for avialans. Nonetheless, hoatzins (*Opisthocomus hoazin*) are the only modern birds which climb using wing claws, although some other arboreal birds have claws on the wing. This is a long-standing mystery in avian evolution.

We used CT scans of intact bird hands to study the distribution of manual unguals, and performed a literature review of fossil birds to inform ancestral nodes. Ancestral state reconstructions from this show that crown-birds (Neornithes) ancestrally had two wing claws. Due to their terrestrial lifestyle, these were probably not used for climbing.

Claws have been lost or reduced over thirty times independently in Neornithes, but rarely regained. Claw loss is strongly associated with altriciality, which occurs primarily in tree-nesting or cliff-nesting birds; claw loss events are associated with transitions to inaccessible nesting. Altriciality causes claw loss by post-displacing wing development relative to hatching, forcing the wings to ‘catch up’ without fully ossifying or even forming the unguals.

Where precocial taxa have lost claws, this is associated with secondary precociality or short wings relative to body size. We introduce the wing:femur ratio as a metric of wing length to

body size, and use it to show that precocial clawless taxa have shorter wings and much weaker allometry than clawed precocial taxa do. Heterochrony also causes claw loss in these short-winged taxa.

Hoatzin claws are neither atavistic nor regained, but a specialization for the hoatzin's folivorous lifestyle, unique life history and foregut fermentation.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Using pop-culture phenomenon to engage wider audiences in museum and informal learning spaces: integrating demographic and survey data to inform specialized outreach strategies for high-impact fossil programming

Cone, Marjean

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Informal education practices are vital for dissemination of information to the mass public. Focusing on ways to improve engagement in these settings will likely have a high impact on a number of communities across the globe that SVP stands to serve. The Georgia Southern University Museum houses an impressive collection of vertebrate fossils of coastal plain Georgia, including the type specimen *Georgiacetus vogtlensis*, *Tylosaurus proriger*, and *Otodus megalodon* (to name a few). The museum is a small facility, located on a university campus and we are consistently working to grow and develop programming designed to reach campus, local, and broader coastal plain communities.

We've begun measuring visitor data related to specific outreach strategies to improve data-informed approaches to place-based educational programming. One main outreach event we are achieving this through is our annual summer Shark Week event; strategically using an existing pop-culture phenomenon (Discovery Channel's sensationalized "Shark Week") to draw in visitors to learn more about extinct marine creatures such as the megalodon through new gallery additions, fossil shark teeth digs, and hands-on activities related to our marine vertebrate collections.

Initial inventory of visitor data showed that last year's Shark Week hosted 4.9 times the number of visitors compared to a normal week that summer, made up 61.4% of visitation for the month of July alone, and 38.5% of the museum's visitation for the entire summer. Additionally, preliminary survey data was collected to assess visitor demographics to get a better understanding of which communities were engaging the most. 92.3% of visitors were general public, 4.1% of visitors were Georgia Southern University students, and 3.7% of visitors returned multiple times throughout the week to attend the program again. Additionally, survey data showed that 30.4% self-reported having attended the event in previous years.

This summer we will be creating more focused visitor surveys to increase our data to assess pre- and -post knowledge, exposure, and perceptions of marine vertebrate fossils, and engagement experience after attending a Shark Week event. Integrating themed and relevant pop-culture phenomena into outreach strategies are proving to be successful tools for engaging public audiences in museum and informal learning environments, which will undoubtedly foster a bridge of trust and effective communication between scientists and the public.

Funding Sources Georgia Southern Museum.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

In situ otoliths from Triassic Fishes

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Otoliths are paired elements housed within the inner ears of fish and are involved in the sense of hearing and balance. They have a calcareous (aragonite, occasionally vaterite) and protein composition, so in the fossil record their occurrence is mostly dependent on the aragonite preservation. Although rare, in situ fossil otoliths have gained major importance because they allow the correlation of each distinct morphology with the corresponding fish taxon. Contrary to the Cenozoic, the knowledge on the otoliths of Mesozoic fish is still very scarce, and the Triassic record of in situ specimens is so far limited to a single taxon, the flying fish *Thoracopterus magnificus* from the Norian (Late Triassic) Zorzino Limestone (N Italy).

We discovered in situ otoliths in several specimens from Middle Triassic and early Carnian sites. In the recently discovered Pelsa/Vazzoler Lagerstätte (Dolomites, N Italy; late Ladinian), at least five actinopterygians have been found with otoliths in situ, namely *Habroichthys* (Peltopleuriformes), *Placopleurus* and *Marcopoloichthys* (Neopterygii), a perleidiform, and a palaeonisciform. Otoliths have also been found in a few *Prohalecites porroi* specimens (out of the more than 4000 recovered) from the Monte San Giorgio Kalkschiferzone (N Italy; late Ladinian), and at least in *Eosemionotus* and a halecomorph from the Raibl 'Rossi Level' (NE Italy; Ladinian/Carnian boundary). *Habroichthys* specimens from Slovenia and Xingyi (China) also present otoliths. From the Austrian early Carnian Polzberg Fauna, otoliths are recorded in *Nannolepis*, *Peltopleurus,* and *Thoracopterus* (Peltopleuriformes), in *Phaidrosoma* (Neopterygii) and in yet undescribed palaeonisciforms. Thus, otoliths are present in both primitive (Palaeonisciformes and 'Subholostei') and advanced Actinopterygii (Halecomorpha and basal Teleostei), although only a few specimens preserve them. We suppose that, owing to their mineralogical composition, they were typically dissolved in the acidic anoxic bottom environment that favoured the preservation of articulated fish skeletons. Due to the usually very small size of most fish specimens, micro-CT scanning has proven useful to reconstruct the 3D shape of the otoliths. With this study, we shed new light on the very scattered record of Triassic otoliths, allowing future micropaleontological research to better link the loose samples with the most likely producer.

Funding Sources PhD fellowship of Davide Conedera.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Postcranial osteology of the gorgonopsian *Cyonosaurus,* and the impacts of postcranial characters on the phylogeny of Gorgonopsia

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Gorgonopsia is a clade of hypercarnivorous saber-toothed therapsids that reigned as the dominant predators from the middle to late Permian. Research on gorgonopsians has seen a revival with a focus on systematic and anatomical analyses, including the development of a reliable phylogenetic framework. Despite these improvements, gorgonopsian research remains focused on cranial remains, in part due to the collection methods surrounding this taxonomic group, resulting in many gorgonopsian specimens that consist only of a skull. Postcranial anatomy has the potential to provide substantial ecomorphological data relating to specific gorgonopsian niches and behaviors. Even recent descriptions of gorgonopsian postcrania have focused on introducing anatomical data in the literature and have not yet contributed to our understanding of gorgonopsian phylogeny or ecology.

Here we describe the gorgonopsian specimen USNM PAL 412381 from the *Cistecephalus*

Zone of the Karoo Basin in South Africa, which represents one of the most anatomically complete and articulated fossils of the long-snouted gorgonopsian *Cyonosaurus*. Mechanical preparation revealed multiple articulated cervical vertebrae, a partial left humerus, and provided a clearer view of the ribs. The vertebral column consists of 43 vertebrae (cervical: 7; dorsal: 20; sacral: 3; caudal: 13) and, despite missing the posterior tip of the tail, presents a rare, nearly accurate vertebral count. The skeleton also features a partial skull, a partial pelvic girdle, a complete left forelimb and partial manus, two nearly complete hindlimbs, and a partial right pes. The smaller bauplan, gracile limb elements, and long neck present in this specimen are suggestive of a mesocarnivore with a potentially more specialized diet and contribute to the hypothesis of a unique gorgonopsian niche partitioning pattern based on morphological differentiations. Comparative anatomical analysis of known gorgonopsian postcrania provides the first opportunity to add postcranial-focused characters to the existing phylogeny. These include the presence of a foramen on the centrum of cervical vertebrae and the proportion of tibial length compared to the width of the head, among others. A specimen-based phylogenetic parsimony analysis, including the holotype (FMNH UC 1515) and other specimens in this study, recovers a novel phylogenetic position for *Cyonosaurus* as the sister-taxon to the clade containing *Arctognathus curvimola* and the clade Rubidgeinae.

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Functional diversity of sharks through time: past, present and future

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Modern sharks have played multiple key roles in marine ecosystems for over 250 million years, structuring food webs and facilitating energy flow across ocean habitats. Despite surviving past environmental disruptions and extinction events, sharks are now among the most threatened marine vertebrates, primarily due to overfishing. Understanding the ecological consequences of shark extinctions is urgent, as it offers predictive insights critical for conservation. These consequences are mediated through species' functional traits—such as body size, feeding mechanism, and diet—which determine their ecological roles. The diversity of these traits, or functional diversity, reflects the range of ecological functions in a community and how they respond to disturbances.

How has shark functional diversity changed through deep time, and how might it be altered under future anthropogenic pressures? To answer this question, we first tackled a major limitation of the shark fossil record: most extinct species are known only from isolated teeth. Through a literature review and two validation analyses, we identified seven dental measurements that reliably proxy key functional traits in living sharks, providing a framework to infer these traits from the fossil record. We then investigated changes in shark functional diversity over the Cenozoic based on a tooth dataset collected from museums and the literature. We found that sharks maintained relatively high levels of functional diversity for over 50 million years, followed by the loss of nearly half of this diversity in the last 10 million years. To assess how will shark functional diversity could change in the Anthropocene, we simulated species extinctions based on IUCN status and quantified changes in functional diversity while accounting for projected range shifts in response to climate change. Our results suggest that shark functional diversity could decline by 2100 at a rate comparable to levels last seen in deep time. While climate change alone drives a poleward shift in functional richness, overfishing amplifies species loss and eliminates many of these climate-driven gains.

Together, our findings reveal that current anthropogenic pressures are compounding an

already diminished functional legacy, threatening to leave future shark communities—and the ecosystems they support—ecologically impoverished relative to their evolutionary past.

Funding Sources PhD studentship from the Fisheries Society of the British Isles; international travel grant from the University of Florida

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Revisiting Cretaceous dinosaur diversity dynamics using deep learning

Cooper, Rebecca B.[1,2], Silvestro, Daniele[3,4]

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Whether or not the diversity of non-avian dinosaurs was already in decline prior to the end-Cretaceous asteroid impact remains unresolved. Phylogenetic modelling approaches have yielded inconclusive results, while estimates using fossil occurrences have been undermined by the relative scarcity of fossils or have been restricted to individual well sampled regions of the globe. Here we use a deep learning approach, DeepDive, designed to cope with depauperate and spatially heterogeneous data to estimate how non-avian dinosaur diversity changed over time and how many dinosaurs in total may have lived in the Cretaceous. We find no evidence of substantial or long-term decline before the K-Pg mass extinction in Theropoda or Sauropoda which were near the peak of their diversity shortly before the impact event. However, we do find evidence for substantial decline in the ornithischians in the 10 million years prior to the Cretaceous-Palaeogene boundary. We estimate that the total number of non-avian dinosaur taxa strongly exceeds sampled diversity for the Cretaceous. Our findings demonstrate that previous estimates might have overestimated the level of completeness of the dinosaur fossil record and that global diversity trends may differ from the regional dynamics of few best sampled areas.

Funding Sources Swiss National Science Foundation (PCEFP3_187012) to R.B.C. and ETH Zurich to D.S.

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Unique early-diverging pachycormid fish (Pachycormiformes) elucidates the origins and early evolutionary history of the group

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Pachycormiformes is a successful Mesozoic group of bony fishes known for high morphological, ecological, and trophic disparity. The group is already surprisingly diverse at first appearance in the Toarcian stage (Early Jurassic). Although generally optimized near the base of Teleosteomorpha, the sister-group relationships of Pachycormiformes are less well-resolved. Restudy of the earliest-diverging pachycormid lineages can potentially inform this debate, elucidating the order of appearance of synapomorphies to reconstruct the primitive state for the clade and better understand the abundant evolutionary convergence observed between the constituent subfamilies.

Euthynotus represents the earliest-diverging and most morphologically primitive pachycormid, represented by abundant Toarcian-aged specimens. Examination of referred materials reveals that this genus instead likely represents a grade of several distinct taxa. One of these, a unique genus and species with clear pachycormid synapomorphies including a toothed rostrodermethmoid contributing to the oral margin and falciform pectoral fin, additionally shows several primitive character states that have been lost in both *Euthynotus* and more derived pachycormids.

The new species shares some primitive characters with *Euthynotus*, including ring-like chordacentra and ossified interdorsal elements. However, it also shows additional primitive actinopterygian characters absent in all other pachycormids, such as enlarged peg-and-socket articulation of the scales, a feature secondarily reduced in *Euthynotus* and lost in most deeply nested pachycormids, and bifurcation of caudal lepidotrichia associated with joints. The new taxon retains the maxilla and premaxilla as independent ossifications, the primitive state in Actinopterygii, but differing from *Euthynotus* in which these elements are co-ossified. Phylogenetic analysis places the new taxon in an unresolved relationship with *Euthynotus* at the base of Pachycormiformes.

This new taxon is therefore of paramount significance to understand the early evolution of pachycormid fishes. Novel pachycormid characters arose in a progressive manner, with many postcranial innovations lagging behind the appearance of key characters in the skull. An improved understanding of the evolutionary history and homologies of these features will contribute to improved stability in the phylogenetic relationships of early teleosteomorphs and constrain the evolutionary origins of Pachycormiformes.

Funding Sources Funding: DFG grant MA 4693/7-1 awarded to E. E. Maxwell

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

An unusually complete specimen of *Bubo virginianus* (Aves, Strigiformes, Strigidae) from the Pleistocene of Kansas and the use of skeletal proportions in the identification of fossil owls

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The Strigiformes have an extensive and diverse fossil record, yet this record is largely composed of single skeletal elements. The fragmentary nature of Strigiformes remains and morphological similarity between closely related species makes the identification of species difficult and reliant on skeletal size ranges as well as the preservation of diagnostic elements. A relatively complete skeleton of a Pleistocene-aged *Bubo virginianus*, Fort Hays State University Sternberg Museum specimen VP-5117, was diagnosed using comparisons to morphology and size ranges of bones in extant Strigiformes species from the same geographic region as the fossil specimen.

Following the identification of the specimen, a novel method for the taxonomic diagnosis of Strigiformes was tested. Measurements were taken of the lengths and widths of appendicular elements in extant Strigiformes specimens, followed by the calculation of a Spearman rank correlation coefficient for each pair of measurements within each taxa. Proportions that were found to be significantly correlated ($P < 0.01$) within multiple extant taxa were plotted with linear regression models. FHSM VP-5117 fell within the expected proportions of *B. virginianus*, supporting its diagnosis and the use of appendicular element proportions in the identification of Strigiformes fossils. The distal and proximal width of the humerus in this specimen were narrower than expected for *B. virginianus*, which may be attributed to extensive weathering. This study demonstrates the difficulty and unreliability in using any single method of diagnosing Strigiformes specimens and supports the use of significantly correlated skeletal proportions in aiding the identification of otherwise undiagnostic elements in the Strigiformes.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Taxonomic and biostratigraphic revision of tyrannosaurids from the Belly River Group of Alberta, Canada: insights into evolutionary history of Albertosaurinae

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The Belly River Group (BRG) of Canada, is one of the best-sampled Campanian aged rock units, comprising three major dinosaur-bearing terrestrial rock formations: the basal Foremost Formation (FFm), the middle Oldman Formation (OFm), and the uppermost Dinosaur Park Formation (DPFm). The BRG hosts one of the most diverse assemblages of tyrannosaurids globally, with four species currently recognized from this interval: *Daspletosaurus horneri*, *Daspletosaurus torosus*, *Gorgosaurus libratus*, and *Thanatotheristes degrootorum*. However, our understanding of the stratigraphic ranges, cryptic taxonomic diversity, and phylogenetic relationships of these taxa remains ambiguous. Recent work on the relocation of several tyrannosaurid quarries and revised taxonomic interpretations has improved our understanding of these issues.

G. libratus was recovered as the dominant tyrannosaurid within the bounds of the DPFm. *Daspletosaurus* spp. specimens are also commonly found in the DPFm, with an unnamed taxon represented in the lower half and *D. horneri* in the uppermost rocks of the formation. A stratigraphic reassessment of several *Gorgosaurus* sp. quarries revealed that albertosaurine abundance extends back into the OFm. These albertosaurine specimens, contemporaneous with the tyrannosaurine *D. torosus*, exhibit a unique suite of cranial morphologies that indicate the presence of an unnamed albertosaurine species within the OFm.

Thanatotheristes remains the only positively identified tyrannosaurid from the FFm. Although previously considered a close relative of *Daspletosaurus*, review of the cranial morphology of the holotype, expanded by a well-preserved and previously undescribed cf. *Thanatotheristes* frontal, indicate morphological affinities with the Teratophoneini clade. This contrasts with earlier hypotheses that proposed teratophonein taxa were restricted to southern Laramidia, based on the geographical distribution of *Lythronax* and *Teratophoneus*, and instead supports widespread occurrences throughout Laramidia in the early Campanian. An unweighted parsimony analysis, that included new data on *Thanatotheristes* and the OFm albertosaurine, recovered a single most parsimonious tree where *Thanatotheristes* placed within Teratophoneini and formed a major branch of the broader Albertosaurinae. Although the findings of this study provide an alternative hypothesis regarding albertosaurine origins, they also suggest a degree of uncertainty at the base of tyrannosauridae.

Funding Sources Dinosaur Research Institute Student Project Grant, Dinosaur Research Institute Rene Vandervelde Travel Grant.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

The osteopathology of extant crocodiles as a window into the paleopathology of phytosaurs and other extinct archosauriforms

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The Middle to Late Triassic phytosaurs provide an excellent opportunity for large-scale paleopathological analysis given their abundant and well-preserved fossil record. However, diagnosing ancient diseases in early archosaurs and archosauriforms remains challenging due to the limited comparative data on bone physiology and diseases in extant reptiles. The remarkable

ecomorphological convergence of phytosaurs with extant crocodilians makes living crocodilians an ideal extant analog for comparative studies. Here, we present the results of a comprehensive epidemiological survey of skeletal pathologies in extant crocodilians. Our dataset includes first-hand observations of 927 individuals, comprising 858 skulls and 19,849 postcranial bones. Of these, 418 individuals (45%) exhibited a total of 1,969 osseous lesions. Traumatic injuries were the most common (43.9%), followed by inflammatory responses (27.2%), degenerative joint disorders (11.5%), and infectious diseases (5%). Developmental and congenital anomalies (4.4%), pathologies of undetermined origin (7.4%), and metabolic/nutritional disorders (0.6%) were less frequently observed. Further analyses revealed that the frequency of traumatic injuries increases with adult body size (i.e., larger species), ontogenetic stages, and within the skull region. Our results suggest a behavioral component in larger and/or more aggressive species such as *Crocodylus porosus,* which may experience severe injuries during intraspecific conflict or prey capture. Furthermore, increasing prey sizes during growth likely contributes to bone traumatic injuries. We also show that the frequencies of degenerative joint disorders and inflammatory lesions increase during ontogeny, potentially reflecting the rise in traumatic injuries as well as age-related physiological changes.

These findings provide a robust comparative framework for interpreting paleopathologies in our ongoing research on phytosaur skeletal remains, from which we have already identified 270 pathological elements. These comparative studies will also aid as a valuable reference for future paleopathological investigations across archosauriforms, including non-avian dinosaurs.

Funding Sources This project is supported by the German Research Foundation (DFG), reference number WI 3144/5-1.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

The first crocodylian from Qatar: a new species of tomistomine from the early Miocene (Aquitanian and Burdigalian) Dam Formation

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Global fossil occurrences indicate a long and speciose history for Tomistominae, a clade of crocodylians currently represented by one species, *Tomistoma schlegelii*, restricted to Southeast Asia. While the earliest tomistomine species are from the Eocene, by the Miocene the group reached an apogee of diversity. Yet geographically and temporally proximal species are not one another's closest relatives in the phylogenetic analyses. Here we describe a new species of tomistomine represented by a three-dimensionally preserved cranium from the Miocene Dam Formation of Qatar. Paleoenvironmental reconstruction of the type locality suggests a mixed brackish-saltwater estuarine setting proximal to the coastline with associated ichnofossils in the subtidal to lower intertidal or shoreface environments. The new species, dated to the boundary of the Aquitanian and Burdigalian, represents the first known tomistomine from Arabia and the first crocodylian from Qatar. The 81 cm cranium preserves a relatively long and wide snout, bulbous premaxillae and a unique suite of diagnostic characters differentiating it from all other crocodylians. Phylogenetic analyses recover the new taxon as a derived tomistomine alongside contemporaneous *Tomistoma gaudense* and *Gavialosuchus eggenburgensis* from the broader Mediterranean region. This early Miocene clade is defined on the character basis of possessing posterior projections of the maxillae between the lacrimal and nasal, anteroposteriorly elongate supratemporal fenestrae, and the presence of a prominent ovoid

indentations on the dorsal surface of the posterolateral squamosal. Phylogenetic analyses of Tomistominae recover a clade of the stratigraphically earliest members, which arose in Europe and North Africa during the Eocene, at the base of the group. A stratigraphically younger clade of African species is recovered crownward to this group and suggests a proliferation of African tomistomines during the Miocene and unsampled phylogenetic diversity within this clade. That these relatively basal North and East African Miocene species are not closely related to the new, derived taxon indicates a complicated history of dispersal and European faunal influence in Arabia or may reveal bias in character or taxon sampling. Future directions are indicated by this study and common to many modern analyses, phylogenetic hypotheses presented here recover a polyphyletic *Tomistoma* and suggests revision of the genus is necessary.

Funding Sources NYITCOM Catalyst Grant to APC

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Exploring the aerodynamic impact of the head crest in *Tupuxuara leonardii* (Pterosauria)

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Pterosaurs were the first vertebrates to engage in active flight and some of them had exhibit cranial crests. Here we investigated the influence of the cranial crest on the aerodynamics of the Brazilian pterosaur *Tupuxuara leonardii*. Using IMCF 1052 images for photogrammetry, a 3D skull reconstruction was performed, and three geometries were modeled: without a crest (TMIN), based on the preserved fossil (TMED), and with the maximum estimated crest size (TMAX). These models were constructed to allow a comparative analysis. Computational Fluid Dynamics (CFD) simulations were performed under steady-state conditions for a constant velocity of 16.5 m/s, the cranial angle ranging from 0°–45°. The SST turbulence model was employed. Details of pressure and velocity fields, as well as the determination of aerodynamic forces addressed through dimensionless coefficients for drag, lift, and lateral forces were evaluated from the numerical results. Computational aerodynamic analyses of *T. leonardii* skulls indicate that crest morphology significantly affects flight performance. At low angles of attack (0°–10°), drag increases gradually due to organized airflow, whereas angles above 20° lead to a sharp rise in drag caused by flow detachment. Lift decreases initially, suggesting the skull behaves unlike a typical airfoil; a stall occurs near 20°, with partial recovery linked to vortex-induced lift. Peak yaw forces at moderate angles imply the crest could assist in directional control. The largest crest (TMAX) generated the greatest drag and yaw but the least lift, while the smallest (TMIN) maintained higher lift and more stable flow. These findings support a functional role for the crest as a maneuvering structure during flight. Results showed that the crest indeed has an aerodynamic influence and may exert a biomechanical function similar to that of a directional rudder during flight. As a huge structure located at the front of the pterosaur, it could induce initial instability, which would be advantageous for adjusting flight path. However, a well-developed control mechanism would be necessary to assist the animal in its flight.

Funding Sources CAPES, grant #88887.6668494/2022-00 (to GS), FAPESP, grant #2022/03099-7 and #2025/05605- (to FC and RP), and CNPq, grant #404352/2023-5 and #406902/2022-4 (to FC).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Morphometrics and functional implications of tusk-like teeth in fossil waipatiids: peculiar

cranial and dental evolution in early odontocetes

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Fossil waipatiids from the Oligocene and early Miocene of New Zealand represent a morphologically diverse group of early odontocetes, many of which exhibit distinctive procumbent, tusk-like anterior teeth. Building on recent work, the scope was expanded to a broader comparative analysis of cranial and dental traits using geometric morphometrics in addition to the measurements studied previously.

Landmark-based morphometric methods and principal component analysis (PCA) are applied to a dataset of fossil and extant odontocetes, quantifying variation in rostral proportions, premaxillary extension, and crown morphology. Previous results revealed that waipatiids occupy a distinct morphospace defined by elongated, dorsoventrally compressed rostra and highly procumbent, slender anterior teeth. Further work on this is done to replicate and further investigate the interrelations of dental shape and hypothesized functions. Significant correlations between crown angle, crown shape ratio, and premaxillary length suggest a strong integration of cranial and dental traits, likely reflecting functional or behavioural specializations.

This expanded analysis further supports the hypothesis that tusk-like teeth in waipatiids represent a convergent morphological adaptation, potentially linked to prey capture or display. The use of geometric morphometrics provides a robust framework for further understanding tusk-like teeth and true tusks and offers new tools for diagnosing waipatiid-grade odontocetes. Our findings provide new insights into the evolution of feeding strategies and sexual dimorphism in early odontocetes and underscore the importance of New Zealand's fossil record in understanding cetacean cranial evolution.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Meswa Bridge (~23 Ma) is now Tonde Bridge (21.4 Ma)

Cote, Susanne[1], McNulty, Kieran P.[4], Peppe, Daniel J.[2], Deino, Alan L.[3], Kioko, Mitchelle W.[6], Ochieng, Cliff[6], Jenkins, Kirsten E.[8], Hall, Abigail S.[4], Head, Jason[5], Siembo, Joshua[7]

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The early Miocene site of Meswa Bridge, Kenya is associated with the extinct Tinderet Volcano. Fieldwork in 1978/1979 recovered vertebrate fossils from a channel, including abundant anthracotheres, proboscideans, a large hyaenodont, limited small mammals, and the ape *Proconsul meswae*. With an often-inferred age of ~22–23 Ma, Meswa Bridge has long been considered the oldest Miocene site in the region, and *P. meswae* therefore the oldest known hominoid.

As part of a larger paleontological project at Tinderet, we re-located the site and renewed excavations. The site is next to the Tonde River, not the Meswa River. Community consultations determined that the most appropriate name for the site is Tonde Bridge, a recommendation that has been adopted by the National Museums of Kenya.

We excavated fossils from three channel fills, one of which is the continuation of the original channel, described the stratigraphy, and dated the site using $^{40}Ar/^{39}Ar$ geochronology. Significant fossil finds included three isolated teeth of *Proconsul meswae*, a modest number

but doubling the number of adult teeth of this species. We recovered many more anthracothere fossils that clarify the degree of sexual dimorphism found in the Tonde anthracothere. A new canine of *Simbakubwa* (Hyaenodonta) likely belongs to the holotype and was found in the same channel. The most impressive material is a set of associated upper and lower teeth of the deinothere *Prodeinotherium*, a new taxon for the site.

An ash located within the fossil-bearing strata produced a $^{40}Ar/^{39}Ar$ age of 21.4 Ma, substantially younger than previous age estimates for Tonde Bridge. This result, while surprising, is congruent with the mammalian fauna. It remains the oldest of the Tinderet localities, but is similar in age to Moroto, Uganda (21 Ma) and younger than some of the Nakwai localities in the Turkana Basin.

The mammalian assemblage is small and clearly size-biased. Yet, it has important implications for faunal turnover in eastern Africa during the earliest Miocene. The assemblage is dominated by afrotherians rather than laurasiatherians. The only artiodactyl sampled is the anthracothere and perissodactyls are absent. Rodents are present, but all represent groups with clear Oligocene African antecedents. Ultimately, the new age for Tonde Bridge contributes to the growing evidence that the shift from afrothere-dominated to laurasiatherian-dominated faunas took place well after the Oligocene–Miocene boundary.

Funding Sources The Leakey Foundation, National Science Foundation, and Natural Sciences and Engineering Research Council of Canada. Permits from NACOSTI and NMK, Kenyan Government.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Stratigraphy of marine reptile horizons in the Anisian Fossil Hill Member (Middle Triassic, Nevada, USA) reveals trends in Panthalassic ichthyosaur diversity

Counts, Nicholas T.[1], Blouet, Jean-Philippe[2], Klein, Nicole[3], Li, Qiang[4], Li, Jun[4], Sander, P. Martin[5]

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The Fossil Hill Member is a marine rock unit dating to the middle and late Anisian (Middle Triassic) located in Central Nevada, USA. The ichthyosaur-dominated assemblage preserved in the Fossil Hill Member is notable for its diversity, with eight named ichthyosaur species and three further species awaiting description. This ichthyosaur biota is especially significant for its large morphological and size disparity, with small-bodied mixosaurs (1–2 m) co-occurring with the 17-meter *Cymbospondylus youngorum*. This species represents the earliest giant marine vertebrate and the largest known animal to that point in time. The macrophagous predatory ichthyosaur *Thalattoarchon*, the first marine tetrapod to occupy this niche, was of similar body size.

The dark muddy limestones and shales of the Fossil Hill Member indicate an anoxic, deep-water environment open to the global Panthalassic Ocean. The base of the section in the Augusta Mountains is ca. 244 Ma old, and the top ca. 242 Ma. Given its close chronological proximity to the P–Tr extinctions at 252 Ma, the Fossil Hill fauna offers crucial insight into the biotic recovery, being the only early Middle Triassic Lagerstätte in Panthalassa. A census based on field and collection records from >3 decades of field work includes 91 ichthyosaur and four other reptile skeletons from the Fossil Hill Member's 250-meter outcrop, but their distribution in the section has remained unclear.

In a composite stratigraphic section, we found six stratigraphic horizons producing skeletons and plotted their abundance and size

distribution. Broad size categories (total length: small <2.5 m; medium, 2.5–5 m; large, 5–15 m; giant: >15 m) assigned to each specimen reveal a clear trend. Moving upsection, small-bodied ichthyosaurs become more common while larger ichthyosaur occurrence decreases, although it is unclear if these trends have an evolutionary or ecological background. The dominance of large ichthyosaurs in the lowest horizons of the Fossil Hill Member reflects the ongoing recovery of pelagic marine communities in Panthalassa. Full recovery is documented by the third horizon, yielding the giant *Thalattoarchon* and *C. youngorum*, nine million years into the Triassic. The trends we have identified will aid in focusing further field efforts in the Augusta Mountains and other Fossil Hill Member outcrops. Furthermore, studying these earliest ocean-going tetrapods informs on how life in the World's Ocean recovered from catastrophic collapse.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Stable isotopes reveal dynamics of dietary change amongst late Cenozoic Australian herbivores

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During the late Cenozoic there was an increase in the global biomass of plants utilising the C_4 photosynthetic pathway. The ability to capitalise early on C_4 resources may have been an important factor in the success of grazing cursorial mammals such as bovids, equids, and cervids. In Australia, the mammalian herbivore niche is dominated by marsupials, especially macropodids—the only large hopping mammals, and the most diverse and abundant marsupial herbivores. However, little is known about how marsupial herbivores exploited C_4 resources during the late Cenozoic. We analysed stable carbon and oxygen isotopic ratios from 102 herbivore taxa and >100 Australian fossil assemblages extending from the late Oligocene until the Holocene. All pre-Pliocene assemblages were dominated by herbivores with C_3 diets, with evidence for mixed C_3/C_4 herbivore assemblages only emerging during the mid-Pliocene. Over the last 15 million years, all major marsupial herbivore groups (diprotodontoids, macropodids, and vombatids) show trends toward more enriched $\delta^{13}C$ and $\delta^{18}O$ values. Vombatids consistently show the earliest shifts towards more enriched $\delta^{13}C$ values, including evidence for C_4 diets in the mid-Pliocene Bluff Downs Local Fauna. Compared with hindgut fermenting vombatids and diprotodontoids, foregut fermenting macropodids likely consumed mainly C_3 or mixed C_3/C_4 diets until the Pleistocene. Overall, these results suggest an important role for dietary flexibility, as well as locomotory and physiological traits, in explaining the relative success of herbivore lineages during the C_4 revolution.

Funding Sources Australian Research Council DP210100508.

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Novel insights from modern birds inform non-destructive criteria for identifying sex-specific bone tissue in fossil avemetatarsalians

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Medullary bone is an ephemeral bone tissue found inside the bone cavities of female birds which acts as a store of calcium for egg laying. As a sex-specific bone tissue, the potential use of medullary bone for determining female fossil birds and non-avian dinosaurs has been the source of considerable research interest. Much

of the controversy and uncertainty which has mired the identification of medullary bone in fossil specimens is rooted in the poor state of knowledge of this tissue in modern birds. To confidently identify this sex-specific tissue in fossil avemetatarsalians, we must first establish a more thorough baseline understanding of medullary bone in modern birds.

My ongoing work is establishing a framework for describing and categorising the structure of this enigmatic tissue type in modern birds using non-destructive techniques. Here, I use high-resolution computed tomography (μCT) to image the medullary cavity of modern bird bones with the aim to describe and categorize the three-dimensional structure of medullary bone. I identify both qualitative and quantitative features, such as connectivity density and osteocyte lacunar orientation, which are found to be characteristic of medullary bone. Furthermore, these features allow it to be distinguished from avian osteopetrosis, a commonly-referenced pathology producing lesions which superficially resemble medullary bone. Investigation of medullary bone in a diverse range of modern bird specimens is helping us to establish the link between medullary bone structure and factors such as phylogeny, body size and flight capability.

By describing and categorising the variable three-dimensional structure of medullary bone in modern birds, my analyses can be added to the existing framework of osteohistological and chemical techniques used to identify fossil medullary bone. The novel, non-destructive criteria for identifying medullary bone established in this work will allow for an increased sample rate in fossil specimens, raising the chance of specimens containing this ephemeral bone tissue being discovered. Ultimately, by establishing a more thorough understanding of this enigmatic, sex-specific bone tissue in modern birds, this work will help clarify instances of medullary bone in the fossil record and thus allow the sex of fossil avemetarsalians to be more confidently determined.

Funding Sources Natural Environment Research Council [grant number NE/S00710/1] and Paleontological Society Student Research Grant (Steven M. Stanley Award).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Limited-angle computed tomography (LACT): a simple approach to improve scan quality for plate-like fossils

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Fossils preserved on high aspect ratio slabs of matrix (‘plate-like’ fossils with one short axis and two longer axes) include some of the most complete and scientifically significant vertebrate fossils ever discovered. Despite their flattened preservation, there is still much to be gained from the three-dimensional imaging of these fossils, such as uncovering fossil surfaces hidden by the matrix or as a non-destructive alternative to histology to image internal structures.

These plate-like fossils are problematic to scan using conventional lab-based X-ray computed tomography (CT). The issues with producing quality scans of plate-like fossils are twofold: 1) poor penetration of X-rays through the long, flat axis of the matrix slab leads to photon extinction imaging artefacts, and 2) resolution is limited by the distance required for the specimen to complete a full rotation, avoiding collision with the X-ray source. One potential solution to these issues, which has yet to be thoroughly explored, is limited-angle computed tomography (LACT), a technique that involves rotating the specimen through an angle less than the full 360° typically

used in lab-based CT. By reducing the angle of rotation, the projections parallel to the long axis of the specimen can be removed and it is also possible to reduce the source-object distance, increasing the resulting resolution. The key advantages of LACT over other potential solutions such as computed laminography are the simplicity of the set-up and image reconstruction, which involves little to no alteration from conventional CT.

Here, we demonstrate limited-angle scanning on a fossil specimen for the first time, highlighting the effects of adjusting angular sampling on scan quality. Although small angles of rotation result in significant imaging artefacts using conventional reconstruction methods (e.g., filter-back projection), we find these artefacts are minimised at angles of rotation greater than 180°. The relative benefits of LACT are dependent on the purpose of the scan and the shape, size, and material of the specimen, with potential advantages including increased resolution and reduced photon extinction artefacts. We outline scenarios in which palaeontologists should consider using LACT over conventional CT to scan plate-like fossils, taking advantage of a relatively simple alteration to the scanning process to improve imaging results for these problematic specimens.

Funding Sources Funded by the Natural Environment Research Council [grant number NE/S00710/1] and National Research Facility for Lab X-ray CT (NXCT) through EPSRC grant EP/T02593X/1.

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

A diverse vertebrate assemblage from the late Oligocene of central Australia and its biochronological implications

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The familial and ordinal origins of Australian marsupials are obscured by a gap in the fossil record from the early Eocene to the late Oligocene (ca. 55–25 Ma). A 2006 discovery of a new terrestrial vertebrate site (near Pwerte Marnte Marnte in the Northern Territory) provided hints that it may be the oldest-known Oligocene assemblage in Australia, and thus potentially able to shed light on the ancestry of Australia's iconic modern marsupials. This preliminary assessment was, however, based on a small sample of specimens, with few taxa recognized and none named. Here, using an additional 600 specimens, I assess the diversity and relative age of the Pwerte Marnte Marnte assemblage, recognizing at least 35 vertebrate taxa (4 reptiles, 10 birds, and 21 mammals). Most of the marsupial taxa are new at the genus or species level, including early relatives of koalas, wombats, possums, kangaroos, marsupial moles, and thylacinids, as well as numerous archaic forms with no living descendants. Radiometric and palynological dating of the assemblage were unsuccessful, leaving vertebrate biochronological methods to constrain its relative age. The Australian Land Mammal Ages are currently defined by species level composition. For consistency with the definition of land mammal ages used in other continents, the Australian assemblages of nominally late-Oligocene-to-Late-Miocene-age were biochronologically categorised at the genus level. Five land mammal ages are recognised: the Etadunnan; Wipajirian; Camfieldian 1; Camfieldian 2; and Waitean. The Pwerte Marnte Marnte assemblage is resolved within the Etadunnan, together with five nominally late-Oligocene-aged local faunas from South Australia. Between the Etadunnan and succeeding Wipajirian there is near complete genus-level turnover in nonarboreal herbivores (vombatomorphians and macropodoids). This is accentuated by the substantial increase in marsupial diversity afforded by the Pwerte Marnte Marnte assemblage. The magnitude of this Etadunnan–Wipajirian turnover is discordant with its short duration (within the interval 24.7–24.5 Ma) under the generally accepted temporal framework (a hypothesised calibration of magnetostratigraphic data). It is suggested that nominally late-Oligocene-aged

Wipajirian assemblages may sit closer to the Oligocene–Miocene boundary or within the earliest Miocene. Furthermore, the faunal turnover at the Etadunnan–Wipajirian transition was likely caused by the onset of a drier climate.

Funding Sources This research was funded by the Australian Government Research Training Program Scholarship.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Stable isotope geochemistry illustrates niche partitioning in the Bayanshiree Formation of Mongolia

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Stable isotope geochemistry has been shown to indicate niche partitioning and ecological guilds in the Late Cretaceous of North America but is underutilized in Asian systems. The mid-Cretaceous Bayanshiree Formation of Mongolia represents fluvial and lacustrine basins post Cretaceous Thermal Maximum (KTM), providing the opportunity to study the niche partitioning within an Asian lacustrine system after the large climatic event. The Bayanshiree Formation preserves a taxonomically diverse vertebrate assemblage, with currently described multiple co-occurring species of mammals, crocodyliforms, therizinosaurs, ankylosaurs, and iguanodontians. Morphological differences in dentition, body size, and inferred feeding strategies among these taxa suggest potential ecological niche partitioning. We use $\delta^{13}C$ and $\delta^{18}O$ stable isotope compositions from enamel and ganoine of microvertebrate material to examine niche partitioning in the Bayanshiree Formation at the Shangri-La Site in the Eastern Gobi Basin. $\delta^{13}C$ shows fractionation between predators and prey and can indicate if the plants being consumed are from an open or closed canopy system, while $\delta^{18}O$ indicates average temperature at the time of tooth formation. When paired, $\delta^{13}C$ and $\delta^{18}O$ isotopes map ecological guilds and indicate niche partitioning. Taxa in this study include theropod, sauropod, and iguanodontian dinosaurs, pterosaurs, and crocodyliforms. Five theropod tooth morphotypes are investigated to compare niche partitioning between 'morphospecies.' Niche occupation is compared between sauropods and iguanodontians to test for subhabitat specialization. These data contribute to paleoecological understanding of post-KTM Asian inland lacustrine basins by showing partitioning between taxa and provides the first geochemical evidence of trophic networks in the Upper Cretaceous Bayanshiree Formation of Mongolia.

Funding Sources National Geographic Society award NGS-100601R-23 to LEZ, TC, and RTT.

Paleontological Society student award and Jurassic Foundation grant to EGC.

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

Paleobiogeography patterns of amphibians and reptiles from Rancho La Brea

Cruz, J. Alberto, Lindsey, Emily

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Amphibians and reptiles (collectively, herpetofauna) have great potential to inform paleoecological research, as they can serve as the basis for paleoenvironmental and paleoclimatic reconstructions, studies of adaptational changes in functional traits, and paleobiogeographic studies of climate induced range shifts. One of the best sites for

paleoecological studies of herpetofauna is the late Pleistocene Rancho La Brea (RLB) locality in Los Angeles, California, USA, owing to naturally-occurring seeps of viscous asphalt that have trapped and exquisitely preserved hundreds of species over the past 60,000 years. This site contains thousands of fossil remains of amphibians and reptiles. However, these groups have been poorly studied, with only seven publications on the fauna in the past 107 years. In this study, we analyzed the RLB fossil collections from the La Brea Tar Pits and the University of California Museum of Paleontology to develop a complete herpetofaunal taxonomic list for this site. These studies added two anurans, three turtles, two lizards and four snakes to the known fossil herpetofauna from RLB. We found a new extinct species of spadefoot toad. We identified a Mexican burrowing toad (Rhinophrynidae) and arboreal alligator lizard (*Abronia*), both of which are currently present in Mexico but not in the United States. Species that are not currently present in Los Angeles basin today, as well as the desert tortoise (*Gopherus agassizi*), mud turtle (*Kinosternon*), tree lizard (*Urosaurus*), shovel-nosed snake (*Chionactis*), leaf-nosed snake (*Phyllorhynchus*), and patch-nosed snake (*Salvadora*), indicate a biogeographic relationship between southwestern California and the Mojave-Sonoran Desert regions. Finally, the presence of the Northwestern pond turtle (*Actinemys marmorata*) indicates a relationship with northern California. We used radiocarbon dating and ecological niche models to infer the paleodistribution of these species during the latest Pleistocene and Holocene to reconstruct environmental changes during the late Quaternary. These data allow us to clarify the timing of herpetofaunal range shifts and their relationship with climatic and anthropogenic landscape changes across the past 60,000 years in the Los Angeles Basin.

Funding Sources Thanks to NSF grant 2146505 to Emily L. Lindsey, which supported this research.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New vertebrate assemblage from the Upper Cretaceous (Maastrichtian) El Rayo Formation of Puerto Rico

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The Mesozoic fossil record of the Caribbean region is notably sparse and remains relatively understudied. Various factors (climate, dense vegetation cover, limited rock exposures) have contributed to the challenges in accessing and systematically documenting fossil material. Yet, the few documented fossils largely consist of marine invertebrates (e.g., rudistid bivalves, crustaceans, gastropods, ammonites). To date, Upper Cretaceous vertebrate fossils have not yet been described from Puerto Rico, primarily due to the absence of diagnostic material or fragmentary preservation. However, recent discoveries are beginning to shed light on the composition and diversity of Upper Cretaceous vertebrate faunas in the region. Here, we report a new fossil assemblage from the Upper Cretaceous (Maastrichtian; ~ 68 Ma) El Rayo Formation in southwestern PR. Recovered taxa includes batoids, selachians, and osteichthyans (e.g., pycnodonts). Most elasmobranch material is represented by isolated teeth, although denticles and a well-preserved myliobatiform spine were also recovered, the latter constituting the first record of a Cretaceous myliobatiform from the Caribbean. The batoid teeth represent male and female morphotypes of *Dasyatis* sp., while bony fishes are represented by isolated teeth and fragmentary cranial and postcranial elements. The assemblage also bears the first record of testudines, represented by shell fragments. Perhaps more intriguingly, an

incompletely preserved appendicular element, tentatively assigned to Archosauria, was also recovered. Although the specimen is too fragmentary for a more precise taxonomic identification, the preserved morphology allows us to rule out other contemporaneous vertebrates (e.g., Osteichthyes, Plesiosauria, Mosasauria, Chelonia). If confirmed, this would constitute the first reported occurrence of an archosaur from PR and one of the few terrestrial vertebrate occurrences from the Upper Cretaceous Caribbean. While the taxonomic affinity of the specimen remains uncertain, its presence offers new insight into the potential diversity and biogeographic distribution of Upper Cretaceous tetrapods in the region. Given the bioclast-rich depositional facies, the faunal assemblage is interpreted to represent a nearshore lagoonal environment. Beyond expanding the known fossil record of PR, it also informs our understanding of the role of the Caribbean as a dynamic region of faunal interchange.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Temporal muscle orientation correlates with tooth reduction and loss in paravian dinosaurs

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Paravians evolved from dentigerous theropod dinosaurs with tall skulls and relatively vertically-oriented temporal muscles adapted for orthal biting and torsional loading. Along the line to extant birds, temporal muscles oriented more laterally, caudally, and diagonally, changing the system to more shear and propalinal loading environments. This often co-occurred with changes in dentition, with the typical ziphodont condition frequently giving way to the reduction and eventual loss of the teeth. However, the relationship between skull shape, muscle orientations, and tooth morphology has yet to be studied in the clade. Here we test for the correlation between temporal muscle orientation and dental condition across Paraves. We collected data from photographs of Mesozoic paravian skulls from the lateral perspective from both the literature and fossil collections (n = 58). To measure temporal muscle orientations in the parasagittal plane, landmarks were placed on the quadratoarticular joint (jaw joint), the coronoid process of the mandible (muscle insertion), and the supratemporal fossa (muscle origin). The percentage of the jaw with teeth and the average tooth height (if present) were measured as covariates. Members of Ornithuromorpha with very tiny teeth (i.e., *Changzuiornis* and *Iteravis*) were included, but teeth were not measured. Almost all paravians with measurable teeth had temporal muscle angles >45°, with a variety of tooth sizes and distributions. Dromaeosauridae had the largest angles (average ~60°) and tallest teeth. Specimens with more horizontal temporal muscles (<45°) were mostly edentulous, and only three had measurable teeth (*Longipteryx* and two troodontids). Tiny-toothed Ornithuromorpha had orientations 44–46°. Overall, toothed paravians had a significantly greater average muscle orientation (52.6°) than edentulous/tiny-toothed taxa (43.6°). These data suggested that a temporal muscle angle ≤45° may impart loads impractical for ‘full sized’ tooth function. Avialan teeth that were strongly recurved or stout, as well as the unique dental condition of troodontids, may have evolved to limit these deleterious effects. Reversions to more vertical orientations occurred later in robust-beaked taxa such as the Confuciusornithidae and many modern birds (parrots, hornbills). Future studies will test for relationships between jaw muscle orientations and dentition in other edentulous lineages such as such as ornithomimosaurs, oviraptorsaurs, and pterosaurs.

Funding Sources The Daemen University Student-Faculty Interdisciplinary Research Think Tank

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Evaluating the relationship between ungulate herbivore muzzle width and $\delta^{13}C$ variability among modern species: implications for interpreting stable isotope data from the fossil record

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Characterizing the paleoecology of extinct herbivorous mammals has long been a valuable approach to interpreting evolutionary and environmental changes throughout the Cenozoic Era. The analysis of carbon stable isotopes ($\delta^{13}C$) from tooth enamel is a common paleoecological proxy, but there are complications in the interpretation of these data. In the past, ecological and morphological traits have been used to contextualize isotopic ecologies such as the difference in $\delta^{13}C$ enamel values between grazers and browsers. Understanding how these isotopic differences relate to an animal's morphological and ecological characteristics has been integral for clarifying isotopic records of climate and environment from the geologic past. An understudied morphologic trait that could drive isotopic variability is muzzle width. Hypothetically, an animal with a wider muzzle is less capable of selectivity in the plant material it intakes, leading to increased consumption of non-desired plants and thus a more variable $\delta^{13}C$ signal among individuals of the same species. In this study, we assembled a dataset of more than 2000 published modern ungulate $\delta^{13}C$ enamel measurements for 107 species across five continents to analyze the isotopic breadth of a species as a function of its muzzle width. Each species' muzzle width and other morphological and ecological traits (e.g., body mass, water dependence, hypsodonty index) were compared to the standard deviation of $\delta^{13}C$ for that species. When controlling for sample size, an apparent correlation exists between body mass, muzzle width, and $\delta^{13}C$ standard deviation. When subdividing the dataset by continent, species from North America show the strongest correlation for these variables. Despite having the widest muzzle among sampled species, *Hippopotamus amphibius* appears to be a major outlier among African herbivores, with a narrow standard deviation relative to its large body mass and wide muzzle, reflecting more its specialized ecology as a semiaquatic grazer. Overall, although there is evidence to suggest some correlation between the variation of $\delta^{13}C$ and muzzle width, body mass appears to be a major predictor of $\delta^{13}C$ variance, suggesting muzzle width is one facet of body size, which plays a greater role in determining plant selectivity through multiple mechanisms. This suggests that in the fossil record, both body size and muzzle width influence $\delta^{13}C$ variance independently of other ecological variables.

Funding Sources Undergraduate Scholar Program of the Wilkes Center for Climate Science & Policy, University of Utah.

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

The teleost fish fauna of Elam (Eocene of Iran): an exceptional glimpse into Paleogene deep-sea ecosystems

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The deep ocean is the largest ecosystem on Earth, yet the origins of its biodiversity remain poorly known and time-constrained due to a scarce and inadequately described fossil record. In this work, we revisit a candidate deep-sea fish fauna from the middle-late Eocene of Elam, Iran. The Elam fauna was described from material collected in the early 20th century,

hosted at the MNHN in Paris. Despite a large quantity of exceptionally preserved material, the fauna has barely been studied ever since. We revise the whole fauna, verifying the taxonomic attribution of each taxon. Several spiny-rayed teleost (Acanthomorpha) taxa were singled out as potential targets for taxonomic revision, due to their current *incertae sedis* status.

Among those, *Berycomorus* is the oldest confirmed representative of Berycidae (alfonsinos). *Aluvarus*, originally described as a louvar (Luvaridae), is an enigmatic taxon with possible affinities to Zeiformes (dories). The abundant *Cottopsis* is reinterpreted as a probable Howellidae (oceanic basslets), a poorly known extant family exclusive to the deep sea. Finally, two enigmatic taxa represent probable larval stages due to their diminutive sizes. *Pseudholocentrum*, described as a Holocentridae (squirrelfishes) instead, shows clear affinities with larval Scorpaenidae (scorpionfishes). Finally, *Camilleacanthus* is reinterpreted as a larval butterflyfish (Chaetodontidae). It becomes the oldest known representative of this family, which is abundant in modern reef settings but conspicuously absent from Paleogene reef faunas.

In addition to these newly reinterpreted taxa, the Elam fauna also preserves deep-sea eels (Anguilliformes), hatchetfishes and bristlemouths (Stomiiformes), crestfishes (Lampriformes), brotulas (Ophidiiformes), and snake mackerels (Scombriformes). The most abundant taxon by far is *Bregmaceros* (Gadiformes), whose extant species are associated with deep-sea anoxic zones.

The faunal composition thus clearly reflects affinities with modern pelagic and deep-sea faunas, confirms its historical assessment as a deep-sea teleost fauna with a few epipelagic components. This is reinforced by the exceptional preservation of bioluminescent organs in several specimens.

The preservation of the material, its abundance and its taxon diversity, establish the Elam fauna as an invaluable glimpse into the deep ocean in the Paleogene, a key time interval in the establishment of modern oceanic ecosystems.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A plesiosaur deathfall from the Middle Jurassic of the Isle of Skye, Scotland

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Plesiosaurs were a group of marine reptiles with global distribution throughout the Mesozoic. They were first described in the 1800s from specimens found in England by Mary Anning and contemporaries, and today several localities in the United Kingdom, such as the Blue Lias Formation and the Oxford Clay, produce near complete and articulated plesiosaur fossils. Scottish plesiosaurs, however, are known only from isolated and fragmentary material. A boulder collected from the Middle Jurassic Bearreraig Sandstone, a nearshore marine unit, on the Isle of Skye contains among the largest set of associated plesiosaur bones yet to be found in Scotland. A combination of physical preparation and high-resolution computed tomography scanning—reveals the presence of numerous skeletal elements including vertebral centra, neural arches, ribs, caudal chevrons, a phalanx, an ilium, and a fragmented bone that is potentially an ischium. These remains indicate a fairly large-bodied plesiosaur, with early comparisons indicating a size commensurate with *Muraenosaurus leedsi*. The identification of this plesiosaur adds to the more common records of ichthyosaurs in the Bearreraig Sandstone, and recently described thalattosuchian fossils from a similar formation on Skye, demonstrating that these marine reptile faunas were generally similar to those known from England. Intriguingly, tooth marks on several ribs, worm burrows on the surfaces of several skeletal elements, and associated invertebrates provide evidence that the carcass

was extensively scavenged after it fell to the seafloor in the Jurassic. These characteristics are shared with other marine reptile deathfall assemblages and is most comparable to other specimens that exhibit lower diversity of scavengers. Significantly, the Skye plesiosaur was collected from shallow marine sediments, which offers a different perspective on marine scavenging compared to the more common deep-water death fall assemblages, including most whalefalls today, which become transient self-contained ecosystems in the deep ocean. These features make the Skye plesiosaur not only invaluable to Scotland's fossil record, but a rare window into the ecology of Mesozoic oceans.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Chronology of avian extinction, survival, and turnover in the terminal Pleistocene at Rancho La Brea, California

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The chronology and inferred causes of the terminal Pleistocene extinction event for North American mammals have been extensively studied. Equivalent research on the concurrent extinctions of birds, however, has lagged far behind. Late Pleistocene North America had a rich avifauna which incurred significant but poorly understood extinctions, especially amongst large-bodied carnivorous species (teratorns, condors, vultures, and eagles). To address this knowledge gap, we obtained >100 radiocarbon dates between 16 ka to the present on 12 avian species (9 extinct, 3 extant) from the Rancho La Brea lagerstaette. This novel dataset permitted us to investigate several questions: (1) when did bird species at La Brea become extirpated or extinct?; (2) was the avian extinction synchronous with that of the La Brea mammals?; (3) were extinctions among avifaunal species synchronous, or were there species-specific patterns of disappearance?; and (4) did extant bird species retain a continuous presence at La Brea throughout the terminal Pleistocene and Holocene? In this presentation, we will report results addressing these questions and the implications for the causation of the end Pleistocene extinction event in North America.

Funding Sources North Star Archaeological Research Fund at the Center for the Study of the First Americans, Texas A&M University

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Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

The Wordian/Capitanian boundary in the Karoo Basin: chronological constraints on the first occurrence of *Tiarajudens* (Therapsida, Anomodontia) in South Africa

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The main Karoo Basin of South Africa possesses a rich record of the tetrapod fauna of southern Gondwana in the late Palaeozoic and early Mesozoic. The richest part of the sequence is found in the Beaufort Group, surrounding the Permo-Triassic boundary but the oldest, Guadalupian part of the Beaufort Group has been more poorly sampled. This is especially true for the lower half of the basal Abrahamskraal Formation, corresponding to *Eodicynodon* Assemblage Zone, the lowest part of the overlying *Tapinocephalus* Assemblage

Zone. For the past decade, our working group has targeted the hitherto unexplored strata between the *Eodicynodon* and *Tapinocephalus* Assemblage Zones, which have revealed a great diversity of fossil tetrapods. One such discovery is the presence of the highly specialised anomodont genus *Tiarajudens*, represented by at least five individuals, and previously known from only a single specimen from the Parana Basin of Brazil. The South African material displays the large and straight caniniform teeth, combined with a row of pterygoid closely packed and oblique postcanine teeth, which is diagnostic of this genus. The new specimens reveal new morphological information about the unusual morphology of this genus, notably of the lower jaw. Parallel geochronological investigations based on U-Pb CA-ID-TIMS analyses of tuffaceous horizons have provided high-precision age constraints on the lower Beaufort Group, demonstrating it was deposited around the Wordian/Capitanian transition. They also demonstrate that the South African *Tiarajudens* occurs within the latest Wordian, at about 265 Ma. Further discoveries await preparation and description, but our results indicate a greater tetrapod diversity of the *Eodicynodon* Assemblage Zone than previously thought and a complex boundary with the overlying *Tapinocephalus* Assemblage Zone.

Funding Sources GENUS, Palaeontological Scientific Trust (PAST), Linnean Society of London, The DSI-NRF African Origins Platform (AOP210218587003; AOP240418214774UID: 136505).

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

Building the earliest vertebrate skull—microtomography sheds light on endoskeletal cranial construction in the Ordovician vertebrate *Eriptychius americanus*

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Vertebrate evolutionary origins lie in the early Palaeozoic, with the earliest skeletonising fishes possessing mineralised skulls being found in the Ordovician. The anatomy of these early armoured vertebrates remains obscure beyond their outer skeleton of dermal scales and plates, leaving the internal structure of the earliest vertebrate crania largely unknown. The sole known exception is a specimen of *Eriptychius americanus*, an armoured vertebrate from the Sandbian (458.4–453.0 Ma) Harding Sandstone of Colorado, USA, which preserves an articulated head incorporating dermal and endoskeletal structures. Using microCT (computed tomography), we show that this specimen harbours a set of symmetrical paired and midline cartilages, which we interpret as the front of the cranial endoskeleton surrounding the mouth, olfactory bulbs, pineal organ, and orbits. These cartilages are separate from but closely wrapped by the dermal skeleton, suggesting that they filled and framed the head as in osteostracans and galeaspids. Unlike these taxa though, they are not united into a single unit with each other and more posterior parts of the cranial skeleton. These cartilages are also pervaded by an unusual network of branching tubules. However, the structure of the cartilage itself and its relationship to tubules and the surrounding dermal skeleton were poorly characterised by micro CT. Further investigation using synchrotron microtomography has enabled us to image the cranial endoskeleton of *Eriptychius* at high resolution. These new data

reveal the tissue comprising the endoskeletal mineralisations of *Eriptychius* to be a form of globular calcified cartilage, comprising globules surrounding chondrocyte spaces. Structurally, however, it is unlike other globular calcified cartilages, with the tissue becoming more densely packed in proximity to the edges of the cartilage elements and where the cartilage tissue is pervaded by the extensive tubular network. These new data show that the tissues making up this endoskeleton, as well as its overall morphology, are unlike those of any other described vertebrate, revealing unexpected tissue composition as well as gross morphology in the earliest vertebrate skulls.

Funding Sources Funded by The Leverhulme Trust grant RPG-2021-271 “Feeding without jaws - innovations in early vertebrates” and the European Synchrotron Radiation Facility award ES-1458.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Modern avian polar section modulus plots predict the lifestyle of the latest Cretaceous fossil avians *Antarcticavis capelambensis* and *Vegavis iaai*

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When it comes to shallow marine fossil deposits of Late Cretaceous age, the avian fossils present are few and specific. The avian fossils that are excavated almost exclusively show a foot-propelled diving lifestyle. Lifestyles such as running, soaring, or flapping, are not represented. Latest Cretaceous avian fossils that show a foot-propelled diving lifestyle include *Vegavis iaai* from Antarctica, *Polarornis gregorii* from Antarctica, *Neogaeornis wetzeli* from Chile, and a grebe-like tarsometatarsus from New Jersey. When looking for avian fossils in a shallow marine deposit, one would expect to find a mix of shore birds, sea birds, and foot-propelled divers rather than only one of those groups. *Antarcticavis capelambensis*, discovered in Antarctica, may be a ‘missing link’ fossil in regards to lifestyles present, and finding the lifestyle will give greater insight as to what niches were present within Neornithes during the Maastrichtian. To predict fossil avian lifestyle, this study is examining and comparing the polar section modulus of *Antarcticavis* capelambensis and *Vegavis iaai* with the polar section modulus of birds that represent different modern avian lifestyles, such as the *Mergus merganser* as well as ground birds, wading birds, and others. Eleven polar section modulus morphospace plots were generated representing eleven different lifestyles to build on a previous study. *Antarcticavis* plotted into the amphibious bird and seabird morphospaces, closest to *Mergus merganser* and *Larus marinus*, showing *Antarcticavis* would live similarly to those modern avians. *Vegavis iaai* plotted similarly to *Antarcticavis*. *Polarornis gregorii* from the latest Maastrichtian of Seymour Island, Antarctica, is thought to be a loon or loon-like, but only the femur and not the humerus is known for the species. Thus, a univariate plot of femur polar section modulus ratios were plotted, to determine lifestyle. On this linear plot *Polarornis* was surrounded by femoral ratios of loons and cormorants, all foot-propelled diving birds. Additionally, a very large Antarctic vegaviid femur from the Sandwich Bluff Member from Vega Island (68.5 Ma) whose femoral ratio was extremely large, plotted not with *Vegavis iaai* or *Antarcticavis*, but rather at the other end of the scale with pelicans, so seabirds. Because of how well the modern morphospaces predicted the lifestyle of *Antarcticavis* and *Vegavis*, polar section modulus appears to be a valid method of predicting fossil avian lifestyle.

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

Reassessing the anatomy and affinities of *Mirischia asymmetrica* (Theropoda,

Coelurosauria) from the Early Cretaceous of Brazil

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Mirischia asymmetrica is known from a partially articulated specimen (SMNK 2349) from the Albian (Lower Cretaceous) Romualdo Formation of the Araripe Basin, Brazil. Often classified within Compsognathidae (Theropoda, Coelurosauria), its taxonomic affinity remains debated. We conducted a comprehensive anatomical reassessment of SMNK 2349, including new observations on its osteology and exceptionally preserved soft tissues. The axial skeleton exhibits a complex set of laminae, forming deep spinopostzygapophyseal fossae, dorsoventrally concave lateral surfaces of the fan-shaped neural spines, and a subdivided postspinal fossa. The neural arches are craniocaudally abbreviated and asymmetrically developed across the series. The pelvic girdle as well as the hindlimb are particularly distinctive amongst coelurosaurs, preserving internal soft tissues interpreted as remnants of the rectum. The intestinal tract is located near the pubic boot and exhibits a curved morphology like that seen in *Scipionyx.* Unlike the latter, the wide loop made by the distalmost portion of the rectum is, however, preserved ventral to the ischium. The globular surface texture of the rectum ventral to the right ischium is here interpreted as the imprint of the epidermal scales from the overlying scaly skin. If true, this would indicate that the pelvic region of *Mirischia* was covered with minute pebbly tuberculate and larger irregular, often polarized basement scales instead of protofeathers such as filamentous, branched, or pennaceous integuments. The femora are bowed cranially with distinct proximal trochanters. The tibia offers another rare trait: the medial condyle of its proximal end bears a projected, spine-like caudal process. Although caudal projections of the tibial condyles occur sporadically in maniraptorans and tyrannosauroids, the prominence, and orientation of the caudal process of *Mirischia* is exceptional and appears to be restricted to some Gondwanan theropods such as *Santanaraptor*, *Gualicho*, and *Deltadromeus*. A revised phylogenetic analysis incorporating new morphological characters recovers *Mirischia* as an early-branching ornithomimosaurs. The revised anatomical and phylogenetic evidence suggests that *Mirischia* belongs to a still poorly documented lineage of Gondwanan coelurosaurs, highlighting the significant gaps in our knowledge on the relationships of basal coelurosaurs.

Funding Sources FAPESP 2020/07997-4 ;2021/12231-3; CONICET Legajo 181417.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Biomechanics of swimming in ophthalmosaurian ichthyosaurs (Reptilia, Ichthyosauria) from the Lower Cretaceous of Torres del Paine National Park, Southern Chile

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Among marine reptiles, ophthalmosaurian ichthyosaurs stand out, starting in the Jurassic by evolving a thunniform body shape, which

provided them with greater stability in the marine environment. Despite this conservative body plan, the fossil record shows morphological variability in the fins of ophthalmosaurians, with a multiplicity of shapes that reveal both intra- and interspecific variation but also different priorities of use. This diversity offers an exceptional opportunity to understand how these fins became specialized in shape, size and function. The aim of this investigation is to analyze the diversity of different fore- and hind fin outlines of Cretaceous ophthalmosaurian ichthyosaurs (Hauterivian 131.07 +/- 0.07 Ma) recorded from the rocky edge of the Tyndall Glacier in the Torres del Paine National Park, southernmost Chile. The analysis included only almost fully exposed and articulated fins (n = 5 individuals, one family), and used geometric morphometrics, finite element analysis and mechanical inferences to quantify diversity of morphotypes. Results focus on fin contours and the generation of a predictive model based on their morphologies. Two main morphotypes were identified: orbicular (proximally-distally short and antero-posteriorly wide) and lanceolate (proximally-distally elongated and antero-posteriorly narrow). This suggests that ichthyosaurs may have occupied at least two distinct ecological niches: nearshore taxa may have evolved lanceolate fins for speed and maneuverability, while those with orbicular fins may have been more suited to offshore habitats, improving control and buoyancy. This research not only expands knowledge of the paleobiology of Tyndall's ichthyosaurs, but also provides a framework for future studies on fin diversity and its impact on the ecology, behavior, and potential niche segregation in other ichthyosaur-dominated Mesozoic faunas. Future work will focus on testing biomechanical and functional inferences, and consideration of other anatomical units, to allow better comprehension of the swimming dynamics and paleoecology of the Tyndall ichthyosaurs.

Funding Sources Projects PAI77200036 and FONDECYT de Iniciación 11240506 of ANID (Chile) (J.P-P.); INACH, MHNRS (Punta Arenas, CL) and PALEOVERTUACh (Valdivia, CL)

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Flight of early birds—insights from joint mobility

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The origin of birds within non-avian theropods represents one of the most dramatic locomotor transitions in the evolutionary history of vertebrates—the evolutionary origin of avian powered flight. However, the mechanisms underlying the emergence of active, flapping flight and the multitude of different flight behaviors exhibited in extant birds remain elusive despite considerable scientific interest over the past century. The dynamic aspect of avian wings—adjusting and morphing the aerofoil for different aerodynamic conditions—is essential for flight and directly subjected to aerodynamic and thus evolutionary pressures. Yet, despite its importance and strong association with flight behavior, the evolution of wing joint mobility has received little attention to date. The morphing of the wing shape is directly linked to the morphology of the underlying wing bones and their articular surfaces, whose complex interplay both permit and restrict movement. To draw justified inferences about flight capabilities from potential movement of the wing skeleton in

extinct species, we conducted ex vivo, cadaveric X-ray Reconstruction of Moving Morphology experiments on extant birds. We quantified the mobility of the shoulder joint in a phylogenetically broad dataset of 11 living bird species representing most major clades and spanning a wide range of ecological niches and flight behaviors. We assessed the covariation between flight ecology and shoulder joint mobility in modern birds in the *EcoPhyloMobilitySpace*, an ecologically and phylogenetically informed framework for quantitative comparisons of joint mobility data. We then conducted soft tissue-constrained joint mobility simulations for the shoulder of several extinct birds spanning the stem-to-crown bird transition and the deepest divergences within crown group birds, thus providing crucial insights into the evolution of flight behavior at the dawn of extant birds. The simulated fossil birds were projected into the *EcoPhyloMobilitySpace* of the extant birds to retrace the evolution of bird flight behaviors and infer their locomotory ecology. Our results indicate that diverse flight behaviors similar to those evident in extant birds were already present in Cretaceous near-crown birds, which may have been a contributing factor for the survival of crown birds across the Cretaceous-Paleogene Boundary.

Funding Sources EAVP Research Grant (O.E.D.); UKRI Future Leaders Fellowship MR/X015130/1 (D.J.F.); Horizon 2020 ERC grant 695517 (J.R.H.)

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The vertebrate fauna of the Isle of Muck, Scotland, UK, including a new dinosaur tracksite

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The Great Estuarine Group (GEG) of the Inner Hebrides, Scotland, UK, is a paralic sedimentary sequence spanning the Middle Jurassic (174–164 Ma). The GEG is known for a rich assemblage of vertebrate body fossils and dinosaur footprints from the Isle of Skye. Less explored outcrops of the GEG are found on several of the Small Isles of the Inner Hebrides, including at Camas Mór on the Isle of Muck. This locality spans a transitional sequence from the deltaic sandstones of the Valtos Sandstone Formation to the brackish lagoonal limestones of the Duntulm Formation. The most common vertebrate fossils found at Camas Mór are dinosaur footprints which occur at multiple stratigraphic levels within the site below the first oyster bed that marks the base of the Duntulm Formation. The ichnological assemblage is dominated by sauropod footprints with a low proportion of tridactyl theropod tracks and a single footprint of ornithopod affinity. The Isle of Muck tracksite is also notable for the preservation of dinosaur footprints visible in cross-section as load casts. These sedimentary features are identifiable as footprints by both the deep propagation of localized deformation through fine-grained shale layers to underlying coarse-grained beds and by the asymmetry of the casts in cross-section. In addition to dinosaur footprints, we document several isolated body fossils from Camas Mór including the costal plate of a turtle and the cephalic hook of a hybodont shark. These isolated bones supplement the ichnological record and expand the known vertebrate diversity of the locality. The assemblage from the Isle of Muck is broadly consistent with those of contemporaneous beds on the Trotternish Peninsula of the Isle of Skye. The mixed composition of sauropod and theropod tracks resonates with that of localities like Duntulm, Brothers' Point, and Prince Charles's Point. As

with these localities, the abundant dinosaur footprints are coupled with isolated, disarticulated, and rare body fossils from other vertebrate taxa. However, while turtle fossils are known from the Isle of Skye, they are reported from rocks on the Strathaird Peninsula that potentially had more freshwater influence than those at Camas Mór. As seen on Skye, a diverse range of dinosaurs traversed these dynamic and marginal coastal environments. Camas Mór preserves varied aquatic and terrestrial vertebrate fossils and further extends the record of Scottish dinosaurs to the Isle of Muck.

Funding Sources Edinburgh Geological Society (P.E.dP.); Royal Commission for the Exhibition of 1851 – Science Fellowship (D.F.); National Geographic Society & Philip Leverhulme Prize (S.L.B.)

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Gnashing or gnawing? Contextualizing the dietary ecology of domesticated dogs (*Canis lupus familiaris, Canis lupus dingo*) via dental microwear comparison across continents

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Understanding the dietary ecology of mammals is critical for reconstructing past ecosystems, evaluating ecological flexibility, and informing conservation efforts. Dental microwear texture analysis (DMTA), a quantitative method that assesses microscopic tooth wear resulting from food processing, offers key insights into extant and extinct mammals over time. By quantifying surface textures such as anisotropy (*epLsar*) and complexity (*Asfc*), DMTA can distinguish between dietary behaviors that are often cryptic using traditional morphological approaches—including identifying carcass utilization and/or scavenging behavior in carnivores. Application of DMTA to modern wild-caught museum specimens of *Canis lupus dingo* and domesticated dogs from North America (*Canis lupus familiaris*) reveals remarkable differences in their dietary ecology. Dingoes have high variability in surface textures indicative of both pursuit predation and scavenging—consuming varying amounts of flesh and bone across diverse environments. In contrast, wild domesticated dogs in North America do not demonstrate the same degree of dietary flexibility. Further, DMTA of *Canis lupus* from around the globe and at the Rancho La Brea tar pits (California, USA) during the Pleistocene shows dietary consistency over millennia, with wear patterns reflective of active predation on large-bodied herbivores and more constrained dietary flexibility. These differences underscore the ecological distinctiveness of dingoes, supporting arguments for species-level separation under the ecological species concept. DMTA attribute values of *Canis lupus dingo* overlap the entire 'microwear space' of all canids—exemplifying their generalist dietary behavior that is observed today. The broad dietary niche of dingoes is not synonymous with domestication, as dogs in North America are much more 'wolf-like' in their dietary behavior. Dingoes may be better able to withstand and persist in Australia due to their highly adaptable nature and/or environmental circumstances may have ultimately shaped and driven their dietary plasticity.

Funding Sources Vanderbilt University and National Science Foundation.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Tiny teeth make tiny holes: breakage patterns of microfossils from microvertebrates in the Chadronian and Orellan periods from the White River Group

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Microvertebrates are the most abundant vertebrate members of ecosystems but are underrepresented in the fossil record. Despite the importance of microvertebrates in ecosystems, ascertaining their predator-prey relationships is difficult since remains are sparse and fragmentary. It is often impossible to taxonomically identify species from microvertebrate remains and determine the anatomical identity of the fossil. This study uses gross description alongside Procrustes analysis of taphonomic landmarks to analyze fragmentation patterns and bite marks on microvertebrate remains from the modern of Paraguay and the late Chadronian (~33.8 Ma) and middle Orellan (~33.4 Ma) land mammal ages of Nebraska, USA. We aim to determine the importance of predators and geologic processes in driving microvertebrate fragmentation and identify the predators/scavengers producing bite marks.

Modern microvertebrates were collected as three samples from the Pilcomayo River in Paraguay. Additional assemblages were gathered from western harvester ant hills in Nebraska. A subset of 480 microfossils were analyzed for breakage patterns; 73 had suspected bite marks, 49 of which had multiple indentations, which could be caused by various teeth. The Geomorph package in R was used to record the coordinates and size of each suspected tooth mark and quantify the cusp patterns from the teeth of 12 common potential predators/scavengers from the ecosystems. Indentation patterns were then compared to potential predators/scavengers using Procrustes analysis with fuzzy matching. Likely predators/scavengers were identified for all 49 specimens with multiple indentations, with *Herpetotherium*, *Copedelphys*, and *Nanodelphys* being the most identified genera. This appears to be a novel and useful method to match indentation marks on the microfossils to candidate predators/scavengers. No major patterns were detected among gross taphonomic characteristics measured from the microfossils. Patterns of damage and predation were compared to a similar sample from the modern Paraguayan microsites, showing approximately the same frequency of modification.

The two samples from the Nebraska source, from immediately prior to and after the Eocene–Oligocene Transition (EOT) allow a comparison to be made between ecosystems. Comparing the two time periods on either side of a global climate transition and an understanding of how the transition can provide insight into changes in ecosystem dynamics across the EOT.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Catalog number woes: strategies for digitizing a poorly cataloged collection

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The Science Museum of Minnesota (SMM)'s 60-million-year-old Wannagan Creek collection from western North Dakota was initially believed to be fully cataloged, but after beginning the first phase of the Wannagan Digitization Project in 2022, it was quickly realized that the collection was nowhere near fully cataloged. Thousands of specimens were found without catalog numbers, and numerous other catalog number issues were common. To resolve these issues, several different protocols were implemented.

In order to keep track of specimens found without a catalog number, a temporary accession was created with individual catalog numbers for each specimen. Following further investigation, these temporary accession and catalog numbers are replaced with permanent SMM numbers. Specimens with these temporary numbers are also not released to iDigBio or GBIF, in order to

avoid creating catalog number confusion in the future. Similarly, any specimens found to share a duplicate catalog number were also removed from the public dataset until the issue was resolved. As a temporary measure, the second specimen found was given a fourth number in the SMM tripartite numbering system to differentiate the two, until it was determined which specimen was supposed to have that catalog number, and which was the typo.

Other catalog number issues included specimens cataloged into incorrect accessions—either accessions that were unrelated to the Wannagan Creek collection, or accessions that did not exist at all. These specimens were also pulled from the public dataset while it was determined whether this was merely an easily fixed typo, or if these specimens needed a new accession. Finally, there were specimens where the label and the tag listed two different numbers. This was usually easily fixed by checking the specimen against paper records to see which number was correct.

While some catalog number issues can be resolved quickly, some take time, and it is recommended to have a physical note explaining the catalog number issue with the specimen until the issue can be resolved, so that visiting researchers know to ask for a corrected catalog number. If researchers are interested in publishing a specimen with a catalog number issue, that specimen can be expedited through the appropriate process. Following these protocols has helped stop further incorrect SMM catalog numbers from being introduced into the published record.

Funding Sources Institute of Museum and Library Services grant MA-255597-OMS-24.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Dietary reconstructions and disparity through time of South American fossil metatherians using dental topography

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Dental topography is a powerful and increasingly widely used tool for quantifying tooth shape and its relationship to diet. Here, we use dental topographic methods and a 'training set' of lower molars of extant marsupials (43 species, 12 families) and primates (52 species, 13 families) of known diet to reconstruct the diet of 36 extinct metatherians from multiple middle Eocene to early Miocene South American localities. All fossil metatherian data were derived from moulds of casts, which were μCT-scanned at high resolution (16 to 22 μm). Among currently used dental topographic metrics, we found ariaDNE (quantifying curvature) and Relief Index were the least affected by differences in sample type (cast, mould, original specimen) and scanning modality (μCT, surface scan) in our training and test sets. Dietary prediction accuracy using quadratic discriminant analysis was higher using only the marsupial training set (91% mean accuracy) than when using both primates and marsupials (82% mean accuracy). However, the combined training set was used to reconstruct diets of extinct species because it includes diets (e.g., hard-object feeding) not present in the marsupial-only dataset. The majority of fossil metatherians plot within the dental morphospace occupied by extant marsupials and primates; however, some extinct metatherians (the polydolopids *Pseudolops princeps*, *Amphidolops serrula*, and *Polydolops thomasi*, and the paucituberculatan *Perulestes cardichi*) plot outside this space, implying they have no analogues in our extant comparative sample. Consistent dietary interpretations include: the fossil paucituberculatan *Phonocdromus gracilis* as a frugivore-insectivore (>50% posterior probability); the paucituberculatan *Perulestes*

cardichi (>73%) and microbiotherian *Microbiotherium praecursor* (>54%) as insectivores; and the protodidelphid *Guggenheimia crocheti* as a faunivore (>95%). The Eocene metatherian sample (n = 26) is reconstructed as including faunivores, frugivores, insectivores, frugivore-insectivores, and one hard-object feeder. The Oligocene sample, albeit much smaller (n = 10), includes only insectivores and insectivore-frugivores, reflecting the absence of species in the dental morphospace previously occupied by some Eocene metatherians with larger molars and lower curvature and Relief Index values. However, as our Oligocene sample is limited, further sampling is needed to ensure this is not a sample-specific result.

Funding Sources Natural Environment Research Council (NERC, NE/T000341/1) and the Dutch Research Council (NWO, VI.Veni.232.136).

Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Intracrystalline insights: refining mammalian evolution through enamel-based amino acid geochronology

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Constructing robust dating frameworks for vertebrate fossils remains a significant challenge particularly for Quaternary material that lies beyond the range of radiocarbon. Amino acid geochronology (AAG) of tooth enamel provides a powerful biomolecular solution enabling the direct relative dating of mammalian remains spanning the past several million years. By targeting the intracrystalline protein fraction preserved within enamel (a fraction demonstrated to act as a closed system), this method effectively removes the impacts of leaching, and contamination. Crucially, the technique also allows screening for the endogeneity of amino acids and proteins found within ancient teeth. This validation step is vital for confirming the integrity of data used in palaeoproteomic investigations and underpins the generation of reliable chronological interpretations in enamel AAG studies.

We present two methodological developments that enhance the applicability and reliability of enamel-based AAG: (i) a novel microfluidics-based preparation protocol that reduces sample size and allows enamel processing outside of clean lab facilities promoting more sustainable and inclusive research practices and (ii) the reuse of enamel powders previously exposed to gamma irradiation during electron spin resonance (ESR) dating demonstrating minimal impact on amino acid integrity and allowing integrated multi-method chronologies from the same specimen.

To demonstrate the utility of this approach, we apply it to the case of Sicilian dwarf elephants, developing a new enamel AAG framework that refines the chronology of this iconic insular lineage. This direct dating strategy provides a foundation for testing evolutionary and biogeographic hypotheses while also offering a model for future applications to other faunal assemblages across Palaeolithic contexts. Collectively, these advances position enamel IcPD as a valuable tool in vertebrate palaeontology enabling more accurate and sustainable chronologies for fossil mammals.

Funding Sources This project (EQuaTe) has received funding from the European Research Council (grant agreement No. 865222).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Identifying the trackmaker for the tetradactyl theropod ichnogenus *Saurexallopus*

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While it is true that theropod footprints typically display a tridactyl morphology, the occurrence of tetradactyl theropod tracks has led many to discuss what types of theropod dinosaurs might have produced these uncommon tracks. There are currently six theropod-attributed tetradactyl ichnogenera: *Macropodosaurus*, *Xiangxipus*, *Picunichnus*, *Boutakioutichnium*, *Ordexallopus*, and *Saurexallopus*. The latter, in particular, has been the subject of much discourse. Some have proposed Therizinosauria as the trackmaker group, while others believe it to be Oviraptorosauria. The discovery of two large footprints attributable to a new ichnospecies of *Saurexallopus* in the Early Cretaceous Gething Formation of northeastern British Columbia inspired a multivariate study to compare different *Saurexallopus* footprints to the skeletal pes remains of the proposed trackmaker groups Therizinosauria and Oviraptorosauria as well as Neornithischia and Leptoceratopsidae—two non-theropod groups with comparatively long, narrow digits. Results of the principal components analyses showed overlapping convex hulls for *Saurexallopus* and oviraptorosaurs, which were distinctly separated from therizinosaurs, small neornithischians, and leptoceratopsids. *Saurexallopus* tracks are also more consistent with oviraptorosaurs, which have widely splayed toes, compared to therizinosaurs, which have more parallel toes in comparison. The Gething Formation *Saurexallopus* can thus be identified with confidence as having been made by a large-bodied oviraptorosaur, with an estimated hip height of 2 m. This is second only to *Gigantoraptor*, which has a hip height of 3.5 m. The Gething Formation *Saurexallopus* tracks support both an earlier presence and larger body size for oviraptorosaurs in North America than is currently represented by the body fossil record.

Funding Sources Dinosaur Research Institute, Natural Sciences and Engineering Research Council of Canada, Canadian Museum of Nature.

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Advancing natural heritage research through synchrotron X-ray imaging: applications, innovations, and future directions

Dollman, Kathleen, Fernandez, Vincent

European Synchrotron and Radiation Facility, Grenoble, France

Synchrotron imaging for natural heritage, which includes palaeontology and evolutionary biology, provides a mitigated or non-destructive means to recover detailed information from fossil and conserved museum specimens at multiple resolution scales, from gross morphology to microstructural, ultrastructural, and geochemical signatures. Recent technological and methodological innovations have significantly enhanced synchrotron imaging capabilities, unlocking new potential for natural heritage research and contributing to several noteworthy discoveries. Furthermore, the improved efficiency in synchrotron measurements enable the acquisition of large, statistically robust datasets essential for addressing macroevolutionary research questions.

Recent key infrastructural developments, such as the ESRF-EBS upgrade, which includes the upgrade of beamline BM05 and commissioning of the new flagship large-field tomography beamline BM18, have expanded the scope and resolution of synchrotron X-ray micro-Computed Tomography (SRμCT). These upgrades support efficient multiscale imaging workflows and offer previously unachievable access to internal fossil structures across a wide range of specimen sizes and preservation types.

Furthermore, integration with complementary techniques such as Synchrotron Radiation X-ray Diffraction (SR-XRD) and X-ray Fluorescence (SR-XRF) has opened new avenues in palaeontology, including fine-scale geochemical mapping and ultrastructural analysis. This multi-modal approach offers hierarchical insights from macroscopic form to elemental composition.

The development of high-throughput capabilities, in combination with implementation of user-friendly interfaces, now facilitate efficient large-scale data acquisition. Recent studies leveraging these advancements have generated expansive datasets on morphology, osteohistology, and dental histology.

We will present case studies demonstrating the impact of recent synchrotron imaging advancements and its growing role in natural heritage research. As a rapidly progressing science, synchrotron imaging is central to many scientific inquiries and further advancements in this field will no doubt lead to future discoveries of significance.

Funding Sources The ESRF is thanked for inhouse beamtime on BM18 and BM05. Fraunhofer and BMBF are thanked for their contribution towards BM18.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A taphonomic analysis of the fossil lizards from Blanche Cave, Naracoorte Caves (South Australia)

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The Naracoorte Caves World Heritage Area (NCWHA, South Australia) yields a rich record of exceptionally preserved Quaternary vertebrate fossils. The vertebrate fossil deposits across the cave sites span a continuous record of biodiversity over the last 500,000 years, encompassing both the Last Glacial Maximum (LGM) and Australia's megafaunal extinction window. At Naracoorte, like other Australian Quaternary deposits, taphonomic studies highlight mammalian taxa, but other vertebrate taxa are understudied. This study presents the first taphonomic study dedicated to the fossil lizards from NCWHA. We quantified the preservation features of lizard fossils from an open, roof window cave deposit known as Blanche Cave, sampling across existing sedimentary units to uncover accumulation histories of the fossils. The units were analysed for the skeletal element representation of diagnostic fossils (number of identified specimens, NISP; and relative abundance, Re%). The breakage patterns, colouration and staining, as well as weathering and abrasion, were quantified using predefined scales to discern the degree of alteration. Taxonomic identifications and preservation assessments were based on comparative osteological specimens and micro-CT scan data held at the SA Museum, Adelaide. Robust elements (maxilla, dentaries, proximal limbs, vertebrae, osteoderms) were preserved readily in the deposits and were most represented by the skinks. Dragons (Agamidae) and monitor lizards (Varanidae) were also reported in this study; gekkotans were not detected but are reported to live in the area today. The relative abundance of the fossils varied across units, complementing the environmental shifts previously elucidated from the sedimentology and faunal analyses. The increased abundance in lizard fossils in units 3 and 4 corresponds to a shift to savannah vegetation seen in previous studies; lizard fossils are more abundant during the peak MIS 4 glacial compared to the LGM. Previous studies demonstrate that the Blanche Cave fossil deposit is primarily from avian predation (i.e., owls - *Tyto novaehollandiae, Ninox boobook*) evidenced by the corrosion on the immense number of rodent and small marsupial fossils. An open roof window cave like Blanche Cave is also accessible for animals to live and die within the cave, and squamates have been observed to using the cave for refugia, particularly agamids during the breeding season. It is likely to have also accumulated fossils in this way.

Funding Sources The Ecological Society of Australia's Holsworth Endowment Award, the University of Adelaide's Student Support Fund, and ARC Linkage grant (LP160101249) to E.H.R.

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Late Cretaceous anguimorphs from East Asia suggest a complex evolutionary history for the group

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The Upper Cretaceous deposits of eastern Asia have yielded over a dozen anguimorph taxa, represented by some of the most important three-dimensionally preserved fossils. These Late Cretaceous taxa seem to represent almost all of the major living anguimorph clades including xenosaurs/anguids (*Carusia* and its relatives), helodermatids (within the larger monstersaur clade, e.g. *Estesia*), lanthanotids (e.g. *Cherminotus*) and stem varanids (e.g. *Telmasaurus*). In recent years, new anguimorph fossils from the famous Gobi localities, the Qiupa locality of Henan, and Ganzhou localities of Jiangxi reveal that the group flourished across East Asia. Moreover, the vomerine teeth in *Zhongyuanxi*, and a different venom-conducting tooth morphology in *Parviderma*, reveal novel morphological features within Anguimorpha. Phylogenetic analyses, based on these new fossils and the restudy of older specimens, and using molecular constraints, result in an anguimorph topology with most of these Late Cretaceous anguimorphs placed on the stem of Varanidae. These results seem to be more consistent biogeographically, and suggest a complex character evolution, especially of 'varanoid' features such as posterior extension of the narial openings, within Anguimorpha. Many of the known Gobi species were described prior to the widespread availability of high-resolution micro-computerized tomography, and their restudy based on CT scans, as well as further new anguimorph fossils, will help us to further understand anguimorph evolution.

Funding Sources Supported by the funds from the National Natural Science Foundation of China (Grant Nos. 42288201, 4247021835).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Evidence of repeated evolution of wing spurs in Anseriformes based on X-rays of study skins

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Bony, horn-like weapons known as spurs are present on the forelimbs of many extant and extinct bird species. In waterfowl (Anseriformes), these wing spurs are present throughout the order, with their earliest fossil evidence found in the Upper Miocene. There is a limited body of research regarding anseriform wing spurs, and their anatomy is poorly understood. The current body of literature excludes multiple spur-bearing genera and fails to completely describe the osteological differences of the spurs between species. Moreover, there have been no attempts to reconstruct the evolutionary history of their presence and absence in the order using specimen-based data. Here, we X-ray museum specimens of most (n = 57) waterfowl genera to describe their superficial and osteological structure and reconstruct their evolutionary history. We identified three unique types of spurs within Anseriformes that likely arose independently due to similar selective pressures. We found that in most spurred waterfowl, wing spurs are an outgrowth of the extensor process of the carpometacarpus. However, some species bear spurs on both the proximal and distal ends of the carpometacarpus, and others have spurs which grow from the distal end of the radiale. The only spurred avians with fossilized manual bones have single spurs attached to the extensor process of the carpometacarpus, such as those in the genera *Archaeotrogon* and *Garganornis*.

Using phylogenetic comparative methods, we also found a correlation between spur presence and nonmigratory behaviors, which provides useful context for the reconstruction of behavior and spur presence among extinct organisms while further justifying the use of specialized wing weaponry as a proxy for a nonmigratory lifestyle. This information is also pertinent for reconstructions of extinct anseriforms without preserved carpal material and supports future research on the structure and presence of wing spurs in a taxon given its phylogenetic history. Additionally, we suggest that the extinct anhimid *Chaunoides antiquus* likely had wing spurs and describe the spurs of two species: *Cairina moschata* and *Neochen jubata*.

Funding Sources Drexel University STAR (Students Tackling Advanced Research) Scholars Program

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The Late Cretaceous fishes of Lac des Bois, Northwest Territories, Canada: implications for marine conservation

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The Lac des Bois fossil site, located in the Northwest Territories, Canada, provides a unique window into the northernmost Western Interior Seaway at the time of a global thermal maximum and oceanic anoxic event. Radiometric dating suggests the sediments of Lac des Bois are approximately 94 million years old, preserving the Cenomanian–Turonian boundary of the early Late Cretaceous. This period coincides with the Cretaceous Thermal Maximum (CTM) and Oceanic Anoxic Event 2 (OAE2), intervals characterized by high global temperatures and widespread oceanic deoxygenation. Fossils have been collected from Lac des Bois during three expeditions, including its discovery in 1968. They include a diverse fauna of marine fishes and invertebrates. Many of the specimens from these previous expeditions to Lac des Bois are still awaiting scientific description. This study presents the undescribed fossils and compares them to fossils from localities of similar high latitude to Lac des Bois. The comparison sites, from the Loon River Formation of the Northwest Territories and the Kaskapau Formation of Alberta, Canada, represent time intervals before and after the CTM and OAE2. New specimens collected from these localities add to the sample of northern Western Interior Seaway fishes, providing insight into faunal and environmental shifts at the Cenomanian–Turonian boundary. Additionally, comparisons of the palaeoclimate effects on the Lac des Bois fauna with modern marine ecosystems lead to a framework for understanding climate change impacts on extant marine faunas. Although no modern equivalent of the Western Interior Seaway exists, current restricted basins like the Baltic Sea are of similar depths and latitude. These basins may represent the best systems to bridge our palaeontological knowledge with modern ecological problems. The Baltic Sea has suffered from high rises in water temperature and a large oxygen-depleted zone due to human-induced climate change. Deciphering how the prehistoric marine fauna at Lac des Bois responded to environmental stressors can help guide efforts to mitigate climate change impacts on marine ecosystems today.

Funding Sources Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant 327448

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Rethinking dinosaur ‘mummies’: insights from a long-term study of reptilian decomposition

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Dinosaurian 'mummies' represent unusual examples of soft tissue preservation. They typically are found preserved outside of lagerstätten-style deposits, without their associated chemical drivers of high-quality preservation. Previous attempts to explain these isolated examples of fossilized dermal tissues often cited unusually rapid burial and desiccation. However, recent research has identified taphonomic modifications that suggest longer-term exposure of some mummies, including evidence of scavenging on the *Edmontosaurus* mummy 'Dakota' and insect traces on bones associated with the *Brachylophosaurus* mummy 'Leonardo.' Attempts to better understand the preservational pathways of these specimens have been hindered by the fact that the actualistic literature describing the expected patterns of vertebrate decomposition are heavily biased towards mammalian taxa.

To better understand patterns of reptilian decomposition, a long-term survey of *Salvator merianae* decomposition was launched in 2023, to which two species of crocodylian, *Alligator mississippiensis* and *Osteolaemus tetraspis*, were added in 2025. Two years into this project, several notable patterns have been observed. Progression through the stages of soft tissue decomposition, entomological and microbial community succession, biogeochemical changes in soils, and early stages of weathering are consistent with patterns observed in mammals, with exceptions related to the longer-term retention of complete to nearly-complete skin envelopes months or even years after initial exposure. This is a significant deviation from the mammalian model in later stages of decomposition, specifically related to skeletal articulation and postmortem postural changes.

These findings suggest that inclusion of significant dermal tissues at the time of final burial may well have been the rule rather than the exception among reptiles, especially in cases where the preserved skeletons are still articulated. It would therefore follow that the post-burial chemistry of the depositional environment, rather than the speed of initial burial, was the main limiting factor governing the subsequent preservation of those tissues. Preliminary geochemical analysis surveying multiple dinosaurian mummies, as well as detailed analysis of both 'Dakota' and 'Leonardo,' suggest multiple diagenetic pathways, further highlighting the complex taphonomic histories of these unusual specimens.

Funding Sources David B. Jones Foundation, the University of Tennessee Office of Undergraduate Research and Fellowships, and the University of Tennessee-Oak Ridge Innovation Institute.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Investigating niche competition in Mesozoic ornithischian, maniraptoriform and sauropodomorph dinosaurs

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Mesozoic herbivorous dinosaurs often coexisted in multiple assemblages, despite apparently similar plant-eating lifestyles. This research investigates niche partitioning and niche competition in three major herbivorous clades: Ornithischia, Maniraptoriformes, and Sauropodomorpha. Three different metrics were analyzed for this: maximum feeding height (MFH reflecting the highest levels of vegetation that the dinosaurs could have reached), relative bite force (RBF reflecting the ability to process mechanically resistant vegetation), and body mass (reflecting physiology). A dataset of over 138 species was collected from published sources, to explore how these factors enabled coexistence and reduced competition, or conversely, increased it.

Sauropodomorphs displayed the highest MFHs and the largest body masses indicating specialization in high canopy browsing. Ornithopods showed intermediate MFHs (~2–3m), with high RBF values (~0.675), likely enabling them to shear coarse, fibrous plants. Maniraptoriforms, despite small body sizes (<500 kg), had intermediate MFHs (~1–2m), facilitated by bipedal postures. Their low RBFs (~0.3) were offset by specialized feeding morphologies, such as keratinous beaks or gut processing mechanisms. PCA analyses and statistical tests confirmed significant differences in ecological traits across clades. These results suggest that herbivorous dinosaurs partitioned their ecological niches in three dimensions: vertical stratification of feeding heights, dietary specialization via bite mechanics, and physiological strategies linked to body size. While some overlap occurred, especially among ornithischians, niche differentiation was apparent at broader scales. Sauropodomorphs occupied a largely unique high-browsing, low-RBF niche, while ornithopods and ceratopsians diversified in jaw mechanics and feeding levels. Maniraptoriforms exploited feeding heights disproportionate to their size, occupying ecological space between low-browsing and mid-sized taxa.

Previous research often looked at feeding height, jaw mechanics and body size as isolated factors, neglecting their combined effect on niche partitioning. This study is the first to integrate all three factors across these major clades. By demonstrating that multi-dimensional niche differentiation underpinned the coexistence of Mesozoic herbivores, this research offers a more holistic view of dinosaur paleoecology.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Evolution of feeding mechanics in Iguanodontia (Ornithischia, Ornithopoda)

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Iguanodontians were a diverse group of megaherbivorous dinosaurs characterized by adaptations for oral food processing, including a complex dental battery and an expanded coronoid process to increase the mechanical efficiency of the lower jaws. These adaptations were most extreme in derived hadrosaurids, and hypotheses on associated changes in feeding mechanics have been tested using 2D biomechanics, skull morphometrics, and tooth microwear. Computational 3D biomechanics of iguanodontian jaws has rarely been performed, and previous analyses used a simplified muscle morphology that assumed little interspecific variation in muscle attachment sites. Here, we tested for changes in feeding mechanics throughout iguanodontian evolution by applying 3D muscle reconstructions and finite element analysis to the jaws of 10 iguanodontians. Muscle morphology was informed by whole skulls and included multiple lambeosaurines and hadrosaurines (the hadrosaurids), and a diverse set of non-hadrosaurid iguanodontians (including *Tenontosaurus*, *Gobihadros*, and *Eotrachodon*). We found bite force is consistently highest in hadrosaurines, and lowest in non-hadrosaurid iguanodontians, but these differences are entirely size-dependent.

Mechanical efficiency is much higher in hadrosaurids than earlier diverging taxa, but is highest in lambeosaurines. Adjusted stress and strain in the jaws are consistent across all taxa; major differences are noted only at the predentary where greater stress and strain are associated with a longer diastema. Our results support previous hypotheses that hadrosaurids were better able to process tough materials than non-hadrosaurid iguanodontians. Adult hadrosaurines would have been better able to process tougher food materials than lambeosaurines due to their larger skull sizes and higher bite forces. Differences in mechanical efficiency between lambeosaurines and hadrosaurines are unexpected but are due to differences in muscle morphology, as informed by their cranial attachments, a factor that was previously assumed to have little variation. High mechanical advantage in lambeosaurines may be due to two factors: an adaptation to increase bite force without increasing skull or jaw muscle size, or changes in cranial shape associated with their characteristic supracranial crests. Our results together demonstrate a clear trend towards increased oral food processing in iguanodontian evolution, with the greatest potential achieved by the largest hadrosaurines.

Funding Sources Funding from an Ontario Graduate Scholarship, Queen Elizabeth II Scholarship, and NSERC Vanier Canada Graduate Scholarship to TWD, and a NSERC Discovery Grant to DCE.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

New holomorphic specimen of *Hybodus fraasi* Brown, 1900—a very rare hybodont shark from the Late Jurassic of the Solnhofen Archipelago

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Hybodont sharks dominate chondrichthyan faunas known mainly from isolated teeth in the Triassic and Early Jurassic, but neoselachians are far more numerous in faunas containing both isolated teeth and holomorphic specimens from the Late Jurassic. This is particularly true of the Plattenkalks of the Tithonian (Late Jurassic) of the Solnhofen Archipelago, where neoselachians are represented by 19 genera and 23 species. Hybodonts, on the other hand are represented by three genera and three species, all of which are extremely rare.

The first hybodont shark recorded from the Solnhofen Plattenkalks—*Hybodus fraasi*—was described in 1900. In reviews of Mesozoic hybodonts in the 1980s, the holotype of *H. fraasi*, a female example, was still the only specimen known for this taxon. We report here a second holomorphic specimen of *H. fraasi*, beautifully prepared, from the lithographic limestones (Altmühltal Formation, Tithonian, Late Jurassic) of the Solnhofen Archipelago, southwest Germany.

The new specimen is approximately 68 cm long and complete, although the hinder part of the caudal fin has been transferred from the counterpart onto the main block. Exposed in left lateral view, elements of the chondrocranium, jaw cartilages, and branchial basket are preserved in the skull area. Cephalic spines are absent, suggesting that the specimen is a female. The small number of teeth visible from the dentition is identical to those on the holotype, confirming the taxonomic identity of the specimen. The two dorsal fins are supported by fin spines, with the second spine inserted at a steeper angle than the first. Pectoral, pelvic, anal, and caudal fins are all preserved, together with supporting cartilages. Pectoral and pelvic fin outlines can be discerned by mapping the distribution of dermal denticles under UVIF. Ribs, occasional vertebral centra, and large amounts of myotomic musculature are also present. A medially expanded, spindle-shaped structure situated anterior to the pelvic fin base probably represents the faecal contents of the valvular intestine (enterospirae). The specimen holds much promise for clarifying and extending the diagnosis of the taxon.

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

A new Late Devonian sarcopterygian assemblage from the Parting Formation of Central Colorado

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The fin-to-limb transition is a pivotal event in vertebrate evolution that catalyzed the vertebrate colonization of dry land. This transformation occurred by ~360 million years ago during the Late Devonian. Concurrently, the first appearance of widespread forests stabilized river channels, creating a diverse array of freshwater and brackish environments. These new habitats were the locus for substantial morphological and ecological experimentation among lobe-finned fishes, resulting in several lineages of stem tetrapods, some of which are now recognized as transitional forms. However, the majority of fossil stem tetrapods, such as *Eusthenopteron, Tiktaalik*, and *Elpistostege*, have been recovered from Europe and eastern North America in rocks that formed the east coast of the Devonian continent Laurentia. By contrast, western North America, where rock units from Laurentia's west coast are exposed, has yielded comparatively few stem-tetrapod fossils due to insufficient sampling. Here we report a new, taxonomically-rich assemblage of sarcopterygians from the Late Devonian shallow-marine Parting Formation of Colorado. Fossils and fossiliferous sandstone blocks were surface collected from multiple horizons. Specimens show various degrees of articulation and are generally well-preserved and abundant. Among the data are remains of dipnomorphs, including lungfish ribs and diagnostic tooth plates, scales and teeth from porolepiforms, including *Holoptychius*. Osteolepidids are also common, with post-crania and at least one cranium in several blocks. Other taxa from this unit may include rhizodonts and more crownward stem-tetrapods, as well as ctenacanth sharks. Antiarchs and onychodonts are known from this formation but have not yet been recovered from this new assemblage. The nearest terrestrial stem tetrapod-bearing site of the same age is the Red Hill locality in Pennsylvania, which has produced a similar faunal assemblage but with additional members such as acanthodians, more crownward stem-tetrapods, and actinopterygians. These glimpses of Late Devonian marine vertebrates from North America show considerable overlap, suggesting that further exploration of this new assemblage is likely to reveal additional diversity. This new set of horizons in the Parting Formation contributes an important comparative datapoint among the historic localities of this unit, as well as greater insight into the diversification of sarcopterygians globally in the Late Devonian.

Funding Sources University of Chicago, Denver Museum of Nature and Science, Paleontological Society Graduate Student Grant.

Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

The earliest-diverging cynodont? New middle Permian specimen sheds light on the early morphological evolution of eutheriodonts

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The mammalian lineage can be traced back to Permo-Triassic cynodonts (Eutheriodontia), a group of early-diverging therapsids. While recent tip-dated phylogenetic studies suggest that most therapsid subgroups, including therocephalian eutheriodonts, originated around

the transition between the early to middle Permian, cynodonts are the only major therapsid subgroup whose fossils first appear in the late Permian. The oldest cynodonts being morphologically derived, some authors have proposed that they either evolved rapidly or that their middle Permian fossils are yet to be discovered.

Recent fieldwork in the middle Permian deposits of the South African Karoo Basin has yielded several small, unassigned eutheriodont specimens, including a partial skull that exhibits a mixture of therocephalian-like and cynodont-like morphological features. The new specimen displays plesiomorphic traits normally found outside therocephalians, including a lack of suborbital vacuities, as well as apomorphic traits consistent with therocephalians. In addition, it bears some unmistakably derived cynodont-like traits, such as a narrow supraoccipital.

Preliminary cladistic analyses place the new specimen as an early-diverging eutheriodont, while tip-dated Bayesian models suggest it may represent the earliest-diverging—and stratigraphically oldest—cynodont currently known. If the latter is confirmed, this would significantly push back the origin of the cynodont lineage into the middle Permian, aligning it with the major diversification events of other therapsid clades. Mosaicism in the expression of these traits suggests that some classic therocephalian features were evolutionarily labile—e.g., the absence or loss of suborbital vacuities as in *Euchambersia* and *Theriognathus*. Correct optimization of these character states is contingent on high evolutionary rates in these morphological systems.

Funding Sources The project is financially supported by the University of the Witwatersrand and the Paleontological Society

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Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Entitlement: the naming and claiming of dinosaur species

Dunne, Emma[1], Raja, Nussaïbah[1], Halliday, Thomas[2], Vlachos, Evan[3], Medina-García, Paula[4], Wong Hearing, Thomas[5], Clements, Thomas[1,5], Gee, Bryan[6], Tschopp, Emanuel[7], Greene, Sarah[2]

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Linnaean taxonomy is fundamental to organizing and managing our knowledge of the history of life on Earth. The final step in the formalisation of a new species is the assignment of a binomial (two-part) name and designation of a holotype (name-bearing) specimen in an appropriate repository, as governed by the Codes of Nomenclature. However, the ways in which palaeontologists work are neither apolitical nor neutral, but rather naturally and necessarily influenced by the cultures and societies in which we live and operate. Here, we examine the 200-year history of the naming of dinosaur species and global patterns in the repositing of dinosaur holotypes to reveal the relationships between dinosaur scientific practices and societal/global power structures. We find that dinosaur species naming is dominated by researchers based in middle- and upper-income countries. In the last half century, there has been a notable rise in the use of indigenous languages, highlighting potential progress towards inclusion, but also revealing tokenism. Eponyms (species named for people) have grown in popularity in recent decades, yet we find that individual naming choices often reflect and reinforce power asymmetries such as patriarchy and neocolonialism. Dinosaur holotypes have been collected from 54 countries across the world and 37 countries currently hold type specimens in their collections. Of the holotypes reposited outside of their country of origin (15% of total), all were transported to countries in the Global North (87% of which originated in the Global

South). Further, we observe a recurring pattern of dinosaurs collected in colonised countries being reposited in the corresponding colonising country. This pattern is not merely historical, but persists even after the former colony gains independence. This work highlights the power of pairing data-driven investigations with critical approaches borrowed from disciplines such as sociology, history, and linguistics to interrogate and challenge scientific practice. Studies like this that illuminate how power asymmetries in our field arise and persist are a critical first step to generating more just and ethical research practices.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Tactile bill-tip organs in extant and Paleogene seabirds suggest conservation of a deep avian symplesiomorphy

Du Toit, Carla[1], Bond, Alexander[2], Cunningham, Susan[6], Portugal, Steven[4], Salas-Gismondi, Rodolfo M.[3], Field, Daniel J.[5]

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Birds' bills are their main tactile interface with the outside world. Tactile bill-tip organs associated with specialized foraging techniques are present in several bird groups, yet remain understudied in most clades. One example is Austrodyptornithes, the major seabird clade uniting Procellariiformes (albatrosses + petrels) and Sphenisciformes (penguins). Here, we describe the mechanoreceptor arrangement and neurovascular anatomy in the premaxillae of Austrodyptornithes, including analyses of fossil material. Using a wide phylogenetic sample of extant birds (361 species), we show that albatrosses and penguins exhibit complex tactile bill-tip anatomies, comparable to birds with known bill-tip organs, despite not being known to use tactile foraging. The bill-tip organ in Austrodyptornithes may be functionally related to nocturnal foraging and prey detection under water, or courtship displays involving tactile stimulation of the bill. Alternatively, these organs may be vestigial as is likely the case in most paleognaths (e.g., ostriches and emu). Inclusion of fossil data from Eocene specimens indicates that the last common ancestor of Austrodyptornithes had a bill-tip organ in our ancestral state reconstructions; thus, tactile foraging was likely ancestral for this major extant clade, perhaps retained from a deeper point in crown bird evolutionary history. The presence of such tactile specializations in various stem representatives of Neornithine clades supports the hypothesis that the sense played an important and overlooked role in the evolution of modern birds.

Funding Sources The Royal Society Newton International Fellowship NIF\R1\221542; UKRI Future Leaders Fellowship MR/X015130/1.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Thirty years of discovery at the UK's largest dinosaur track site: Ardley and Dewar's Farm Quarries in north Oxfordshire

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In 1997, dinosaur trackways were discovered at Ardley Quarry near Bicester in Oxfordshire during excavation of the White Limestone

Formation (Middle Jurassic) for use in road construction. This work revealed the largest dinosaur track site ever discovered in the UK, comprising 40 theropod and sauropod trackways on a single bedding plane, with individual trackways extending up to 180 m in length. These trackways yielded important new insights into theropod and sauropod locomotion and suggested a potentially much earlier origin for titanosaurian sauropods than indicated by the body fossil record. However, following a change in the use of the site after completion of quarrying work and to preserve the prints the trackway surface at Ardley was buried and is no longer accessible. Recording also pre-dated the widespread use of photogrammetric and other similar imaging approaches, limiting potential for the restudy and reinterpretation of the 1990s trackways. Since the late 1990s, there were further (albeit limited) intermittent discoveries of predominantly sauropod tracks variously recorded in unpublished reports as quarrying continued. In 2022–2024, to the south of the 1990s discoveries, the quarry operators, Smith & Sons Bletchington Ltd reported multiple new footprint discoveries in the same rock unit as the previous discoveries. An initial excavation took place in 2022, and again in 2024 on an adjoining portion of the track surface. The latter excavation brought together >100 volunteers over the course of a week to clear an area of ~10,000 m^2. We revealed >200 dinosaur tracks, including six sauropod and two theropod trackways with some at least 150 m in length. A comprehensive photogrammetric record of the site was also created. Here, we provide a detailed description of the trackways uncovered in 2022–2024 and discuss trackmaker identities and locomotor inferences. Moreover, we place these recent discoveries within the context of the original discoveries from the 1990s and discoveries made in intervening years to shed further light on the scale of the site and the nature of middle Jurassic ecosystems in north Oxfordshire, ~166 million years ago.

Funding Sources Curry Fund, Geologists' Association (to RJB, KME, EN & DM), School of Geography, Earth & Environmental Sciences and the Alumni Fund, University of Birmingham (KME &RJB).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The first Bashkirian-aged marine Chondrichthyan assemblage from the eastern United States, including the earliest occurrence of the ctenacanth *Glikmanius occidentalis*

Egli, Hunter C.[1,2]

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A newly identified assemblage of marine chondrichthyans has been recovered from a nodular limestone layer within the Union Chapel Mine (Stephen C. Minkin Paleozoic Footprint Site) in Walker County, Alabama, USA. The assemblage—containing *Stethacanthus* sp., *Glikmanius occidentalis* (Leidy, 1859), Eugeneodontiformes indet., and Holocephali indet.—from the Upper Pottsville Formation represents the first documented Bashkirian chondrichthyan fauna from the eastern United States, as well as the first Pennsylvanian chondrichthyan assemblage described from Alabama. This assemblage ranks among the most diverse Bashkirian chondrichthyan faunas currently known from North America. The presence of this assemblage within a mid-Bashkirian (Namurian C / Morrowan) unit extends the lower stratigraphic boundary of *G. occidentalis*, which had previously only been reported from the mid-Desmoinesian onward. Furthermore, the discovery of a eugeneodont non-symphyseal tooth supports earlier interpretations that the origin of the Eugeneodontiformes dates back to approximately the Serpukhovian–Bashkirian boundary.

Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

Tusk histology of Permian dicynodonts reveals a diversity in growth patterns and adaptations to seasonality

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The Permian–Triassic Mass Extinction (PTME) is a key system to study climate-driven extinction and recovery. Taxa that survived this extinction endured extreme climatic shifts leading up to and in the aftermath of this event. Growth patterns have been hypothesized to be an important factor in determining survival during the PTME, but these hypotheses have largely been generated using fossils from the Karoo Basin of South Africa. Here, we expand the geographic sampling of growth rates by examining the dentine growth marks recorded in tusks and caniniform teeth of Permian dicynodonts from the Luangwa Basin of Zambia.

Our sample includes dicynodonts such as *Aulacephalodon*, *Diictodon*, and indeterminate bidentalians and dicynodontoids. We measured both regular growth marks expected in the deposition of dentine and thicker irregular stress lines. For stress lines, we examined the space between each line (time of uninterrupted growth) and the thickness of lines (duration of stressful event). Results reveal disparity in stress line number, spacing, and thickness. Some tusks exhibit extended periods of relatively thin, regularly deposited stress marks while others are much thicker and laid down sporadically. Further, the tusks vary in the number of stress marks identified; some display large numbers of stress marks, whereas others have very few. This suggests that Zambian dicynodonts from the Permian do not adhere to a single growth pattern. Instead, they demonstrate an array of strategies that cannot be stereotyped into a single growth regime.

The diversity of growth patterns present in the Permian dicynodonts of Zambia contrasts with the narrow range of growth patterns previously observed in Triassic dicynodonts. There are two potential explanations for this difference. First, the variation seen in the Permian may have been reduced in the Triassic because of selection for the 'live fast, die young' pattern exemplified by *Lystrosaurus*, with taxa lacking this growth pattern becoming extinct. Second, Permian dicynodonts may have had the ability to modulate their seasonal growth, facilitating adaptation to the environmentally unstable conditions of the PTME and standardizing growth patterns in the group during the Early Triassic. Dicynodont tusks provide a highly resolved record of growth, and continued sampling will be important for testing hypotheses about the importance of changes to life history to the clade's survival during the PTME in southern Africa.

Funding Sources NSF DEB-1701383 ; National Geographic 158R-18 ; NSF EAR-1337569

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Late Cretaceous (Turonian) hybodont (Chondrichthyes, Hybodontiformes) egg capsules from New Jersey, USA

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Chondrichthyan egg capsules are known from several different taxa in the fossil record. Identifications are based on morphotypes and most specimens have been assigned to chimaeroids or hybodontiform sharks, however

specific taxonomic assignments are not possible. Here we report on multiple hybodont egg capsules (*Palaeoxyris* sp.) recovered from the Old Bridge Sand Member, Magothy Formation (Turonian age) of Middlesex County, New Jersey. The Magothy Formation is well-known for its lignite and amber deposits that have yielded insects, plants, fungi and feathers. The Old Bridge Sand Member has been interpreted as both point bar and delta-front facies. Based on the presence of the egg capsules and some marine fossils (oysters and bivalve steinkerns), this would suggest a delta-front facies for the locality, which is interpreted as a probable environment for some hybodont sharks.

The two capsules in the collections of the New Jersey State Museum are three-dimensionally preserved. They both exhibit a spiral collarette, beak, body, and pedicle but no tendril. The larger of the two, NJSM 27975 is more complete and is only missing the distal tips of the beak and pedicle, with an overall length of 99.4 mm and width of 26.6 mm. The second specimen, NJSM 27974, is less complete, missing the beak and the distal portion of the pedicle. The total length of the specimen is 69.2 mm, and it is 28.2 mm wide. NJSM 27974 is also broken in half lengthwise, exposing a hollow internal structure. These capsules were likely deposited in a brackish, deltaic environment where they would be anchored to plant material by tendrils. This type of occurrence may not be uncommon in the Magothy Formation, as there are other similar specimens verified from a nearby location in a private collection. They represent the latest geological occurrences (Turonian) of hybodontifom egg capsules published to date.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Structural and pneumatic characteristics of the cervical vertebrae of sauropods from the Lower Cretaceous Sao Khua Formation, Thailand

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The internal structure of sauropod vertebrae is characterized by pneumatic diverticular systems akin to those observed in modern birds. Their vertebral columns show evidence of extensive air sac systems, which are especially prominent in the cervical region. In this study, the pneumatic features in the cervical vertebrae of two sauropod taxa, *Phuwiangosaurus sirindhornae* and an indeterminate diplodocoid sauropod from the Lower Cretaceous Sao Khua Formation in northeastern Thailand, were examined using computed tomography (CT) imaging. The internal anatomy of *P. sirindhornae* reveals predominantly camerae within the centrum and networks of camellae around the articular areas, indicative of a semicamellate pattern. In contrast, the diplodocoid sauropod displays the camerate pattern, with its centrum composed solely of pneumatic camerae. The semicamellate structure in *P. sirindhornae* closely resembles those of basal titanosauriformes, challenging previous analyses that often assigned it to the Somphospondyli clade. Based on these more basal pneumatic features, we suggest that *P. sirindhornae* represents a non-somphospondylan titanosauriform, more closely related to brachiosaurids. The Sao Khua diplodocoid sauropod exhibits two unambiguous characters shared with dicraeosaurids: (1) narrow posterior cervical and anterior dorsal bifid neural spines that are parallel or converging in anterior or

posterior view, and (2) middle and posterior cervical centroprezygapophyseal laminae divided into lateral and medial branches, the latter of which connects with the intraprezygapophyseal lamina (shared with all dicraeosaurids). The vertebral pneumaticity of the Sao Khua diplodocoid appears more developed than in other dicraeosaurids, but less extensive than that typically observed in neosauropods. The identification of a semicamellate condition in *Phuwiangosaurus* extends the known temporal range of this pattern into the Early Cretaceous, while the camerate condition in the Sao Khua diplodocoid suggests that Cretaceous dicraeosaurids may have exhibited a varying degree of pneumaticity.

Funding Sources Center of Excellence in Morphology of Earth Surface and Advanced Geohazards in Southeast Asia (MESA CE), Chulalongkorn University.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Reassessing late Quaternary megafaunal occurrences in Doggerland through amino acid ^{14}C dating

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Throughout the Quaternary, the southern North Sea basin experienced drastic environmental changes due to climate shifts, sea-level change, and glaciation. During major parts of the Late Pleistocene, this region formed a vast steppe environment known as Doggerland, and housed the iconic mammoth steppe fauna that is found across most of Eurasia and North America. The modern North Sea floor has yielded hundreds of thousands of late Quaternary vertebrate fossils, collected by fishers and citizen scientists, reflecting changes in regional biodiversity and ecosystems. However, since all fossils are recovered ex situ, their exact context is largely unknown. To contextualize these fossils and learn more about changes in ecosystem composition during the Late Pleistocene, we rely heavily on ^{14}C dating.

Although conventional quality metrics such as collagen yield, %C, %N and atomic C/N ratio fall well within acceptable limits, we consider some ^{14}C dates as anomalous based on their contemporary climatological and environmental circumstances (e.g., marine and thermophile mammals dating to the Late Pleistocene mammoth steppe). We hypothesize that in some cases, remaining cross-linked contamination in the collagen produces a younger ^{14}C date. Exogenous carbon from sources such as fulvic acid, humic acid and humates from the surrounding soil may form cross-links with collagen and not be fully removed with a conventional bulk collagen pretreatment protocol.

Here we present a dataset of ~45 vertebrate fossils from Doggerland which were ^{14}C dated based on both bulk collagen samples and XAD2-resin-treated samples. Collagen was extracted using a standard acid-base-acid protocol, followed by gelatinization, Ezee-filtration, and ultrafiltration before being freeze-dried. Part of the freeze-dried collagen was hydrolyzed in acid and passed through pre-cleaned and pre-conditioned XAD2 columns. Hydrolysis breaks down the collagen structure and releases the contaminants, which are then adsorbed by the XAD2 resin, leaving a residue of contaminant-free amino acids for dating.

Initial results show considerable deviations in ^{14}C age ranges compared to published age data. If substantiated by amino acid analyses this will challenge our understanding of successive Late Pleistocene megafaunal associations in western Eurasia. Based on our results we make

recommendations on the best practices for ^{14}C dating of fossils from Doggerland and similar (reworked) settings around the world.

Funding Sources Dutch Research Council (NWO) through an "Open Competitie ENW-M" grant (dossier number: OCENW.M20.360).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The taxonomy and phylogeny of British 'cephalaspids'

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Osteostracans are armoured jawless fishes from the Silurian and Devonian periods bearing robust bony headshields, which are readily preserved in the fossil record. This makes them a highly informative taxon in the context of early vertebrate evolution. Osteostracans are considered the closest jawless relatives of jawed vertebrates and provide the earliest record of paired pectoral fins with skeletal and muscular support. Hence, they are key to understanding the origins of jaws and fins. Unfortunately, despite extensive work towards elucidating their phylogeny, our knowledge of their interrelationships is limited by the current rudimentary state of their taxonomy. This, in turn, obscures the broader macroevolutionary significance of the group. The Early Devonian genus '*Cephalaspis'* is particularly problematic, as it shows a significant amount of inter- and intraspecies variation. A taxonomic revision of this group is crucial to achieve a more accurate and complete picture of Osteostraci. The Old Red Sandstone deposits of Great Britain have yielded hundreds of osteostracan specimens assigned to '*Cephalaspis'* from two main basins: the Midland Valley (Scotland) and the Anglo-Welsh Basin (Welsh Borderlands). These two faunas may have been connected, allowing for taxonomic exchange, suggesting British 'cephalaspids' should not be considered only as independent faunas, but also in the context of an overall freshwater system across Great Britain. We conduct a major taxonomic revision of British osteostracan species associated with the wastebasket taxon '*Cephalaspis'*. We perform a morphometric study of the Scottish and Welsh faunas to assess the morphological disparity within and between them. Our analysis resolves a central cluster including most specimens, which fills the majority of the morphospace. This invalidates classical diagnoses of 'cephalaspids', which were mostly based on relative proportions of certain characters. Furthermore, smaller but morphologically distinct clusters at the edges of the morphospace warrant the erection of new taxa. We revise osteostracan taxonomy accordingly and provide a new framework for more robust diagnoses. We integrate these revisions into an updated character matrix and explore their bearing on osteostracan phylogeny. This represents a major step in resolving the wastebasket genus '*Cephalaspis'* and gaining a more complete understanding of osteostracan diversity.

Funding Sources The Palaeontological Association's Stan Wood Award, reference number PA-SW202401

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Late Pleistocene fossil Ursidae from Portugal (Iberian Peninsula): morphometry and paleobiological inferences

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This study examines over 500 bear remains from six Portuguese Late Pleistocene sites (Furninha, Fontainhas, Serra de Molianos, Caldeirão, Escoural, and Oliveira). We have confirmed that no remains of cave bears (*Ursus spelaeus*) or Asian black bears (*Ursus thibetanus*) have been identified so far in the Late Pleistocene of Portugal, while revealing significant morphological changes in brown bear (*Ursus arctos*) populations over time. The bear population from Furninha Cave (MIS 5, approximately 80,000 years ago) includes over 400 brown bear remains and consists of exceptionally large and robust individuals, some exceeding 300 kg, being much larger than the Middle Pleistocene bears from Postes Cave (Extremadura, Spain). These bears displayed features convergent with cave bears, including their overall robustness, suggesting they may have been occupying the ecological niche of cave bears in SW Iberia. Their fossils also showed gnawing marks and pathological bone modifications, offering clues about the life history of these animals. The brown bears from Escoural and Oliveira Caves, with a similar age, might have also belonged to this population, but this still has to be confirmed. During the later Late Pleistocene (MIS 2, ~30,000 years ago), bear populations from the sites of Caldeirão, Fontainhas, and possibly Serra de Molianos showed a slenderer build, but with some individuals reaching up to 385 kg, being some of the largest *Ursus arctos* in the fossil record. Nevertheless, on average, these bears were comparable in size to contemporaneous Pleistocene populations in northwestern Spain, with some weighting around 250 kg. The transition to the Holocene marked the disappearance of the largest “Pleistocene giants”, with Early Holocene males averaging 270 kg compared to females at 140 kg. Modern Iberian brown bears have undergone size and sexual dimorphism reduction, with current populations in the Pyrenees and Cantabrian Mountains averaging just 140 kg for males and 100 kg for females. These findings highlight the trend of decreasing body size in Iberian brown bears, possibly linked to environmental changes and human pressures. This study provides crucial insights into the evolution of brown bears in western Iberia and a framework for further works, underscoring the need for further research incorporating molecular studies (isotopes and aDNA) as well as detailed paleopathological and taphonomic analyses to fully understand the evolutionary patterns of bears.

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Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Drivers and constraints in the evolution of the turtle body plan

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Turtles have a strongly modified body plan with a rigid shell and an akinetic skull. Despite a Late Triassic origin and a respectable repertoire of ecological specializations, turtles are species-poor today and fossils document low variation of body form over time. We explore patterns of skull and shell shape evolution in the context of turtle diversification and examine if the presence of the shell acts as an evolutionary constraint on turtle evolvability. For this, we use digitized skeletons of 300 extant and fossil species and combine 3D geometric morphometrics, anatomical network analysis, and phylogenetic comparative methods.

Variation in body proportions achieves diversity of body form in many amniotes. Strong, isometric relationships in phylogenetic regressions of humerus-femur-shell lengths

show that turtles have strict body proportions that already existed in Triassic turtles. We propose that the presence of the shell limits evolutionary possibilities of proportional variation in turtles. These constraints, paired with low rates of variance accumulation in body proportions over evolutionary timescales are likely explain why turtles have conservative body plans.

Despite constrained body proportions, turtles have diversified ecologically, and we explore cranial innovations as drivers. Early turtle skull evolution is characterized by bone reductions and the establishment of unusual contacts (e.g., parietal-pterygoid). These strengthen the akinetic skull and form mechanical prerequisites for later innovations, such as neck retraction. Turtle skull shape has a strong relationship with neck retraction, which evolved in the Middle Jurassic. We hypothesize that the evolution of higher neck mobility weakens the integration of skull and shell, enabling turtles to evolve novel feeding modes that facilitate the Jurassic diversification in aquatic settings. Several feeding ecologies (suction feeding, durophagy) later evolved convergently in different lineages. Anatomical network analysis shows that turtles also experience cranial constraints, having limited topologies of skull bone connections. Diversity of skull form is more strongly affected by shape changes than by topological variation. Thus, cranial shape evolution explains diversification patterns of turtles, whereas constraints in cranial topology and body form imposed by the shell contribute to high morphological conservatism and low species diversity in the group.

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Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

New specimens of *Lewisuchus admixtus* (early Carnian, Argentina) inform about the origin of the dinosaur body plan

Ezcurra, Martin D.[1,2], Novas, Fernando E.[3], Agnolín, Federico L.[4], Fiorelli, Lucas E.[5], von Baczko, Belén[1], Martinelli, Agustin[1], Garcia Marsà, Jordi A.[4], Trotteyn, M. Jimena[6], Desojo, Julia B.[7]

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The taxonomic and morphological diversity of the Triassic dinosauromorphs has increased substantially in the last 25 years. This has resulted from the recognition of a diversification of Middle–Late Triassic species grouped among the silesaurids, a clade of non-dinosaurian dinosauromorphs or a paraphyletic grade leading to core-ornithischians. The silesaurids, especially those deeply nested in the group, include non-cursorial, probably quadrupedal forms with specialized tooth crowns and an edentulous lower beak, suggesting an omnivorous-herbivorous diet. The specialized silesaurid anatomy departs from the expected body plan for the common ancestor of dinosaurs (or of the core-ornithischians if silesaurids are members of that clade). The dinosauromorph *Lewisuchus admixtus* from the lower Carnian rocks of the Chañares Formation of Argentina

has been recovered as the earliest diverging silesaurid in most recent phylogenetic analyses. This result is supported by the absence of the specializations present in other silesaurids. Unfortunately, currently known specimens of *Lewisuchus* are considerably more incomplete than those of the best-known silesaurids, and most of the skull, forelimb, and pes have remained unknown. This has obscured the implications of *Lewisuchus* regarding dinosaur origins. Here, we report on several new specimens of *L. admixtus* collected in the Chañares Formation, including an exquisitely preserved, almost complete skull and complete manus and pes. These new specimens, in addition to the repreparation of historical ones, make *Lewisuchus* one of the most complete Triassic dinosauromorphs known so far. An expanded version of the most comprehensive phylogenetic analysis focused on Permo–Triassic archosauromorphs robustly recovered *Lewisuchus* as the sister taxon to Dinosauria under both implied weighting parsimony and Bayesian inference. Silesaurids are found to be a monophyletic group sister to the *Lewisuchus* + Dinosauria clade. Thus, *Lewisuchus* becomes the first non-dinosaurian dinosauromorph to preserve an almost complete skull and manus and shows that features that were previously thought to be restricted to dinosaurs already evolved outside the clade (e.g., downturned premaxilla, manual digit IV with a single phalanx and digit V without phalanges, perforated acetabulum). Our study illuminates the origin of the dinosaur body plan and, contrasting with some previous hypotheses, indicates ancestral predatory habits for Dinosauria.

Funding Sources ANPCyT PICT 2018-0717, 2018-01186, 2018-01390, Coleman Burke Foundation, Jurassic Foundation, PROJOVI 3635/2015, and Secretaría de Cultura de La Rioja.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Myological reconstruction of the forelimb of *Yutyrannus huali* and muscular trends within Tyrannosauroidea

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Paleontology is a field of comparison and inference. This is evident in the study of theropod forelimb function and evolution, for which there are few modern analogs. Forelimb function in tyrannosaurs is a hotly contested topic, but the overall evolution of the musculature in the clade remains poorly understood. To help fill these gaps, we've undertaken a reconstruction of the forelimb musculature of *Yutyrannus huali*, a basal tyrannosauroid of Cretaceous China and a distant cousin of the more famous *Tyrannosaurus rex*. This reconstruction was developed to better conceptualize muscle evolution in the tyrannosaur clade as a whole and was conducted by using morphological comparisons to taxa in multiple lineages. The structure of the *Y. huali* forelimb was illustrated and muscle attachment sites were reconstructed. These locations were inferred using preserved osteological correlates along with prior reconstructions of *Tawa*, a basal theropod, and the tyrannosauroids *Guanlong* and *Tyrannosaurus*. Upon completion of this reconstruction, the forelimb morphology of *Y. huali* was compared with that of other tyrannosauroids, and differences in the shape of bone, presence or absence of specific features, and location of muscle attachments sites were noted. The forelimb of *Y. huali* shows an intermediate muscular morphology between the gracile forelimb of basal tyrannosaurs and the extreme reduction of derived taxa. The humerus, radius, and ulna all exhibit an overall trend in broadening, providing more area for attachment of muscles such as coracobrachialis and supinator. In the manus, a trend is evident in the reduction of digit III. In *Y. huali*, the manus remains robust and digit III is well developed, whereas in derived species, digit III is reduced to only the metacarpal containing a single attachment for the flexor carpi ulnaris. Overall,

there is a clear change in proportion, with the scapula being relatively larger than the other bones in derived taxa. This suggests proximally located muscles remained important throughout the lineage, even as more distal muscles were reduced along with the forelimb. This in-depth reconstruction allows for better understanding of the morphological changes in the forelimb of this clade and will serve as an important future reference in other similar analyses. Continued myological reconstructions of species like *Y. huali* will lead to more accurate estimates of morphological trends in tyrannosaurs and across Theropoda.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

On ichthyosaurs' metabolism: first results

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Endothermy is one of the most studied biological processes in modern vertebrate paleontology. It has been successfully identified in at least three different vertebrate clades (Mammalia, Archosauria, and †Sauropterygia). Past studies using geochemical data provided evidence of a sustained endothermic regime in †Ichthyosauria, but direct evidence of their metabolism is lacking. Here, we present preliminary results of a new study based on osteohistological data, aiming to estimate the metabolic regime of these extinct marine tetrapods.

Osteohistological quantitative data were measured in humeral and femoral sections from five species of ichthyosaurs across their phylogeny and were used in two different statistical models aiming to infer their bone growth rate and the volume of their erythrocytes (red blood cells). Indeed, both features are tightly connected to the metabolic regime. These models were expanded by the addition of humeral data from three cetaceans for the first time, which are believed to be the best modern analogs to extinct ichthyosaurs.

Moreover, a new approach aiming to mix these models to directly infer the metabolic rate is tested here. We used various phylogenetic comparative methods to discuss the validity of these models and methods in inferring metabolism.

The first results are interesting and confounding. Despite the currently accepted interpretation of ichthyosaurs as endothermic, our results are closer to those expected for slow growing animals with ectothermic-like erythrocytes.

Funding Sources Research Council of Norway, project number 335111

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Biostratigraphic and taphonomic studies from Middle–Late Pleistocene fossil mammals assemblages in the Argentine Pampas

Fernandez-Jalvo, Yolanda

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The fossil site of Salto de Piedra is located in the upper basin of the Tapalqué Creek, which fossil-bearing strata cover the last 300 ka BP. This period includes the Middle–Late Pleistocene–Holocene (glacial-interglacial) transition. Different taphonomic methods have been applied to the small mammals, macro- and megafauna, and gastropods recorded at the different facies in profile. Systematic excavations have provided a relatively large fossil collection of the small, meso- and large mammal fossils. The different taphonomic methods, applied to different taxonomic groups, have allowed us to obtain a conclusive interpretation of the formation of the site and exclude potential reworking of these fossils recorded in a riverbank site. Re-sedimentation, however, has affected these fossil assemblages. The taxonomic identifications, combined with

taphonomic results and radiometric dating, suggest that the biozones established in the Pampas region should be revised. We identified two biostratigraphic units based on the study of faunal associations. The basal section (Unit 1) corresponds to the MIS5/8 (Middle Pleistocene) or even older according to radiometric dating. Based on the presence of *Equus neogeus*, we assign the fauna of this unit to the *Equus neogeus* Biozone. In the same way, we associate Units 2 (MIS 3), 3, and 4 (MIS 2) to the same biozone. Units 5 and 6 (MIS 1) to the biozone of *Lagostomus maximus* (Holocene). These new faunal results and the associated dating provide crucial data to redefine the Bonaerian and Lujanian Stages/Ages and allow us to better identify and calibrate the biozones' limits. Our results indicate the need to revise the biozone schemes established for the Quaternary of South America.

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Theoretical adaptive landscapes suggest that bite efficiency and opening speed—but not strength—shape the mandibles of turtles

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Mapping functional traits onto a morphospace is a powerful approach to explain the morphological diversity of organisms. Aided more recently by developments in digitization, the usage of geometric morphometrics to construct a morphospace enables the warping of three-dimensional virtual models into hypothetical shapes that can then be used in simulations to quantify functional traits to infer theoretical adaptive landscapes. Analyzing functional morphology under this framework has the potential to illuminate constraints and selective forces shaping the evolution of morphology. Here, I used this framework to explore the evolution of mandibles in turtles. Due to their direct relation to feeding, mandibles can shed light on different aspects of paleobiology. I modelled a morphospace using the first two principal components (corresponding to 51% of the variation) of a dataset containing 15 single landmarks and six curves on mandibles of 44 turtles, including six extinct species. I then generated a 5 x 4 grid of 20 hypothetical 3D warps, from which I quantified proxies for bite force (mechanical advantage, MA), opening speed (jaw opening mechanical advantage, OMA), and strength (second mandibular moment of inertia, SMOI), for the shapes along the grid, creating three functional landscapes that overlaid the morphospace. The preliminary results indicate a strong tradeoff between MA and OMA, which appears to influence the distribution of species. The mandibles approach the optima for either trait, but only surround them, maybe because those also represent the poorest performance in the opposite trait. Suction-feeders approach the two optima of OMA, occurring on positive and negative PC2 values. There appears to be a trend among pleurodiran suction-feeders to approach the latter, whereas cryptodires tend to approach the former. Durophagous species, on the other hand, approach the MA optimum, with *Solnhofia parsoni* closest to it. Most turtles are distributed along mean values of SMOI, and the lowest values of this trait are depopulated. *Proganochelys quenstedtii* is the only taxon placed near the optimum of this trait, suggesting that turtles initially had more resistant mandibles and, over their evolution, might have sacrificed strength for more efficient bites or faster jaws. The next steps include increasing theoretical and empirical sampling, particularly of non-Testudines, to better explore the shift in strength of turtle mandibles.

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Macroevolutionary analysis of developmental mode illuminates underpinnings of the neoavian radiation

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Neoaves, one of the three deepest crown bird subclades, comprises over 95% of living bird diversity. Time-calibrated phylogenies indicate that Neoaves underwent explosive diversification in the aftermath of the Cretaceous–Paleogene (K–Pg) mass extinction, which has generally been attributed to rapid ecological niche-filling. To date, however, few studies have explored the factors underpinning the differential diversification of Neoaves relative to Palaeognathae and Galloanserae, the other two subclades of crown birds which collectively account for only 4.9% of extant avian diversity. Here, we analyze the evolution of avian developmental mode, with a focus on the selective drivers influencing individual parameters related to the altricial-precocial spectrum. We find that major transitions in neoavian foraging ecology—from plesiomorphic terrestrial or nearshore aquatic niches to derived aerial, arboreal or pelagic niches—are correlated with shifts from low nest attendance strategies to high nest attendance strategies. Ancestral state reconstructions suggest that the evolutionary origin of parental feeding was a prerequisite for high nest attendance, enabling transitions to novel foraging ecologies following the K–Pg mass extinction. Resultant shifts to high nest attendance enabled the evolution of greater flexibility in post-hatching developmental trajectories and durations, amplifying disparification of neoavian ecology and morphology. Our results support the origin of more altricial developmental strategies as a key element of the early Cenozoic diversification of Neoaves and provide a cohesive framework for interpreting the interplay between the origin of developmental mode disparity and ecological diversification in the wake of the K–Pg mass extinction.

Funding Sources UKRI FLF MR/X015130/1

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Vertebral column evolution in Sirenia (Mammalia, Afrotheria)

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Vertebral column regionalization is widely considered a hallmark adaptation in tetrapod evolution, which in most mammals results in constrained vertebral counts, yet high morphological disparity. However, marine mammals such as sirenians (manatees and dugongs) and cetaceans (whales, dolphins and porpoises) appear to have re-acquired flexibility in vertebral count, raising questions about whether their columns underwent genuine de-regionalization or a more complex re-patterning. Here, we use a large dataset (>500) of 3D vertebral models, including living crown sirenians and four-limbed stem taxa (prorastomids), to show that increased vertebral count variability in the thoracolumbar series of sirenians correlates with a markedly lower disparity in vertebral shape compared to terrestrial relatives. Furthermore, the sirenian vertebral column retains discrete transitions indicative of a lumbocaudal series re-patterning, similar to that described in cetaceans, yet in disagreement with partially de-regionalized columns associated with low disparities. These findings are consistent with the proposition that low activity levels, coupled with reduced oxidative DNA damage and cancer incidence—likely linked to seagrass-based diets and relaxed metabolic demands—diminish selective pressures for fixed vertebral counts, thereby fostering morphological flexibility. Contrary to

the prevailing notion that returning to a marine lifestyle minimizes regionalization, our findings reveal that sirenians preserve differentiation of the axial regions while they homogenize the thoracolumbar series. Our findings challenge existing notions of "de-regionalization" in marine mammals and emphasizes the evolutionary plasticity and complexity of the axial skeleton across macroevolutionary transitions.

Funding Sources Spanish Ministry of Economy and Competitiveness (MINECO) (grant number PID2019-111185GB-I00).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New vertebrate fossil discoveries from the Early Cretaceous Dzun Shakhai and Shine Usny Tolgod localities from the Eastern Gobi Basin of Mongolia

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Lower Cretaceous strata of the Eastern Gobi Basin (EGB) of Mongolia preserve one of the most diverse vertebrate assemblages in Central Asia. Despite its importance, many of the fossiliferous localities in this region remain coarsely dated and stratigraphically poorly correlated due to complex basinal development associated with syn-rift tectonics. Recent redescription of the near-continuous sedimentological successions at Dzun Shakhai and Shine Usny Tolgod fossil localities, located in the Sainshand Sub-basin of the EGB, provides unprecedented stratigraphic resolution for contextualizing Early Cretaceous vertebrate communities in this region. Previous paleontological surveys recovered material from the ceratopsian Psittacosaurus, a sauropod femur, a hadrosaur mandible, dromaeosaurid claws, ankylosaur osteoderms, a theropod femur, and isolated theropod teeth. Non-dinosaurian material includes testudine shell fragments, ganoid fish scales, and wood. In 2023, new field explorations were conducted in the EGB by the NC Museum of Natural Sciences and the Institute of Paleontology of the Mongolian Academy of Sciences team, Mongolian Alliance for Dinosaur Exploration (MADEx). Here we report newly discovered vertebrate materials from the aforementioned localities. The recovered materials include isolated but well-preserved remains of ganoid fish scales, non-avian dinosaurs, crocodyliforms, champsosaurs, and testudines. Fossils were collected from the alluvial plain successions of the Sharilyn Formation and the fluvial floodplain of the Khukhteeg Formation. Preliminary taxonomic assessments confirm the presence of previously unrecognized taxa, including three theropod tooth morphotypes, a paravian theropod, a large-bodied theropod (possible carcharodontosaurian), a narrow-crowned sauropod, and a tooth from a new medium-sized neoceratopsian. These taxa expand our understanding of the Early Cretaceous vertebrate diversity and biogeography in the EGB in Mongolia and highlight the significance of regional tectono-sedimentary controls on faunal distribution. Together, these data underscore the importance of continued sampling and dating efforts in Lower Cretaceous localities within the EGB for resolving evolutionary and paleoecological patterns preceding major faunal turnover and landscape reorganization during the Late Cretaceous.

Funding Sources National Geographic Society award NGS-100601R-23 to LEZ, TC, and RTT.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The nature of the Cenomanian–Turonian turnover in marine reptiles

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The highest trophic niches in Mesozoic oceans were occupied by multiple, loosely related clades of marine reptiles, which evolved a series of craniodental and postcranial morphologies. The Jurassic and Early Cretaceous are characterized by relative stability of higher taxonomic levels, with three main clades dominated trophic chains: ichthyosaurians, plesiosaurians, and thalattosuchian crocodyliformes. This macroevolutionary picture changes drastically during the 'middle' Cretaceous: ichthyosaurians, thalattosuchians, and pliosaurid plesiosaurians disappear, whereas mosasaurids and peculiar xenopsarian plesiosaurians diversify, alongside acanthomorph teleosts, neoselachian sharks, marine turtles, and marine birds. This shift created the unique and somewhat short-lived oceanic trophic webs of the Late Cretaceous. Many of these clade turnovers (although not all) are concentrated within the Cenomanian–Turonian interval, a time known for its climatic volatility.

Our goal is to assess the impact of these Cenomanian–Turonian events on marine reptiles, by analysing extinction selectivity and changes in functional diversity. We carried out phylogeny-informed analyses of extinction selectivity, using Fritz & Purvis' D metric on an informal supertree sampling 370 marine reptile lineages; we found that lineages' extinctions are both elevated and selective during the 'middle Cretaceous', targeting different clades at each boundary. Then, we computed univariate and multivariate distributions of functional traits (vision range, approximated bite force, snout elongation) using the largest sample of 2D and 3D data on marine reptiles ever assembled. The weak morphological and functional convergence between Early and Late Cretaceous marine reptiles resulted in marine reptile assemblages that are clearly dissimilar not only in terms of phenotypes, but also in the biomechanical and functional aspects of their skulls. This highlights the importance of past extinction events in reshaping the highest tiers of marine trophic webs.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Pterosaurs show earliest known loss of vertebrate powered flight and deep origin of 'ornithoscelidan' anatomy

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Flight acquisition and secondary flight loss represent two of the greatest topics of discourse in evolution. Nowhere is this more true than in the avian total group, Panaves, which contains at least two flighted groups, Pterosauria and Aves. Recent phylogenetic analyses have revealed considerable support for the non-volant lagerpetids as sister group to, or a grade around, Pterosauria and have proposed that this group represents a morphological intermediate in the evolution of pterosaur flight. However, analyses focusing on lagerpetid relationships within Panaves typically exclude or under-represent Pterosauria.

Here, we provide a new phylogenetic dataset and analysis using an iteration of a previously published dinosauromorph matrix. The resulting dataset consists of 162 OTUs and 624 discrete morphological characters. The dataset includes a much larger sample of outgroup archosauriforms and a comprehensive sampling of Triassic and

Jurassic panavians, including 39 pterosaur taxa. The dataset was analyzed using maximum parsimony and Bayesian framework. Our results show the most support for a monophyletic Lagerpetidae lying within Pterosauria, representing the earliest known lineage of secondarily flightless vertebrates. Lagerpetids are recovered as part of a distinct clade with 'dimorphodont' and 'eudimorphodont' pterosaurs united by the following characters: multicuspid, heterodont teeth, and several details of the endocranial and distal femoral anatomy, among others. *Campylognathoides* is consistently recovered as the earliest diverging pterosaur, with lagerpetids and the rest of Pterosauria united by several characters not found in the former, including an expansive secondary maxillary palate, a pubo-ischiadic plate, the absence of an occipital condyle neck, and unique processes on the distal radius and ulna. Several features that previously supported the Theropoda+Ornithischia-exclusive clade Ornithoscelida are also found to be widely present among pterosaurs, and as such we do not recover Ornithoscelida in this analysis. These 'ornithoscelidan' features include medial/lateral malleoli of the distal tibia, dorsosacral and caudosacral vertebrae, the absence of a calcaneal tuber, and a fused astragalocalcaneum. We discuss the implications of these results for the phylogenetic and evolutionary relationships of Pterosauria and of Panaves as a whole.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A dromaeosaurid theropod tooth from an Upper Cretaceous (Turonian) marine deposit in northeastern South Dakota, USA

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The Dakota Rose Granite Quarry ('Rose Quarry') near Milbank in Grant County, South Dakota, USA, is a now-inactive Precambrian granite quarry with a massive spoil bank consisting of overlying Upper Cretaceous sedimentary lenses largely composed of arkosic chalky marl and boulder conglomerates. Those deposits are rich in marine fossil vertebrates, including shark (e.g., *Ptychodus*, *Scapanorhynchus*, *Cretodus*, *Cretalamna*, *Cretoxyrhina*, *Leptostyrax*, *Squalicorax*, *Ptychotrygon*, and *Pseudohypolophus*), bony fish (*Gillicus*, *Ichthyodectes*, and *Pachyrhizodus*), marine turtle (*Desmatochelys*), plesiosaur (cf. *Brachauchenius*), and aquatic bird (Hespeornithiformes) taxa. Another previously noted occurrence is a dromaeosaurid theropod dinosaur, but it was never formally described. Here, we report an isolated tooth of cf. *Dromaeosaurus* sp. collected from Rose Quarry and is cataloged as SMM P95.3.1 at the Science Museum of Minnesota in St. Paul, Minnesota, USA. The tooth is represented by a nearly complete crown and measures 12 mm in apicobasal height, 5.6 mm in anteroposterior length, and 4 mm in labiolingual width. The anterior margin is tightly curved distally with a serration count of 38, whereas the posterior edge is weakly concave with a serration count of 26. The occurrence of the tooth from the Rose Quarry is noteworthy not only because it was deposited in a nearshore environment of the Late Cretaceous Western Interior Seaway but also because the area was along the western margin of Appalachia, a landmass where dromaeosaur records are scant. The taxonomic composition of the vertebrate assemblage at the Rose Quarry has suggested that the marine deposit is middle–late Turonian in age and likely formed during the Turonian–Coniacian Time Transgressive Event, like the Carlile Shale to the west. This timeframe places SMM P95.3.1 as the stratigraphically oldest dromaeosaurid record in Appalachia, providing new insights into the evolution and paleobiogeography of Dromaeosauridae.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The phylogenetic signal of extinction through the rise and fall of early vertebrates—field of bullets or clustered strike?

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Early vertebrates provide a remarkable study system for investigating the drivers of extinction and turnover in Palaeozoic ecosystems. Phylogenetic conservation of ecological traits that promoted or alleviated extinction risk has the potential to explain differential patterns of extinction across early vertebrate groups. Elucidating the factors that shaped their rise and fall, however, is challenged by a lack of phylogenetic trees that include an adequate proportion of their taxonomic diversity, coupled with the unavailability of the well-revolved fossil occurrence data required to characterise the spatiotemporal distribution of early vertebrate taxonomic diversity. To address these issues, we construct a formal supertree of over 1000 early vertebrate species, time calibrated using an expanded fossil occurrence dataset compiled through an intensive databasing campaign. We use this supertree to assess the phylogenetic signal of extinction clustering across early vertebrate phylogeny and through geological time. Preliminary results indicate substantial variability across both temporal and phylogenetic axes, but indicate that clustering was most severe amongst jawless vertebrates as gnathostomes became increasingly prominent within Palaeozoic ecosystems. Conversely, clustering within gnathostomes was strongest during the Hangenberg mass extinction at the end of the Devonian. This work forms the basis for linking their phylogenetic and taxonomic diversity patterns to explanatory ecological and geographic factors in future work.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Aerodynamic impacts of hind limb presence, size, and posture on the pterosaur flight apparatus

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Pterosaurs, an extinct group of flying reptiles that lived between 220 and 66 million years ago during the Mesozoic, were the first vertebrates to evolve active flight. Previous investigations on the morphology and function of pterosaur wings have focused on the forelimbs while the hind limbs have been largely ignored. Prior studies agreed the hind limb was an integral part of the wing apparatus because the main membrane (brachiopatagium) was connected between the distal wing fingertips and the hind limbs, and the cruropatagium between the tail and the hind limbs. This study investigates the impact of hind limb presence and posture on pterosaur flight capabilities. This was achieved by using three wing shape models: the narrow wing model (NWM) that excludes the hind limbs; the standard wing model (SWM) that includes the hind limbs with the femur positioned at an angle of 90° to the body; and the extended wing model (EWM) with the femur

positioned at 45° from the body. Wing surface areas were calculated for 395 specimens from 185 species and were used to calculate aerodynamic properties such as aspect ratio and wing loading that served as proxies for flight styles. Comparisons between the wing shape models reveal wing areas using the SWM and EWM are twice that of the NWM. Aspect ratios of specimens are lower using the SWM and EWM, indicating broader wing profiles and lower wing loading values. Placing these data within a phylogenetic framework finds the largest wing loading values independently evolved in multiple distantly related pterodactyloid groups. Clades characterized by long hind limbs (e.g., Azhdarchoidea) exhibited greater variation compared to clades with short–medium length hind limbs (e.g., Rhamphorhynchinae). Inner and outer wing surface variations in the SWM and EWM suggests specific contributions to flight capabilities. This includes highly maneuverable flight styles among taxa with high inner wing contributions (e.g., Anurognathidae) and soaring flight styles among taxa with high outer wing contributions (e.g., Pteranodontia). Small differences between the SWM and EWM model suggest that the angle at which the hind limbs were positioned during flight had less importance on aspect ratio and wing loading than hind limb inclusion. Overall, this study demonstrates that pterosaur wing profiles and flight capabilities are sensitive to hind limb inclusion and posture, which greatly impacts our understanding of their aerial abilities.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Getting a head: the *Mammuthus exilis* Crania Preservation Project

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The Santa Barbara Museum of Natural History (SBMNH) holds *Mammuthus exilis* fossils endemic to California's Northern Channel Islands, including several crania. These skulls are informative because of their diagnostic characteristics and are currently being studied to describe the species's morphological range. Renewed research interest in these skulls has prompted a preservation project focused on improving conservation of the specimens.

The skulls are from two different collections that correspond to when they were excavated and prepared; an SBMNH group that was gathered from 1947 to the late 1970s, and specimens collected from the Channel Islands National Park from the 1980s to present (SBMNH is a National Park Service repository). An inventory of *M. exilis* skulls was undertaken to identify skulls that were at risk from outdated conservation techniques. Five *M. exilis* crania from the SBMNH collection required urgent conservation work due to inadequate support and failing adhesives.

This poster documents the materials and methods used to restore the crania for research and to preserve the fossils for long-term conservation. Key objectives included: identification of the old preparation materials used (e.g., epoxies, caulks, plaster of Paris, shellacs, and varnishes), testing various removal techniques (e.g., application of solvent-soaked poultices, use of gels formulated from conservation literature instructions, experimentation with commercial products, and elimination by air scribe), removal of stains left by some of these materials, and application of modern reversible consolidants (e.g., 10% w/w Paraloid B-72) to stabilize the specimens.

The pneumatic bone on all five crania posed interesting challenges. One cranium had a thin film applied that had begun to peel. Plaster had been applied directly to the pneumatic bone of another cranium to create a support strut. Matrix still infilled or encased multiple specimens; its removal revealed internal cranial features like possible petrosal bone which is useful for DNA sampling. Overall, the research utility and long-term conservation of the crania have been significantly improved. The materials and methods developed through this project will be

used to better conserve other *M. exilis* fossils in the collection.

Funding Sources Santa Barbara Museum of Natural History

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

The vertebrate fauna of the Moenkopi Formation, including a new microvertebrate locality, and the diversification of low-latitude Triassic communities

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Middle Triassic assemblages are key to understanding patterns of community diversification following the end-Permian mass extinction, but vertebrates from this interval are scarce, particularly at low latitudes. The Moenkopi Formation (~246.8–241.5 Ma, Anisian, Middle Triassic) from the southwestern U.S.A. yields rare examples of low-latitude terrestrial faunas. The richest assemblages from the Holbrook Member of Arizona and its lateral equivalent in New Mexico (Anton Chico Member) document a widespread low-diversity fauna of hybodontiforms, actinopterygians, sarcopterygians, temnospondyl amphibians, dicynodonts, and archosauromorphs. However, our understanding of the Moenkopi fauna is still limited to isolated and fragmentary remains. Here we describe VT-MK-10, a new site from the Holbrook Member exposed at 'Radar Mesa' near Winslow in northern Arizona. VT-MK-10 is the first terrestrial microvertebrate assemblage from the Moenkopi Formation, the oldest in North America, and documents new scale, tooth, and jaw morphotypes that expand the diversity of hybodontiforms, actinopterygians, sarcopterygians, amphibians, parareptiles, and archosauromorphs in the region. Although our study nearly doubles the number of taxa reported from the Moenkopi Formation, it supports the hypothesis of lower diversity of Anisian low-latitude ecosystems compared to those of younger stages (i.e., Upper Triassic Chinle Formation and Dockum Group). We tested this hypothesis by documenting ~30 Ma of tetrapod evolution in the southwestern U.S.A. in the Anisian–middle Norian interval. We assembled a high-resolution regional dataset of 108 tetrapod taxa (>15,000 specimens) from eleven well-sampled paleocommunities. Using ecological trait modelling, resampling methods, and multivariate analyses, we quantified and compared their taxonomic and ecological richness through time. Our results show that low-latitude paleocommunities were subject to intense taxonomic and ecological turnover that constrained their diversity up to the Carnian. The early Late Triassic radiation of crown archosaurs (i.e., phytosaurs, aetosaurs, dinosauromorphs, and pterosauromorphs), which are absent in the Moenkopi Formation, predates a drop in turnover and an increase in taxonomic and ecological richness, which were maintained through the Norian. Overall, our results support the hypothesis of a slow recovery from the end-Permian mass extinction and delayed diversification of land paleocommunities at low latitudes.

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Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Using Discord-based community gaming servers as a means to teach paleontology

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Modern science outreach spans social media, streaming platforms, documentaries, public events, and even pop culture conventions. While researchers often use sites like Twitter/X or Instagram to share science, they can pose barriers such as restrictive word counts, algorithmic limitations, and spammy or bot-filled comment sections. Recently, private social media platforms like Discord have surged in popularity, particularly among those aged 18–34. With over 150 million monthly users, Discord blends features of traditional social media with real-time messaging. Its server-based structure allows for community-led moderation, topic-specific channels, and both text and voice communication. Discord has also uniquely established itself as the primary social media tool for the video game community, especially for online multiplayer games where people rally in dedicated community servers.

Nat Hist (Natural History) is one such community server for the video game Path of Titans, a survival multiplayer game in which players control dinosaur characters and interact with both their environment and other players in cooperative and competitive ways. Launched in January 2022, Nat Hist is branded as a paleontologist-founded community for Path of Titans players interested in natural science and now boasts over 11,400 members. The server enforces evidence-informed gameplay rules (e.g., clade-based herding and cannibalism behavior grounded in fossil evidence) and also hosts channels for science trivia, paleontology news, and science discussions.

To evaluate Nat Hist's educational impact, a survey was conducted asking members to rate their paleontology knowledge before and after joining. Over 200 members from ~20 countries responded, with 70% aged 18–34. Results showed a clear increase in self-reported knowledge: average ratings rose from 6.72 to 8.89 out of 10. Specific knowledge gains were notable—73% correctly identified members of the clade Thyreophora, with 68% unfamiliar with the term before joining. In another example, 92.5% accurately defined sympatric speciation, a term 75% didn't know previously, attributed to a themed Nat Hist "server lore" channel.

These findings suggest that Discord-based gaming communities like Nat Hist can be effective tools for science education. Their topic-specific organization, real-time discussion, and community engagement create a unique and accessible environment for informal learning, particularly among younger, global audiences.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Surface swimming drag of terrestrial amniotes and insights into secondarily aquatic transformations and lack thereof

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Secondarily aquatic (SecAq) transformations are underpinned by dramatic changes in morphology as terrestrial animals evolve to overcome the

constraints of aquatic environments. The factors that lead some groups to occupy these niches over others are not well understood. For example, non-avian dinosaurs never developed advanced aquatic forms during their 150-million-year reign, while other Mesozoic reptiles like mosasaurs, plesiosaurs, and thalattosaurs made such transitions. Avian dinosaurs, however, underwent multiple aquatic invasions (e.g., penguins, loons). Numerous factors likely influence these transformations. We set out to test the factor of relative surface swimming capabilities through a hydrodynamics lens in terrestrial amniotes. It can be presumed that surface swimming was the initial aquatic adaptation for fully terrestrial SecAq ancestors.

We hypothesize that the morphologies of the terrestrial ancestors of SecAq clades experienced lower drag forces than those of lineages that never made the transition. To test this, we used Blender and skeletal references to construct 3D models of terrestrial outgroups of SecAq clades (Cetacea: *Diacodexis*, Mosasauroidea: *Varanus*, Aves: *Gallus*) and the non-avian dinosaur *Eoraptor*, representing a potential transitional morphology due to its small size (<1.5 m), consistent with other SecAq trends, and its bipedalism—the ancestral dinosaurian condition. We then used OpenFOAM, an open-source computational fluid dynamics (CFD) software, to simulate these models in a two-phase flow of air and water, representing surface swimming, using the InterFoam solver.

Our results revealed that *Varanus* had the lowest drag force (3.68 N) and drag coefficient, C_D, of 0.021, which aligns with the limb-tucking behavior in lizards that reduces drag during undulation. This may help explain the repeated aquatic invasions by sprawling reptiles in the Mesozoic. *Diacodexis* followed with a C_D of 0.045, while *Eoraptor* had both the highest drag force (22.8 N) and C_D (0.064), suggesting that dinosaurs may be hydrodynamically constrained. *Gallus* showed the most variable results contingent on water depth, suggesting an inverse relationship between buoyancy and surface swimming drag in terrestrial avian dinosaurs. These results support the hypothesis that the hydrodynamics of certain morphologies may have contributed to both ease and prevention of SecAq transitions, while leaving room for the investigation of additional contributing factors.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A unique tooth replacement pattern in the enigmatic Middle Triassic marine reptile, *Omphalosaurus*

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The Lower and Middle Triassic are characterized by a large radiation and worldwide distribution of marine reptiles. Out of the several lineages that diversified in this period, one of the most enigmatic is the genus *Omphalosaurus*, which has exclusively been found in Lower and Middle Triassic open marine deposits in the northern hemisphere. *Omphalosaurus* is set apart by its unique dentition, which is one of the most derived in amniotes. The maxilla and dentaries present teeth in a densely packed and irregularly spaced manner, focusing especially along the symphysis. Unlike other ichthyosaurs, *Omphalosaurus* teeth are completely embedded in the matrix of the bone and have a bulbous crown with a button-like shape. The microstructure is highly complex and unusual, characterized by a thick, dense enamel cap, vascularized dentine with a globular shape, absence of alveolar bone and a poorly defined or entirely absent root. Whereas some attention has been given to the enigmatic tooth structure, not much is known about the tooth replacement pattern in *Omphalosaurus*. We focus on investigating the unique replacement pattern and function of the teeth in these exceptional reptiles. To do so, several dentaries of early Triassic specimens of *Omphalosaurus* are analyzed from thin sections and micro-CT scans.

We hypothesize that, in *Omphalosaurus*, teeth migrated through the bone tissue toward the occlusal surface, where they were worn down entirely without being shed, often even leading

to wear facets on the jaw bones. New teeth likely form within the dental lamina and gradually push older teeth occlusally. Moreover, the bulbous teeth and thick enamel suggest a durophagous feeding strategy, adapted for crushing hard-shelled prey such as ammonoids in open marine environments. *Omphalosaurus* was seemingly highly successful in the Panthalssian ecosystem of the Lower and Middle Triassic as indicated by the density of finds and the wide geographic distribution. Surprisingly, the taxon disappears completely by the Late Triassic, despite its food source (ammonoids) continuing to thrive. A deeper understanding of the tooth structure in *Omphalosuarus* will not only give us novel insights into the diversity of tooth development and dental replacement patterns in amniotes, but also provide a better understanding the dynamics of the trophic marine structures throughout the Triassic.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A new ornithischian from the Upper Jurassic Shishugou Formation, Xinjiang, China, and a novel analysis of ornithischian phylogeny

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A new ornithischian dinosaur from the Upper Jurassic Shishugou Formation, Xinjiang, China, is represented by numerous specimens that together preserve the entire skull and postcranial skeleton, including unusual features such as a patella-like sesamoid and clover-leaf shaped teeth. To test the position of this new taxon and the arrangement of major clades within Ornithischia, we constructed a novel character matrix. We approached the problem by reviewing, from snout to tip of tail, the variation in morphology across our range of 58 ingroup taxa while simultaneously evaluating and rethinking previously published characters. In particular, we strove to eliminate characters concerning negative spaces in favor of those dealing with bony changes, reduce the number of ratio characters, employ a consistent coding scheme using binary additive coding, and ensure as much character independence as possible across the matrix. Parsimony analysis was conducted in TNT with implied weighting of 2 using a new technology driven search with sectorial searches, ratchet, drift, and tree fusing. Our resulting phylogeny supports many previous hypotheses of relationships, but not all. Our analysis places heterodontosaurs near the base of Ornithischia, and a monophyletic Thyreophora near the base of Genasauria. Within Neornithischia, Ornithopoda resolves as a monophyletic clade sister to Pachycephalosauria, thus breaking up Marginocephalia. Ceratopsia is sister to the Pachycephalosauria + Ornithopoda clade. Ornithopoda splits into two distinct clades: Thescelosauridae and Clypeodonta. Our new taxon is placed at the base of Neornithischia along with *Hexinlusaurus* and *Agilisaurus* from the temporally equivalent Shaximiao Formation, Sichuan, China. Although its range is geographically and temporally similar to that of *Agilisaurus* and *Hexinlusaurus*, our new taxon can be distinguished by contact between the postorbital and parietal, lack of a hamular process on the quadrate, an ossified clavicle, and a concave dorsal margin of the prepubic process.

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

Finite element modeling reveals effect of jaw muscles on intramandibular joint flexibility

and strain in taxa with differently built mandibles

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The intramandibular joint (IMJ) in archosaurs and other tetrapods separates the rostral, dentigerous bones from the caudal, jaw adductor-bearing bones, creating a potentially flexible "weak spot" constraining mandibular performance. Many nonavian theropod dinosaurs possessed superficially "hinge-like" IMJs hypothesized to have been significantly flexible in life and may have used isometric muscle contraction to limit excursion about the IMJ. However, many analyses on theropod mandibular mechanics don't account for flexible joint tissues or the effect of differential muscle contraction on IMJ flexibility. We built 3D finite element models of two nonavian theropods with highly anatomically divergent IMJs—the putatively akinetic *Tyrannosaurus rex* and putatively kinetic *Majungasaurus crenatissimus*—and compared them to that of the extant, akinetic crocodilian *Alligator mississippiensis*. We quantified IMJ flexibility, IMJ ligament strain, and bone strain for each taxon, and further determined the effect of differential muscle activity on mandibular performance. Joint excursions were minimal for *T. rex* and *Alligator*, while *Majungasaurus* displayed modest (~10°) joint excursion associated with pathologically higher bone and joint ligament strains than either *T. rex* or *Alligator*. *Musculus pterygoideus ventralis* (mPTv) and *m. intramandibularis* (mIM) had a greater influence on bone and joint strain in *Majungasaurus* and *T. rex* than in *Alligator.* During unilateral bites, bone and joint strain decreased when mPTv was activated contralaterally to the bite point and increased when activated ipsilaterally. Furthermore, mPTv contributes very little to overall bite force in either *T. rex* or *Majungasaurus*, whereas mIM was an important contributor in all taxa. Our results suggest that mPTv in nonavian theropods maintained IMJ coherence during feeding by actively controlling long axis rotation of the mandible, whereas mIM functioned primarily to increase bite force, and not to control joint excursion as previously hypothesized. Moreover, *Majungasaurus*' pathologically high bone and joint ligament strains indicates that additional recruitment of the craniocervical musculature or specialized feeding behaviors were necessary to maintain mandibular coherence during feeding.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Early morphogenesis of the turtle body wall: a new origin model for the turtle carapace based on fossils and embryos

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The fossilized skeleton is our most direct, and often our only, source of data regarding critical evolutionary transformations and the biodiversity they support. As paleontologists, it is easy to overlook the possibility that these skeletal features are secondary to the neighboring soft tissues that physically and/or chemically pattern their morphogenesis, with the consequence that explanatory hypotheses may be directed at the wrong tissues. We used this conceptual approach to reexamine how the embryogenesis of the modern turtle body wall can be integrated with the fossil history of the turtle stem lineage to test existing origin hypotheses for the turtle shell. Specifically, we considered the hypothesis that the carapacial ridge, a turtle-specific signaling centre that has been experimentally linked to both rib widening and axial arrest, was necessarily present at the base of the turtle stem and whose origin

represents the foundational transformation on which the turtle shell was built. The fossil record casts doubt on at least the details of this hypothesis in that the putative earliest stem turtles *Eunotosaurus africanus* and *Pappochelys rosinae* possess the uniquely widened ribs of crown turtles but lack their axial arrest. This suggests the former is the product of an evolutionarily older developmental dynamic that remains either undiscovered or unappreciated. Using multiple imaging modalities, we show that the unique nature of turtle rib development is correlated with the morphogenetic activity of intercostal muscles—known signaling centers that influence rib morphology in other amniotes. Our data demonstrate that the evolutionary loss of these muscles in adult turtles is paralleled developmentally in an advanced embryogenesis and subsequent breakdown. TUNEL assays indicate this breakdown occurs via an apoptosis-driven form of cell death and is associated with a non-pathological inflammatory response that in other cases promotes ossification. We present a new model of turtle development and evolution wherein the loss of trunk muscles marks an early disruption of primaxial signaling and morphogenesis, one that promoted hyperossification of the axial skeleton and that set the stage for the later, but still critical, effects of the carapacial ridge. This study is yet another example of how fossils and development can combine to inform the complex evolutionary events on which our modern biota was built.

Funding Sources NSF-DEB-1947001 to Gabriel S. Bever and NSF-DEB-1947025 to Tyler Lyson.

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Biogeography and diversity of Miocene ungulates in central and western North America in relation to topography

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Elevation and relief are strong correlates of species richness for modern North American mammals at the continental scale. Higher richness in montane regions likely results from topographic barriers to dispersal, promoting speciation and elevational stacking of habitats accommodating high species density. While the topographic contrast between tectonically active western North America and the quiescent, low elevation Great Plains has been a feature of North American physiography at least since the Cretaceous-Paleogene Laramide Orogeny, the Miocene Epoch is arguably the earliest interval in which the mammal fossil record is sufficient to examine the relationship between topography and species richness at the continental scale. Prior work revealed that rodent richness increases in the montane west to a peak in the Middle Miocene, coincident with Basin and Range extension and increased topographic complexity, while rodent richness in the Great Plains is effectively constant. Here we use the MioMap database to examine the Miocene biogeography of North American ungulates with localities aggregated into 1-million-year time bins and 100 km x 100 km grid cells. We test three predictions: ungulate species in the Great Plains have greater latitudinal extents than those in the montane west due to weaker topographic barriers; grid cells in the Great Plains are more similar taxonomically (based on the Jaccard index) than those in the montane west due to greater topographically-forced turnover in the montane west; and similarity is low between regions because topography is a barrier to dispersal, even for large mammals. In contrast to rodents, ungulate richness in both regions peaks in the Middle Miocene, though at different times. For species that occur at more than one locality, Great Plains species have greater latitudinal extents than those in the west. Jaccard indices for Miocene ungulates in grid cells are generally lower than for modern ungulates in the same grid cells, due to complete taxon sampling and secure taxonomy for modern species. Nonetheless, Miocene Jaccard indices are generally highest among Great Plains grid cells

and low between regions. We conclude that the elevation and topographic complexity of the North American Cordillera was a barrier to ungulate dispersal during the Miocene despite their greater mobility than small-bodied mammals. The cause for a mid-Miocene peak in Great Plains ungulate diversity, if not an artefact, remains elusive.

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

Osteohistology and population biology of two therizinosaurian bonebeds

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Life history determines an organism's body size, morphology, ecophysiology, and reproductive success. Sociality and life history have reciprocal impacts, and differences in these complex traits between taxa may promote ecological and evolutionary diversification. Most studies of life history in extinct organisms are derived from datasets that span relatively large spatiotemporal scales, obfuscating population-level and individual patterns—the scale at which natural selection operates. Monodominant mass-death assemblages provide the means to study developmental and population dynamics at these lower-level biological scales, but they are often limited to relatively distantly related taxa.

Two monotaxic therizinosaurian bonebeds from the lower Yellow Cat Member of the Cedar Mountain Formation (Barremian, Utah, USA) offer rare insight into life history strategies and social dynamics of sister taxa. The first taxon, *Falcarius utahensis*, is represented by dense, largely disarticulated remains from the Crystal Geyser Quarry (CGQ), interpreted as a colluvial-style deposit. A second taxon, "*Geminiraptor*" *suarezarum*, occurs at the Suarez Site (SS) <1 m stratigraphically above CGQ, representing a more gravelly, braided depositional environment. Femora at CGQ range from 103–386 mm in length (mean = 295 mm, minimum number of individuals (MNI) = 16), whereas SS femora (MNI = 30) preserve a different distribution with a mean femoral length of 310 mm and a narrower range (235–390 mm). Ongoing histological sampling indicates a mixed-age assemblage at CGQ with roughly even distribution of young, rapidly growing and older, slower growing individuals, whereas SS is skewed towards individuals of advanced maturity (est. 10 of 13 exhibit slowed growth, frequent secondary remodeling). The absence of young juveniles (<1 year old) at SS may reflect taphonomic and/or mortality biases, or segregation of yearlings from the primary group, as noted in other non-avian dinosaurs. Both assemblages exhibit discrepancies between specimen age, size, and maturity, likely wrought by combined sexual dimorphism and individual variation. Whether these developmental and social differences (along with other selective pressures) generated species-level distinctions between the two bonebeds remains to be tested. This work underscores the importance of histology data in interpreting age-size frequencies, social structure, and other life history patterns from monotaxic bonebeds.

Funding Sources Jurassic Foundation, Paleontological Society, Paleontological Research Institute (W.J.F.), and National Science Foundation award #1925973 (L.E.Z.)

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Tracking archosaurian brain evolution through early embryonic development

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Archosaurs are among the most prolific and disparate groups in the history of vertebrate life. Throughout their evolutionary history, they have undergone radiations into a wide range of habitats, diets, and behaviors, including multiple independent origins of bipedalism and flight. This diversification in lifestyle has been coupled with dramatic changes in archosaurian sensory capabilities, which are reflected in changes to brain shape and proportions. Therefore, the endocasts of fossil braincases have been major sources of data for paleontologists studying changes in brain morphology over deep time. They have enabled the reconstruction of sensory capabilities, habitats, and behavior in extinct taxa. However, despite clear morphological differences between the brains of pseudosuchians and ornithodirans (the two major clades of extant archosaurs), endocasts are not readily available from taxa around the time of their divergence. Fortunately, studying the embryonic development of extant taxa that bracket this division offers a unique window into the mechanisms underlying evolutionary changes that took place millions of years ago. While many studies have observed late embryonic development, in this study we investigate the timing of first significant embryonic changes between bird and crocodilian brain shapes and explore the potential morphology of the ancestral archosaurian brain. We imaged contrast-enhanced brains of early embryonic chickens (*Gallus gallus*) and American alligators (*Alligator mississippiensis*) using µCT and conducted a 3D geometric morphometrics analysis, yielding the developmentally earliest morphometric dataset of embryonic archosaur brains to date (including Ferguson stage 1 alligator embryos and HH stage 11 chicken embryos) closely following formation of the brain vesicles. We find that alligator and chicken brains diverge in shape shortly after brain formation—much earlier than previously described. While there are strong similarities in general fore- and midbrain proportions in early development, forebrain shape and proportion of the pituitary gland diverge rapidly after initial brain formation. This study improves our understanding of the developmental drivers of brain shape change, offering novel insights into the evolutionary history of the archosaurian brain that could not be reached with fossils alone.

Funding Sources Yale Institute for Biospheric Studies Early Grant; NSF CAREER (DEB-2046868)

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

New evidence of a large theropod dinosaur in the Yellow Cat Member (Barremian) of the Cedar Mountain Formation, Utah, USA

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The past few decades of research across the Yellow Cat Member (Yellow Cat) of the Cedar Mountain Formation of Utah has yielded several new taxa of relatively small sized theropods. The largest is *Utahraptor*, at ~4 m long.

Several teeth and isolated/fragmentary bones from the member collected by several institutions hint at the presence of at least one relatively large theropod taxon in the Yellow Cat. BYU has found evidence of a relatively large theropod in the form of a vertebra, large teeth, and pneumatic ribs. These are from three quarries within the member that provide new insights into Yellow Cat Fauna theropods.

An isolated, 33-cm-tall, posterior dorsal vertebra (BYU 53409) from the Cisgo Quarry pertains to a medium to large-sized theropod. The vertebra is in poor condition due to preburial weathering. It is similar in morphology to that of *Allosaurus* but differs in that the transverse processes are internally pneumatic, giving them a round cross

section like that of the *Neovenator*, as opposed the T-shaped cross section typical of less derived theropods.

Seven large teeth, with enamel crowns up to 60 mm tall from the GreyAsh quarry represent a medium-sized theropod. Most bones at the site are unidentifiable due to extensive insect damage. Most of the teeth are semi D-shaped in cross section, indicating they are from the premaxillary.

The MayRae quarry, which is within 400 m of the GreyAsh quarry, has produced seven dorsal ribs and a 95-mm-long proximal phalanx of manual digit I. Both are indicative of a large theropod. The ribs are up to 115 cm long, with pneumatic heads. The dorsal ribs found range from about the 1st to 9th in the dorsal series. Pneumatic fossae are present on the posterior side of every rib head which invades the proximal portion of the rib shaft.

These bones provide solid evidence for the existence of one or more medium to large theropods in the Yellow Cat Member of the Cedar Mountain Formation. By comparing what information we can gather from these specimens we begin to see what type of theropods served as the top predators of the Early Cretaceous ecosystems of Utah.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Scramble or stride: pterosaur pelvic disparity suggests locomotor shift occurred gradually and independently of body size

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Pterosaur pelves have the potential to inform many debates on their biology but are relatively unstudied. Morphological disparity of the pterosaur pelves was investigated using geometric morphometrics to test for a relationship between shape and phylogenetic position, and between shape and size. This allowed the testing of two long-standing hypotheses in pterosaur paleontology: that locomotion in pterosaurs fundamentally differed between pterodactyloid and non-pterodactyloid pterosaurs, with suggestions that increasing terrestriality in pterodactyloids removed an evolutionary constraint and allowed diversification of that clade; and that the cranio-cervical and post-cervical skeleton of pterosaurs evolved as two separate modules.

Principal components analysis demonstrates that non-pterodactyloid monofenestratan and non-monofenestratan pelvic morphospace is at one edge of the pterosaurian morphospace, though some overlap exists with the pterodactyloid morphospace. A between-groups analysis can distinguish between the morphologies of the different phylogenetic grades. There are no significant relationships between morphology and wingspan, a common proxy for body size in pterosaurs. Pterosaur pelvic morphology shows a strong phylogenetic signal, though there is no increased rate of change in pelvic morphology at the base of either Pterodactyloidea or Monofenestrata.

Accordingly, it is concluded that non-pterodactyloid and pterodactyloid pelves do have different shapes, and this may reflect a shift in non-volant locomotor habit from scansorial to terrestrial. However, this morphological shift does not show an increased rate of change of disparity and so does not seem to represent the removal of a constraint or the opening of a new ecological niche that allows a radiation. Non-pterodactyloid monofenestratans show an intermediate morphology between non-monofenstratans and pterodactyloids, showing that simple ideas of modularity are too abstracted to represent the full picture of what is occurring across this evolutionary transition.

Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

Evolutionary history of limb regeneration in lissamphibians: new evidence from two paleozoic stem-group species

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Unlike amniotes, salamanders and frogs (i.e., limbed lissamphibians) can fully regenerate their limbs. It has been shown that this capacity was also present in temnospondyls, the lissamphibian stem group. Based on fossil specimens showing skeletal abnormalities that are distinctive of irregular limb regeneration in living salamanders, regeneration capabilities have been inferred for *Micromelerpeton credneri*, a 300-million-year-old temnospondyl closely related to lissamphibians. However, limb regeneration has not yet been reported in any other temnospondyl. In this study, we show that limb abnormalities indicative of regeneration are also present in *Apateon pedestris* and *Sclerocephalus haeuseri*, two temnospondyl species that coexisted with *Micromelerpeton*. The evidence presented here further supports the idea that limb regeneration is ancestral to lissamphibians. In addition, since *Sclerocephalus* diverged from *Micromelerpeton*, *Apateon*, and lissamphibians at an early stage in temnospondyl evolution, the presence of limb regeneration in *Sclerocephalus* suggests that this trait was likely a widespread phenomenon in the group. In light of our findings combined with recent paleontological and neontological evidence, we revisit different hypotheses that have been proposed on why batrachians (salamanders and frogs) are the only living tetrapods with limb regeneration capabilities. On the one hand, the origin of limb regeneration predates the evolution of metamorphosis within temnospondyls, suggesting that metamorphosis would not be linked to regenerative capabilities. Moreover, it would not be linked to a large genome/cell size because temnospondyls did not have particularly large cells. Instead, the idea that lissamphibians can regenerate limbs due to self-organizational properties characteristic of their late limb development is consistent with the lack of limbs in the smallest known *Apateon*. Finally, given that the preaxial polarity of limb development characteristic of salamanders has also been documented in *Micromelerpeton*, *Apateon*, and *Sclerocephalus*, the evidence of regeneration in these species supports the hypothesis of a pleiotropic link between these two features, which would be plesiomorphic for lissamphibians and would have been decoupled later in the anuran lineage.

Funding Sources Alexander von Humboldt Foundation Research grant to C.P.B.; German Research Foundation (DFG) Grant to N.B.F.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Soft-tissue anatomy of intervertebral joints in *Alligator mississippiensis*

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Joints between vertebral centra play crucial roles in influencing the flexibility, stability, and posture of the vertebrate body. However, because the soft tissues of the joints seldom fossilize, reconstructing them in extinct organisms often relies on comparisons to extant taxa. For non-avian dinosaurs, the extant phylogenetic bracket consists of birds and crocodylians. However, for crocodylians, conflicting reports in the literature suggest the joints between vertebral centra are either mammalian-style intervertebral discs or synovial joints as in birds. To resolve this, we histologically sectioned joints between vertebral centra in *Alligator mississippiensis* from multiple locations in the cervical, thoracic, lumbar, and caudal regions.

Across all body regions observed, the centra were connected by a solid mass of fibrocartilage, lacking either a nucleus pulposus or a synovial space. The cartilage fibers primarily radiate outwards from the cotyle, almost perpendicular to the surface of the condyle. This orientation permits the vertebrae to separate easily when dissected. Near the center of the joint, some fibers connect directly to the condyle in the approximate location of the fovea condyli, a depression commonly observed in skeletal material. Chondrocytes show ongoing growth at the time of death, with proliferation, maturation, hypertrophy, and calcification clearly visible. This joint architecture is distinct from that of mammals or birds, presenting a third possible morphology for non-avian dinosaurs and rendering the extant phylogenetic bracket inconclusive for those animals. Further examination of crocodylians and other reptiles is warranted to determine the distribution of different joint types and seek unambiguous osteological correlates with which to identify them from fossils.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Many-to-one relationships of tribosphenic molar morphology and diet in mammals

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The tribosphenic molar has been extensively investigated as a key component of mammalian evolutionary patterns. However, the use of tooth shape to quantitatively study the dietary diversity of early therians has historically been done using comparisons to a narrow selection of extant taxa (e.g., opossums, treeshrews). Therefore, to enhance ecological inferences of early therians, it is critical to establish an understanding of the form-function relationship between molar shape and diet across the greater extant diversity of tribosphenic taxa. Here we test and compare the use of ten functional molar measurements for predicting diet in a large and diverse sample of extant tribosphenic mammals across four classification models: linear discriminant analysis (LDA), random forests (RF), gradient boosted models (GBM), and classification trees (CT). Following model generation, dietary predictions were made for a sample of 38 Late Cretaceous and Early Paleogene therians. While primary diet is a partial predictor of tooth morphology, we found secondary diet components to be important discriminators for classification across all methods, especially with regards to two measurements related to shearing function: paracristid length and cristid obliqua length. RF, GBM, and CT models outperform LDA in dietary classification accuracy (avg. 71.4% correct versus 54.5%). Further, inclusion of molar size as a trait improved classification accuracy in all models (4–29%), with "omnivore" and "insectivore with herbivorous supplement" diet categories appreciating the greatest improvements (avg. improvement 25% and 66.67%). Evidence from the CT model suggests that several diet categories—"carnivore", "omnivore", and three categories representing a grade of insectivory—are each associated with multiple, distinct combinations of molar traits. Most (33 of 38) fossil mammals in our sample are predicted to be primarily insectivorous, but our models contribute predictions of secondary diet components (e.g., supplemental herbivory) to many taxa. While the fossil taxa exhibit less morphological diversity per-diet-category, they resemble the "more common" molar trait combinations found in our extant sample. This implies that certain form-function relationships found among extant tribosphenic taxa were also present among the Late Cretaceous and Early Paleogene taxa, while additional—but less common—relationships were established later.

Funding Sources Funding was provided by the NSF-GRFP, the DoE GAANN Fellowship, the IU Dept. of Earth and Space Sciences, and the U. Chicago Committee on Evolutionary Biology.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

45,000 years of California turkey (*Meleagris californica*) paleoecology at Rancho La Brea reconstructed with radiocarbon dates paired with bulk and amino acid isotopic measurements

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The extinct California turkey (*Meleagris californica*) is one of the most prevalent species of bird recovered from the open asphalt seeps, known as the Rancho La Brea (RLB) ‘tar pits’, in Los Angeles, California, USA. Comparative osteological studies suggest that *M. californica* is most closely related to the modern wild turkey of North America (*Meleagris gallopavo*) rather than the wild turkey of Central America (*Meleagris ocellata*). While the ecology and feeding habits of *M. californica* are thought to be similar to the extant *M. gallopavo*, there have been no previous paleodietary reconstructions for this extinct species. Here, bulk stable isotope ratio measurements ($\delta^{13}C$, $\delta^{15}N$) directly paired with ^{14}C dates for more than 90 individual *M. californica* specimens spanning from 45,000 years BP to their extinction are presented. In addition, $\delta^{13}C$ and $\delta^{15}N$ compound-specific isotope analyses of amino acids were performed on a subset of these specimens to investigate in more detail the possible input of C_4 plants in the diet, as well as the trophic position of *M. californica*. Our data indicate that the dietary habits of *M. californica* were static through time, notwithstanding major climatic events such as the Last Glacial Maximum (LGM) and the Bølling-Allerød Late Glacial warming, for tens of thousands of years up until their sudden disappearance from the RLB record at the beginning of the Younger Dryas. This lack of any apparent change in the diet of the California turkey over >30,000 years that comprised significant environmental perturbations, suggests they were not significantly affected by these changes and implicates other causes for their extirpation from the Los Angeles Basin. Further, as no isotopic evidence was found to support a dietary dependence on the local megafauna, and since *M. californica* appears to have survived later than the other extinct avifauna that were dependent on the megafauna, this suggests that human activities (e.g., predation, habitat loss from fire activity) combined with a drying climate led to their ultimate extinction in North America.

Funding Sources North Star Archaeological Research Fund, Center for the Study of the First Americans, Texas A&M University

DEDiT (AUFF-E-2015-FLS-8-2; Aarhus Universitets Forskningsfond)

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

A remarkably complete caenagnathid (Dinosauria: Oviraptorosauria) skull reveals specializations for herbivory and potentially frugivory

Funston, Gregory F.[1,2], Dudgeon, Thomas[3], Simon, D. Jade[3,2], Dufault, Danielle[2], Boyd, Clint A.[4], Fowler, Denver[5], Currie, Philip J.[6], Evans, David[7]

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The diversification of herbivorous dinosaurs and the rise of angiosperms in the Late Cretaceous are well established, but the link between the two is debated. Broad-scale diversity patterns in the two groups appear not to closely align, and direct evidence of dinosaur adaptations to angiosperm-based diets has not been demonstrated. Here we present an exceptional skeleton of a new diminutive species of caenagnathid oviraptorosaur that contributes to this debate. The specimen includes a virtually complete, articulated skull, the first for the clade. Although clues from other specimens hinted at some unusual features, the new specimen confirms a suite of highly specialized cranial traits in caenagnathids. Most notable among the novelties are drastic changes to the adductor musculature reflected in the greatly reduced temporal region and unusual palate, unique in non-avian theropods but remarkably similar in extant obligately frugivorous parrots. These modifications drastically reorganize the chewing stroke of caenagnathids, enabling extensive oral processing of soft food using powerful anteroposterior movement of the mandible and occlusion of ridges and grooves on opposed elements. Comparison with extant beaked species attests to a highly specialized herbivorous diet in caenagnathids, probably consisting in large part of soft fleshy plant parts. Of potential foods, angiosperm fruits are particularly suitable candidates: the adaptations that differentiate fruit-mashing parrots from granivorous parrots parallel those that distinguish caenagnathids from oviraptorids. Likewise, based on an extensively improved phylogenetic matrix and the first tip-dated Bayesian analyses of Oviraptorosauria, angiosperm fruits increased in size and diversity in correlation with key steps in the radiation of oviraptorosaurs. Thus, both diversity patterns and functional adaptations in caenagnathids match predictions for an angiosperm-based diet. Altogether, caenagnathids, and perhaps oviraptorosaurs more broadly, provide one of the strongest candidates for angiosperm-based diet adaptations in dinosaurs, but their role in the Late Cretaceous proliferation of fruit—which shaped early Cenozoic flora—remains unclear.

Funding Sources NSERC and the Vanier-Banting Commission (G.F.F. and T.W.D.); NSERC Discovery Grant (D.C.E)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Quaternary fish diversity in the southern Black Hills of South Dakota

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Fish are an ubiquitous and critical component of aquatic systems, both in the present day and in the geological past, but their Pleistocene record is poorly documented relative to other vertebrate taxa especially for the upper Great Plains of North America. This study examines previously undescribed Quaternary freshwater fish fossils from localities in the Black Hills of southwestern South Dakota. Three sites were recently examined for their micro-vertebrate remains, including 1) the Fall River Site (open

air fluvial locality), 2) Parker's Pit (natural trap cave locality, and 3) the Mammoth Site (large sinkhole containing a pond with over 50 mammoth skeletons). Paleoenvironmental and taphonomic conditions varied among the sites, resulting in varying specimen quantity and preservation quality. Two articulated specimens (from the Mammoth Site) and a variety of disarticulated bone fragments are identified as members of the families Catostomidae (suckers), Leuciscidae (minnows), and Ictaluridae (catfish). The presence of these generalist fish taxa and the apparent lack of specialized species may imply the unstable nature of the late Pleistocene glacial climate in the Black Hills. This study serves as a preliminary description of these fish taxa and their environments in the Black Hills.

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

The anatomy of galeaspids (stem-gnathostomes) and its evo-devo implications

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The galeaspid is an armored jawless stem-gnathostome group to understand the sequential evolutionary origin of the gnathostome bodyplan. In the past twenty years, the cranial and postcranial anatomy have been largely resolved by discoveries of extinct galeaspids from China and have provided corroborative evidence for models of developmental evolution. For example, using synchrotron radiation X-ray tomographic microscopy, we have shown that the paired nasal sacs and hypophyseal duct in galeaspid *Shuyu* are independent of each other, as in gnathostomes, but different from cyclostomes or osteostracans, which is the condition that current developmental models regard as a prerequisite for the development of jaws. The cranial anatomy of *Shuyu* also shows the first fossil evidence for a complete gill-functional hyomandibular pouch (aphetohyoidean condition) in stem-gnathostomes, an observation that sheds new light on the origin of the spiracle of jawed vertebrates. The articulated galeaspid remains of *Tujiaaspis* and *Foxaspis* provide the details of the postcranial anatomy of galeaspids and reveal a pair of skeletal ventrolateral fin folds, which are compatible with aspects of the fin-fold hypothesis for the origin of vertebrate paired appendages. Here, we further show that the prechordal cranium and all of the gill arches (splanchnocranium), including mandibular and hyoid arches in galeaspids, are incorporated medially into the parachordal cranium to form a single massive endoskeletal ossification. This pattern is compatible with aspects of the intermediate stage of branchiomere development in gnathostomes in which neural crest cells have a specific median relocation to form a cylindrical wall surrounding a mesodermal core. A hollowed cylinder-shaped branchial chamber enclosing gills and their associated musculature and vessels are widely seen in Silurian–Devonian armored ostracoderms (e.g., osteostracans, heterostracans). Therefore, the cylindrical branchial chamber in jawless ostracoderms probably represents an intermediate condition between the lateral in lampreys and medial location of gills aches in gnathostomes.

Funding Sources National Natural Science Foundation of China (42130209, 92255301)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

First subadult skeleton of *Teleoceras aepysoma* (Perissodactyla, Rhinocerotidae): insights into morphology and ontogeny in a North American rhinoceros

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The fossil rhinoceros (*Teleoceras aepysoma*) material recovered from the late Neogene-aged Gray Fossil Site in east Tennessee, USA, represents one of the most morphologically distinct populations of *Teleoceras*, characterized by longer limbs and exaggerated cranial dimensions relative to congenerics. Recent recovery of a partial skeleton (ETMNH 32999) has provided insights into ontogeny of the skull, dentition, and forelimbs of this taxon. Morphological comparisons with the tusks of other *Teleoceras* samples suggest that ETMNH 32999 is a subadult male, and eruption of the cheekteeth most closely corresponds with an age class equivalent to ~20% of potential lifespan; an age that, in most members of Rhinocerotidae, correlates with sexual, but not yet skeletal, maturity. Related taxa with the same degree of dental wear are often considered to be ~85–90% of total body size. However, comparisons with other rhinocerotids, both extant and extinct, indicate that ETMNH 32999 may have experienced delays in the onset of skeletal maturity. Specifically, certain cranial features appear underdeveloped for a specimen of this age class, especially when compared to known ontogenetic sequences of other rhinoceroses. Further analysis is needed to determine whether these differences are species-specific or related to external ecological stressors. Comparative analyses also suggest potential novel characteristics for *T. aepysoma* related to the deciduous dentition. Findings of this study add to the scarce published literature on ontogeny in rhinocerotids. As an additional component to this morphological investigation, the diagnostic features of *T. aepysoma* are placed within a phylogenetic context to enable a greater understanding of evolutionary trends in Rhinocerotidae.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The oldest North American occurrence of the extinct 'snouted' bony fish genus *Plethodus* (Tselfatiiformes, Plethodidae) from the mid-Cenomanian of Texas, USA

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Plethodidae is a Late Cretaceous bony fish family belonging to the order Tselfatiiformes and includes genera with a robust rostrum, such as *Martinichthys*, *Plethodus*, *Rhamphoichthys*, and *Thryptodus*. Here, we report a new isolated rostral specimen of a 'snouted' plethodid (DMNH PAL 2013-07-2096 housed in the Perot Museum of Nature and Science) found from the Lewisville Member (mid-Cenomanian) of the Woodbine Group in Tarrant County, Texas, U.S.A. It consists of a massive, fused left and right premaxillae, measuring 29.2, 41.2, and 22.7 mm in preserved anteroposterior length, width, and dorsoventral height, respectively. The angle between its anterodorsal and ventral faces and that between each lateral side of the rostrum measure about 42 and 78 degrees, respectively. These angles and its overall morphology closely resemble those of previously described rostra of the genus *Plethodus*, known from the English Chalk (Albian–Turonian) of the U.K. and the Britton Formation (upper Cenomanian–lower Turonian) of the Eagle Ford Shale in Texas. Thus, DMNH PAL 2013-07-2096 is identified as *Plethodus*. However, the ventral surface of the previously described rostra is convex, whereas that of DMNH PAL 2013-07-2096 is slightly concave, suggesting that the new specimen may belong to a different species from the previously described forma of *Plethodus*. More significantly, its occurrence from the mid-Cenomanian Lewisville Member marks the geologically oldest record of 'snouted' Plethodidae in North America. Because the oldest record of *Plethodus* comes from the Albian of the U.K., the present fossil record indicates that the genus emerged in Europe, became dispersed to North America by the mid-Cenomanian, and subsequently possibly gave rise to a clade comprising of at least two other

North American plethodids with a massive rostrum. These include *Thryptodus* (late Cenomanian–early Campanian?) and *Martinichthys* (late Coniacian).

Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Integrating stable isotopes, ancient DNA, and radiocarbon dating to reconstruct the ecological and genetic history of Iberian brown bears

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Today, only two unconnected populations of brown bears (*Ursus arctos*) persist in the Iberian Peninsula—the Cantabrian and the Pyrenean populations—both of which were on the brink of extinction during the 20th century. However, fossil evidence shows that, in the past, brown bears were widely distributed across the entire peninsula.

Mitochondrial DNA analyses reveal that the oldest Iberian sequences belong to an extinct subclade present until the Last Glacial Maximum (LGM). There is no evidence of genetic continuity between the Pleistocene populations of Iberia and Holocene brown bears in western Europe. All known haplotypes were extirpated during or shortly after the LGM, at least in the north. Radiocarbon dates suggest a post-LGM recolonization of Iberia from a source population that likely persisted in a cryptic refugium in Atlantic Europe, expanding as ice sheets retreated. Recolonization appears to have proceeded first in Britain (~15,000 yr B.P.), then in Iberia (~10,000 yr B.P.), and later in southern Scandinavia (~9,500–7,500 yr B.P.) once a land bridge was viable. The delay in Iberia may be explained by the complex orography of the Pyrenean–Cantabrian region, combined with increased human presence and cave competition in natural access corridors. Of 77 Iberian mitochondrial DNA sequences available, all but two belong to the dominant clade in western Europe. The two exceptions, dating to ~31,800 and ~30,800 yr B.P., derive from an extinct lineage once present on both sides of the Bering Strait, and coincide with the cooling phase of MIS 3. These bears may represent a vagrant lineage that failed to establish a lasting presence in Iberia.

Stable isotope ($\delta^{15}N$ and $\delta^{13}C$) analysis of bone collagen shows a predominantly herbivorous diet, with animal protein representing ~10–20% of dietary input. This pattern appears stable from the Pleistocene to the present, with no clear evidence of dietary shifts due to competition with cave bears. One exception is a bear from the end of the LGM showing a marine protein signal—unique in the Iberian record.

Morphometric data suggest a decrease in body mass during historical times, likely due to the introduction of firearms and dramatic population decline. These results highlight the ecological resilience of brown bears, despite major climatic and anthropogenic pressures, and underscore the role of glacial dynamics and geography in shaping their population history.

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Variation, ecology, and anterior rostral anatomy in small, ‘insectivoran’ mammals.

Gardiner, Aisling, Asher, Robert J.

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The vomeronasal organ is a paired receptive organ for the accessory olfactory system in tetrapods. It is thought to have a role in inter- and intra-specific communication and is often regarded as lost, or reduced, in secondarily aquatic mammals.

Focusing on lipotyphlans (moles, shrews, hedgehogs, and solenodons) and tenrecids (tenrecs and otter shrews), this project aims to assess whether different taxonomic and ecological (terrestrial, semi-fossorial, semi-aquatic) groups have characteristic vomeronasal morphologies. This project has analyzed extant variation by building a database of osteological indicators of vomeronasal dimensions from extant mammals and has determined the features of vomeronasal morphology that are characteristic of certain taxa and ecologies. For example, the vomeronasal organ in soricids is narrow, and among tenrecids it is taller. Furthermore, vomeronasal volume distinguishes between tenrecid subfamilies. Regarding ecology, the vomeronasal organ of semi-aquatic mammals is significantly longer than that of terrestrial or semi-fossorial mammals. This result is particularly surprising due to the frequent characterization of the vomeronasal organ as lost or reduced in secondarily aquatic mammals.

These results can be applied to better understand the affinities of extinct mammals. For example, an exceptionally well-preserved specimen of the extinct heterosoricid *Domnina gradata* shows a typical soricid morphology of its anterior rostrum, indicative of a narrow vomeronasal canal. Eocene–Oligocene specimens of *Apternodus* and *Micropternodus* similarly exhibit features of their anterior nasal skeleton that are suggestive of affinities to particular, extant lipotyphlan groups.

Funding Sources Pigott Studentship, King's College Cambridge

Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

Hominin body mass increased between but not within species over time

Gardner, Jacob[1], Püschel, Thomas[2], White, Suzanna[1], Sakamoto, Manabu[1], Venditti, Chris[1]

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Body size is central to organismal biology, including ecology, physiology, and neuroanatomy. An increase in body size has long been thought to drive many aspects of hominin evolution. However, other studies have argued that body size did not increase gradually over time but rather evolved in a punctuated fashion with speciation or only increased in *Homo*. Numerous uncertainties have hindered a consensus on whether body size increased over time among hominins. Moreover, no study has examined the effects of individual variation on the evolution of hominin body size. Here, we combine within-subject centring and phylogenetic generalised linear mixed modelling to simultaneously test for trends in hominin body mass over time within and between species. Our approach further enables us to quantify and account for uncertainties in body mass estimates, specimen ages, phylogenetic relationships, and taxonomic assignments. We apply this approach to body mass estimates from 565 hominin specimens across 21 taxa and find evidence for a general increase in mass through time between species but not within them. This increase in mass between species is not associated with speciation and was detected after finding an average decrease in body mass in three small-bodied hominins: *Australopithecus sediba*, *Homo floresiensis*, and *Homo naledi*. We also find evidence for an increase in body mass in non-*habilis Homo*, which unites both hypotheses of hominin evolution. These results are consistent after accounting for multiple body mass proxies sourced from different body regions and the non-independence of specimens collected from the same localities. The study clarifies the dynamics of hominin body size

evolution at multiple scales, unifies separate hypotheses of hominin evolution, and demonstrates how to detect evolutionary trends while accounting for numerous sources of uncertainty.

Funding Sources Leverhulme Trust Leadership Award (RL-2019-012) to C.V.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Phylogenetic prediction outperforms other methods in simulated and real data

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Inferring unknown trait values is ubiquitous across biological sciences—whether for reconstructing the past, imputing missing values for further analysis, or understanding evolution. Models explicitly incorporating shared ancestry amongst species with both known and unknown values (phylogenetically informed prediction) provide accurate reconstructions. However, nearly 25 years after the introduction of such models, it remains common practice to use only the coefficients (predictive equations) estimated from phylogenetic generalised least squares (PGLS) or ordinary least squares (OLS) regression models to calculate unknown values. Here, we use a comprehensive set of simulations to demonstrate two- to three-fold improvement in the performance of phylogenetically informed predictions compared to both OLS and PGLS predictive equations. Phylogenetically informed predictions are more accurate than OLS and PGLS predictive equations for ultrametric and non-ultrametric trees of varying shapes and sizes. A critique and comparison of three published predictive analyses showcase real-world examples of phylogenetically informed prediction incorporating both living and fossil diversity: primate neonatal brain size, avian body mass, and *Tyrannosaurus rex* (non-avian theropod) neuron number. We also highlight the importance of prediction intervals, which increase with increasing phylogenetic distance. Finally, we offer guidelines for making phylogenetically informed predictions across diverse fields such as ecology, evolution, and palaeontology.

Funding Sources This work was supported by a Leverhulme Trust Leadership Award (RL-2019-012) to C.V.

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

Uncovering the evolutionary origins and developmental foundations of beak shape in theropods using a universal rule of growth

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In theropods, the beak has evolved into a staggering array of forms, not only in living birds but also in non-avian theropods. Evolving multiple times from a toothed rostrum, the beaks of theropods have led to the exploration of diverse ecologies. Determining if these beaks grow and evolve according to similar underlying developmental processes has not been thoroughly explored. Here, we use the power cascade as a model of growth, describing the log-log linear relationship of the rostrum radius

with distance from the tip. We measured the rostrum shape of 127 theropod species across 120 families of extant birds and extinct non-avian theropods and found that 95% of them followed the power cascade model (R^2 >0.90). All non-avian theropod species had rostrum shapes that significantly followed the power cascade model of growth ($0.927 < R^2 < 0.999$; n = 21). By comparing the *Slope* and *Log Aspect Ratio* power cascade parameters of extant bird species, we also found that the power cascade can describe beak shape within an ecologically informed morphospace. Ancestral state estimation suggests that the power cascade constitutes a fundamental growth pattern of the theropod rostrum, and perhaps all vertebrate rostra. To further test the power cascade, we compared the beak shapes of six phylogenetically and morphologically distinct bird species, hypothesized to follow (Palaeognathae, Galliformes, and Estrildidae) or not to follow (Anseriformes and Pelecaniformes) the power cascade. We found that bird species with beaks that follow the cascade in adulthood exhibit a consistent and predictable model of growth throughout ontogeny (R^2 >0.94). In contrast, species with elongate and compound beaks (including the royal spoonbill *Platalea regia*) did not follow the power cascade rule of growth during juvenile and adult growth stages. However, in the early stages of juvenile beak growth, a precursor rostrum structure existed in the royal spoonbill, suggesting potential adherence to the power cascade at earlier developmental stages. These findings demonstrate that, from the developmental to the macroevolutionary level, the power cascade may govern the shape of most theropod rostra.

Funding Sources Australian RTP, Robert Blackwood Partnership, ARC DP230100613 and UKRI MR/X015130/1.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

In defense of destructive sampling: comparison of paired microCT and histological sampling of theropod metatarsals from the Dinosaur Park Formation (DPF) reveal the importance of histology for paleopathological interpretation

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Paleopathology is a comparatively young discipline subject to rapid evolution and reworking alongside improvement of technology and increased interdisciplinary collaboration with those in the medical field. Coinciding with best practice in medical and veterinary pathology, histology is often touted as the gold standard for studying the key features of lesions. However, given its destructive nature, paleohistology is often avoided, especially in specimens considered rare or valuable. Thus, CT and microCT have become increasingly popular not just as part of the paleopathology diagnostic process but as a replacement of histology entirely. In this study we investigate the efficacy of CT versus paleohistology for paleopathology applications by taking both microCT and histologic samples from five pathologic theropod metatarsals from four Dinosaur Park Formation (DPF) taxa: Dromaeosauridae, Ornithomimidae, Troodontidae, and Tyrannosauridae, and describe the features that can be discerned from both. These microCT scans were also compared with scans from other DPF tyrannosaur bones and theropoda specimens from North America. Here we demonstrate good quality microCT data in specimens with minimal artifact and taphonomic distortion, like many specimens from the DPF. Even though good quality microCT scans among our sample can provide an excellent view of the subgross structures of a pathology (e.g., external vs. internal expansion, periosteal reactive bone, cortical disruption), they can still fail to capture pathologic features that require higher resolution and magnification to discern (e.g., draining tract, sequestra, osteolysis, endosteal changes, stage of

response or healing). Moreover, even the most excellent scans can fail to capture pathologic features of bone microanatomy that permit more detailed examination of characteristic patterns associated with disease, trauma or infection, information that is crucial in making accurate interpretations of pathologic processes. For example, destructive patterns caused by a fracture vs. infection (e.g., soft tissue extension vs. systemic spread) vs. cancer may have overlapping general features grossly or on CT imagery but exhibit very different patterns histologically. Therefore, we recommend that whenever possible, osteohistology should not be neglected and instead, CT should be used as a guide to inform on where the most optimal sections should be taken to avoid unnecessary excessive damage to the fossil.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Endocranial cavity in extant and extinct anteaters (Xenarthra, Vermilingua)

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Anteaters (Vermilingua) are a group of placental mammals exhibiting adaptations towards a myrmecophagous diet. The cranial anatomy of three extant (*Cyclopes*, *Tamandua*, and *Myrmecophaga*) and three extinct (*Palaeomyrmidon*, *Protamandua*, and *Neotamandua*) genera of Vermilingua is known; however, their endocranial morphology remains largely unexplored. Recently, computed tomography (CT) has provided non-destructive access to endocranial structures, offering tools for obtaining new anatomical information. In this work, CT scans were performed on adult crania from all known Vermilingua genera, including a juvenile cranium of *Myrmecophaga*. A 3D model of the endocranial cavity was reconstructed for each specimen to qualitatively analyse and compare the cerebral morphologies. In general, the endocranial cavity in Vermilingua exhibits an anteroposteriorly elongated morphology, except for *Cyclopes*, whose brain is notably globular in lateral view. Among the extant genera, the olfactory bulbs of *Cyclopes* are inconspicuous and medially fused, whereas they are more expanded and anteriorly separated in *Myrmecophaga*, with intermediate conditions observed in *Tamandua*. In *Protamandua* and *Palaeomyrmidon*, the olfactory bulbs are fused, as in *Cyclopes*, but exhibit an expansion similar to that of *Tamandua* and *Myrmecophaga*. The cerebral convolutions exhibit a similar pattern in most anteaters, with marked lateral gyri and piriform lobes. In contrast, *Cyclopes* has a notably lissencephalic surface. Cerebellar morphology is similar across the group, except for the petrosal lobes (paraflocculi), which are prominent in all studied genera but almost absent in juvenile and adult *Myrmecophaga*. These results indicate that the previously proposed effect of heterochronic processes (paedomorphosis) on cranial structure in *Cyclopes* may also have influenced its encephalic morphology. Furthermore, the presence of a marked paraflocculus could suggest arboreal/semi-arboreal lifestyles in all extinct representatives of anteaters.

Funding Sources Univ of TN-Chattanooga Faculty Development grant, Bramblett Gift fund

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Taxonomic and ecological diversity of middle Eocene protocetids from Togo

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The evolutionary history of cetaceans is documented by a rich fossil record tracing their origin to the early Eocene of the Indo-Pakistani region, which is considered the cradle of the group. By the middle to late Eocene, cetaceans achieved a global distribution, indicating a dispersal phase during the Lutetian. Western Africa, with its Lutetian deposits, likely played a central role in one of the earliest dispersal events of this group, acting as a pivot between the Indo-Pakistani region and the Americas. Among Paleogene cetaceans, the paraphyletic family Protocetidae stands out as the most diverse group, whose diversification and dispersal played a major role in the evolutionary history of cetaceans. Protocetids were the first to reach Western Africa and the Americas and their retention of an amphibious lifestyle holds significant ecological importance. Recent expeditions in Togolese outcrops have led to the discovery of numerous protocetid remains (articulated skeletons and isolated remains including abundant teeth) in Lutetian phosphate deposits. New X-ray microtomography techniques, combined with traditional comparative anatomy, enabled thorough and non-destructive analysis of both the external and internal structures of these fossil remains. Most protocedid-bearing localities known so far yielded a single protocetid species each, with exceptions in Pakistan, Egypt, and South Carolina (USA), where two or three species are known to co-occur. In Togo, the situation appears even more complex with three to four forms identified, depending on whether dental or auditory characteristics are considered. This level of protocetid diversity is remarkable for Western Africa, considering that only one species has been identified in either Nigeria and Senegal. While Morocco might have hosted up to three coexisting species, only one has been clearly identified to date. Here, we present the anatomical description of a newly discovered large protocetid from Togo. This new form is represented by several individuals, including nearly complete cranio-dental remains. One specimen is remarkably well preserved, featuring a complete skull and numerous postcranial elements. By studying these more complete fossil remains, we aim to enhance our understanding of protocetid taxonomic diversity at both regional (Western Africa) and global scales.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Regional implementation of a non-intrusive evaluation tool to assess program and educational quality

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Effective science education is more important now than ever before. Yet many informal education institutions do not assess the quality of their programming, including within the realm of natural history. Barriers to this historically include access to effective evaluation tools, institutional support for evaluation programs, and the time required to conduct traditional classroom-style assessments,

which often are time-intensive in time-limited settings.

Since late 2023, the Idaho Museum of Natural History (IMNH) has been developing and testing an easy-to-use evaluation tool, with full implementation beginning in 2024. This tool utilizes two questions on guide behavior self-reflection (based on educational best practices such as multimodal instruction and student-led inquiry techniques) and two guide observations of the participants' behaviors, plotted within Bloom's Taxonomy of Verbs on a 1–5 scale, to create a 20-point scale that forms the base rubric.

Based on this initial use, a coalition of museums and educational centers across the American West has started utilizing this evaluation tool, including other sites in Idaho as well as Colorado, Montana, and New Mexico. As of May 2025, this tool has been used to evaluate over 300 educational interactions across four states.

Each site has identified modifications required to be able to most effectively use the evaluation tool at their site. This includes the adoption of an online submission form to enable rapid feedback from students at the IMNH, additional sections for culturally informed educational practices at New Mexico Museum of Nature and Science and other sites.

Evaluation outcomes have been used to modify existing programming, such as increasing purposeful inclusion of multiple modes of instruction, revising curriculum and training, and providing guidelines for new guides on program expectations. The verification of proper assessment has been critical to ensure accurate scoring; at the IMNH the Museums of Western Colorado (MWC), guides were rating their performance and student engagement higher than what supervisors observed. This has led to more explicit instructions within the rubric at the IMNH as well as additional training for guides to become familiar with the terms used and their implementation and observation at both IMNH and MWC.

Funding Sources None

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new dinosaur body fossil from the Navajo Sandstone of Utah (USA) represents the northernmost body fossil yet recovered from the Navajo erg

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Here, we report a partial and articulated limb of a theropod dinosaur from the San Rafael Swell. MWC 9978 is represented by both impressions and weathered original bone, mainly the cortical surface, with preservation similar to other Navajo Sandstone body fossils. This specimen represents the northernmost body fossil yet discovered from the Navajo Sandstone. While incomplete, it is a scientifically significant specimen that expands upon the limited number of body fossils and their geographic range within the formation.

The Navajo Sandstone, and equivalent units such as the Aztec Sandstone and portions of the Nugget Sandstone, provide insights into how the Triassic–Jurassic transition unfolded. While the trace fossil record of the Navajo Sandstone is well known, only a handful of body fossils have been identified. These include unionid bivalves, semionotid fishes, protosuchid crocodylomorphs, the theropod dinosaur *Segisaurus halli*, and several specimens of sauropodomorphs that belong to two taxa (*Seitaad ruessi* and a second distinct, but indeterminate taxon). Furthermore, tritylodontid cynodonts have been reported from the Navajo Sandstone at two localities in the American Southwest. This new specimen comprises several long bones, preserved in a red-brown calcareous sandstone, found as float. The slab originated from an interdune lake or ephemeral stream deposit within five meters of the

specimen's discovery location. A femur, identified on the basis of a fourth trochanter, as well as other long bones are most evident. A partial digit, consisting of two articulated phalanges, may also be present. The straight nature and its size precludes all non-dinosaurian taxa known from the Navajo Sandstone. In size and shape it most closely resembles the theropod *Segisaurus*, but an apomorphic diagnosis is not possible owing to the condition of the preserved elements.

A pattern of less well-preserved body fossils recovered from interdune fluvial or lacustrine deposits and well-preserved body fossils recovered from dune-face collapse deposits is supported by this specimen. We hypothesize that systematic surveys of these readily identifiable deposits may be easier to conduct than random sampling of dune faces in search of collapse deposits and would reveal additional body fossils across exposures of the Navajo Sandstone.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

We're all ears: a comparison of five merycoidodontid petrosals

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Oreodonts are a group of North American artiodactyls which experienced a notable radiation during the Paleogene and Neogene periods. Despite being common in the fossil record, their taxonomic relationships within Oreodontoidea and with other artiodactyls has remained a contentious issue. This is in part due to specimens being misinterpreted as separate species based on taphonomic deformation. The group is divided into the early diverging agriochoerids and the more speciose merycoidodontids. This study describes and compares the previously undescribed petrosals of four merycoidodontid genera: *Aclistomycter*, *Limnenetes*, *Miniochoerus* and *Bathygenys*. *Merycoidodon,* described previously in the literature, is also included in this comparison.

In life, the petrosal bone houses the series of hair-lined membranous channels responsible for an animal's sense of balance and hearing. The petrosal forms early in development with little subsequent change and may provide valuable information for phylogenetic analysis. Using μCT scanning we have been able to produce high-resolution reconstructions of both the petrosals themselves and the hollow channels of the bony labyrinth within to make detailed comparisons between genera. All taxa have relatively square petrosals, with similar width and height. The subarcuate fossa, which is bordered by the anterior semicircular canal and cups part of the cerebellum in life, shows notable variation in both shape and depth. *Aclistomycter* is the only genus to lack a true subarcuate fossa, instead having a shallow, cone-shaped depression on the endocranial surface with no association with the anterior canal. All others, including the odd shallow, notch-shaped fossa in *Limnenetes*, show a close association between the semicircular canal and subarcuate fossa. *Bathygenys* and *Merycoidodon* share some interesting features, including a pronounced basicapsular groove bordered by two ridges, an inferior petrosal venous sinus walled by both the basicapsular groove, and an indentation on the basioccipital bone. Observations of the petrosal and associated bony labyrinth of each specimen will be used to create a taxon-character matrix, which will allow us to conduct a more in-depth phylogenetic analysis of the merycoidodontids.

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Slightly before the collapse—new lizard and snake remains from the late Eocene (MP 19) of Escamps (Phosphorites du Quercy, France) reveal a fascinating and diverse squamate assemblage prior to the 'Grande Coupure'

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The Eocene–Oligocene transition witnessed a major extinction event and faunal turnover that tremendously shaped European Cenozoic faunas. This event, occurring at around 33.9–33.4 Ma, is commonly known as the 'Grande Coupure'. The great impact of the 'Grande Coupure' is aptly reflected in the radically different taxonomic compositions that characterize late Eocene and early Oligocene European fossil localities. It is further characteristic that certain vertebrate groups have their youngest remains in Europe at the latest Eocene, while certain other groups mark their earliest documented occurrences in the area in the earliest Oligocene, all these emphasizing therefore a prominent faunal turnover, linked to climatic fluctuations and dispersals from other continents. The area of the Phosphorites du Quercy in southern France comprises a large number of late Eocene and early Oligocene fossil localities, offering thus an opportunity to study taxonomic diversity and the impact of the 'Grande Coupure'. One of the richest late Eocene (MP 19) localities in Quercy is Escamps, which has yielded a considerably diverse vertebrate assemblage. In terms of squamates, Escamps represents one of the most diverse latest Eocene faunas known from the European continent, with an array of lizard and snake taxa having been identified. Nevertheless, the majority of these squamate occurrences from Escamps represent simple mentions in preliminary faunal lists, while only a few remains of scincoids, lacertids, blanids, iguanids, anguids, paleovaranids, and constrictors have so far been formally described and figured. Abundant new, previously undescribed, material from Escamps provides an opportunity to document and properly assess the taxonomic diversity of squamates from this important locality of Quercy. The new material comprises a few thousands of disarticulated cranial and postcranial remains of lizards and snakes. A preliminary analysis of this much abundant fossil material shows the existence of gekkotans, scincoids, amphisbaenians, iguanids (at least two different morphotypes), anguids, paleovaranids, "anilioids", and constrictors (multiple morphotypes). In particular for snakes, the unusually high number of different cranial remains, encompassing also beautifully preserved braincases and pterygoids, offers the unique potential not only to assess diversity but also to make more confident taxonomic referrals of certain isolated elements to particular snake clades.

Funding Sources Research project no. 2023/49/B/ST10/02631 financed by the National Science Center of Poland (Narodowe Centrum Nauki)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Osteology and ecology of the Middle Jurassic teleosauroid thalattosuchian *Neosteneosaurus edwardsi*

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Teleosauroidea was a highly successful, near-global lineage of thalattosuchian crocodylomorphs that inhabited freshwater, brackish, and deep-water ecosystems from the Early Jurassic until the Early Cretaceous. They are historically important to the field of vertebrate paleontology as they represent a major part of early scientific studies on British marine reptiles. However, only recently has their alpha taxonomy been revised, resulting in the erection of several taxa from the 'wastebasket' genus "*Steneosaurus*." Among these newly named taxa is *Neosteneosaurus edwardsi*, a Callovian (end Middle Jurassic) age species known from the Oxford Clay Formation in Peterborough, UK. Here, we provide a comprehensive redescription of the extensive material referred to this taxon, including its historic, and often forgotten, holotype as well as many nearly complete skeletons. Furthermore, we build upon our understanding of the ecology of *N. edwardsi* with the new morphological data.

New anatomical findings of *N. edwardsi* include the presence of a foramen between the neural arches of the atlas-axis complex; oval-shaped neural canals in the cervical vertebrae; dorsoventrally tall neural spines of the dorsal vertebrae; and sharply angled first metatarsals. The relatively taller neural spines identified herein indicate larger attachment sites for back muscles involved in underwater propulsion than in most other Callovian Peterborough teleosauroids. When this new anatomical information is supplemented with the hypothesis posing a high mechanical advantage (e.g., robusticity and stronger biting) in large *N. edwardsi* than in most other Callovian Peterborough teleosauroids, and previously identified cranial traits (e.g., presence of an anterior process of the jugal and lack of antorbital fenestrae) that are related to reinforcement of the skull to withstand powerful forces, it suggests that *N. edwardsi* occupied a separate niche to its piscivorous contemporaries and was capable of preying on large animals like marine reptiles. This would be somewhat similar to the machimosaurin teleosauroid *Lemmysuchus obtusidens* that was one of the apex predators of Callovian age from Peterborough, and likely could have preyed on even larger animals. This fresh perspective on the ecology of *N. edwardsi* builds upon recent studies on marine ecology in the Jurassic and supports the argument for teleosauroids occupying at least three separate ecological niches by the end of the Middle Jurassic.

Funding Sources Whittington Award, Palaeontological Association Small Grant (grant reference number: PA-WA202301).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Preliminary data about histology of the bone of attachment in Temnospondyli and Ichthyosauria

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Tooth implantation and attachment are important features in tetrapod dentitions, influencing feeding mechanics, tooth replacement, and overall craniofacial morphology. Teeth could be implanted either in a shallow (subthecodonty) or deep (thecodonty) alveolus, on the lingual side of the labial wall of the jawbone (pleurodonty), or on the margin of the jawbone (acrodonty). A tooth could either be firmly anchored to the tooth-bearing element (ankylosis) via attachment bone or linked to it through a soft periodontal ligament (gomphosis). Despite the importance of this attachment bone, its histology is insufficiently studied. For this reason, this study aims to characterize and histologically analyze the bone of attachment in the lower jaws of three Triassic Temnospondyli: *Metoposaurus*, *Cyclotosaurs,* and *Mastodonsaurus*.

In temnospondyls, plicidentine teeth are mostly pleurodont or acrodont, except the large tusks which are implanted into large oval alveoli-like openings. All teeth link with the bone-bearing elements via attachment bone. Morphologically, the attachment bone is not a prominent structure but still shows histological differentiation from the surrounding jawbone. In temnospondyls, the bone of attachment deeply penetrates between the globular layer of dentin. The bone consists of highly vascularized parallel-fibred bone in early ontogenetic stages and mostly trabecular lamellar bone as an effect due to active remodeling in later ontogenetic stages. Numerous Sharpey's fibers are visible. The active remodeling is an adaptation to tooth replacement, where the new tooth grows in a slightly lateral position, as the previous one. A lower jaw fragment of Triassic ichthyosaurian *Cymbospondylus* is included for comparison in this study. *Cymbospondylus* dentition is usually described as being thecodont or subthecodont. *Cymbospondylus* teeth are set in alveoli, show plicidentine—as temnospondyls do and which additionally contributes to the anchorage of teeth to the jawbone—and has additionally the basis

of the exposed teeth surrounded by thick, bulgy bone of attachment. Analyzing methods include micro-CT data of the *Cymbospondylus* specimen and thin sections through the bone of attachment for all taxa included in this study. The morphological and histological adaptation of teeth of temnospondyls and Triassic ichthyosaurian *Cymbospondylus* showing plicidentine seem to be very similar which must be related to functional constraints.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Comparative dental microwear texture analyses of fossil, subfossil, and modern platyrrhine monkeys: implications for diet, adaptation, and sexual dimorphism

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Although hundreds of mammal fossils are known from the Quaternary fossil accumulations of Brazil, primates are among the rarest finds. Four large (> 20 kg) atelids are known from Pleistocene karst deposits: *Protopithecus brasiliensis*, *Caipora bambuiorum*, *Cartelles coimbrafilhoi,* and a new undescribed primate. However, there is little paleoecological information about any of these animals. To reconstruct diet, a crucial information to understand ancient ecology, we pioneered the use of dental microwear texture analysis (DMTA) on Brazilian fossil platyrrhines, except *P. brasiliensis*, and compared them with modern howler monkeys. We performed DMTA on extant *Alouatta guariba* (n = 9) and *A. palliata* (n = 28), on subfossils of *Alouatta* sp. (n = 2), and the fossil *Caipora bambuiorum* (n = 1). We made molds of the chewing surface of the, preferentially, second molars. Epoxy replicas were made and analyzed using a Sensofar Plμ white light confocal microscope. The data were then acquired using MountainsMap software (version 8.1). Our findings demonstrate that *A. palliata*, from Panamanian rainforests, exhibited higher anisotropy and lower complexity, indicative of a diet rich in fibrous foods, likely leaves. In contrast, *A. guariba*, from Brazilian Atlantic Forest fragments, showed higher complexity and lower anisotropy, consistent with a more generalized and flexible, mixed-feeding strategy, which may reflect adaptation to resource variability in fragmented habitats. *Alouatta* sp. from Minas Gerais, Brazil, showed a diet similar to *A. guariba*, with a consumption of softer food items, and *Alouatta* sp., from Bahia, Brazil, showed signals indicative of a diet specialized in tougher fruits. *Caipora bambuiorum* displayed intermediate microwear values, suggesting a mixed-feeding strategy that included fruit and leaves, thereby refining previous interpretations of its diet as strictly frugivorous. MANOVA indicated a significant species effect ($p < 0.0001$) but no multivariate effect of sex ($p = 0.13$) nor of the sex × species interaction ($p = 0.56$). Univariate tests revealed a sex influence on surface complexity ($F_{1,31} = 4.57$, $p = 0.04$), suggesting that males might consume slightly tougher or more varied foods; this result warrants caution given the small, unbalanced sample. Our study provides insights into the feeding ecology of Neotropical primates and contributes to a broader understanding of their adaptive strategies in response to past and present environmental conditions.

Funding Sources CAPES (Finance Code 001), CNPq (314260/2021-8, 305576/2021-6, 406902/2022-4, 304394/2023-8), FAPES (509/2020, 168/2021) and FAPERJ (E-26/204.464/2024).

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

HYPERPAST—non-invasive fossil screening for material identification, preservation assessment, and conservation management

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The more a fossil is exposed to natural agents, the more it is affected by progressive and irreversible degradation. This process is also destructive when a fossil is sampled to describe the taphonomy, to detect the preservation of organic residues, or to assess past conservation treatments. For this reason, the best practice in paleontology pushes for minimizing the compromission of the specimens, establishing measurable and objective methods to monitor the status of preservation of exposed materials and to detect, in advance, the best regions for sampling.

The primary goal of the HYPERPAST project is to develop a standardized method for screening the mineralogical composition of the fossils' surfaces using a combined hyperspectral camera. The procedure is non-invasive and the output is stable through time, repetitive and verifiable. The produced maps record the fossils' characteristics as a semi-continuous curve of reflectance. The range of recorded wavelengths, between 450-2500 µm, allows a spatial interpretation of the scanned surface and includes both the UV and IR lights, making it possible to compare these maps with previous existing studies. The method is broadly applicable across different types of fossil materials and taphonomic processes.

Launched in May 2025, the project is presented in its workflow and impacts, and through practical examples, including the Permian plant remains from the Bletterbach Gorge (Italy), Cretaceous and Eocene fishes from Pietraroia and Bolca (Italy), respectively, and stromatolites from the Ashenge Lake (Ethiopia). Some insights into this application to prehistoric contexts with human settlements will also be presented.

Funding Sources The HYPERPAST project is supported by the Italian Ministero dell'Università e della Ricerca, under the Young Researcher Call 2024 and PNRR (proj. n. MSCA2024_0000017).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Testing the effect of different rotation centers in procoelous caudal vertebrae on the ranges of motion (RoM) of two sauropod tails from the Late Jurassic of Tendaguru (Tanzania)

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In this study, the ranges of motion (RoM) of the caudal series of two sauropod dinosaurs from the Late Jurassic of Tendaguru (Tanzania), *Wamweracaudia keranjei* and *Dicraeosaurus hansemanni,* were examined. The 3D models of the caudal vertebrae were assembled in different cartilaginous neutral poses (CNPs) to account for the unknown intervertebral cartilage thickness, using sub-parallel centra and zygapophyseal contact faces as proxies.

For the first time in procoelous vertebrae, we tested different locations for the center of rotation (CoR) to assess if the CoR placement plays an important role for the calculation of maximum RoMs. We defined two different placements: CoR.1 in the most prominent point of the condyle, and CoR.2 inside the 'ball' of the condyle (i.e., center of the modelled sphere). For amphyplatyan and amphicoelous articulations we reconstructed the intervertebral disc as an ellipsoid solid element between two centra as the CoR.

The two studied species present clearly differentiating caudal series, mainly in the articulation types, morphology and orientation of the neural spine. The *Dicraeosaurus* tail is strongly curving downward in the anterior section which lines up with the elongation of the neural spines, and exhibits mainly amphiplatyan and amphicoelous articulations compared to the strong procoely present in the anterior region of the straighter oriented *Wamweracaudia* tail.

Our results show that CoR placement affects maximum RoMs in procoelous vertebrae, as was already shown for other articulation types. This is especially apparent in the dorsiflexion of the strongly procoelous caudal vertebrae of *Wamweracaudia*. However, it is important to stress that CoRs are not only influenced by osteological factors but also vary during the movement because of the redistribution of stresses. Caudal procoely has been linked to shear stresses in sauropods and is more pronounced in the anterior tail of *Wamweracaudia* compared to *Dicraeosaurus.* Hence, a behavior that required stabilization of the vertebral column against shear stresses is more probable in the former.

The results of this study help shed light at the different intra- and interspecific behavior of sauropod dinosaurs. Comparing RoMs of different sauropod species from the same formation may help to understand in what different ways those animals communicated within their respective herds whilst migrating over long distances, and how they defended themselves against predators on those journeys.

Funding Sources Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - Project number 470751746

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

'Back' to the sea: backbone evolution in secondarily aquatic mammals

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Secondary invasions of the aquatic realm by land-dwelling vertebrates represent some of the most fascinating ecological transitions in the evolutionary history of life. These land-to-water transitions involve a shift from a limb-based to axial-driven locomotion, resulting in dramatic reorganization of the vertebrate body plan, including limb reduction and body streamlining. While such transitions occurred independently in several lineages, such as ichthyosaurs, mosasaurs, whales, and manatees, more than 150 living species of mammals exhibit some level of aquatic adaptation, offering a rare opportunity to investigate the impact of the land-to-water transitions on morphofunctional evolution. Despite the central role of the backbone for aquatic locomotion, our understanding of evolutionary changes of the vertebral column across land-to-water transitions remain limited compared to the limbs or skull. Here, we aim to understand how repeated land-to-water transitions have shaped the evolution of the mammalian backbone, and whether these ecological shifts have resulted in common patterns of vertebral adaptation.

To this end, we examined vertebral morphology across a broad range of extant terrestrial (n = 15), semiaquatic (n = 19) and fully aquatic (n = 23) mammals, along with key fossil taxa (n = 7) representing transitional forms in several lineages that independently reinvaded the aquatic environment. Using morphometrics collected across cervical, thoracic, lumbar, and caudal vertebrae, combined with advanced statistical tools including phylogenetic comparative methods, we assessed variation in vertebral shape with degree of aquatic specialization. Our analyses of extant mammals reveal strong convergence between fully aquatic

sirenians and cetaceans, both displaying marked divergence from terrestrial and semiaquatic species. In contrast, semiaquatic lineages exhibit greater variation and largely overlap with terrestrial taxa. Quadrupedal fossil sirenians and cetaceans bridge the morphological gap between semi and fully aquatic taxa, indicating transitional vertebral function, while other fossil forms possess a unique morphology unmatched in living mammals suggesting divergent or specialized adaptations. Overall, our findings show that major vertebral transformations are associated with a full departure from terrestrial life, likely linked to hind limb loss and a shift to axial propulsion using flukes.

Funding Sources European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement no. 101023931.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Ca isotopes in tooth enamel and its potential for paleoenvironmental reconstruction

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Tooth enamel serves as a robust archive for paleoecological studies due to its crystalline hydroxyapatite composition, which results in high resistance to diagenesis. Recently, calcium (Ca) isotopes in tooth enamel have been interpreted as proxies for diet, trophic level, nursing practices, and ecosystem structures—particularly when paired with $\delta^{13}C$—in terrestrial systems. However, questions remain about how and why Ca fractionates in ecological and biological systems. The American bison (*Bison bison*) provides an ideal model for investigating environmental and physiological controls on Ca isotopes in enamel, owing to its broad habitat range and the opportunity to sample associated Ca reservoirs across entire ecosystems. We aim to refine our understanding of Ca source pathways and isotope incorporation into enamel by integrating enamel isotope data with environmental samples—including water, soil, and vegetation. To this end, we analyzed Ca isotopes in modern bison teeth and corresponding environmental samples from nine localities across the United States. We find that as Ca fractionates from surface water to the exchangeable soil fraction to vegetation to enamel, lighter Ca is preferentially uptaken, resulting in progressively lighter $\delta^{44/40}Ca$ values. Though, the vegetation and the exchangeable soil fraction have considerable overlap. Modern bison tooth enamel exhibits total variability of ~1.5‰ in $\delta^{44/40}Ca$ across all nine sampled sites; however, the following discussion focuses on a subset of four sites, which show ~1.2‰ variability. This variability may be partially influenced by local differences in $\%C_4$ biomass—indicated by a negative correlation between $\delta^{44/40}Ca$ and $\delta^{13}C$ values. However, the small differences in $\delta^{44/40}Ca$ values between C_3 and C_4 whole plant and leaf samples from these four sites are insufficient to fully explain the variability seen in the enamel. This suggests other process(es)—potentially related to digestion—could account for the remainder of the variability. Furthermore, improving our understanding of Ca isotopes in modern bison enamel can be used to interpret Ca isotope signals in other ungulate fossil assemblages and past ecosystems.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The cranial and mandibular anatomy of soft-shell turtles (Trionychidae): a revised character list and phylogenetic analysis

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Soft-shell turtles (Pan-Trionychidae) are an early branching clade of hidden-necked turtles (Cryptodira) with a rich fossil record extending back to the Upper Cretaceous. The evolutionary history of softshell turtles is still unclear, mostly because phylogenetic relationships remain unresolved. The difficulty in resolving these relationships arises from the overall conservative morphology of soft-shell turtles combined with high levels of polymorphism related to morphological plasticity and ontogenetic changes. We assembled a revised list of characters focused on the skull anatomy of extant and extinct trionychids through the reassessment of pre-existing characters and the exploration of new characters, including phrasing of morphometric characters. To better assess the polymorphism present in soft-shell turtle skulls, we assembled a sample of 334 specimens of extant trionychids representing most extant species. This sample includes CT-scan data for 44 specimens, of which 30 were partially segmented to aid visualization. Specimens were initially scored individually to document all available polymorphism. Terminal taxa were then scored polymorphic in the final matrix if a given character state is present in more than 20% of specimens. We carried out numerous parsimony analyses under several parameters and compared the results with a reference tree built from molecular data. The matrix is found to perform best with ordered characters and moderate implied weighting, but many relationships remain incorrectly resolved. The best performing trees manage to recover the four main groups of trionychids with the notable exception of *Trionyx triunguis*, which is recovered outside of Chitrini. Use of early fossil trionychids or *Carettochelys insculpta* as outgroups not only affects internal relationships but also character evolution. Despite progress relative to previous analyses, the use of a backbone is still recommended.

Funding Sources Swiss National Science Foundation (SNF 200021_207377).

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

A new bizarre basilosaurid from the Pisco Basin of Peru displaying unexpected primitive features challenges the major trends in cetacean evolution

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Basilosaurid whales are the first truly marine mammals ever to evolve. With many of them being top predators, their origin and cosmopolitan dispersal are important topics to understand how Cenozoic marine trophic webs evolved. Despite being known from every continent, some aspects of their anatomy, disparity, and how they derived from a protocetid ancestor are still unclear. Here, we present a nearly complete and well-preserved specimen collected from the mid Eocene of the Pisco Basin in Ica, Perú that possesses a mosaic of protocetid and basilosaurid characteristics and expand the known ecological disparity of archaeocete cetaceans. The animal retains a big pelvis and functional hind limbs that appear to articulate with differentiated sacral vertebrae. It also retains a short tail, low vertebral count and shows no evidence of caudal flukes. The anterior part of its body, however, shows more derived anatomical features, such as a basilosaurid-like humerus, denticles in the cheek teeth and the acquisition of the basilosaurid tooth formula. Surprisingly, an initial phylogenetic analysis using implied weights parsimony has placed this specimen within Basilosauridae, in a nesting more closely related to the Pachycetinae than to *Dorudon* and *Basilosaurus.* This implies that our specimen is not plesiomorphic to the clade but instead exhibits a secondary enlarged pelvis and hind limbs, accompanied by a reduced vertebral count compared to a more elongated ancestor, and therefore possibly occupying an ecological

niche not previously documented among Pelagiceti.

Funding Sources George Mason University

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New giant protocetid pelves from the middle Eocene of Egypt: implications for hindlimb evolution in early whales

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The transition from land to sea in early cetaceans involved dramatic anatomical changes, particularly in the pelvis and hindlimbs. These structures were progressively reduced and decoupled from the vertebral column as locomotion shifted from quadrupedalism to axial propulsion. However, well-preserved pelves of stem cetaceans remain rare in the fossil record, limiting insight into the functional and evolutionary pathways of hindlimb reduction. Here, we report on two exceptionally large innominates (MUVP 832 and MUVP 833) from the Lutetian Midawara Formation in the Fayum Depression, Egypt. Recovered from the same stratigraphic level and ~2 km apart near the type locality of *Phiomicetus anubis*, the specimens likely represent two individuals of the same species, potentially referable to *Phiomicetus*. If confirmed, they would constitute the first pelvic material attributable to this taxon. MUVP 833, the more complete left innominate, preserves the ischium (285 mm), pubis (229 mm), obturator foramen (160 mm in height), acetabulum (58.5 mm in diameter), and posterior ilium. Although the anterior ilium is missing, the preserved elements exhibit exceptional robustness and exceed the dimensions of all known protocetid pelves by 25–65%, ranking among the largest for any archaeocete. The circular acetabulum is well developed and preserves an open acetabular notch, consistent with articulation to a large functional femur. MUVP 832 (right innominate) is more fragmentary but consistent in overall morphology and size. The ischium curves dorsomedially, forming a broad, flat ischiatic table—broader than in other protocetids, though less expansive than in remingtonocetids such as *Rayanistes*. This surface likely anchored powerful femoral retractor muscles (m. gluteobiceps, m. semitendinosus, m. semimembranosus) involved in knee flexion and pelvic paddling. Overall, these pelves highlight a previously undocumented pelvic morphology within Protocetidae, supporting semi-aquatic propulsion via pelvic paddling and reinforcing the evolutionary diversity of hindlimb function among middle Eocene cetaceans.

Funding Sources Mansoura University; American University in Cairo; Science and Technology Development Fund (STDF); Egyptian Environmental Affairs Agency (EEAA).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new avifauna from the Lower Miocene of Austria

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We present a newly discovered avifauna from the Lower Miocene fossil site Kühnring near the

town of Eggenburg in Austria, which is located about 75 km northwest of Vienna. The marine sands of the Kühnring localities (several historic sand pits) are well known already since the 19th century for their richness of invertebrate and vertebrate fossils, especially shark teeth. Only recently, during new excavations at the site "Kühnring-Hochstrasse" (since 2022–ongoing), fossils of different vertebrate groups were found. Besides the abundant teeth of sharks, rays and teleosts, this concentration Lagerstätte also yielded remains of marine mammals (e.g., sirenia, dolphins) and occasionally isolated finds of terrestrial mammals (e.g., anthracotheres, rhinos, micromammals), of reptiles (e.g., turtles, crocodiles), and for the very first time of birds.

The fossil-bearing marine sands at Kühnring were deposited during the Early Miocene in a tropical bay. This so-called "Eggenburg bay" was situated at the northwestern coast line of the Central Paratethys Sea on the Bohemian Massif. The near-shore deposits at the site "Kühnring-Hochstrasse" represent the interfingering marine sands of the Burgschleinitz and Gauderndorf Formation biostratigraphically dated to the Early Miocene, late Eggenburgian regional age of the Central Paratethys (correlating with the early Burdigalian, early Orleanian, Mammal Neogene Unit MN3).

Despite the fact that fossil bird remains from the Kühnring site are sparse and preserved fragmentarily, they add significant information to the meager Early Miocene avifauna known from the Central Paratethys. So far, only aquatic bird taxa were identified from this locality. They represent boobies and darters (snakebirds) (both Suliformes). The record of the darter *Anhinga* (Anhingidae) is remarkable in several respects. Several of the long bones of the *Anhinga* show pachyostosis in adaption to their diving lifestyle. This record in the late Eggenburgian (early Burdigalian) is its earliest known occurrence in Europe and predates its first appearance from formerly 16 Ma to now ca. 19–18 Ma. Extant darters are shallow-water diving birds and mainly inhabit freshwater lakes, rivers, marshes, and swamps. And also in the fossil record anhingids are linked to freshwater habitats. Thus, the occurrence of the darter fossils in the marine deposits of Kühnring requires further investigation if they are autochthonous or washed in from the nearby hinterland.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A freely accessible, digital, cranial atlas of hatchling *Gavialis gangeticus* and notes on the paranasal and paratympanic sinuses, endocranium and associated nervous structures, and ossification of the crista interfenestralis and the first three cervical vertebrae

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Gavialis gangeticus is a long-snouted, critically endangered crocodylian. Its evolutionary history has long been debated as morphology-only and molecular-only analyses return different phylogenetic placements. A lack of stem fossils and ontogenetic changes of the skull obscure the issue further. To address this, we used computed tomography (CT) scanning to digitize the skull of a rare, hatchling specimen of *Gavialis gangeticus* with preserved soft tissue. We digitally isolated each cranial element to produce an osteological atlas, which we have made freely available via SketchFab. The exceptional preservation of this tiny specimen enabled us to investigate pneumaticity patterns in detail. The nasal cavity, olfactory recess, and nasopharyngeal duct are well defined and follow typical crocodylian patterns. The age of the specimen precludes it from having the pterygoid bullae that are typical of older specimens of *Gavialis*. We were not able to confirm the presence of the antorbital recess but did identify a recess corresponding to the maxillary sinus. The paratympanic sinuses resemble, but are not identical to, those in adult *Gavialis*. For

example, the laterosphenoid recess is fully developed in adults, but in the hatchling is thin and apneumatic anteriorly, and with only discontinuous spaces posteriorly. The basioccipital and pterygoid recesses more closely resemble other hatchling crocodylians, like *Alligator*, rather than adult *Gavialis*. The endocranium is rounded with a flexed olfactory tract, consistent with other hatchling crocodylians. Notably, the boot of the crista interfenestralis contacts a separate ossification anterior to the otoccipital, which we interpret as an early ossification of the perilymphatic loop. Additionally, two, somewhat symmetrical, radiopaque structures appear inside the posterodorsal portion of the endocranium. We interpret these as potentially partially calcified dorsal venous sinuses, though published analogs in other reptiles are lacking. This exceptionally preserved, ontogenetically young specimen provides a critical point of comparison for both developmental and phylogenetic studies. We present a detailed digital atlas for future efforts to resolve the phylogenetic position of *Gavialis* among extant crocodylians.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Patching the 'leaky pipeline' in paleontology through *DrNeurosaurus*, a YouTube channel showcasing women paleontologists

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Women have had a critical role in paleontology for as long as it has been a field of study, and yet they make up a minority portion of professional roles as curators, professors, and scientific societies. Though in early life, interest in paleontology is roughly equal among all children, young girls start to be dissuaded from a career in paleontology and other STEM fields. Contributing factors include a lack of opportunities, lack of accessible role models, societal pressures, and more. Among those who pursue STEM in higher education, the "leaky pipeline" persists, resulting in diminishing representation of women at each successive career stage. One way to address the lack of role models is to showcase the stories, struggles, and successes of women paleontologists across different career paths. This serves two goals: (1) to increase representation and (2) to demonstrate how paleontological training can lead to a wide variety of career outcomes. To reach a broad, global audience, I turned to YouTube, a free and accessible video medium. Inspired by *She Found Fossils*, a co-authored children's book on women paleontologists, I launched the YouTube channel *DrNeurosaurus*. The core segment of the channel is *PaleoSpotlight*, where I interview diverse women paleontologists working in a range of careers. We discuss their paths into paleontology, the obstacles they've overcome, and the advice they have for young, aspiring paleontologists. Additional content includes book reviews, particularly books authored by interviewees, paleo-themed Lego builds, and news segments highlighting recent paleontological research. This channel has already inspired some viewers, some of whom have shared that hearing these stories helped them feel seen and motivated them to continue their paths in STEM. Moving forward, my goal is for *DrNeurosaurus* to continue offering accessible role models, countering misinformation, and helping to strengthen retention in the STEM pipeline.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

What large teeth (sockets) you have! Using dental alveolus lengths to predict phytosaur skull size distributions in a phylogenetic and paleoecological context

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Paleobiological studies often prioritize the most complete or well-preserved specimens to represent species, forming the basis for testing hypotheses related to evolution and ecology.

However, it is unclear whether these specimens are the most appropriate for such analyses, especially those focused on body size evolution or population dynamics, because they may not reflect the most skeletally mature individuals or the broader size distribution at a locality. This is particularly true for Triassic phytosaurs (large, quadrupedal archosauriforms), where evolutionary and functional ecological studies rely almost exclusively on complete to nearly complete skulls, despite the abundance of fragmentary cranial material across Late Triassic deposits. Because previous studies identified qualitative and quantitative relationships between dental alveolus dimensions and skull length in phytosaurs, we use fragmentary rostra bearing dental alveoli to estimate skull lengths and assess whether (a) single localities preserve multiple size classes and (b) phylogenetic datasets disproportionately sample skeletally immature or mature individuals. We measured alveolus lengths, rostral widths, and skull lengths from complete skulls (n = 44) to generate a linear model predicting skull length from fragmentary rostral fragments and incomplete crania (n = 23). Regression analyses showed that dental alveolus length alone can predict skull length across all phytosaurs (R^2 = 0.6), but model fit improved (R^2 = 0.7) when implementing an interactive effect between alveolus length and rostral width. We found that multiple fossil sites across the southwestern USA preserve wide ranges of predicted skull lengths (~350–1000 mm) within single localities, indicating multiple size classes may have cohabited. Additionally, complete skulls used in phylogenetic analyses (n = 23) averaged between the 62nd and 67th percentiles of all observed and predicted skull lengths, indicating they do not all represent the largest individuals. Therefore, our data suggest that phytosaur evolutionary reconstructions may be influenced by intraspecific variation, potentially due to ontogeny, and future phylogenetic analyses should account for ontogeny in character coding. Ultimately, this study highlights the importance of specimen selection in phylogenetic analyses and incorporation of fragmentary material to test paleobiological hypotheses in evolution and ecology.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Evolution of dental eruption patterns in placental mammals

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Numerous studies on extant mammalian species suggest that a tight relationship might exist between ontogenetic dental traits, ecological traits, and life-history traits, the latter often being difficult to assess in extinct species. Among these dental traits, modifications affecting dental growth and eruption are thought to be associated with changes in feeding habits, growth rates, or longevity. Prolonged dental growth characterized by crown height increase (or hypsodonty) has been extensively studied in extinct forms in relation to major environmental changes during the Cenozoic. Changes associated with the sequence of dental eruption (i.e., eruption of permanent premolars versus molars) are conversely poorly studied in extinct mammals, despite its potential palaeoecological, palaeobiological, and phylogenetic significance. I studied the evolution of these dental eruption patterns in different groups of large herbivorous mammals such as the “South American native ungulates” (SANU; e.g., Notoungulata, Astrapotheria, Litopterna), Artiodactyla and Perissodactyla. Based on large datasets, I showed that the evolution of these patterns was very dissimilar from one group to another and that it could be associated with different parameters (e.g., hypsodonty, body mass) and in relation or not to environmental variations. For instance, a putative link might exist between dental eruption and hypsodonty in SANU, while the link between dental eruption and body mass seems major in Perissodactyla, compared to Artiodactyla where it is more limited. These results also allowed me to propose paleoecological (e.g., dietary) and paleobiological (e.g., growth rate) hypotheses that will be the subject of future studies to better understand the putative ecological and biological

adaptations of herbivorous mammals to environmental variations.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Analysis and description of a partially prepared sub-adult *Mosasaurus missouriensis* (Squamata, Mosasauridae) from the Bearpaw Formation during the Upper Cretaceous in Western Canada

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In recent years, southern Alberta has had a boom in mosasaur discoveries, in large part due to the ammonite mines excavations. These mines provide well-preserved specimens of marine organisms that were living in the Bearpaw Formation during the upper Cretaceous. In particular, mosasaur remains have become a regular occurrence with many in remarkable condition. One such specimen is TMP 2013.045.0001, a subadult *Mosasaurus missouriensis* discovered in 2013 in a Korite International mine. The animal is in three jackets, which this paper will describe the partially prepared fossils in the upper body and skull jacket after the summer of 2023. Morphological characteristics and analysis designate this species as *Mosasaurus missouriensis*. Low faceting on the dentition provides evidence that subadult *M. missouriensis* may have transitioned to the same diet as the adults, thereby filling the same niche. The specimen only has 56% of its visible teeth intact, which is unusual in mosasaurs from the Bearpaw Formation. The missing teeth are correlated with bulges in the premaxilla, maxilla, and dentary suggesting plastic deformation in these empty 2 of 24 tooth sockets is the reason for these bulges. A possible calcified cartilaginous sternum is also preserved with a small amount exposed, suggesting more soft tissue may remain underneath the unprepared rock.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Using mesowear analysis on *Teleoceras fossiger* and *Teleoceras aepysoma* material to understand feeding ecology

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Teleoceras is a genus of rhinocerotids that belongs to the Tribe Teleoceratines and was widespread across North America from the late Early Miocene into the Early Pliocene. This genus was very successful, spreading across the continental United States from Florida and Tennessee to California and Washington state down to central Mexico and Honduras. *Teleoceras* is characterized by having a large, rounded chest cavity and short limbs with relatively high crowned teeth and lower incisors modified into tusk-like teeth. Initial ecological comparisons were made to the modern hippopotamus based on proportions of the chest cavity and its hypsodont dentition. Stable carbon isotopic analyses of *Teleoceras proterum* material from the Early Pliocene of Florida strongly suggest that *T. proterum* was a terrestrial mixed feeder that heavily consumed C_4 grasses. However, for material dated before 4.5 Ma, nothing could confidently be said about the dietary preferences of *Teleoceras* other than the fact that it was consuming C_3 foliage. Evidence from gut content and tooth crown height from sites dated before the spread of C_4 grasses around 7 Ma (e.g., Ashfall Fossil Beds) suggest that *Teleoceras* was a mixed feeder. Studies continue to suggest that some species of *Teleoceras* were browsers/mixed feeders while others suggest that species like *T. hicksi* range from browsing to grazing. In this study, we used a 2D Geometric Morphometric Mesowear Analysis on eight *T. fossiger* individuals from the Late Miocene Minium and Jack Swayze

Quarries of Kansas and four *T. aepysoma* individuals from the Early Pliocene Gray Fossil Site in Tennessee in order to understand their feeding ecology. We created a dataset of 137 individual perissodactyls with 82 equid individuals and 55 rhinocerotid individuals with dietary information collected from the literature to classify *T. fossiger* and *T. aepysoma*. Our results show a mixed feeding ecology for *T. fossiger* and a browsing feeding ecology for *T. aeypsoma*. Both of these dietary classifications align with previous studies. Analysis of *T. fossiger* gives us a better understanding as to how much browse and graze *T. fossiger* consumed. Analyzing *T. aepysoma* provides a better explanation of *T. aepysoma* C_3 grass or C_3 browse preferences. By comparing the diet/feeding ecology of *Teleoceras* across temporal and spatial ranges, we can get an increased understanding of the responses to C_4 grasses, and *Teleoceras* preferences for C_3 trees or C_3 grasses overall.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Locomotor reassessment of *Iguanodon*, *Ouranosaurus* and *Lurdusaurus* (Dinosauria, Ornithopoda) using comparative osteology

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Large ornithopod dinosaurs have been successively described as quadrupeds, bipeds and facultative bipeds. Here we study the case of three ankylopollexians (*Iguanodon bernissartensis*, *Ouranosaurus nigeriensis* and *Lurdusaurus arenatus*) for which locomotion remains debated. We examined in detail their appendicular skeleton, focusing on osteological features that were previously associated with quadrupedality in dinosaurs. We compared our observations with data obtained for 12 saurischians and 27 ornithischians whose bipedal or quadrupedal locomotion was known a priori. *Iguanodon* and *Ouranosaurus* are found among quadrupeds for respectively seven and eight of the eleven locomotor proxies used in this study and are therefore considered to be facultative bipeds, in agreement with previous hypotheses of facultative bipedalism in Ankylopollexia. *Lurdusaurus* is found among quadrupeds for all the locomotor proxies employed and thus is considered as an obligate quadruped. The extreme humeral and femoral eccentricity, along with the very short metatarsus, indicate graviportalism in *Lurdusaurus*, making it the first graviportal ornithopod. Further biomechanical investigations are definitely needed to fully appreciate the locomotion of this unique taxon. Locomotor proxies are proving to be useful tools for studying the transition to quadrupedalism in ornithopods, supporting previous hypotheses of an intermediate facultative bipedal stage.

Funding Sources ERC GRAVIBONE (grant agreement: 715300)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New genomic data shed light on the biogeographic history of *Lynx lynx* in Western Europe

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The Pleistocene distribution of the Eurasian lynx (*Lynx lynx*) extended from East Asia to Western Europe, reaching the northern regions of Spain, where it coexisted with the Iberian lynx (*Lynx pardinus*) for nearly 12,000 years. However, little is known about this Iberian *Lynx lynx* population. Their remains are scarce and only a few individuals have been studied at the genetic level. Mitochondrial DNA analysis has linked the Pleistocene populations to modern Eurasian

lynx from the Caucasus and the Balkans, while Holocene populations have been associated with the current clade C, which is widespread across central and northern Europe. At the nuclear level, only one individual of *Lynx lynx* has been analyzed to date.

Here we present the genome analysis of Sima Topinoria (hereafter referred to as ST), a *Lynx lynx* specimen from northern Spain dated to approximately 200 years ago (^{14}C). This individual represents the most recent known occurrence of the species in the Iberian Peninsula. We reconstructed its complete genome and analyzed both nuclear and mitochondrial data within the context of the ancient and modern genetic diversity of the species.

ST's mitochondrial lineage was found to be basal to all modern clade C lineages in both Eastern and Western Eurasia, with a divergence time close to the split between the major clades in the species' phylogeny. At the nuclear level, ST does not belong to any of the genetic clusters identified in modern populations, although it is genetically closer to western than to eastern Eurasian populations. We also tested whether ST's population could have been involved in the ancient hybridization event with *Lynx pardinus*, and found it to be more closely related to *L. pardinus* than any other sample in our dataset.

Altogether, our analysis indicates that ST descends from an ancient *Lynx lynx* population that expanded into Europe during the Pleistocene and persisted in northern Spain, even after the population turnover associated with the onset of the Holocene. Its lineage shares ancestral variants with the Caucasus and Balkan clades, which may have led to the misidentification of western Pleistocene lynx as belonging to these southern groups. Indeed, our analysis suggests that this connection is better explained by shared ancestry between the Pleistocene *L. lynx* and ST's ancestral population—a finding that redefines the species' biogeographic history in Western Europe.

Funding Sources Xunta de Galicia (ED431B 2024/17, ED431B 2021/17, ED431B 2018/47) Gobierno de España, Ministerio de Universidades, Programa Beatriz Galindo (BG22/00146)

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Taxonomy and evolution of North American Gomphotheriinae (Mammalia, Proboscidea): a reassessment of proposed holotypes housed at the American Museum of Natural History and preliminary phylogenetic analysis

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Gomphotheriinae and *Gomphotherium* itself encompass many proboscidean species with 'basic' bunodont molars found across Africa, Eurasia, and North America. The taxonomy of North American taxa within this subfamily is contentious, with over 40 (likely morphologically distinct) species condensed into a single species, *G. productum*. Afro-Eurasian *Gomphotherium* is also likely polyphyletic. Currently, the evolution of this group in North America and its relation to Eurasian and African taxa remains an enigma. This taxonomic confusion has also prevented analyses of biogeography and diversification of the group in North America. I hypothesize that the *G. productum*-complex is a polyphyletic aggregation of many distinct gomphotheriid species representing several episodes of immigration from Eurasia. Using new data from 0.2 mm resolution surface scans of the holotype specimens of 19 proposed species known from cranial and mandibular remains within the *G. productum* complex and six referred specimens from the Espanola basin, I assembled a data matrix of 128 craniodental characters across 69 bunodont proboscidean taxa including four proposed species in the *G. productum* complex. My results found that *'Trilophodon giganteus'*

and *'Ocalientinus ojocaliensis'* did not form a monophyletic group with *G. productum* to the exclusion of any gomphotheriid species, supporting the hypothesis that they are distinct from *G. productum.* I show that other taxa included within *G. productum* are also distinct, such as '*T. cruziensis*' AMNH F:AM 21300 which I recover as more closely related to *Megabelodon lulli* and *Eubelodon morrilli* than to *G. productu*m. Examination of the holotype of '*Trilophodon joraki'* AMNH F:AM 21296 suggests the individual is not a pathological *G. productum* individual. An unstudied partial mandible from the same strata shares the distinctive combination of mandibular characters, as seen in multiple *M. lulli* specimens from Nebraska, suggesting assignment of *'T. joraki'* to *Megabelodon* and lending support to the validity of the latter. *P. campester* was also recovered as an amebelodontine gomphothere rather than derived from '*Gomphotherium* stock.' These results support the hypothesis that the *G. productum complex* is a polyphyletic aggregation of taxa with a complex history of migration between North America and Eurasia, requiring further study.

Funding Sources Funding for this project was provided by a Richard Gilder Graduate School Student Fellowship and a Paleontological Society Graduate Research Grant

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Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Phylogenetic machine learning predicts cryptic aquatic habits and soft-tissue features in extinct amniotes

Gordon, Caleb M.

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Amniotes descended from terrestrial ancestors but independently adapted to life in the water dozens of times over the last 300 million years. The most aquatically specialized of these groups have limb morphologies that suggest a fully marine lifestyle, but their transitional, semi-aquatic ancestors have more ambiguous morphologies, making it difficult to determine which fossil species were aquatic and resolve precisely how aquatic they were. Predicted soft-tissue limb features, such as interdigital webbing and flippers, offer promise to help discern the semi-aquatic habits of extinct species, but these structures lack validated osteological correlates. To address this uncertainty, I developed a novel phylogenetic supervised machine-learning approach to test the validity of previously proposed osteological correlates for both (1) webbing/flippers and (2) highly or fully aquatic habits within an extant bracket encompassing crown amniotes. Assembling the largest morphometric dataset of amniote limbs to date (11,410 linear measurements on n= 747 specimens and three geometric morphometric analyses on n= 174 specimens), I compared the proportions and shapes of the major limb regions and phalanges among webbed, unwebbed, and flippered species of differing aquatic affinities. For each purported osteological correlate, I trained phylogenetic logistic regression models on extant species with known soft-tissue phenotypes or aquatic affinities. I then assessed the validity of each correlate with phylogenetic Receiver-Operating Characteristic (ROC) analysis—a new technique that compares the predictive accuracies of competing osteological correlates. Finally, I used the best of the tested correlates to predict the soft-tissue phenotypes and aquatic habits of contentious extinct taxa. In doing so, I ultimately found that simple limb region proportions predict amniote flippers and highly/fully aquatic habits with >90% accuracy. These predictions shed new light on the evolutionary histories of marine adaptation in seafaring amniotes. Most notably, they confirm that no Paleozoic stem reptiles were fully aquatic, support multiple origins for fully aquatic habits sauropterygians and mosasaurs, and clarify that a semi-aquatic ichthyosauromorph has yet to be found. More broadly, this work offers a versatile new method for reconstructing cryptic functional phenotypes (such as powered flight and bipedality) from sparse fossil remains in extinct species.

Funding Sources National Science Foundation Graduate Research Fellowship No.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Micro-CT analysis of the internal bone structure of nodosaurid osteoderms: a comparative study of osteoderm morphology across the cervical, thoracic, and caudal regions of *Denversaurus*

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Micro-CT scanning offers valuable insights into the internal bone structures of fossilized osteoderms, enabling a detailed exploration of their microanatomy. In this study, we apply micro-CT imaging to investigate the internal architecture of osteoderms from various anatomical regions (cervical, thoracic, and caudal) of *Denversaurus.* The osteoderms evaluated were from a single individual of *Denversaurus,* MINS-1090, from the Lance Formation of Wyoming. Focusing on a single specimen will eliminate the possibility of inter- and intraspecific variation affecting the results.

Through the processing of our micro-CT scan data of these osteoderms, we were able to reveal variations in their internal bone structure across different regions of the body. These results may inform our understanding of osteoderm function in thermoregulation, defense, and taxonomic classification, as well as possible variation in function across the cervical, thoracic, and caudal regions of *Denversaurus.* Our analysis revealed distinct differences in vascularization patterns, trabecular density, and cortical thickness among osteoderms from different anatomical regions, suggesting a region-specific adaptation potentially linked to functional demands. Some of the osteoderms displayed a denser, more robust internal framework with thicker cortical bone and limited internal cavities, features consistent with a primarily defensive role. Others exhibited a lighter, more porous structure with extensive vascularization and a higher proportion of trabecular bone, which may indicate a role in thermoregulation, metabolic exchange, or mobility optimization. These microanatomical distinctions provide further evidence supporting the hypothesis of diversified physiological roles within the osteoderm system.

By comparing internal osteoderm architecture across regions of MINS-1090, this study contributes to a growing body of evidence that osteoderm morphology is not uniform but highly variable and functionally significant. These findings not only enhance our understanding of *Denversaurus* biology but also offer comparative data useful for evaluating osteoderm evolution across Ankylosauria and related taxa.

Funding Sources Wyoming Research Scholars Program (WRSP)

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The role of trade-offs in shaping cranial morphological variation in domestic chickens

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Understanding the relationship between osteological and soft tissue systems is crucial to accurate fossil reconstruction, which can be done by studying extant taxa with directly observable soft tissue. The cranium is particularly interesting as the process of encephalization has dramatically changed the size and shape of the soft and hard tissues within

the cranium. There is a large body of work using bony proxies of cranial soft tissue (e.g., endocast, orbit, and muscle attachments), but it remains unclear how these hard and soft tissues all interact to shape morphological variation. Moreover, our understanding of intracranial integration is from large interspecific analyses with one specimen per species, and understanding the role of intraspecific variation is important to accurately reconstruct fossil diversity.

Birds are an excellent candidate for developing this understanding, as they are unique across vertebrates in their large orbits and brain size relative to body size. We investigated the consequences of encephalization on the structure and function of the brain, eye, jaw musculature, and the skull, and the size and shape relationships between these structures. We used a combination of 3D geometric morphometrics, linear metrics, and contrast-enhanced CT scanning to capture phenotypic variation that would not be captured by traditional size/shape analyses. We collected landmark data from the crania of 50 domestic chickens (*Gallus gallus*) and subsequently used PLS to determine allometry and shape relationships.

Contrary to the current literature surrounding shape and size relationships within the avian skull, we found no significant shape integration between any pair of structures amongst brain, eye, jaw musculature, and the skull, and no significant allometry between the skull and endocast ($p = 0.18$), the jaw and the endocast ($p = 0.15$) and the orbit and the endocast ($p = 0.72$). This suggests that although evolutionary relationships among the size and shape of avian cranial traits appear heavily integrated, at a within species level, this integration is not present and must be acting according to different underlying mechanisms than at a macro scale. The role of intraspecific variation and the mechanisms behind the intracranial relationships are important for accurate reconstruction and interpretation of fossils and yet is not currently well understood.

Funding Sources UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee EP/Y010256/1 – BRAIN-DRAIN

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Diversity of tooth mineralization sequences and histological patterns at the stem of crown chondrichthyans

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Modern sharks cover a wide range of trophic levels, from top predators that patrol and hunt via mesopredators that feed on smaller fish or invertebrates, to durophagous specialists and even filter feeders. One key characteristic enabling them to evolve such a large variety of trophic strategies is their dentition. More precisely, a large variety of tooth morphologies combined with continuous tooth replacement and a specialized histology. The arrangement of chondrichthyan teeth makes for ideal conditions to study replacement rates, histology, as well as the sequence of mineralization of tooth-forming tissues such as enameloid, orthodentine, and osteodentine (trabecular dentine) during the ontogenetic development of the tooth. While these characters are largely studied in modern sharks (i.e., neoselachians), little is known about these character states among their earliest ancestors. Especially the sequence of tooth mineralization has, to date, not been documented for early chondrichthyans. Exceptional fossil preservation of three Devonian key taxa allow to document and study not only tooth histology in detail, but also the mineralization sequence of these basal chondrichthyans for the first time. Thin sections of the tooth files of *Ctenacanthus concinnus*, *Maghriboselache mohamezanei* (one of the oldest stem holocephalans), and *Phoebodus saidselachus* (one of the first elasmobranchs) from the Late Devonian of the Anti-Atlas, Morocco, reveal a high histological

disparity already in some of the earliest chondrichthyans. The presence of similar mineralization patterns in phylogenetically and chronostratigraphically distant chondrichthyan taxa suggests a functional rather than a phylogenetic signal. Furthermore, tooth size differences indicate slow tooth replacement rates in all three taxa. Tooth retention on the labial side of the jaw is evident in *Maghriboselache* and the importance of this character as a precursor for the holocephalan evolution of tooth plates is discussed.

Funding Sources Swiss National Science Foundation (project Nr. 200020_184894).

Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

Track robusticity: subsurface layers consistently capture motion irrespective of substrate properties

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Penetrative tracks increase the amount of interaction between the foot and the sediment, allowing more information about the motion of the trackmaker to be preserved. By following the paths of digits through the volume of a penetrative track, a hypothesis of the motion used by extinct animals can be reconstructed and then tested experimentally. However, surface track morphology varies with sediment consistency, and water content at the time of track formation is incredibly difficult to even constrain in fossils. Variations in the morphology of tracks at the surface are well studied, but how sediment consistency affects morphology in the more constrained subsurface is more difficult to determine and poorly understood. Can we therefore be confident that the morphology of a penetrative track truly reflects the movements of the foot that made it? Through Discrete Element Modelling, we examined the degree of variability in subsurface track morphology with changes to sediment consistency. Two model systems were tested; a vertically indenting simple abstract cylinder, and a more realistic dynamic foot, using motion derived from an early Jurassic penetrative dinosaur track. Surface traces differed substantially with changes to sediment properties. Increasing sediment friction (reducing 'flowability') resulted in higher and more extensive displacement rims. Increased cohesion led to tracks remaining open. However, tracks exposed along subsurface layers (equivalent to laminations in rock), even slightly below the tracking surface, had morphologies that were considerably more robust to changes in sediment properties. We quantified this by tracking locations of analogous points (digit tips, hypex, and exit) throughout the track volumes. Across the sediment consistencies tested, the location of digit three on the surface layer deviated from the true point of contact by an average of 7.35 mm (12.25% of the toe length) while in the subsurface this deviation was reduced to values as low as 2.02 mm (3.37% of toe length). On average the total deviation of points decreased from a surface deviation of 4.78 mm to 2.94 mm in the deepest lamination. Subsurface track morphology is robust to sediment conditions. Foot motions recovered from penetrative tracks can therefore be accurate regardless of sediment consistency at the time of track formation, removing an unknown from the reconstruction process.

Funding Sources This work was funded by UKRI Frontier Research Grant TRACKEVOL (selected by the ERC for a consolidator award) awarded to PLF.

Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Large body sizes were widespread among the earliest carnivorous dinosaurs

Griffin, Christopher[1], Munyikwa, Darlington[2,3], Zondo, Michel[3], Broderick, Timothy[4], Nesbitt, Sterling J.[5], Trinidad, Valerie[6,7], Tolan, Stephen[8]

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Carnivorous dinosaurs reached the largest body sizes of any group of terrestrial predators. Although dinosaurs originated deep in the Triassic Period as small (~10 kg) carnivorous bipeds, the first large theropods (*Dilophosaurus*-sized, ~500 kg) were long thought to have only evolved following the extinction of other large predators at the end of the Triassic, roughly 30 Ma later. This has been challenged by the revelation that many larger Triassic theropods are known from immature individuals, suggesting the mature body size of these taxa would have been roughly equivalent to those of the Early Jurassic, coupled with the recent discovery of a very large mature neotheropod from Europe. This pushes the evolution of large carnivorous dinosaurs earlier than previously thought, but a single large-bodied *Herrerasaurus* from Argentina (PVSJ 53; ~500 kg body mass) suggests that these large sizes may have been present within the earliest definitive dinosaur-containing assemblages. Here we describe a new herrerasaurid from the late? Carnian-aged Pebbly Arkose Formation of Zimbabwe, roughly equivalent in age to herrerasaurid-bearing sediments from South America and India. The Zimbabwean herrerasaurid is known from a single associated individual preserving a premaxilla, prefrontal, surangular, coracoid, fragmentary humerus, radius, ulna, femur, fibula, and an articulated caudal series. Although almost identical in comparable measurements (± 5%) to one of the largest-known *Herrerasaurus ischigualastensis* (PVL 2566), fibular histology reveals that this individual was still growing rapidly and continuously at time of death, indicating that it would have reached a much larger body size at skeletal maturity. This suggests that large-bodied carnivorous dinosaurs were widespread among even the earliest dinosaur-bearing assemblages. Some of the earliest definitive dinosaurs were therefore already filling the ecological niche of large-bodied predator, a role dinosaurs would retain throughout the rest of the Mesozoic Era.

Funding Sources National Geographic, Princeton University Department of Geosciences.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Fossil Giraffidae from Early Miocene deposits of the Hazeva Formation, northern Negev, Israel

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The giraffe and the okapi are the only living members of a much larger radiation of the Giraffidae. While the group is confined to Africa today, in the past it was dispersed across Eurasia as well. The origins of the Giraffidae are murky. DNA analysis confirms that the Giraffoidea, the group that contains the Giraffidae, diverged from other artiodactyl ruminants approximately 25 Ma, coinciding with the beginning of the Miocene. However, fossil evidence for the Giraffidae is unknown prior to the later part of

the Early Miocene, where they are found together with other Giraffoidea such as Climacocerotidae. The earliest known giraffid, *Canthumeryx syrtensis*, is known from late Early Miocene deposits in Kenya and Libya dated around 17–18 Ma. Giraffid materials ascribed to *C. syrtensis* were reported but not described from similarly-aged deposits in Egypt, Saudi Arabia, and southern Israel. In the Siwaliks of Pakistan, *Progiraffa exigua* is known from deposits of similar, later Early Miocene age. However, the status of this genus as a member of Giraffidae remains in flux. Early Miocene giraffids were smaller, had a shorter neck and legs, and narrower and more elongated cheek teeth compared to later Giraffidae species. Here we describe several specimens from the Early Miocene deposits of the sites of Givat Qadmai, Nahal Oron, Kamus Junction, and Nahal Mamshit, all part of the Hazeva Formation in the Northern Negev Desert of Israel. The sample includes specimens previously mentioned but never described, as well as newly recovered materials collected by the Israel Miocene Research group (A.G., R.C., R.R.). We compared this material with *Canthumeryx syrtensis* fossils from Kenya as well as published descriptions of Libyan and Kenyan materials. The specimens from the Hazeva Formation maintain primitive Giraffidae morphology (e.g., elongated and narrow lower cheek teeth). While they agree in general size and basic morphology with *Canthumeryx syrtensis* and *Progiraffa exigua,* several details of the lower dentition differ from either of these species. These specimens provide important information about morphological and biogeographical diversity in the earliest Giraffidae.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Evolution of a highly convergent dental trait: how to quantify and analyse the multiple independent acquisitions of hypsodonty in rodents?

Guyonneau, Emma, Gomes Rodrigues, Helder, Billet, Guillaume

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Evolutionary convergences, where unrelated lineages independently evolve similar traits, are a long-discussed theme among biologists. A textbook example is hypsodonty—*i.e.,* high-crowned jugal teeth in mammals, a trait widely interpreted as an adaptation to withstand abrasive items. Hypsodonty has been documented across numerous herbivorous mammalian orders, with evidence suggesting multiple independent acquisitions. The trait is notably prevalent within Rodentia, the most speciose mammalian order, occupying a vast array of ecological niches and exhibiting diverse, mostly herbivorous adaptations. But despite their significant diversity, hypsodonty in rodents remains insufficiently quantified, precluding a comprehensive understanding of its highly convergent nature.

To address this gap, we first undertook a comprehensive literature review. We surveyed existing literature on dental crown height in extant and extinct rodents, thereby characterizing the prevalence of hypsodonty within the order. Our literary review, encompassing over 500 genera of extant and extinct rodents, provides a detailed record of hypsodonty evolution in the clade. Recognizing inconsistencies and ambiguities in the definition and description of hypsodonty arising from this review, we then conducted original 2D and 3D measurements and calculations of the hypsodonty index on a selected sample of more than 120 extant and extinct taxa, within lineages exhibiting convergent evolution of hypsodonty.

Our approach enabled us to document at least 35 independent acquisitions of hypsodonty and 15 events for hypselodonty (ever-growing teeth) within the rodent crown-group. Including fossil data significantly refined our understanding, revealing almost twice as many independent acquisition events than understood based on extant taxa only. Finally, this work resulted in an extensive database of hypsodonty records in the rodent crown group. It incorporates both qualitative crown height categories and quantitative data with calculated hypsodonty indexes, thereby providing a powerful tool for

subsequent investigations into the evolutionary dynamics and ecological drivers of this highly convergent dental trait across vast geological timescales.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Is *Smilodon fatalis* the cat we think it is? Using computed tomography to find the answer

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The first report on *Smilodon fatalis*, presented by Merriam and Stock in 1932, has significantly shaped our understanding of this species. Their work, along with contributions of numerous other researchers, has been the basis for studies and theories about *S. fatalis*. Questions that scientists ask concern canine placement, bite, bite force, hunting styles, and gape. These questions have been primarily studied based on external observations and computer programs like finite element analysis. CT scans have given us a new, noninvasive way to answer some of these questions.

The introduction of the latest medical computed tomography (CT) scans, a method using 2,000 X-ray slices, conducted with a Nikon XT H 225ST Industrial microCT at the Molecular Imaging Center, Department of Radiology, University of Southern California, has revealed new insights into previously unobservable areas of the skull, sparking a sense of intrigue and excitement among researchers and enthusiasts.

This study focuses on two areas: 1) the alveoli - are there matrix or void areas that would prevent the canines from being fully inserted into the alveolar pocket? 2) the brain case - what can the CT scan reveal about *Smilodon*? The placement of the canines in the alveoli has not been previously studied. The single-rooted canines often slip out of the alveolar pocket due to the slow agitation of the asphalt in the La Brea Tar Pits. Asphalt and other debris can enter the empty alveolar pocket, making replacing the canines entirely in the pocket impossible. CT scans of LACMP 2001-2 clearly show the matrix and empty space at the crown of the canine, approximately 12 mm. Correcting to a deeper placement of the canines in the alveoli will lead to changes in the bite, gape, bite force, and hunting styles. This study also shows the braincase volume, including the size and shape of the brain, the visual cortex, the olfactory area, and the nerves that supply the brain. Merriam and Stock could only look at latex casts or slice open a skull in these areas.

Computed tomography (CT) scans have played a pivotal role in unveiling new insights into *Smilodon fatalis.* This breakthrough has significantly enhanced our understanding of this species, sparking a wave of enlightenment and intrigue among paleontology enthusiasts and offering a fresh perspective on *S. fatalis.* These new findings have the potential to reshape our understanding of this fascinating species.

Funding Sources No Funding Sources

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Virtual Fossil Friday: expanding museum education beyond walls and borders

Hall, Ashley E., Widdicombe, MaggieJo

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In March 2023, Museum of the Rockies completed construction of the E.L. Wiegand Digital Learning Studio—an innovative educational space designed to facilitate distance learning. Since its launch, the studio has connected with 86,000 K–12 students across 30 states and 7 countries (Canada, England, Japan, Korea, Latin America, Spain, Sweden), significantly extending the museum's reach beyond its physical location. Through Zoom, our digital programming now delivers engaging,

high-quality content directly to classrooms and homes with the click of a button.

Among our catalog of online offerings, one program has emerged as a standout: *Virtual Fossil Friday*. Aligned with the museum's mission to bring the world to Montana and share the Northern Rockies with the world, this free, hour-long livestream connects rural and urban audiences alike to paleontology in real-time. Hosted by museum educators and paleontologists Ashley Hall and MaggieJo Widdicombe, the program originally launched with just five participants. In two years, it has grown to 50+ regular weekly connections, with an enthusiastic and returning audience.

Virtual Fossil Friday blends science communication with creativity and accessibility. Episodes feature interviews with diverse paleontologists, focused deep dives into specific taxa or fossils, and interactive drawing sessions led by MSU student paleoartist Ruby Pines in the segment "Dino Doodles with Ruby." This variety of content provides multiple entry points for learners, encouraging participation and sparking curiosity across a wide age range—from 3-year-olds to life-long learners.

Our goal in sharing this program is to inspire other institutions to embrace virtual outreach as a dynamic, low-cost, and scalable solution to increasing accessibility. In an era when museums must meet learners where they are—geographically and technologically—*Virtual Fossil Friday* offers a model for meaningful, equitable engagement with science education on a global scale.

Funding Sources E.L. Wiegand Foundation.

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Operational impacts and recovery of a paleontology research program following the COVID-19 pandemic: a case study from Museum of the Rockies

Hall, Lee[1], Metz, Eric T.[2], Lamm, Ellen-Thérèse[3], Knight, Cassi[1], Meld, Levi[1], Johnson, Dane D.[1], Scannella, John[4]

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The COVID-19 pandemic posed substantial challenges for paleontological research institutions, including financial constraints, staffing reductions, and major disruptions to research. At Museum of the Rockies (MOR), the Paleontology Department depends heavily on student and volunteer contributions to support fossil preparation, collections management, histological processing, and fieldwork. As a result of the pandemic, progress across preparation labs, collections, and field operations came to a near standstill. Although restrictions gradually relaxed in 2021 and the volunteer program reopened, student access to MOR's paleontological facilities remained limited well into 2021. By the time full access was restored, many previously engaged students had graduated or secured opportunities elsewhere, leaving the student and volunteer corps effectively diminished. Over the past several years, MOR's Paleontology Department has undertaken a concerted effort to rebuild its student and volunteer base. Recruitment strategies have included announcements during university courses, outreach through guest lectures, engagement with student organizations and campus events, targeted flyer distribution, and word-of-mouth referrals. These initiatives have facilitated the revitalization of participation across fossil preparation, collections care, and field research. Student involvement in fieldwork resumed in 2022, including the addition of paid field assistant positions. By 2025, MOR successfully reinstated multiple concurrent field camps for the first time in five years. Competitive grants have funded seasonal internships in collections since 2022, while

institutional budgeting has supported paid work-study positions in collections and preparation laboratories for the past three years. Despite pandemic-related setbacks, MOR has emerged with renewed capacity for training and research, sustained by a strengthened infrastructure of student and volunteer engagement.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Validation of predictive modelling with field observation in the vertebrate paleontology of the Central Narmada Valley

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Predictive modelling has been used increasingly in vertebrate paleontology, but almost no studies have tested the reliability of such methods and models in Indian paleontology. Thus, this pilot study focuses on the Central Narmada Basin and employs the MaxEnt model to predict zones with high potential for fossil occurrence based on environmental variables and known fossil localities. Within these predicted zones, the RUSLE model was applied to estimate soil erosion rates, which proved useful not only for refining the selection of survey areas but also for assessing the preservation potential of fossil-bearing deposits. Ground-truthing through detailed field investigations validated the results of both models. The study demonstrates the effectiveness of integrating MaxEnt and RUSLE in fossil site prediction within fluvial contexts, while also addressing the methodological strengths and limitations of each approach. The present study will aid in understanding the model's applicability in fluvial systems. The fluvial sedimentary deposits of Narmada River have preserved evidence for Quaternary fossils of various mammals, reptiles, fishes, amphibians, and molluscan shells as well as a few human fossils. In a recent study in the Narsinghpur district of the Central Narmada Valley, 314 fossil remains were recovered from 26 sites, indicating the high potential of this region.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The Camouflage Dinosaur Project: teaching ecology and evolution by hiding dinosaurs

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Camouflage is ironically one of the most conspicuous animal adaptations, as the appearance of a camouflaged animal often reflects the environment it lives in. Camouflage is so taxonomically and ecologically ubiquitous that it has even been found in the fossilized integument of non-avian dinosaurs such as *Psittacosaurus*, *Sinosauropteryx*, and *Borealopelta*. For over half a century, teachers have recognized the effectiveness of camouflage in teaching natural selection, citing how changes in the external environment due to the Industrial Revolution influenced the frequency of white and black phenotypes in peppered moths. Within animal color research, evolutionary algorithms have increasingly been used to heuristically explore optimal coloration under different selection pressures, such as camouflage. These algorithms simulate evolution by creating random populations within a phenotypic space and then repeatedly selecting and recombining the fittest phenotypes to produce new generations of increasingly fitter phenotypes. This mimicry of natural selection makes evolutionary algorithms a powerful method for teaching simple and advanced concepts in evolution, such as adaptation, directional selection, recombination, and mutation. The Camo Dino Project is a series of free resources designed to educate the public about evolution and adaptation by integrating tools for modern camouflage research, such as image analysis, with evolutionary algorithms and computer games to create an interactive, intuitive visual

learning tool for schools and museums. The result is a simulation of how camouflage evolves within different habitats using charismatic dinosaur models and computer-generated environments from the game Prehistoric Kingdom™. Participants can choose to either 'hunt' for pre-generated dinosaurs over progressively better camouflaged generations or play through an 'arms race' in real time between their vision and the evolution of the dinosaur population's appearance. This tool is supplemented by explanations of key concepts through presentation slides, posters, and even plots of fitness over time. The strength of the Camo Dino Project is its interactive and visual nature, which may engage users regardless of their reading or language ability. Data from the pilot deployment of the Camo Dino Project at the University of Exeter and surrounding schools is presented here to demonstrate successful playthroughs of the game by real, anonymous participants.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Incorporating the fossil record into modern species recovery objectives

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Ecological niche models, crucial in biodiversity conservation planning, typically depend on recent data (≤50 years old). However, given that current species' distributions likely reflect long-term anthropogenic disturbances, the use of recent data is likely to lead to misunderstood niches and erroneous conservation planning. The IUCN Green Status of Species has set a pre-industrial baseline of 1500 CE to define the natural range of species, which underpins its three recovery component metrics. As members of the Green Status of Species pre-impact distribution working group, we have sought to consider the broadest range of data available, finding the fossil record to provide vital context for species ranges before human impacts began to redefine the space species inhabit.

Here we present the first example in the development of the pre-industrial distribution baseline workflow: incorporating fossil remains with more recent records into multi-temporally calibrated ecological niche models (ENM). This case study focuses on the critically endangered Chinese alligator (*Alligator sinensis*). Presently, the Chinese alligator's distribution is constrained to a single province in China, however, paleontological archives record a much broader past distribution.

Our dataset has resulted in an order of magnitude increase in available records. As this record spans time with climatic conditions different to the modern era, it is necessary to use multi-temporal calibration of the ENM to account for both climate and range shifts. This augmented range enhances the accuracy of our predictive ENMs through improving spatial and niche completeness. Moreover, it helps mitigate a common pitfall associated with ENMs, especially with range-retracted species: a tendency to overfit when data representing niche completeness is sparse. Our findings underscore the importance of leveraging the temporal as well as spatial distribution of species in the development of baselines and the need to consider the dynamic nature of species distribution in defining recovery objectives.

Funding Sources Leverhulme Trust and the Zoological Society of London

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Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Ordovician vertebrates and the origin of bone remodeling

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Bone remodeling is an essential physiological process where bone resorbing cells, osteoclasts, remove bone tissue and osteoblasts deposit new bone tissue. The remodeling process is critical for growth, mineral homeostasis, tooth eruption, and fracture repair. Additionally, remodeling is correlated with metabolic rate, and therefore has been used extensively in paleontology as a marker for ancient physiology, yet little is known about its evolutionary origin. Previous studies found histological evidence of remodeling in a late Devonian 'placoderm', this was hypothesized to result from a shift in growth rate due to the origin of jaws and predation. While some evidence of resorption has been found in basal jawless vertebrates, the accepted paradigm is that these early skeletal tissues were simpler and grew by accretion and only had superficial resorption. Here we use high-resolution synchrotron tomography, FIB-SEM imaging and traditional histology to show that the Middle Ordovician jawless vertebrate Astraspis had extensive secondary osteons, classic markers of vascular-led internal bone remodeling. Interestingly, Astraspis, like other heterostracans, has bone that lacks osteocytes, a cell type that appears later in evolution but is thought to be critical in bone remodeling in modern gnathostomes. These results shift the origin of remodeling back ~100 million years, supporting the hypothesis that the essential physiological tool kit that our modern bones demonstrate appeared at the origin of vertebrate skeletons.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Exploring the benefits of palaeontology for education in Australia

Hart, Lachlan J.[1,2], Tuohilampi, Laura[1]

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Palaeontology offers a powerful entry point into scientific thinking for children, yet it remains underrepresented in the Australian primary science curriculum. The recently released NSW K–6 Science and Technology syllabus (2027) references extinction only once and the word "fossil" twice. This omission represents a missed opportunity to engage young learners with concepts of deep time, evolution, and evidence-based reasoning—concepts that palaeontology communicates naturally and compellingly. Museums, however, continue to play a vital role in palaeontology education by offering hands-on, curriculum-linked programs that are often the only exposure many students have to this field.

This study investigated how museum educators at the American Museum of Natural History (AMNH) determined the effectiveness of palaeontology-based programs for K–5 students. A descriptive, cross-sectional research design was employed, using Likert-scale questionnaires and semi-structured interviews to collect data from educators involved in the design and delivery of these programs. The evaluation framework drew on Kirkpatrick's Four Levels of Evaluation—reaction, learning, behaviour, and results—supporting a structured yet flexible approach to exploring how teaching effectiveness was assessed in informal learning environments. Thematic analysis and descriptive statistics were used to identify patterns in assessment strategies, educator reflections, and contextual factors influencing their judgments.

Preliminary findings suggest that educators used a range of informal indicators to gauge learning and engagement, including student curiosity, observed behaviours, and alignment with intended program outcomes. These insights may offer a useful reference point for best-practice palaeontology education in museum contexts. A subsequent phase of the project will collect comparable data from Australian museum educators to enable cross-contextual comparison. This comparative work is intended

to inform professional learning, enhance program design, and support greater integration of palaeontology into Australian science education. In doing so, the research highlights the value of palaeontology as a powerful vehicle for engaging young learners in science and underscores the critical role that science education can play in expanding its presence within Australian primary education.

Funding Sources UNSW School of Education Research Outputs Scheme, UNSW Education Focussed Grants Program

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Mandibular evidence for suction feeding in the Cretaceous temnospondyl *Koolasuchus cleelandi*

Hart, Lachlan J.[1,2]

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Australia's temnospondyl record is globally significant for its persistence into the Early Cretaceous, long after the group's extinction elsewhere. *Koolasuchus cleelandi*, from the Aptian-aged Wonthaggi Formation of Victoria, remains the only confirmed Cretaceous temnospondyl worldwide and has typically been reconstructed as a large, aquatic ambush predator. However, its mandible morphology, combined with its inferred cranial shape based on close chigutisaurid relatives such as *Siderops*, resembles that of extant giant salamanders (e.g., *Andrias* spp.), which are specialized suction feeders.

To investigate this possibility, we analyzed mandibular proportions using two discrete morphological ratios derived from linear measurements: mandibular length to width (ML/MW) and symphyseal length to mandibular length (SL/ML). These ratios capture functionally significant aspects of jaw architecture related to prey capture and feeding mode. Measurements for *Koolasuchus cleelandi* were taken directly from the holotype mandible (NMV P186213) and compared to a broad dataset of extant and extinct aquatic predators with known or inferred feeding strategies, including amphibians, crocodilians, turtles, and other temnospodyls.

Koolasuchus yielded a low SL/ML ratio of 0.2 and a moderate ML/MW ratio of 0.6. These proportions place it within the morphospace occupied by obligate suction feeders, including extant cryptobranchid salamanders and suction feeding testudines. The short symphysis and relatively broad posterior jaws are consistent with rapid buccal expansion and low resistance during lateral gape, critical traits for suction-based prey capture. In contrast, raptorial feeders—including metoposaurids and modern crocodilians—exhibited higher ML/MW values and narrower skull profiles, reflecting different biomechanical adaptations.

These results constitute the first quantitative functional support for suction feeding in *Koolasuchus cleelandi*, challenging previous assumptions that it was an ambush-based raptorial feeder. These findings refine our understanding of *Koolasuchus* feeding ecology and demonstrate the utility of mandibular morphometrics for inferring trophic adaptations in fossil amphibians.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Identifying variation in dinosaur footprints and classifying problematic specimens via unbiased unsupervised machine learning

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Footprints of dinosaurs and other extinct organisms are often locally abundant and provide valuable paleoecological information, but it can be difficult to determine which features are most useful for distinguishing tracks from each other and for identifying trackmakers. For dinosaurs, two problematic issues are whether certain three-toed tracks were made by ornithopods or theropods, and whether bird-like tracks were made by true birds or closely related theropods. To circumvent human bias in choosing and interpreting diagnostic features of tracks, we employed an unsupervised machine learning technique using a disentangled variational autoencoder network. We compiled a database of 1,924 tracks recorded as 2D binary silhouettes, including those that experts have identified as belonging to non-avian theropods, ornithopods, sauropods, stegosaurs, ankylosaurs, and birds. Crucially, and unlike published machine learning approaches to identifying dinosaur tracks, our technique does not require a priori assignment of tracks to a taxonomic group in a training phase, but rather the neural network algorithm searches in an unsupervised manner for those features that most differentiate the suite of tracks. This technique identified six features: overall load and shape, left and right digit spread, left and right digit attachment, heel load, loading position, and digit separation. With the unsupervised process finished, we a posterori put a taxonomic label on each track based on published expert judgements. We then projected a series of equivocal tracks—including some from the Middle Jurassic of Scotland hypothesized to be among the world's earliest ornithopod fossils and an array of potential bird tracks that predate the first avian body fossils—into the six-dimensional space defined by the features identified by the neural network algorithm. Using nearest-neighbor and average trait-based distance measurements relative to the labelled tracks, we found that a theropod identification for the Scottish tracks is most likely but ornithopod affinities cannot be ruled out, and most bird-like tracks are more similar to true birds than non-avian theropods. This approach illustrates the potential for unsupervised machine learning to supplement expert knowledge to improve understanding of morphological variation and to aid in taxonomic classification.

Funding Sources National Geographic Society (GEFNE185-16) and a Philip Leverhulme Prize to Stephen L. Brusatte.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Pathologies and poop: developing an education kit for the Wannagan Creek Fossil Collection (Paleocene; North Dakota, USA)

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The Wannagan Creek fossil collection at the Science Museum of Minnesota represents a wide variety of life, from crocodiles to insects to fungus, and was collected from Paleocene rock of western North Dakota (USA). This collection contains untold amounts of scientific information, and to communicate some of that to the public, we created an education kit. We chose to focus on two fossil groups from the site, the body fossils of the extinct crocodyliform *Borealosuchus formidabilis* and coprolites.

In order to create a kit that could be loaned to non-scientists for use in education, we needed high-quality copies of the specimens that could withstand frequent handling. We worked with two volunteers that use two different methods of 3D scanning: photogrammetry and a small, hand-held scanner. Each was paired with 3D-software to create STL files that could then be 3D printed.

Numerous *Borealosuchus* elements from the site contained pathologies, many of which could be tied to interactions with other *Borealosuchus* individuals, highlighting the ancient history of social aggression also seen in modern crocodylians. To demonstrate this, we scanned matching healthy and pathologic elements,

including osteoderms, phalanges, tibiae, and gastralia. Some pathologies were due to social aggression, but some were not. Public participants could then examine the pieces to determine which were pathologic and which were healthy, as well as which pathologies were likely caused by social aggression and which were likely not.

More than 500 coprolites were also recovered at the Wannagan site. Coprolites of different sizes and shapes were used to discuss the possible animal of origin, while coprolites containing inclusions were used to discuss how coprolites can show diet. The inclusions were too small to be visible in the 3D prints, so they were painted by hand onto the prints. Additionally, one coprolite was recovered in five pieces, which were scanned individually to create a 3D puzzle, using magnets. This created an interactive way to demonstrate the process of reassembling broken fossils.

The components of this kit have been tested with a variety of audiences from pre-K to adults, in public schools, community events, and at the museum. The pathologic pieces are adaptable to a wide age range of audiences, and the 3D puzzle has been particularly engaging.

Funding Sources Institute of Museum and Library Services grant MA-255597-OMS-24

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Unexpected proboscidean diversity in the middle Eocene phosphate deposits of Togo

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Although Africa was central to the development of early elephants and their extinct relatives, large gaps in both time and geography obscure our knowledge of their evolution. A substantial gap in the fossil record, spanning most of the Eocene epoch (roughly 13 million years), limits our understanding of the early evolutionary history of the group. This is particularly true for the emergence of Elephantiformes, the most successful proboscidean lineage leading to modern elephants. A lower molar was recently identified from Lutetian phosphate deposits in Togo as a new genus and species, *Dagbatitherium tassyi*. This fossil exhibits several dental features characteristic of Elephantiformes, including a three-layered Schmelzmuster, the presence of a mesoconid, transversely enlarged buccal cusps, and the individualization of a third lophid. *Dagbatitherium* potentially unlocks the puzzle of the origin of the unique elephantiform tooth crown organization by bridging a critical temporal and morphological gap between early bunodont incipiently bilophodont proboscidean taxa and more derived elephantiforms. Here, we present further proboscidean dental fossils from the Lutetian Togolese phosphates—a partial tusk and a fragmented lower cheek tooth—found together and likely belonging to the same individual. Surprisingly, these new specimens are different from the previously described molar of *Dagbatitherium*. The recovered mesial fragment of a lower cheek tooth displays a high and strictly lophodont crown morphology. The lophid is characterized by dominant buccal and lingual cusps that are transversely linked by a well-defined, mammillated crest. In its proportions and molar pattern, this specimen shows similarities to other lophodont taxa, including the Eocene genus *Arcanotherium* and the Oligocene genus *Chilgatherium*. Its Schmelzmuster is composed of poorly defined three-dimensional enamel on the inner zone, Hunter-Schreger bands in the middle zone, and radial enamel in the outer zone. It then resembles the characteristic three-layered Schmelzmuster of *Arcanotherium* and elephantiforms, and differs from the 3D enamel of deinotheres. This novel discovery strongly suggests a surprising proboscidean diversity within the middle Eocene deposits of Western Africa. Further exploration of these fossil-rich areas in Togo has the potential to significantly

advance our knowledge on the origin and evolution of early proboscideans and their associated fauna.

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Squamate reptiles from the Early to Middle Miocene of equatorial Eastern Africa: implications for paleoenvironments and the origins of modern diversity

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The modern tropics hold the highest species richness and ecological diversity. This is especially so for hyperdiverse vertebrate clades such as Squamata, but the origins and environmental correlations to the diversification of tropical squamates are poorly understood. In the case of Africa, molecular phylogenetic analyses indicate initial continental-scale immigration with subsequent endemic diversification roughly constrained to the middle to late Paleogene. More precise temporal resolution of these events, and their relationship to environment, require analysis of a fossil record that has been previously understudied. New discoveries from field research within the Nyanza Rift of western Kenya combined with historical collections have produced a record of >1,200 specimens from localities dated between 19.5–13.7 Mya. With the highest concentrations of specimens derived from localities associated with the Tinderet and Kisingiri volcano systems, these collections provide the best record of early Neogene reptiles for Africa and equatorial latitudes globally.

Lizards are represented predominately by acrodontans and varanids, with rarer occurrences of scincimorphs. Chamaeleonids are by far the most abundant taxon within Tinderet localities, whereas Kisingiri localities are more taxonomically diverse. Amphisbaenians are ubiquitous throughout the squamate record, including both large and small-bodied taxa. Snakes are the most diverse and abundant squamates. They include small to medium-sized pythonids, a single typhlopid record, aniliids from some Tinderet sites, and a single record of Erycidae from the Tinderet site of Songhor. Three specimens from the Middle Miocene represent the youngest African record of Tropidophiidae in Africa by ~15–20 million years. Elapoids are the most diverse snakes and include multiple lamprophiid and elapid taxa. The elapoid record demonstrates that diversification within constituent clades had occurred by the early Miocene, consistent with molecular phylogenetic estimates. Patterns of occurrence are also consistent with isotopic and paleobotanical studies that indicate strong environmental heterogeneity during the early Neogene. Community body size structure and taxonomic composition at different localities reflect local habitats ranging from closed forests to patchy, partially open environments. These associations suggest that habitat variability may have been a key driver in squamate diversification in Eastern Africa.

Funding Sources NERC NE/W007576/1; NSF 1241807, 1241812, 2142937, 2124836, 2123497, 2123498; NSERC, DFG, Cambridge Africa ALBORADA, The Leakey Foundation.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Regional and global drivers of Mesozoic dinosaur diversification

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Dinosaurs first appeared in the Late Triassic and had rapidly diversified by the Early Jurassic, dominating Mesozoic terrestrial ecosystems until the extinction of non-avian groups at the Cretaceous–Paleogene boundary. The drivers of this radiation remain debated, with evidence for both abiotic factors (e.g., climate shifts, tectonics—Court Jester model) and biotic interactions (e.g., pseudosuchian decline, angiosperm radiation—Red Queen hypothesis). Whereas most studies have examined dinosaur diversity and diversification at global scales, such approaches risk being skewed by heterogeneous spatiotemporal sampling of the fossil record. Here, Mesozoic dinosaur diversity and diversification are analysed at both global and regional scales, accounting for the uneven distribution of fossil occurrences and variability of environmental conditions across different landmasses. Using a dataset of 5,415 occurrences, diversity is estimated using shareholder quorum subsampling (SQS) and diversification rates are inferred using PyRate, a Bayesian framework that explicitly corrects for temporal sampling heterogeneity. Results reveal marked disparities between global and regional estimates, suggesting that extinction and diversification events were spatially heterogeneous. Additionally, distinct diversity dynamics are reconstructed among the three major dinosaur clades—Theropoda, Ornithischia, and Sauropodomorpha—indicating that extinction and diversification events did not affect all dinosaurs uniformly, but instead varied substantially across clades. This includes elevated extinction rates in Gondwanan theropods and eastern Asian saurischians at the Pliensbachian–Toarcian boundary, while extinction at the Cenomanian–Turonian boundary was notably more severe in South American theropods than in any other clade or region analysed. Using these estimates of diversity dynamics, correlation tests with biotic and abiotic factors indicate that dinosaur diversification was driven by a complex interplay of ecological interactions and environmental change, with the relative influence of these drivers varying across regions. PyRate and SQS provide complementary perspectives on diversity dynamics, enabling the effects of preservation biases and sampling heterogeneity to be disentangled from true biological signals. These findings underscore the importance of spatially explicit approaches in understanding large-scale evolutionary patterns and processes in the fossil record.

Funding Sources London NERC DTP grant 2547175.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

The Ruminatrix—a dataset for investigating morphological evolution of ruminants (Mammalia, Artiodactyla)

Heckeberg, Nicola S.[1,2], Bärmann, Eva Verena[8], Cantalapiedra, Juan[7,3], Costeur, Loïc[5], Li, Yikun[6], Mennecart, Bastien[5], Rozzi, Roberto[4,3], Sorbelli, Leonardo[3], Bibi, Faysal[3]

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Integration of fossil data with rapid advances in genomics is challenging and of particular interest are large clades with rich fossil records such as Ruminantia. Ruminants today comprise the majority of large herbivores on our planet, including over 200 living species of deer, antelopes, musk deer, giraffes, and chevrotains. Their fossil record goes back to the Eocene and ranges from Eurasia, North America, and Africa. Their evolutionary history is characterized by

diversification pulses and especially by an independent origin of four developmentally different types of headgear, which makes them an interesting clade in which to study diversification and disparity over a comparably long period.

Over the last decades, molecular sequences have provided large and well-supported trees, but an applicable dataset for the integration of large numbers of fossil taxa within this new framework has been lacking. We here present the results from a long-term project assembling a new large morphological dataset for ruminants to reveal the late Cenozoic history of this fascinating clade.

Our new 460 character matrix includes 57 fossil and extant taxa from across the ruminant tree. We use these data, combined with topological constraints, to generate a time-calibrated phylogenetic tree that allows us to examine the systematic position of fossil taxa, to assess rates of morphological disparity change over time, and to examine diversification and test models of evolution. Topology of the morphology-only tree shows better fidelity to genomic trees than previous similar attempts, though several relationships are still overwhelmed by homoplasy. Addition of a genetic scaffold resolves problematic relationships, providing a strongly supported phylogeny that also includes fossils in plausible positions in agreement with previous paleontological work and within a single, fossil-dated time tree. Principal coordinates analysis reflects major morphological shifts between tragulids and pecorans as well as within certain bovid clades. Our new dataset provides a reliable core resource for the phylogenetic analysis of the entire ruminant record.

Funding Sources Gerstner Scholarship (AMNH); German Research Foundation (DFG) project 282995372 (BI 1879 1/1); Alexander von Humbdolt Foundation Fellowship.

Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

Forelimb disparity in Late Paleozoic tetrapods: a geometric morphometric approach

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Late Paleozoic tetrapods represent a crucial phase in the evolutionary history of vertebrate locomotion. Though recent years have seen increased appreciation for the importance of skeletal macroevolutionary trends in these early lineages, diverse anatomy and taxonomy complicate direct comparisons between distinct groups, and little work has enabled cross-study analysis. Quantifying morphological disparity in the appendicular skeleton of these animals may reveal the broader implications of macroevolutionary patterns in locomotion and other ecomorphological functions tied to tetrapod motility. Here we collected and analyzed shape data from humeri of Late Paleozoic herpetofauna, including members of Amphibia, Reptilia, and various stem taxa. Data were analyzed using a geometric protocol. Critically, this analysis allowed us to combine data for the herpetofauna with existing data for Synapsida. Overall, the sample included 15 genera for the herpetofauna and 36 genera for Synapsida, totaling 432 specimens. Clades were analyzed for Procrustes variance, calculated both within and between clades. Data were analyzed in time-binned increments of 5 million years for genera present during a given time bin from the Late Pennsylvanian (305 Ma) to the Permian (265 Ma). Amphibia, Reptilia, and Synapsida exhibited the most striking patterns within two distinct intervals: (1) 300–290 Ma and (2) 275–265 Ma. The first showed modest changes in disparity, increasing for Amphibia and Reptilia and decreasing for Synapsida. The second showed more apparent changes, but shifts in opposite directions. Notably, within either interval, magnitudes of change occurring in

opposite directions were relatively proportional to each other. Overall, changes in average disparity at these intervals can be characterized by the same general patterns, with a minor drop at the first and a major fall at the second. When considering a deep time context, the second interval roughly aligns with the Guadalupian epoch (273–260 Ma), bracketed by Olson's Extinction and the end-Capitanian extinction. In contrast, the first interval does not coincide with any specific geologic event but may instead reflect a delayed response to the Carboniferous Rainforest Collapse. This work is a first step toward building the broad morphometric dataset needed to address macroevolutionary questions about this stage in vertebrate evolution.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Analysis of the reduction of diversity within ichthyosaurs through competition using ecospace variables

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Approximately 251 million years ago, ichthyosaurs emerged during the early Triassic period and rapidly occupied the ecological niches that were vacated by marine organisms that became extinct during the Permian–Triassic mass extinction. Throughout the Triassic period, this group evolved into diverse lineages, each fulfilling distinct ecological roles. However, in the aftermath of the end-Triassic extinction event, the available ecospace for ichthyosaurs was significantly reduced, even after their recovery. Numerous hypotheses have been proposed to explain the global decline and extinction of this order, among which are the evolutionary bottleneck effect, competition from other marine reptiles such as mosasaurs, a reduction in primary food sources such as belemnites, and climatic instabilities. The most plausible explanation suggests a confluence of factors, including fluctuations in food availability, migratory routes, and interspecies competition, as drivers of their extinction; however, this remains enigmatic. This is attributed to the lack of definitive paleontological evidence to conclusively elucidate their global disappearance, suggesting that an examination of local-level patterns may yield additional insights into potential causative factors. In this presentation, I will investigate the factors underlying the extinction of ichthyosaurs, focusing on local-level ecological patterns. The primary aim is to uncover evidence that higher taxon density within a shared ecospace increased the likelihood of ecological competition between genera, thereby supporting that such competition contributed to ichthyosaur decline. If competition is not found to be a significant driver, alternative causes such as changes in food availability, migratory disruptions, and environmental stressors will also then be examined.

Funding Sources Leverhulme Trade Charity Trust - £15,000 (Tuition Fees)

Colbert Prize Session

The rhythm of giants: modeling sauropod tail oscillations to infer energetically efficient walking kinematics

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Sauropod dinosaurs were the largest and heaviest terrestrial vertebrates. Due to their high body mass, their musculoskeletal system may have operated near functional limits. Studying their locomotion could thus shed light on evolutionary selective pressures. Despite several studies on their locomotion, many aspects of their gait kinematics remain unknown, such as

their preferred step frequency and walking speed. Extant animals tend to adopt gait kinematics that align with the natural frequencies of key body parts, allowing for energy-efficient movement through resonance. Thus, investigating the natural frequencies of specific sauropod body structures can provide insights into their optimal locomotor dynamics. Non-avian dinosaurs, including sauropods, had large, muscular tails that played both active and passive roles in their movement. Suspended by ligaments, their tails functioned as mass-spring systems, oscillating with each step as they walked, which has been used as a proxy for determining step frequency in previous research (Natural Frequency Method). Here, we are applying the Natural Frequency Method to estimate energetically optimal walking speeds and step frequencies of several sauropods from the Tendaguru site (Late Jurassic, Tanzania). To achieve this, we are constructing biomechanical models based on the three-dimensional morphology of the sauropod tails, where each vertebra is connected by hinge joints and supported by interspinous ligaments. We have started to implement this method in the relatively short- and stout-tailed *Giraffatitan brancai*. Its tail model consists of the 18 preserved anterior caudal vertebrae that are connected by 19 hinge joints. The distal tail was reconstructed as a 4.34 m long cone-shaped segment to replace the up to approximately 40 posterior caudal vertebrae that were not preserved. The entire tail model is 7.34 m long, and its total mass, including soft tissue, is estimated at 1688.4 kg. Our goal is to include more sauropods with differing tail morphologies, such as longer tails, to help us assess how variations in tail morphology influence locomotor dynamics.

Funding Sources Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) Project number 470751746.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Distinct disparity trajectories characterize the evolution of cranial and shell morphology of turtles

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Turtles are an ancient reptilian group with origins in the Late Triassic. The evolution of the shell likely posed morphological constraints on other body parts, resulting in a very conservative bauplan retained for >200 Ma. Still, despite overall low disparity of body forms, turtles exhibit morphological adaptations for multiple ecological roles. These include close associations between cranial shape and feeding ecology, or shell shape and habitat. It is unclear, however, how strongly skulls and shells are morphologically integrated, and what the tempo and mode of their morphological evolution is. We evaluate the strength of integration between turtle cranial and shell shape, and their disparity patterns through time. For this, we use a 3D geometric morphometric approach to quantify the shape of more than 250 extant and extinct turtle species, combined with phylogenetic comparative methods.

Cranial and shell shape are statistically not strongly correlated, despite some integrated aspects of cranial and shell morphology. For instance, flat crania are associated with low-domed shells, whereas higher skulls are usually observed in species with higher-domed shells. Whereas ecological and taxonomic groups are overdispersed in shell morphospace, cranial shapes show strong phylogenetic clustering. Cranial and shell disparity patterns are distinct. An initial peak of shell shape disparity soon after their origin possibly represents an ‘experimental’ period of shell evolution. Cranial disparity only begins to build up in the Jurassic, when the first aquatic turtles evolve, reaching a maximum in the Late Cretaceous. First instances of flattened cranial shapes evolve around the same time as the first low-domed, highly aquatic shells, suggesting a correlated pattern of shape evolution during the aquatic diversification of turtles. Increasing cranial disparities are likely possible due to higher neck mobility that evolved early during the Jurassic Period,

allowing them to exploit novel feeding specializations, and thus loosen their cranial-shell integration.

We find no apparent evidence for ecological selectivity of turtle morphologies across the Cretaceous/Palaeogene mass extinction, differing from other terrestrial vertebrates. Cranial disparity slightly increased and shell disparity remained static. Subsequent additions or removals of turtle morphotypes can be explained by the diversification dynamics of emerging modern lineages in the last 20 million years.

Funding Sources Swiss National Science Foundation Grant PZ00P2_202019/1.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Osteohistology of a new specimen of *Aetosaurus ferratus* (Archosauria, Aetosauria) from the Late Triassic of Frick (Canton Aargau, Switzerland)

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Aetosaurs were a group of armoured, quadrupedal pseudosuchian archosaurs from the Late Triassic. Being widely distributed over Pangaea, they constituted an important faunal component of terrestrial ecosystems during that time. In 2022, new aetosaur material, in the form of a disarticulated skeleton, was recovered from the Late Triassic Klettgau Formation (c. 220–205 million years ago) in Frick, Canton Aargau, in northern Switzerland. The material is identified as a new specimen of *Aetosaurus ferratus*, a central European species so far only known from Germany and Italy. Several bones (a rib, radius, and three osteoderms) were subjected to histological sectioning to investigate the internal bone microanatomy and histological compositions and to infer its possible life history. The internal anatomy of the osteoderms is characterised by a simple histology showing slow-growing bone tissue and an overall compact structure. High content of Sharpey's fibres indicates strong inter-osteoderm connection between paravertebral and lateral osteoderms. The rib shows compacted coarse cancellous bone tissue and no free medulla. The radius shows a complex structure of slowly deposited lamellar portions and faster deposited woven-parallel bone tissue. The count of growth marks is overall consistent between six (osteoderms, rib) and seven LAGs (radius) allowing us to somewhat confidently identify the age of the animal as 6–7 years old at time of death. This, together with the absence of an external fundamental system/outer circumferential layer, indicates that the specimen is neither an early juvenile nor a fully grown adult. The overall size of the bones and histology of the new Swiss specimen thus indicate a larger size and a more advanced ontogenetic stage when compared with the famous nursery of *A. ferratus* (SMNS 5770) from Kaltental, southern Germany. For the latter, an early juvenile ontogenetic stage was recently assessed, based on long bone histology of two specimens. Comparison of the osteoderm histology of the new Swiss specimen with that of previously reported sectioned fragment SMNS 12670 led us to a re-evaluation of the latter. This purported juvenile specimen was very hollow and not compact, as the osteoderms from Frick. Closer inspection of the sectioned fragment SMNS 12670 and other bones accessioned under this number led us to identify the previous section to be part of a broken-off piece from a neural spine instead of from a highly fragmentary osteoderm.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Science education through the lens of paleontology laboratory exhibit design at the North Carolina Museum of Natural Sciences

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The North Carolina Museum of Natural Sciences launched the Dueling Dinosaurs Experience (DDE) in April 2024—an immersive paleontology encounter centered around an overlapping nearly complete *Triceratops horridus* and a complete tyrannosaur. This project's primary goal is to promote public understanding of paleontology as a scientific process. It emphasizes real-time research, fossil preparation, and cross-disciplinary connections through immersive education and transparent laboratory access. The initiative was led by Dr. Lindsay Zanno, Head of Paleontology, and shaped through strong collaboration among paleontology, exhibit design, and museum leadership. The DDE is divided into three zones: an introductory exhibit, an interactive laboratory (SECU DinoLab), and a paleontology methods exhibit. Zone 1 introduces visitors to the ancient environment, species variation, and research questions through features, like 'create-your-own *Triceratops*' and a scale-model specimen video wall designed to foster engagement and critical thinking. The heart of the exhibit is the SECU DinoLab, where visitors can observe live fossil preparation within the lab and paleontology staff interpret the process through live discussion with visuals and props at an interactive table. The critical design feature of this space is that the interactive table is staffed 100% of the time the museum is open. Every visitor that comes through the DDE can talk directly to a staff paleontologist. Inside the fully outfitted preparation lab specimen blocks in variable stages of preparation are actively worked. Zone 3 highlights lab methods through interactive digital and manual displays. Features include virtual fossil preparation, a holographic *Thescelosaurus* skull, and microfossil station. The DDE design supports continuous visitor engagement with the science behind the specimens and has attracted visitors from across all U.S. states, territories, and nearly thirty countries. An external survey (summer 2024) found a positive correlation between speaking with a paleontologist during their visit and perceptions of science, research and the visitor's ability to participate. The project, supported by interdepartmental collaboration, award-winning design, and hands-on science communication, successfully fosters public appreciation for paleontology as a dynamic and collaborative scientific endeavor.

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

A tale of two premaxillae: from ancestral jaw tip to mammalian nose

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In most jawed vertebrates, the marginal jaw bones—premaxilla, maxilla, and dentary—follow a conserved arrangement, originating with maxillate placoderms. But is this truly the case? Here we show that the ancestral premaxilla was lost during mammalian evolution, and that the therian premaxilla was established as a novel structure—coinciding with the emergence of a protruding nose.

We demonstrate this through evo-devo and paleontological approaches. First, we compared craniofacial development across tetrapods using 3D models based on histological sections. In chicken (*Gallus gallus*), gecko (*Paroedura picta*), and frog (*Rana japonica*), the premaxilla ossifies anterior to the septal cartilage of the neurocranium. In echidna (*Tachyglossus aculeatus*), a similar ossification center appears but regresses; instead, the septomaxilla, forming near the caudal edge of the chondrocranial nostril and tip of the nasolacrimal duct, expands to cover the face. In mouse (*Mus musculus*) and other therians, no ossification occurs anterior to the septal cartilage. A bone instead ossifies at the septomaxilla-equivalent site and becomes the incisor-bearing therian premaxilla. We also examined synapsid fossils (e.g., *Dimetrodon*,

Sauroctonus, *Silphoictidoides*) and confirmed a trend toward septomaxilla expansion. These observations suggest morphological homology between the therian premaxilla and the septomaxilla.

To investigate the developmental basis of this shift, we used transgenic mice (*Dlx1-CreER^{T2}*) for cell-lineage tracing of embryonic primordia. In mice, the mandibular arch forms nearly the entire upper jaw—including most of the therian premaxilla—except the primary palatal process. This contrasts with chickens and geckos, where the premaxilla arises from a separate frontonasal primordium; in mice, that primordium instead gives rise to the nose. Notably, this embryonic shift aligns with trigeminal nerve innervation: the ophthalmic branch, which innervates the premaxilla in non-mammalian tetrapods, innervates the nose in mammals. The palatal process—where labeled cells are absent—likely corresponds to the anterior ossification center of the vomer in sauropsids.

Altogether, our findings show that the mammalian face is a typical evolutionary novelty. A major developmental shift restructured the rostral skull, evolving the ancestral jaw tip into a functionally independent nose and giving rise to a unique therian premaxilla, or os incisivum.

Funding Sources Japan Society for the Promotion of Science (JSPS): 17J11177, 20H04858, 20K15858.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Dental microwear texture analysis revealed intraspecific dietary variation of Japanese macaques (*Macaca fuscata*)

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When animal teeth contact food particles, they get scars on their enamel surfaces. The shape and depth of these scars (microwear) are strongly correlated with the physical properties of the ingested food, making it possible to estimate diet from microwear. One of the methods of microwear analysis, DMTA (Dental Microwear Texture Analysis), has been widely applied to reconstruct the diets of extinct animals. This method allows objective, repeatable 3D measurements without observer bias. However, there has been little research verifying whether each parameter is suitable to capture differences in dietary habits within species in primates. In the present study, we obtained the DMTA parameters of 215 individuals of Japanese macaques (*Macaca fuscata*) from 9 regional wild populations (Shimokita, Kinkazan, Tochigi, Gunma, Boso, Kanagawa, Hakusan, Koshima, Yakushima) using a confocal laser microscope (VK-9700) and analyzed the correlations between DMTA parameters and their quantitative dietary data based on behavioral observations or stomach contents analysis.

As a result, we found that these regional populations are divided into 3 groups by DMTA: The Shimokita–Tochigi–Boso–Hakusan populations (Group A), the Gunma–Kanagawa populations (Group B), and the Kinkazan–Yakushima–Koshima populations (Group C). Group A showed relatively low scores in ‘height’ and ‘volume’ parameters, while Group C indicated relatively high scores. Group B showed intermediate characteristics between Groups A and C. The dietary behavior data showed that the Group A monkeys consumed leaves and stems rather than hard fruits and seeds, while the Group C monkeys consumed hard fruits and seeds rather than leaves and stems.

The present study suggests that DMTA parameters of wild Japanese macaques are well correlated with their dietary behaviors, distinguishing food items with ‘tough’ physical properties, such as leaves and stems, from those with ‘hard’ physical properties, such as nuts and fruits. These results indicate that DMTA is a powerful tool for estimating the diets of Japanese macaques. The accumulated DMTA data of the extant Japanese macaques may be

able to estimate the diet not only of fossil macaques but also of other extinct animals.

Funding Sources Support for Pioneering Research Initiated by the Next Generation Home

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Evolutionary changes in the suborbital arch of parrots

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Parrots (Psittaciformes) are notable among birds for possessing highly kinetic skulls, novel facial musculature, and high bite forces, accommodated by a unique skeletal architecture. One of these skeletal traits is a well-defined and often highly ossified structure of bone around the orbit: the suborbital arch. This arch is absent in some species, or may form a partial or complete and robust ring in others. While previous work has investigated the relationship between the suborbital arch and the presence of the novel pseudomasseter muscle, little has been done to establish the evolutionary history of the arch itself; in particular, why it evolved, and how its expression influences the mechanical performance of the skull.

Using data collected from both ex vivo specimens and museum collections, the arch condition of 180 species of parrots (44% of psittaciformes), was established. Phylogenetic comparative methods, including ancestral states reconstruction and rates of trait analysis, were performed using these arch conditions, and confirmed previous suggestions that the suborbital arch evolved several times independently within Psittaciformes, from an ancestral node with no arch. Patterns of diversity observed reveal a complex combination of branch and clade shifts in the rate of evolution, resulting in a range of arch conditions across the clade. Of note is *Amazona*, which demonstrates the closed arch condition in a tribe of otherwise open condition individuals. *Amazona* also presents an enlarged flange of bone on the suborbital arch, the purpose of which is unknown; however, it may offer increased muscle attachment for the pseudomasseter, or could represent a shift to a morphology similar to that seen in cockatoos (Cacatuidae) where the suborbital arch fuses with the zygomatic process. The tribe Arini shows a complex mixture of arch conditions demonstrating high variability in arch closure, from a fully complete and highly reduced arch. Our results demonstrate a complex pattern of acquisition and loss of a structure thought to be intimately linked to feeding performance in a group of high bite force extant birds. Given the poor cranial fossil record of parrots, we highlight how ancestral states reconstructions can uncover important trends in the evolution of feeding structures, with potential for future studies to explore the functional consequences of the appearance of these structures in a phylogenetically informed context.

Funding Sources University of Hull postgraduate studentship, and BBSRC BB/X014479/1

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Assessing *Machaeroprosopus* (Archosauriformes, Phytosauria) squamosal morphology from the Martha's Butte Beds (Upper Sonsela Member Chinle Formation)

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Phytosaurs (Archosauriformes: Phytosauria) are ubiquitous components of Late Triassic, freshwater assemblages in the southwestern United States. The constrained distribution of

phytosaurs at high taxonomic levels has been well studied in Upper Triassic strata; however, the stratigraphic distribution of phytosaur species is understudied. Mystriosuchinine material from 12 individuals was recovered from northeastern Arizona within the Martha's Butte Beds of the Sonsela Member (Chinle Formation). All specimens are referable to *Machaeroprosopus* based on their stratigraphic occurrence and squamosal morphology (e.g., posteriorly elongated and dorsoventrally expanded posterior processes of the squamosals). Using these specimens, we explored the diagnostic power of fragmentary squamosals for higher-level taxonomic identification. Anatomical comparisons among SCSU's collection revealed three morphotypes typified by SCSU-P62, SCSU-P121, and SCSU-P75. Squamosal morphotype #1 (SCSU-P62) is characterized by lateral expansion of the posterior process, a deep squamosal fossa, the absence of a lateral ridge separating the dorsal and lateral faces, and a ridge along the posterior margin of the squamosal fossa. The features of morphotype #1 align most closely with *M. pristinus*, *M. buceros*, and *M. lottorum* but do not match the combination of features found in any one species. Squamosal morphotype #2 (SCSU-P121) aligns most closely with *M. pristinus* and is characterized by the separation of the dorsal and lateral faces, lanceolate-shaped sculpturing on the dorsomedial face, and lateral expansion of the posterior process. Lastly, squamosal morphotype #3 (SCSU-P75) is characterized by the absence of a lateral ridge separating the dorsal and lateral faces, a transversely broad but dorsoventrally shortened posterior process, and a relatively broad, shallow squamosal fossa. These features match those of *M. jablonskiae*. Our results expand the range of squamosal morphological diversity within *Machaeroprosopus* and the Martha's Butte Beds. Until a better understanding of intraspecific and ontogenetic variation is established for *Machaeroprosopus* squamosals, it is unclear whether our results are best explained by the presence of multiple taxa or greater intraspecific variation than previously recognized within species of the genus.

Funding Sources SCSU Connecticut State University Research Grant

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Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

New *Tiktaalik roseae* material reveals locomotor innovation in the water-to-land transition

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The transition from water to land drove major changes in vertebrate skeletal form and function. Different models have been proposed to explain how stem tetrapods first engaged with the substrate, but our understanding remains limited due to the scarcity of well-preserved postcranial material. A persistent question remains: how might an animal begin to experiment with substrate-based locomotion before it has evolved the musculoskeletal structures necessary for appendage-driven propulsion?

Here, I present a new, recently collected specimen of the finned tetrapodomorph *Tiktaalik roseae* that offers new insight into this problem. I describe unexpected morphologies of previously unknown elements with remarkable three-dimensional preservation, documented using high-resolution micro-CT scanning. Through comparative anatomical analysis of this material, alongside specimens of *Eusthenopteron* and *Acanthostega*, I assess joint morphology and infer function in a phylogenetic context. These analyses lead me to propose a new model of locomotion in *Tiktaalik*, where axial bending, rather than limb retraction, provided the primary propulsive force during locomotion. In this model, the appendages contributed to body support during substrate interaction primarily by providing passive form stability through their joint morphologies. This framework suggests that limb-based support during locomotion preceded the evolution of robust retractive musculature and associated bony elaboration. I propose that in this species,

the ancestral locomotor mode of axial bending-driven swimming transitioned into axial bending-driven walking, with limbs coopted to stabilize rather than to propel.

The results suggest a previously unrecognized range of morphological form and locomotor experimentation across the tetrapod stem. This diversity challenges some traditional models of locomotor evolution and supports a more nuanced view in which multiple strategies for substrate interaction and body support were explored during the water-to-land transition, shaping the history of locomotion in our own lineage.

Funding Sources Brinson Foundation; Human Frontiers Science Program; Biological Sciences Division, University of Chicago

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Character matrices vs. geometric morphometrics: evaluating uncertainty in frog fossil identification amid missing data

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Character coding and shape analysis (geometric morphometrics) are two commonly used approaches in paleontology for capturing morphological variation. While both aim to differentiate species based on form, they provide distinct perspectives and come with unique limitations. Furthermore, the application of these methods can be particularly challenging when working with incomplete or fragmentary fossil data. This raises the question: how do these methods compare when dealing with missing data, and which is more reliable? This project aims to assess the statistical reliability in identifying 12 native frog species from three families (Pelodryadidae, Myobatrachidae, Limnodynastidae) in the southeast of South Australia based on multiple skeletal elements. A contemporary dataset was assembled from 94 ethanol-preserved specimens (6–10 per species, representing a range of body sizes for each). These were scanned with micro-computed tomography, and processed digitally to segment the ilium, sacrum, urostyle, tibio-fibula, femur, humerus, and scapula. Resulting 3D surfaces were landmarked, and shape variation is standardized using Procrustes superimposition, removing non-shape variation such as size, orientation, and position. In parallel, morphological features of the same specimens were manually coded into a character matrix comprising both binary and multistate characters. Both datasets were imported into the R statistical environment, where pairwise distances between specimens were calculated: Procrustes distances for the landmark data, and Gower's distance for the character matrix. Principal coordinates analysis (PCoA) was performed on each distance matrix to visualize patterns of taxonomic or ecological grouping. To assess the performance of each method under conditions that simulate the taphonomic damage that can affect fossil specimens, both the landmark and character datasets were subjected to selective data removal. PCoA was then re-run to evaluate the stability of inferred groupings under degradation. By analyzing how well character matrices and geometric morphometric groupings persist under simulated fossil degradation, each method's strengths and limitations are highlighted. The findings provide guidance for selecting appropriate analytical strategies in the face of missing data.

Funding Sources ARC Linkage grant (LP160101249) (E.H.R.); Adelaide of University fund (17125201) supporting ARC Future Fellowship (FT190100803) (E.S.)

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Understanding North American catfish evolution through hearing reconstruction using dynamic finite element methods

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The North America (NA) catfish fossil record charts the disappearance of the lineages of †*Hypsidoris* and †*Astephus* and the arrival of crown ictalurids at the end of the Paleogene. What drove the extinction of the older lineages and success of the newer is not clear. Recent work on the ictalurid catfishes has revealed incredible diversity in the ossicles of the Weberian apparatus, a specialized hearing apparatus that enhances hearing sensitivity and range, significantly correlated with ecology. To better understand NA catfish evolution in deep time, we investigated hearing characteristics of the extinct lineages using the framework of ecomorphology and functional morphology of Weberian apparatus in ictalurids. We scanned a 3-D preserved specimen of cf. †*Astephus* UCMP 194411 using X-ray based Computed Tomography (voxel size 36.7µm, power 140 µA, current 100 kV), from the Farson Cutoff Fishbed from the mid-Eocene Bridger Formation of Wyoming, USA. The intercalarium and tripus were segmented out for visualization and meshed for biomechanical simulations. Using the mesh, we then ran modal and harmonic finite element analyses based on validated models of *Ictalurus punctatus* and *Ameriurus nebulosus*. The power output of the tripus produced a broad, doubled peak distribution, with the first peak at ~500Hz and the second ~1050Hz. However, the intercalarium peaks at ~400Hz and rapidly loses power above 1KHz. This is unlike extant ictalurids, which show no inflections in the high frequencies and lose power gradually. Morphologically, the tripus of the *Astephus* possesses a robust, rectangular anterior process and a thin, pointed posterior process. This is highly dissimilar to †*Astephus antiquus*, which possess long, thin anterior processes and moderate posterior processes. The combination of a robust anterior but delicate posterior process is also uncommon in our survey of extant ictalurids, but is similar to that of *Noturus gyrinus* and *Am. melas*. Both these fish inhabit muddy, slow waters—very similar to the Farson depositional environment, which has been interpreted as a stagnant floodplain. Together, these preliminary results suggest that the mid-Eocene catfishes of North America may have been acoustically adapted to their local environments, but were not yet specialized in high-frequency hearing. This study represents an important first step in understanding the hearing evolution of North American catfishes across the Cenozoic.

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

Comparative anatomy, morphometric analysis, and phylogenetic systematics of the Booneville hadrosaurid (early–middle Campanian Coffee Formation, Mississippi, USA)

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The non-avian dinosaur fossil record of the southeastern United States includes approximately 160 specimens, mostly isolated

finds with poor preservation. Hadrosauroids are the most common dinosaurs in the region, although few preserve diagnostic features allowing referral to lower taxonomic levels. Southeastern hadrosauroids include *Lophorhothon atopus* and *Eotrachodon orientalis*, both from the late Santonian–early Campanian Mooreville Chalk of Alabama, and the specimen described herein, MMNS VP-12239, from the late–early to early–middle Campanian Coffee Formation, Mississippi, USA. Due to extensive modification of their crania, phylogenetic hypotheses of hadrosauroid relationships have been mostly informed by a greater proportion of cranial characters in character–taxon datasets. This is problematic for determining the taxonomic identity of MMNS VP-12239 as it only preserves postcranial elements. This challenge is further compounded by a paucity of more complete southeastern hadrosauroid specimens for comparison.

Here, we describe MMNS VP-12239 and place this specimen in the phylogenetic context within hadrosauroids. The characteristics of the humerus of MMNS VP-12239 are consistent with humeri exhibiting less expanded deltopectoral crests and more elongate proportions like saurolophines and non-hadrosaurid hadrosauroids, and unlike lambeosaurines, in which the opposite is typically observed. Furthermore, the anteroventral corner is less angular than in most lambeosaurines, and is similar to most non-hadrosaurid hadrosauroids, basal hadrosaurids, and saurolophines. Additionally, a geometric morphometric analysis using Procrustes superimposition of the pubis of MMNS VP-12239 with a representative sample of hadrosauroid species indicates that the Booneville hadrosaurid is morphologically most similar to saurolophine pubes.

Nevertheless, a maximum parsimony analysis positions MMNS VP-12239 as a close outgroup to Saurolophidae. This implies that the observed similarities between the pubis of MMNS VP-12239 and that of many Saurolophinae are independently derived. The phylogenetic position of the Booneville hadrosaurid is consistent with the hypothesis that the Appalachian dinosaur faunal community was distinct from the fauna of Laramidia during the late Cretaceous. Additionally, this suggests that basally-branching hadrosaurids persisted in Appalachia well into the middle Campanian.

Funding Sources PID2020-119811GB-I00, MCIN/AEI/10.13039/501100011033, Ministerio de Innovación y Universidades of the Gobierno de España (A.P-M.)

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Evolution of growth dynamics in Notosuchia informed by osteohistology of the Eocene notosuchian crocodyliform *Sebecus icaeorhinus* with implications for survivorship across the K–Pg mass extinction

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Notosuchia is a clade of extinct, primarily terrestrial crocodyliforms that were especially diverse in the Cretaceous, although only one lineage, Sebecoidea, survived the K–Pg mass extinction. Palaeohistological investigations over the past decade indicate that notosuchians were ectothermic, but show a variety of fast and slow growth rates, with substantial qualitative differences between closely related taxa. This variation appears to be unrelated to patterns of body size, so it is unclear what is driving these differences in growth dynamics within Notosuchia. Additionally, very little is known about the paleohistology of Cenozoic notosuchians, with only the Eocene European species, *Iberosuchus macrodon*, currently sampled. To address this, we describe the bone microstructure and histology of *Sebecus icaeorhinus* from the middle Eocene of Argentina, based on a mid-shaft section of the femur of the holotype individual. The primary cortical bone is composed primarily of sparsely vascularized, parallel-fibred bone. The density of vascularization decreases towards the

periosteal surface and is formed of simple vascular canals. Growth marks, in the form of lines of arrested growth, are poorly defined, such that assessing skeletal maturity and measuring growth is difficult. However, what is preserved indicates the individual was still growing and the lack of an external fundamental system indicates the individual had not reached skeletal maturity. The cortical bone preserves numerous Sharpey's fibres, particularly in the anterolateral quadrant of the section. Notosuchians are generally interpreted as primarily terrestrial. Analysis with BoneProfileR recovers parameter values (P = 0.591; S = 0.056) consistent with all crocodylians with a tubular bone and moderate compactness. Thus, terrestriality is not strongly reflected in the bone density profile. When compared to other notosuchians, *Sebecus icaeorhinus* appears to be more similar to slower growing taxa such as *Araripesuchus buitreraensis* and *Iberosuchus macrodon*. Although sample size is small, with *Iberosuchus macrodon* and *Sebecus icaeorhinus* the only histologically sampled notosuchians from the Cenozoic, it is possible that slow growth was key to the survival of the sebecoid notosuchian lineage through the K–Pg extinction.

Funding Sources Funding provided by Natural Environment Research Council (Grant/Award Number: NE/X014010/1) and The Royal Society.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Variation in metaconid morphology and the distribution of twinned metaconids in Perissodactyla, Cambaytheriidae, Anthracobunidae, South American native ungulates, and Desmostylia

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The lower molars of many early perissodactyls possess a peculiar morphology of the metaconid where there are two distinct cusps. Originally these features were considered to be the metaconid and the metastylid, and only later was it recognized that the metastylid was distinct from these two cusps. As a result, this pair of cusps has been referred to as twinned metaconids. Twinned metaconids were first noted in early perissodactyls, but they are also present in anthracobunids and cambaytheriids and provide evidence for uniting these taxa in Perissodactylamorpha, which might also include Desmostylia.

Evidence for close relationships of some South American native ungulates (SANUs) to perissodactyls has led to conflicting interpretations regarding the possible presence of twinned metaconids in SANUs. We review the morphology of lower molar metaconids in perissodactyls, cambaytheriids, anthracobunids, desmostylians, and SANUs in order to evaluate possible homologies among these taxa. SANUs display a variety of metaconid morphologies, including elongated metaconids in didolodontids and litopterns and bifurcated metaconids in some early notoungulates. In didolodontids, what appear to be twinned metaconids are as likely, if not more likely, to be a single metaconid with a closely appressed paraconid. An isolated dp4 attributed to a didolodontid does show what appear to be true twinned metaconids, but otherwise at present there is little to connect the various metaconid morphologies of SANUs to the twinned metaconids of perissodactylamorphans.

We also examine the possibility of twinned metaconids in desmostylians, which some studies have recovered as closely related to perissodactyls. The early desmostylian *Behemotops* does not exhibit twinned metaconids, but this condition might be present in later desmostylians. The evaluation of later desmostylians is hampered by uncertainties in cusp homologies, but the presence of additional

cusps in desmostylian lower molars suggests that twinned metaconids might be present.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The comparative biomechanics and cranial hydrodynamics of Jurassic marine reptiles

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The Jurassic Period is renowned for its diverse selection of marine reptiles, such as plesiosaurians, ichthyosaurs and marine crocodylomorphs. These groups showcased a wide variety of feeding strategies. Research into Jurassic marine reptile phylogeny and anatomy has been conducted previously, however, their feeding biomechanics are understood to a much lesser extent. Understanding the biomechanics and hydrodynamics of these groups is imperative to our understanding of their hunting, feeding and swimming behaviors. It was hypothesized that species with a broader skull and larger mandibular muscles would have a smaller maximum gape, but a stronger bite force. However, this would be achieved at the cost of increased hydrodynamic drag, and therefore slower movement. This hypothesis was tested by investigating the biting biomechanics and hydrodynamics of twelve species of Jurassic marine reptiles, within five phylogenetic groups, and two extant crocodilian species for validation. First, 3D models of their skulls were created using Blender, then the jaw adductor muscle attachment sites were reconstructed. These reconstructions were then used to perform gape analysis using Blender and Python. Finally, the hydrodynamic performance of these species' heads using, mandible and skull surface area data, was calculated using ImageJ. Results indicate that cranially robust apex predators, such as *Pliosaurus* and *Dakosaurus*, contradictorily had comparatively larger maximum jaw gape angles, in conjunction with large mandibular muscle attachments, indicating high bite force. This does typically come at the expense of increased hydrodynamic drag, which is seemingly counteracted by post-cranial morphologies, and would have little impact on swimming and hunting effectiveness.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Recovering lost contextual data from early excavations at the Rancho La Brea and McKittrick tar seeps, California, USA, and disambiguating imperfect data

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Contextual data for early 20th century fossil collections is often vague and/or has been lost or misinterpreted during succeeding decades of study and reorganizations of collections. Recapturing, disambiguating, and standardizing the associated data is key to making these collections more useful for future researchers. A major challenge in ongoing research using Pleistocene to Holocene fossils collected by the University of California from 1906–1912 at Rancho La Brea and in the 1920s at the McKittrick tar seeps is determining where specimens may have been collected and relating the specimens to those for which radiocarbon dates have been obtained. Although distinct excavations, the two sites share an intermingled curatorial and research history. As this field work largely took place prior to the creation of the museum, there was neither a standardized way of capturing information nor an internal archive to house it. Individual specimens may have no contextual data, cryptic coordinate data recorded only on the bones, conflicting locality numbers, or duplicated specimen numbers. Drawing on records from our museum and correspondence distributed in four other archives, it has been possible to reconstruct an imperfect chronology of collection and subsequent preparation and curation that traces and identifies multiple points at which

contextual data were confused and/or lost. These include records taken to other universities by the scientists and collectors, multiple collections moves, early attempts to standardize record-keeping that simply failed to re-record existing data, and efforts by lead researchers to discourage publication by the original field collectors. Through this archival research, some of the missing contextual data has been recovered and it is now possible to estimate the larger amount of data that has been lost and may be unrecoverable. Irretrievable data loss occurred principally within 20 years of the collections being made, whereas data truncation or confusion occurred decades later.

Rediscovering hidden data is the goal, but it is equally important to record where data are lacking and the timelines of that data loss, so that we can learn to avoid repetition of the same patterns. Only by documenting both data loss and data preservation can we best communicate the potential and real biases in the data we share with the research community and serve to the public.

Funding Sources Supported in part by National Science Foundation EAR 2138164 and Institute of Museum and Library Services grant MA-30-14-0244-14.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The Long and the Short of It: fore- and hindlimb proportions show variable degrees of correlation across non-volant theropod dinosaur diversity

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To what degree do forelimb and hindlimb proportions covary within theropod dinosaur subgroups? Recent analyses support the correlation of these elements in maniraptorans close to the origin of Neornithes (crown-birds), suggesting a developmental morphological integration. Does this pattern persist more inclusively among non-volant members of the clade?

Measurements from a diversity of more complete theropod skeletons, from basally branching Triassic forms through representatives of all major clades, were assembled, as well as baseline data from early sauropodomorphs and basal saurischian taxa. Comparative tests failed to recover statistical support for integration of relative lengths of the forelimb and hindlimb when Theropoda was examined as a whole. This suggests that previously recognized covariance within derived Maniraptora arose within that clade rather than reflecting an ancestral theropod pattern.

However, differential patterns were found within some branches. For instance, the proportional reduction of forelimb lengths in abelisauroid ceratosaurs was found to be independent of relative changes in hindlimb lengths (whether elongated, as in elaphrosaurines; reduced, as in majungosaurines, or taxa where the baseline allometric relationship is retained). Eutyrannosaur tyrannosauroids and parvicursorine alvarezsaurids show a strong negative correlation between fore- and hindlimb proportions relative to their more basally branching relatives. Within Maniraptora, the previously discovered positive correlation is found to mask variable patterns among various relationships among subclades (for instance, negative correlation in caudipterid and avimimid oviraptorosaurs vs. positive correlation in many (but not all) caenagnathoids).

These variable patterns likely reflect a combination of different selective effects based on ecology superimposed over developmental integration. The positive correlation among the lineages approaching Neornithes may represent selection associated with aerial-related activity (including behaviors prior to true volancy) as well as other functions (e.g., use of the forelimb in brooding among Pennaraptora).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

How should I publish my digital fossil? Recommendations for the publication of comprehensive 3D datasets in palaeontological studies

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Data sharing is essential to scientific progress, and 3D models, along with their associated data and metadata, are no exception. Sharing data fosters transparency, reproducibility and confidence in the scientific and publication processes, including peer-review, and it improves the global availability of scientific knowledge. While it lies within the responsibility of the authors to generate, share, archive and manage their 3D data, scientific journals and repositories can facilitate the process of making 3D data accessible by providing clear guidelines and data policies. However, it is often not clear how a set of 3D data and associated metadata needs to be composed to be comprehensive and re-usable. The commonly adopted FAIR principles provide a good standard for such a comprehensive dataset but are not specific towards the different 3D file types. Authors, journal editors, academic institutions, funding agencies and repositories play a key role in ensuring data adhere to FAIR Data Principles, which are essential for proper data management and stewardship, benefiting the academic community. Here, we present more standardised ways for researchers and scientific journals to make the 3D models of their research projects and the associated metadata accessible following FAIR Data Principles. To do so, we review the main points of the data cycle and point out how data sharing benefits not only researchers, but the scientific community as a whole.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New specimens from old localities: expanding the Solnhofen region pterosaur community with new taxa

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The pterosaur fossils of the Upper Jurassic beds of the Solnhofen region of southern Germany have been a mainstay of research for the last 250 years. The area remains one of the most important sources for specimens in the world because they are relatively common, often complete and well preserved, and frequently include soft tissues. The region is also important for understanding the transition from early to later pterosaurs, include early forms, transitional early monofenestratans, and pterodactyloids. After an extended period of taxonomic stasis of Solnhofen pterosaur taxonomy (aside from some revisions) in recent years there has been a flurry of new finds. Most of these recent taxa come not from the 'traditional' Solnhofen, but from associated formations both before and after this time, and represent a potentially critical new source of data on this window into pterosaur evolution. Here we present three new and undescribed pterosaur specimens from the

region, primarily from the more recent Mörnsheim Formation. These new pterosaurian taxa include significant new soft tissue and bony anatomy, and information on evolution and taphonomy. The first is a new ctenochasmatoid pterodactyloid that features an extensive soft-tissue cranial crest that is larger than any previously seen in this clade. The soft tissue crest is associated with an ossified part that is not premaxillary in origin as generally assumed, but is a novel, and separate, ossification that later fuses to the premaxilla. There are also two new early monofenestratans present. The first monofenestratan adds important novel information about the transition into pterodactyloid pterosaurs, and in particular, the critical change in the size of the phalanges of the wing-finger. Early pterosaurs wing phalanges 1 and 4 are of subequal size, and larger than 2 and 3. Pterodactyloid phalanges are 1>2>3>4, but the condition in the monofenestratan described here is 1=2=3=4. The second monofenestratan has a unique form of preservation among Solnhofen-region pterosaurs. It has heavily pitted bones that are stained red, indicating the further distinction of the Mörnsheim as a zone differing from the more traditional beds. Collectively, this shows that there is likely still more important information to be known about taxa, evolution and taphonomy despite the intensive study that the Solnhofen archipelago has undergone for more than two centuries.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new specimen of the enigmatic mammal *Lessnessina* from the early Eocene of Abbey Wood, UK, shares important characters with stem members of the superorder Paenungulata

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The rare genus *Lessnessina* from the early Eocene Blackheath Formation of Abbey Wood was originally classified in the stem ungulate subfamily Anisonchinae of the family Periptychidae, based on the holotype maxilla of the type species *L. packmani*, because of its high molar protocones, short broad P3–4 and M1 metacone smaller than paracone. Subsequent alternative suggestions on affinity were with the orders Anagalida or Taeniodonta. The later finding of a p4 and m2 belonging to *Lessnessina* at Abbey Wood showed that the genus *Midiagnus*, based on a mandible from the penecontemporaneous site of Palette, France, is synonymous with *Lessnessina*, thus greatly expanding knowledge of its dentition. Its m1–2 with near equal height trigonid and talonid and connate paraconid and metaconid then suggested instead attribution to the stem ungulate family Hyopsodontidae. A third species was described from the Mongolian early Eocene based on lower dentitions. However, the buccally flexed M1–2 centrocrista with mesostyle and p4 with unbasined talonid and no metaconid of *Lessnessina* were seen to be atypical of hyopsodontids. A dentary belonging to a new species of *Lessnessina*, recently found at Abbey Wood, has an enlarged procumbent first incisor, an otherwise reduced pre-p3 dentition and nonmolariform p3–4, suggesting instead affinities with primitive paenungulates from the Paleocene of Africa. *Lessnessina* also shares with them dilambdodont upper molars and nonmolariform premolars. There is a particular similarity to the stem paenungulate *Abdounodus* in enlargement of the M1–2 metaconule, as a precursor to its development as the fourth cusp of a quadritubercular upper molar. The P3–4 of *Lessnessina* also have mesially shifted protocone lobes and outlines very similar to those of the primitive proboscidean *Eritherium*.

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Understanding Oligocene biogeography and stratigraphy of meniscomyine rodents: revising the biostratigraphic patterns in a lineage of burrowing rodents

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Meniscomyine rodents are abundant and diverse in the late Oligocene record of the Northwestern U.S., ranging from Nebraska to central Oregon in the Arikareean. They have been proposed in both Montana's Deep River Formation and Oregon's John Day Formation as biostratigraphic marker taxa given their rapid evolution and diversity; however, the stratigraphic work of Rensberger has proven difficult to reproduce. Their taxonomy is particularly complicated given changes in occlusal morphology with wear. A reexamination of the diversity of meniscomyines with an emphasis on the well-resolved records in Oregon and Montana reveals some more complex and overlapping stratigraphic distributions than might have been expected on the basis of past work. Additionally, consideration of the meniscomyines in the Cabbage Patch Formation of Montana alongside the addition of a number of previously undescribed specimens from the John Day Formation gives a deeper understanding of this complex and diverse lineage. In both Oregon and Montana, independent lineages diversified in situ through the Arikareean, while a few lineages migrated between regions. The genus *Niglarodon* seems to have been endemic to the Rocky Mountain region, while *Meniscomys* was more cosmopolitan, being found in a variety of assemblages outside of its center of diversity in Oregon. However, *Meniscomys* does show indication of evolution in place through the John Day record. The geographic pattern of distribution in this lineage indicates that, like many extant fossorial taxa, meniscomyine rodents may have been characterized by limited dispersal capacity and a strong evolutionary response to the local environment.

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Colbert Prize Session

A new sphenacodont synapsid from the early Permian Washington Formation of Ohio, USA

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Sphenacodontia comprises a taxonomically diverse and geographically-widespread assemblage of non-mammalian synapsids known from the late Carboniferous to the middle Permian, which includes the first large-bodied, terrestrial apex predators within early ecosystems. The well-known sphenacodontids *Dimetrodon* and *Sphenacodon* constitute the majority of sphenacodont occurrences in the early Permian, with the earlier diverging non-sphenacodontid sphenacodonts ('haptodonts') more sporadically represented in the fossil record.

Here, we present a redescription of the presumed ophiacodontid '*Baldwinonus dunkardensis*' from the Washington Formation (Dunkard Group, lower Permian) of Ohio, based on micro-CT data of the maxillary remains of the only recognized specimen, CM 8563. Digital segmentation identified the presence of a high facial lamina of the maxilla with a gently rounded swelling around the canine, though lacking an ascending supracanine buttress. We additionally revealed a reduced maxillary tooth count, labiolingual compressed teeth, a mediodistal cutting edge of the caniniform tooth, and the presence of festooned or 'clover-shaped' plicidentine in nearly all present tooth roots. Morphological differences in plicidentine—the labiolingual infolding of dentine around the pulp cavity—can potentially represent clade-level differences, particularly within pelycosaurian synapsids. These features collectively indicate that, rather than being an ophiacodontid, CM 8563 has a sphenacodontian affinity.

To further determine the phylogenetic relationships of the two recognized species of *Baldwinonus*, we ran a parsimony-based phylogenetic analysis including an array of craniodental characters. We recovered the type

species *Baldwinonus trux* as an ophiacodontid, sister taxon to *Ophiacodon*, while CM 8563 fell within a polytomy of early diverging sphenacodonts. We reject previous hypotheses that one or both species attributed to *Baldwinonus* have eothyridid affinities. The recognition of CM 8563 as a haptodont-grade sphenacodont represents the first 'haptodont' and the second sphenacodontian, alongside *Ctenospondylus ninevehensis*, from the Dunkard Basin. This finding both increases the known diversity of this group within the early Permian of North America and supports an emerging view that 'haptodont'-grade sphenacodontians remained an important part of terrestrial vertebrate assemblages well into the early Permian.

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Fossorial ecomorphologies in the skull roof of extant and fossil snakes revealed by geometric morphometrics

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Morphological convergence due to fossoriality is common across vertebrates due to the biomechanical constraints of locomoting in a subterranean environment. Previous work on the inner ear of snakes has led to conflicting interpretations of morphologies correlated with fossoriality, particularly when interpreting the ecology of the extinct snake *Dinilysia*. Here we evaluate the morphological diversity of the parietal in snakes as a correlate to fossoriality. We use a functional definition of fossoriality that includes all snakes that use the head to displace substrate during locomotion and sample a wide range of extant snakes that exhibit fossorial behaviour. Using 3D geometric morphometrics we find that parietal morphology is highly plastic in snakes. Fossorial snakes converge on a shared ecomorphology of an elongate parietal with a u-shaped frontoparietal suture and prominent posterior shelf. This morphology represents an allometric relationship only in fossorial taxa. *Dinilysia* possesses an elongate parietal with a prominent posterior shelf, supporting the hypothesis of a fossorial ecology. *Dinilysia* also possesses an unusual morphology of an interdigitated frontoparietal suture, which is present in fossorial squamates but not in any extant snake sampled in this study. We find support for the hypothesis of a fossorial *Dinilysia*, most morphologically similar to the large burrowing snakes *Xenopeltis* and *Loxocemus*. This suggests that early snake evolution was characterized by adaptation to fossorial habitats.

Funding Sources Natural Environment Research Council Award (NE/S000739/1) to JJH, with additional data funded by NSF DBI-1701714 (oVert).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Phalangeal shape variation and its ecological correlates in birds

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Living species with known ecologies provide critical context for reconstructing ecology-morphology relationships in extinct tetrapods. While the link between avian foot morphology and habitat use has been frequently explored, past studies often relied on limited and incomplete data, such as phalanx length ratios or claw curvatures. This has left considerable uncertainty about the ecological inferences drawn from the pedal morphology of birds. To address this, we employ high-resolution 3D geometric morphometrics to comprehensively quantify the shape and relative size of both ungual and non-ungual pedal phalanges in extant

birds. Our dataset comprises 89 species representing a broad phylogenetic and ecological range, capturing multiple origins of key ecological traits such as walking, arboreal perching, cursoriality, digital manipulation, climbing, scansoriality, raptoriality, and swimming. Being far beyond the previous ones in terms of taxonomic coverage and data fidelity, this dataset is analyzed with individual phalanges as well as specific combinations to infer their relationships with habitat use, using advanced multivariate phylogenetic comparative methods. The results show significant associations between the allometric-free shapes of certain individual phalanges and phalangeal groupings and ecological categories, demonstrating the strong relationship between phalangeal shape and ecological adaptation in birds. In the future this work will lay the foundation for inferring the habitat use of early birds and feathered non-avian dinosaurs, offering new insight into the origin and early ecological diversification of birds.

Funding Sources National Key Research and Development Project of China 2024YFF0807603, NSFC 42288201, European Union's Horizon 2020 research and innovation programme No 101024572.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Osteohistological dichotomy suggests divergent marine lifestyles and thermometabolic strategies in thalattosaurs (Reptilia, Archosauromorpha)

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Thalattosaurs are an enigmatic clade of Triassic marine reptiles, forming a minor component of marine reptile faunas in the northern hemisphere during the Middle and Late Triassic periods. Thalattosauria consists of two clades, the Askeptosauroidea and the Thalattosauroidea. The latter was adapted to open marine habitats and typically co-occur with ichthyosaurs. Thalattosaur bone histology has been the subject of a single study, comparing thalattosauroid and askeptosauroid bone histology based on *Askeptosaurus* from the Middle Triassic of the southern Alps and an as yet unnamed thalattosauroid from the Late Triassic of Oregon, USA. The most extensive thalattosaur record, in terms of both abundance and diversity, comes from southwestern China (Guizhou and Yunnan provinces). We sampled the humeri of two different taxa, the askeptosauroid *Anshunsaurus* from two individuals (37% and 68% of maximum size) and the thalattosauroid *Xinpusaurus* from five individuals (25%–74% of maximum size). The *Anshunsaurus* specimens are from the late Ladinian Zhuganpo Formation (Xingyi Fauna) whereas the *Xinpusaurus* specimens are from the early Carnian Xiaowa Formation (Guanling Biota). We aimed to test whether the different degree of morphological aquatic adaptation in askeptosauroids vs. thalattosauroids is reflected in bone histology. In addition, we looked for evidence of fast growth indicative of elevated metabolic rates. Our findings indicate that *Anshunsaurus* shows dense compact bone tissue with poor vascularization and lines of arrested growth. In contrast, *Xinpusaurus* is characterized by highly vascularized bone tissue with longitudinal primary osteons arranged in radial rows, with only a few indistinctive growth marks present. The primary osteons are part of a woven-parallel complex, indicative of fast growth. Thus, *Anshunsaurus* histology is similar to that of *Askeptosaurus*, while *Xinpusaurus* histology is similar to that of a previously described thalattosauroid from Oregon. Like their

morphology, the bone histology of thalattosauroids is more derived than that of askeptosauroids, which suggests that thalattosauroids were already adapted to more open marine habitats. The fast growth of thalattosauroids suggests an elevated metabolic rate.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Paleoecological impacts of major crises on species diversification: insights from the high-resolution fossil record of Perissodactyla during the 'Grande Coupure' in Europe

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The Eocene–Oligocene transition (EOT: ~33.9 Ma) is one of the biggest extinction events of the Cenozoic. In Europe, this event corresponds to a major faunal turnover, where approximately half of the placental mammals went extinct, called the 'Grande Coupure' (33.9 to 33.4 Ma). Two main causes have been proposed for the Grande Coupure: the arrival of immigrant taxa from Asia and major climatic events (global cooling, onset of Antarctic glaciation: Oi-1 event). However, their relative roles in the extinction of endemic taxa are not well defined.

Perissodactyls are among the most affected taxa by the Grande Coupure, with drastic changes in the composition of the assemblages between pre- and post- Grande Coupure faunas. Notably, there is a shift from the dominance of Palaeotheriidae in the Eocene faunas to that of Rhinocerotoidea in Oligocene faunas due to the extinction of palaeotheres at the end of the Eocene or rapidly after the EOT. Moreover, the perissodactyls experienced great changes in their dental morphology (e.g., hypsodonty, molarization of the premolars) that have been linked with a supposed switch in their diet and associated to vegetation modification (increase in abrasiveness). Nevertheless, the ecology of the perissodactyls around the EOT has rarely been studied per se with objective and reliable approaches, such as dental wear or isotopy.

To explore the paleoecological impacts of the Grande Coupure on perissodactyls, we will study 26 Priabonian (late Oligocene)–Rupelian (early Oligocene) localities in Europe. We will use a multi-proxy approach combining several modern methods and based on the abundant dental remains. This approach will be articulated around diet proxies (dental microwear and mesowear, enamel isotopic composition $\delta^{13}C$), indicators of paleoenvironments (local temperature and seasonality: $\delta^{18}O$; habitat openness: $\delta^{13}C$), enamel hypoplasia which is a marker of stress (e.g., seasonality, drought), and body mass prediction. We expect to detect ecological shifts, as morphological changes (e.g., hypsodonty, molarization of the premolars) have already been observed and that rhinocerotids will occupy a similar niche to the latest and biggest lophiodons. For species surviving the Grande Coupure, we should detect adaptions to cooler conditions and tougher vegetation and probably greater body masses, which allow to store fat, a better heat conservation and a greater tolerance for fibrous items.

Funding Sources This research is part of the PIPE project funded by the Swiss National Science Foundation 10.001.379.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Overcoming the challenges presented by the study of enamel histology in extinct mammalian orders: case study of toxodont notoungulates

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Enamel is the hardest tissue in vertebrates and as such is often well preserved in the fossil record. It is also very informative regarding numerous aspects of biology, notably diet, metabolism, and growth. However, the study of enamel histology in fossil species is a challenge, as the identification of increments cannot be tested experimentally. Here, we propose a methodological framework to tackle this issue using Toxodontia, an extinct suborder of South American notoungulates. Toxodontia are notably known for developing unique dental characteristics, combining hypso- to hypselodonty and a faster dental eruption. We sampled 19 molars of four species with different crown height and age: one brachyodont *Pleurostylodon modicus* from Casamayor (Eocene; Argentina), and three hypsodont *Eurygenium pacegnum* from Salla (Late Oligocene; Bolivia), *Adinotherium ovinum*, and *Nesodon imbricatus* from Santa Cruz (Middle Miocene; Argentina). Our protocol starts with the identification of Retzius lines as increments reaching the surface and forming grooves known as perikymata. Retzius lines were often observed in restricted areas of the cervical region and/or outer enamel. Increments between successive Retzius lines were identified as laminations, corresponding to daily features. Laminations were the most common increment observed in the enamel of toxodonts. Lastly, although rare, sub-daily features in the form of cross-striations or laminations were also observed. Then, we inferred enamel growth parameters. The daily secretion rate (DSR) ranged from 6 to 22 µm/day, while the enamel extension rate (EER) ranged from 13 to 376 µm/day. There were great differences by species and position along the crown (occlusal, middle, or cervical), and to a lesser extent between the labial and lingual sides and between upper and lower teeth. Notably, the EER decreased drastically from occlusal to cervical. In more recent toxodonts (*Adinotherium* and *Nesodon*), the drop of EER from occlusal to middle was followed by a relative stasis suggesting a cruising speed in the dental growth and initiating the hypselodonty. As previously noted, the EER seem to be the main means responsible for variations of crown height and crown formation time. We also found an increase of the Retzius interval from 1 in *Pleurostylodon* and *Eurygenium* (35–50 kg), 2 in *Adinotherium* (75–90 kg), and 3 in *Nesodon* (350–400 kg), which has been linked with longer crown formation time and/or slower pace of growth in other taxa.

Funding Sources Emergence project from the Sorbonne University (France), ANR-IDEX-0004_02 SUPER.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Investigating the anatomy and evolution of basipterygoid processes across Dinosauria

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Basipterygoid processes are paired, stalk-like projections of the parabasisphenoid (an element of the braincase) that articulate with the pterygoids (elements of the bony palate). They form a key part of the connection between the palate and the remainder of the dinosaur skull, and in some species, a component of a functional cranial kinetic system. Evaluating the degree of cranial kinesis in non-avian dinosaurs is necessary for interpretating the evolutionary origin of the highly kinetic skulls that typify many extant dinosaurs (birds). However, despite representing a component of the cranial kinetic system, the morphological variability of the basipterygoid processes across Dinosauria

remains incompletely characterized. Here, we provide a thorough assessment of morphological variation of the basipterygoid processes across Dinosauria (including the type of contact between the basipterygoid processes and pterygoids where this is possible to assess) using a dataset of dinosaurian basipterygoid processes built from CT scan-derived three-dimensional models and photographs. For extant species we additionally examine ontogenetic change in basipterygoid process morphology by sampling both immature and mature representatives. We observe variable basipterygoid process morphology within and among each of the major dinosaurian subclades (Sauropodomorpha, Ornithischia and Theropoda). Our ontogenetic investigation of extant species showed variability in the morphology and presence of basipterygoid processes through ontogeny, which may suggest a variable degree of cranial kinetic capacity during skull development in some taxa. Generally, we identify an abrupt shift in both the predominant orientation of the basipterygoid processes and the type of contact with the pterygoid between non-avian theropods and birds. Given that these changes are likely of functional significance, we posit that these changes may have been necessary precursors for the evolution of avian cranial kinesis.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Paleoenvironment of Pleistocene vertebrates from the middle Atbara River, eastern Sudan

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The middle Atbara area in eastern Sudan today is faunally depleted. In contrast, a large and highly diverse vertebrate fossil assemblage has been recovered from the Pleistocene successions in the area. Seasonal rainfall magnitude and seasonality are a primary determinant of African savannas today, governing essential aspects of biomass production, such as primary productivity and habitat type. It remains uncertain to what degree paleoclimate differences might account for the differences in faunal diversity. Growth layers in bivalve shells offer insights into paleoenvironmental conditions, including rainfall, river productivity, and water temperature. In this study, we analyzed stable oxygen and carbon isotopes in eight fossil and three modern *Etheria elliptica* shells collected from the middle Atbara River in eastern Sudan. The fossil specimens are from sediments dated using luminescence to between 224–17 ka in age. The $\delta^{18}O$ values of fossil and modern shells are broadly similar, though the fossils are more enriched (5.9 to -2.4 ‰ for fossils vs. 1.5 to -6.4 ‰ for modern shells), possibly indicating more evaporative and drier conditions during the Pleistocene. However, the Atbara River is today altered by dams, which may influence the isotopic signatures in modern shells. $\delta^{13}C$ values range from -4.5 to -14.1 ‰ in fossil shells and -9.6 to -16.9 ‰ in modern shells. The absence of correlation between $\delta^{18}O$ and $\delta^{13}C$ suggests different controlling factors on $\delta^{13}C$, such as metabolic activity and sources of dissolved inorganic carbon. We also reconstructed the Atbara Local Meteoric Water Line (ALMWL) from 5 river water samples. This confirmed the Atbara experiences low relative humidity compared to the global MWL. Moisture sources inferred from the ALMWL likely include the Indian Ocean, the Atlantic Ocean, and recycled moisture from continental input. These may have also supplied moisture during the Pleistocene, as fossil and modern shells exhibit comparable isotopic ranges. Our results overall indicate that a strong precipitation seasonality pattern has likely persisted in eastern Sudan since at least ~200 ka.

Funding Sources European Research Council (Horizon Europe, ERC Consolidator Grant PALEONILE, grant 101045217). German Research Foundation (DFG) project 282995372.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Evaluating trace fossil preservation in a megafan system: new insights from along the Pilcomayo River, Paraguay

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Trace fossil preservation and distribution offer unique paleoecological insights often absent from body fossil records. However, most modern analogs for terrestrial fossil preservation are poorly matched to the conditions captured in the sedimentary record. We propose that modern megafan systems, such as the Pilcomayo Megafan in Paraguay, provide a more accurate model for fossil preservation on land. This system's low anthropogenic impact and diverse depositional environments make it an ideal modern analog.

Over the past year, our research team has expanded data collection efforts on vertebrate and invertebrate traces across multiple Pilcomayo subenvironments, split between two regions: General Diaz and Pozo Hondo. We conducted randomized locality surveys, described all trace occurrences, and documented diversity-based data regarding the two regions studied. Preliminary results indicate widespread trace preservation throughout the fan system, with higher trace abundance in medial regions compared to proximal zones—likely reflecting differential environmental factors between the dryer Pozo Hondo area and the wetter, more dynamic General Diaz area.

Vertebrate trace data continue to show a predominance of domestic species. Trace presence generally aligns with local faunal occurrence, supporting the ecological fidelity of surficial trace assemblages, even if abundance patterns are less consistent. The reflection of these trace assemblages also provides an excellent comparison to that of the bone assemblages being gathered, leading towards differential bias in terms of diversity representation. Ongoing taphonomic and ecological comparisons suggest that the Pilcomayo Megafan's trace record preserves key behavioral signals and reflects habitat usage across spatial scales along with change in analysis over the course of one year.

These findings strengthen the case for using fan systems as analogs for ancient fluvial environments and offer new methodological approaches for interpreting trace fossil assemblages in the rock record.

Funding Sources David B. Jones Foundation.

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Tooth attachment and replacement in mosasaurs: new insights from dental histology in modern teiid lizards

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Modern Tegu lizards (Teiidae) possess tooth crowns surrounded by significant masses of bony tissue and large external replacement pits, unique tooth attachment morphologies that are very similar to those observed in numerous

clades of extinct mosasaurs. Some studies have contended that mosasaurs have a mammal-like thecodont (socketed) tooth attachment with a calcified periodontal ligament (PDL); this contention contrasts with the conventional view that mosasaurs present a form of pleurodont implantation and attachment to the jawbone via a “bone of attachment.” The peculiar nature of mosasaur dental morphology raises questions around the development of the attaching tissues and how the giant bony bases were removed and the teeth were shed. *Tupinambis* and *Dracaena* in particular are large extant teiids where tooth development can actually be observed, not just inferred from preserved bony evidence as in mosasaurs. These teiids are thus ideal modern analogs to study mosasaur tooth attachment and replacement. We therefore histologically sampled several extant teiid species with teeth at different ontogenetic stages.

Our histological data are the first to reveal that teiid lizards have bony tooth bases that initially consist of a large, vascularized PDL that mineralizes centrifugally from the tooth root surface in a web-like fashion around preexisting vasculature, a process that explains the spongy nature of the mosasaur PDL. These data also reveal that teiid osteoclast (bone resorbing cell) activity is extensive and concentrated lingually in order to resorb the large amount of calcified PDL of a shedding tooth. This contrasts with more typical ‘pleurodont’ squamates that lack resorption pits, like pythons and varanids, and those that do, like pleurodont iguanids, but target much less mineralized tissue. Mosasaurid tooth attachment is characterized by similar large bony bases under the tooth crowns, with large resorption pits in those bony bases; similar to teiids, a replacement tooth is often observed developing within the resorption pit. Considering this, our teiid histological data provides a developmental model for mosasaur tooth attachment and shedding due to similar attachment tissue distribution, and PDL mineralization and resorption. We can therefore characterize a “teiid-” and “mosasaur-type” of tooth resorption that has not been reported previously.

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

Definitive Early–Middle Triassic vertebrate assemblages from Argentina and their implications for non-marine ecosystem evolution

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The Early–Middle Triassic Period is a critical interval of the Mesozoic Era, because it records the ecological aftermath and recovery from the largest-known mass extinction, the end-Permian extinction ~252 million years ago. Ecosystems on land are thought to display low richness and high unevenness during the Early Triassic, with greater species richness and evenness during the early Middle Triassic (Anisian Stage). Furthermore, non-marine vertebrate assemblages from the Early Triassic are hypothesized to be relatively cosmopolitan, whereas those from the Middle Triassic are much more provincial, with fewer shared taxa. Many of these patterns are based largely on data from Gondwana, where most vertebrate fossil assemblages are dated using vertebrate and/or floral biostratigraphy. Recent radioisotopic age constraints for some Gondwanan Triassic assemblages indicate that they are many millions of years older or younger than previously estimated. This calls into question the accuracy and precision of these biostratigraphic schemes, and whether putative

Early–Middle Triassic non-marine fossil assemblages actually date to this time.

Our long-term field program in the Ischigualasto-Villa Unión Basin of northwestern Argentina has documented several non-marine vertebrate fossil assemblages from the Tarjados Formation. These fossils are well-constrained by multiple precise CA-TIMS U-Pb zircon radioisotopic ages. The Early Triassic portion of the formation is characterized by a diverse amniote footprint assemblage with a minimum of six morphotypes, comprising predominantly archosauromorph trackmakers. Middle Triassic assemblages (Anisian and Ladinian) are dominated by body fossils of dicynodont synapsids. The Early Triassic track assemblage is similar to those known from penecontemporaneous deposits across Pangea, whereas the Anisian dicynodont assemblage is strikingly different from assemblages of the lower paleolatitudes in Laurasia with biostratigraphically-independent age constraints, where synapsid body fossils are very rare. This assemblage is also similar to the higher paleolatitude biostratigraphically-dated Karoo Basin assemblages (*Lystrosaurus* & *Cynognathus* zones). These data are evidence for the global diversification of archosauromorphs during the Early Triassic, and suggest that strong latitudinal provinciality was established by the Anisian, a feature of non-marine ecosystems that persisted for the rest of the Triassic Period.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The first report from Britain of the enigmatic Carboniferous chondrichthyan *Lagarodus*

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Lagarodus is a chondrichthyan genus with a durophagous dentition. It is the sole member of the family Lagarodontidae and is of uncertain order. There is only one recognized species, *Lagarodus specularis*, but five tooth morphotypes, some of which were once named as separate species. *Lagarodus specularis* was originally placed in the genus *Psammodus*, but this assignment is invalidated by the fact that the teeth are organized into files, analogously to the dentition of myliobatids, and by other features, such as the presence of enameloid on the sides of the teeth. Stratigraphically, *Lagarodus* is restricted to the middle Pennsylvanian. *Lagarodus* is best known from the Russian Platform, from the early Moscovian (Kashirian) to the early Kasimovian (Krevyakinian). *Lagarodus* is known from widely scattered localities in North America (Colorado, Arizona, Ohio, Kansas, and New Mexico) from the late Atokan (early Moscovian) to the Desmoinesian (late Moscovian). Aside from Russia and North America, the only undoubted reports of *Lagarodus* consist of two teeth of the *angustus* morphotype from the Moscovian of north Greenland and one tooth of the *specularis* morphotype from the middle to late Bashkirian of central Spitzbergen, Norway. During the Pennsylvanian, these two locations were much closer to each other than they are now. Three *Lagarodus specularis* teeth, bearing the registration number NHMUK PV P.8194, all of the *angustus* morphotype, are in the collections of the Natural History Museum (London). They are from the Duckmantian substage of the Westphalian stage (late Bashkirian = late Early Pennsylvanian) of South Staffordshire, England, and are labeled as *Psammodus angustus*. They were acquired from the collection of John Ward (1837–1906). These teeth have never been noted in the literature of *Lagarodus*. This find extends the known geographic range of the genus.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Cranioskeletal elements of *Anolis* lizards from the Greater Antilles exemplify rubato

and harmonic variation within ecomorph specialists

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Greater Antillean *Anolis* lizards are a prime example of adaptive radiation and ecological convergence, with different species from each island sympatrically evolving into distinct ecomorphs, each characterized by its own unique ecological niche. While a great deal of research has examined how the taxa assigned to an ecomorph are similar across the Greater Antilles, little work has been done to examine within-ecomorph variation in tempo and mode. Here, we compare the cranioskeletal morphology of *Anolis* lizards across the islands of Cuba, Hispaniola, Jamaica, and Puerto Rico in order to examine variation in tempo and mode within six distinct ecomorph groups. Our dataset includes 88 species of *Anolis* and over 520 crania and mandibles, which we assessed using a geometric morphometric scheme of 120 landmarks to characterize morphological variation within crown giant, trunk crown, trunk, trunk ground, twig, and grass bush ecomorphs. We found that crown giant and twig ecomorphs showed the greatest within-ecomorph variation between islands both overall and across the greatest number of elements. This also coincides with faster evolutionary rates for these ecomorphs in general. Curiously, the elements that differ in the ecomorphs are not entirely shared, as elements such as the prefrontal and squamosal differ more in crown giant anoles, while the quadrate and braincase differ more in twig anoles. Trunk crown, trunk, and grass bush anoles also showed variation across numerous elements; however, grass bush anoles also showed greater distinction between some unusual taxa on Hispaniola than between islands. Finally, trunk ground anoles showed little distinction in skull morphologies between islands. We found that elements such as the maxilla and parietal consistently showed differences within ecomorphs, while elements such as the postorbital, jugal, and nasal showed less variation. Overall, both ecomorphs and elements with higher evolutionary rates showed greater morphological distinction between islands, suggesting that more extreme habitat specialization in anoles unlocks varied paths to reach convergent morphological trajectories.

Funding Sources NSF EAR grant 2050228 to.M.K.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Tooth imbrication evolution and function in sauropodomorph dinosaurs

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Imbricated dentitions are characterized by teeth rotated in their alveoli and arranged en echelon such that the distal margin of each crown covers the mesial margin of the subsequent crown. Imbricated dentitions have arisen independently in various vertebrates, including some actinopterygian fishes, chondrichthyans, dinocephalians, and dinosaurs. Among the latter, this character is present in early ornithischians and sauropodomorphs but lost in later forms. Within Sauropodomorpha, the loss of imbrication coincides with the growing predominance during the Late Jurassic and Cretaceous of species with narrow-crowned dentitions, which by their nature cannot overlap. Despite the prevalence of imbricated dentitions in early appearing dinosaur herbivores, there has been little investigation into its evolution, disappearance, or functional significance.

We traced the evolution of imbrication within sauropodomorphs by measuring the angle at

which the teeth are rotated, quantified as an angle created by the intersection of the long axis of a tooth in cross-section with the tangent to a curve following the lateral margin of the jaw. We sampled 13 sauropodomorph taxa and found that the angle of imbrication increases slightly from basal sauropodomorphs to sauropodiforms, reaching its peak around 26°.

The increase in tooth imbrication in basal sauropodomorphs and early sauropods is partly related to an increase in tooth breadth. Imbrication allows the apices of broad-crowned teeth to remain close to one another, simultaneously creating longer cutting surfaces that are discontinuous with subsequent teeth. Interdigitation of imbricated upper and lower dentitions during occlusion may have facilitated crushing and cutting of plant material in a manner similar to the action of cusps in mammals. To examine how imbricated dentitions function, we created a robot to model the bite and occlusion of a jaw. An imbricated model based on *Camarasaurus* was compared to a non-imbricated dentition, and preliminary results reveal key differences between these strategies. Non-imbricated dentitions slice material along a single cutting plane in a manner resembling scissors, which may allow for food to slip through the teeth or be bent rather than divided. By contrast, imbricated dentitions have multiple shearing planes corresponding to tooth angulation, and the upper and lower tooth rows interlock, which allows a better grasp on food items and applies the bite force directly to the food item.

Funding Sources University of Michigan Department of Earth and Environmental Sciences Turner Grant, University of Michigan Rackham Graduate Research Grant.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The feet of anchitheriine horses: padding the evidence?

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Equids in the Anchitheriinae are the ‘forgotten middle child’ of the traditional pageant of equid evolution, especially those within the side branch of the Anchitheriini—medium to large-sized (e.g. pony to horse-sized) brachydont tridactyl forms. Anchitheriins were browsers alongside the grazing Equinae in the mid Miocene of North America and Eurasia. Only the Equinae and more crownward anchitheres (e.g. *Parahippus*) had the osteological correlates of the energy-storing ‘spring-foot’ apparatus typical of extant equids; in contrast more basal equids have been assumed to have retained tapir-like foot pads. However, some recent evidence throws doubt on this notion.

Tapirs, rhinoceroses, and hippos have footpads and a subunguligrade stance and retain interosseus muscles in their manus and pes. Other extant ungulates have tendonized these muscles into suspensory ligaments, supporting a fully unguligrade foot posture. While the suspensory apparatus is an obligate support structure for a ‘spring-foot,’ suoids lack the derived foot of ruminants (that resembles the spring-foot of equids), but do have a suspensory ligament (fully tendonized interosseus muscles) and lack a foot pad. Processes on the volar side of the carpus act as the insertion for interosseus and digital adductor muscles in foot-padded ungulates, but these processes are lost or highly reduced in other extant forms. The presence of carpal volar processes in extinct ungulates indicates retention of a fleshy manus and a foot pad (seen for example in oreodonts among artiodactyls).

A preliminary investigation of the condition in extinct equids and palaeotheres (sister clade to Equidae) shows that, whereas palaeotheres and hyracotheres (the most basal equids) retained

volar carpal processes, these are highly reduced or lost in all anchitheres, especially in the large anchitheriins. Furthermore, European trace fossils predating the arrival of spring-footed equines have been ascribed to *Anchitherium*, yet show a 'frog' in the hoofprint (like that of a modern equid): the presence of this structure is incompatible with the presence of a foot pad. With these combined lines of evidence, we propose that anchitheres had a distal foot morphology analogous to that of suoids—lacking a fleshy foot pad but without the derived 'spring-foot' of more crownward equids.

Funding Sources University of Bristol Palaeobiology Masters program

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Reconstructing 3D locomotor capabilities and hindlimb musculature in the early Permian reptile *Eudibamus cursoris*: Implication for the origin of bipedalism

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The bolosaurid reptile *Eudibamus cursoris*, from the early Permian Bromacker locality in central Germany, has long been hypothesized to be one of the earliest tetrapods to have employed a bipedal locomotion. However, its precise locomotor mode, including joint mobility and muscular architecture, remains largely unexplored in a biomechanical framework. Assessing both joint mobility and hindlimb musculature is therefore a crucial step toward evaluating and testing long-standing assumptions about its cursoriality. Here, we combine synchrotron-based imaging, 3D range of motion analysis, and volumetric muscle reconstruction to assess hindlimb function in *Eudibamus*. We first reconstructed joint mobility at the main hindlimb joints (hip, knee, ankle, and selected autopodial joints), providing anatomically constrained estimates of feasible limb postures. Using extant morphofunctional analogues, primarily the facultative biped *Basiliscus basiliscus*, we estimated muscle origin and insertion areas to reconstruct the hindlimb musculature. From this data, we evaluated muscle volumes and lines of action, which provides more precise estimates of individual muscle force direction and potential moment arms, improving input accuracy for future musculoskeletal simulations. While interpretations remain preliminary, this integrative approach provides new quantitative insights into the potential cursoriality of *Eudibamus*. This research sets the stage for future musculoskeletal simulation-based analysis of locomotor performance and contributes to a growing understanding of the functional morphology underpinning the evolution of bipedality in early amniotes.

Funding Sources BROMACKER Project (German Federal Ministry of Research, Technology and Space 01U02002A)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Bridging gaps in the fossil record: diagnostic features of fossilized shark cartilage from the Upper Triassic of southwestern USA

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Cartilage preservation in the fossil record is rare, limiting our understanding of soft tissue evolution in vertebrates. Although chondrichthyan cartilage has been documented since the Paleozoic, temporal gaps and the lack of diagnostic criteria have hindered consistent identification. This study establishes criteria for identifying the first fossil cartilage attributed to the Upper Triassic in the western United States. We report two separate occurrences: PEFO 52632 and PEFO 54505 from the Chinle Formation (~220 Ma, Thunderstorm Ridge locality) in Petrified Forest National Park, Arizona, and TTU-P25078 from the Tecovas Formation (~220 Ma, Gray-Green site) in Crosby County, Texas. Scanning electron microscopy, histological thin sections, and computed tomography reveal that the preserved cartilage exhibits polygonal, prismatically calcified tesserae separated by unmineralized fibrous zones, which are diagnostic features of tessellated calcified cartilage (TCC) found in both extinct and living sharks. Comparative analysis with modern elasmobranchs highlights shared traits, including prismatic mineralization, polygonal tesseral arrangement, and fibrous intertesseral zones, indicating functional and evolutionary continuity. Importantly, xenacanthids appear to possess a more structurally complex TCC, with multilayered tesserae and radial spokes. We attribute these fossils to Xenacanthiformes, a group of marine and freshwater sharks that diversified in the Devonian and were among the earliest to display defining TCC features. The co-occurrence of xenacanthid teeth in the same stratigraphic units supports this attribution. By filling a key gap in the cartilaginous fossil record, these findings provide new insights into shark cartilage characteristics.

Funding Sources Funding: NSF EAR 1943286

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

A new late Permian younginid bearing a tympanic fossa clarifies the cranial evolution of Neodiapsida

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Crown reptiles, or ‘Sauria,’ bear a suite of derived features that set them apart from their closest relatives, including key adaptations for tympanic hearing and streptostyly that likely evolved during their radiation in the late Permian. Two-dimensional fossil preservation and specialized ecomorphology among the closest extinct relatives of crown reptiles, the non-saurian Neodiapsida, has hindered our understanding of the origins of these features and the phylogenetic branching structure leading to the saurian radiation.

Here, we present data on a late Permian neodiapsid represented by several complete skeletons preserved in a burrow aggregation from the *Endothiodon* Assemblage Zone of South Africa (~258 Ma). This specimen was previously identified as juvenile *Youngina capensis* or more recently to *Akkedops bremneri* based on observations of external anatomy but is identified here as an entirely new taxon. High-resolution synchrotron microtomography data reveal a surprising combination of primitive and derived anatomy in apparent conflict with

current phylogenetic schemes of early reptile relationships. These include the presence of an upper temporal fenestra, the hallmark of neodiapsids among late Permian reptiles, but a tympanic fossa that extends over the quadrate, squamosal and quadratojugal, a feature present in coeval millerettid reptiles but is plesiomorphic compared to crown reptiles where this fossa is restricted to the quadrate.

An expanded phylogenetic analysis of early reptile relationships recovers this taxon as sister to *Y. capensis* and *A. bremneri* at the base of the Neodiapsida. These results expand the hitherto monospecific Younginidae and establish this clade as the earliest-recorded neodiapsids. A comprehensive restudy of several classical non-saurian neodiapsid taxa and other stem reptiles indicates that many features diagnostic of 'Sauria' evolved prior to the origin of modern reptiles, akin to the stepwise assembly of bird-like features among non-avian dinosaurs. These deep-time origins of 'saurian' anatomy invite reconsideration of whether these anatomical innovations led to the explosion of diversity of crown reptiles in the Mesozoic or were rather features inherited from their Permian ancestors.

Funding Sources European Synchrotron Radiation Facility proposals ES873 and LS3248; DSI-NRF African Origins Platform Grant #136516; NSF/GSA Graduate Student Geoscience Grant #13090-21

Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

Linking continuous to discontinuous variation in the increase of mammalian dental complexity

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The fossil record of mammalian molar teeth provides many examples of evolutionary increase in morphological complexity. Especially lineages specializing to eat fibrous vegetation have evolved molars with high number of cusps and crests. Developmentally, several genes required for normal patterning of teeth are known to affect molar complexity when mutated. In contrast to the evolutionary trends, the predominant effect of gene mutations is a decrease in dental complexity. A marked exception is *Sostdc1,* an inhibitor of two different signaling pathways. The null mutation of *Sostdc1* in mice causes formation of extra cusps and teeth. Phenotypically, however, many of the changes on molars go beyond what can be observed in the evolutionary diversity of rodents, or mammals in general. These 'hopeless monsters' leave open the question how increases in dental complexity are generated, and how incipient changes in development and morphology can lead to increase in the number of cusps and crests.

We examined the links between development and tooth complexity by gradually adjusting *Sostdc1* activity using CRISPR-Cas9 technology. First, we generated mice that lack either the *Sostdc1* gene or one of its regulatory regions, followed by crossing of the different mouse lines in order to obtain a gradation of *Sostdc1* activity. Next, we used topographic analyses to link continuous to discontinuous variation in tooth shape. The results show that with a partial inactivation of *Sostdc1*, cusp number increases in a manner that remains within the realized macroevolutionary realm of murine diversity. Additional topographic analyses show that the effects of incipient decrease in *Sostdc1* activity can be detected even in molars that otherwise appear normal. These measures link continuous to discontinuous changes in molar shape, suggesting that increase in dental complexity does not need to be an emergent property of dental variation. Rather, evolutionary increase in complexity may be preceded by selection on features already present. Our analyses of topographic variation in different species of rodents corroborate the inferences and provide potentially new tools to link micro- to macroevolution.

Funding Sources The FINDOS Doctoral Programme in Oral Sciences at the University of Helsinki and the Research Council of Finland.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Precise estimation of turning inertia (Lyy) in Late Cretaceous dinosaurs under varying postures and its biomechanical and ecological implications

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To analyze predator-prey interactions in Late Cretaceous dinosaur assemblages, ideally we need precise estimations on turning inertia (Lyy) with considerations of full anatomical complexity. Here we produced highly detailed, density-adjusted 3D reconstructions with extant anatomical referents for muscles and internal organs, and estimated turning inertia in two morphologically dissimilar *Tyrannosaurus rex* individuals: the stout FMNH PR 2081 ("SUE" ~14.17 m^2) and the slender USNM 555000 ("MOR 555, ~9.69 m^3), and contemporaneous prey, *Triceratops* (USNM PAL 500000, ~5.64 m^3 and a larger example ~10.70 m^3).

We calculate *T. rex* inertia in alternative postures (conventional horizontal vs. kangaroo-like), pivoting around a single hindlimb and considering major muscle group contributions. In natural-volume conditions, turning inertia about the hindlimb-centered axis ranged from 41,331–51,127 kg*m^2 for SUE, significantly larger than USNM555000 (30,319~38,943 kg*m^2). After normalizing SUE's volume to USNM555000's 9.69 m^3, SUE's inertia decreased markedly (21,967~27,1734 kg*m^2), suggesting robust morphotypes possessed higher relative maneuverability within their mass and volume constraints. Intraspecific variations reflect differing predatory strategies and ecological niche differentiation among *T. rex* individuals.

Turning inertia for *Triceratops* was assessed about multiple pivot points. For the average-sized specimen like USNMPAL50000, Lyy around the COM was 6,926 kg*m^2. If the limbs are used as the axis Lyy increased substantially to 11,561.7 kg*m^2~17,045 kg*m^2. Larger specimens displayed even greater variability: 19,740.3 kg*m^2 (COM). If the limbs are used as the axis, Lyy rises to 28,236 kg*m^2 ~41,156 kg*m^2. Such dramatic variation indicates previously underappreciated movement complexity in *Triceratops*, highlighting flexibility and size as key determinants of predator avoidance capability.

Cross-sectional muscle area, volume, body mass distributions. and achievable range of movement are all well-defined by our anatomically informed approach. It allows research to assess the capacity for maneuverability with significant variety in body configuration across poses. Second, different muscle attachment points allow more detailed estimations of muscle force and resulting increases in live body mass, providing a stringent framework for future multibody dynamic simulations of Late Maastrichtian predator-prey dynamics.

Funding Sources OSU CHS Startup to E.S.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A Late Cretaceous salamander from Songliao Basin, China, and evolutionary patterns of the cervical vertebra in lissamphibians

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Our understanding of salamander origins and early evolution has been significantly advanced by discoveries of Mesozoic fossils in Asia. Stem salamanders are documented from the Late Triassic to Early Cretaceous in Central and North Asia, while the earliest crown-group salamanders are primarily found in East Asia from the Middle Jurassic to Early Cretaceous. However, the absence of Late Cretaceous salamander fossils from East Asia has left a critical gap in our knowledge of this key period, when modern salamander families emerged.

Here, we describe a new salamander genus and species based on CT-scanned remains from the Late Cretaceous (Campanian) Nenjiang Formation in Nong'an County, Jilin Province, China. The material includes a fragmentary atlantal centrum and four long bones. The atlantal centrum exhibits diagnostic features of Hynobiidae, such as presence of a spinal nerve foramen, a broad and dorsoventrally thin interglenoid tubercle, a continuous articular facet on the tubercle's anterior and lateral surfaces, and an anterodorsally projecting spinal cord support.

This discovery bridges a ~110-million-year gap in the East Asian fossil record of Hynobiidae, spanning from the Early Cretaceous (Aptian) to the Late Miocene (MN9). We also review evolutionary and developmental trends in the atlas—a commonly preserved element in fossil lissamphibians. The interglenoid tubercle shows an evolutionary progression from absent to small to large, corresponding to a shift from cartilage-to-bone to bone-to-bone articulation between the atlas and skull. Additionally, spinal cord supports in the atlas, present in salamanders and caecilians, vary in position and orientation, providing valuable taxonomic insights for lissamphibians.

Funding Sources Start-up grants from the Institute of Vertebrate Paleontology and Paleoanthropology, and the Chinese Academy of Sciences

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Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

An organic and isotopic characterization of a concretion-entombed ichthyosaur: taphonomic insights into the Lower Jurassic Posidonia Shale (Germany)

Jian, Andrew J.[1], Schwark, Lorenz[2], Poropat, Stephen F.[1], Holman, Alexander I.[1], Brosnan, Luke[1], Diaz Mateus, Maria[1], Böttcher, Michael E.[3,4], Grice, Kliti[1]

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The Posidonia Shale of southern Germany is a renowned *Konservat-Lägerstatte* for ichthyosaurs. Their exceptional preservation is commonly attributed to prolonged anoxia/euxinia during the Toarcian Oceanic Anoxic Event (T-OAE; Early Jurassic 183–180 Ma). Although the Posidonia Shale is established as an anoxic, reducing paleoenvironment, there is growing paleontological and geochemical evidence for at least temporarily oxidative microenvironments enabling soft tissue preservation. Here, we describe the mineralogy, bulk organic matter, and stable isotope compositions of a concretion-enclosed *Stenopterygius sp.* specimen further mapped by computer tomography (CT), demonstrating evidence of microbial oxidation driving its exceptional preservation.

Rock Eval pyrolysis revealed the ichthyosaur's bones contained the most degraded and oxidized organic matter, in contrast with the high organic preservation in the shale, signifying the organic carbon of the bones was heavily altered via oxidation post-burial to early diagenesis. The calcitic concretion shows degraded biomass but

is not as oxidized as the bones. SEM-EDS and quantitative XRD established the bones are preserved as fluorapatite, with phosphatized vertebral collagen fibres and trabecula infilled with barite. Phosphatization requires slightly acidic conditions, and barite validates the presence of dissolved sulfate ions within the ichthyosaur's bones likely provided by sulfur-oxidizing bacteria (SOB) that oxidized hydrogen sulfide into sulfate.

SOB activity is further evidenced by elevated $\delta^{34}S$ and bulk $\delta^{13}C_{organic}$ values in the bones, but highly depleted $\delta^{13}C$ of the algal biomarker phytane. These stable isotope compositions indicate a complex microbial sulfur cycle by adding SOB metabolism during early diagenesis. Depleted $\delta^{13}C_{carbonate}$ values of the concretion indicate sulfate-reducing microbes (SRM) producing ^{13}C-depleted bicarbonate, which then precipitated as calcium carbonate, creating a protective concretion.

Our results show within the Posidonia Shale substrate, the bodies of marine vertebrates like ichthyosaurs served as the loci for a microbiome with SOB. SRM then facilitated rapid precipitation of the carbonate concretion around the ichthyosaur's remains, enabling exceptional preservation. A comprehensive 3D biomarker reconstruction is summarized to complement taphonomy interpretations and provide further paleobiological insights into *Stenopterygius* living during the T-OAE.

Funding Sources ARC Fellowship Laureate Grant to K. Grice (FL210100103), Australian Government RTP Scholarship, Curtin University HDR Student Grants, DFG Grant SCHW554/29 to L. Schwark.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New *Sclerocormus* specimens confirming differences in the dentition between Nasorostra and Omphalosauridae

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The Early Triassic basal ichthyosauriform *Cartorhynchus* and *Sclerocormus* form the monophyly Nasorostra, which is the sister taxon to Ichthyopterygia. They were unlike any other ichthyosauromorph by their autapomorphically short and pointed snout with rostrally extended nasals and weakly jointed jaw symphysis, enlarged wrist space of forefins, and a long tail while retaining a short trunk. New specimens of *Sclerocormus* were excavated recently from the Spathian of the Lower Triassic Nanlinghu Formation at Chaohu in Anhui Province, south China, at same quarry as the holotype was found but from the lower beds associated with abundant specimens of *Chaohusaurus*. They are like the holotype, large individuals compared with the sister taxon *Cartorhynchus*, with a deep and heavy-set body with taller dorsal neural spines. One complete skeleton is more than 2 m in length, and the holotype is just 1.6 m long. The well preserved skull has teeth, which were not observed on the holotype because they are completely concealed in lateral view. The teeth are small, rounded, and arranged in multiple rows, with roots and low crowns. They are mostly implanted on the maxilla and posterior dentary, as revealed by CT scanning of the skull of *Cartorhynchus*. Unlike *Sclerocormus*, the teeth of *Cartorhynchus* are perpendicular to the outer walls of the respective jaw rami and thus horizontally orientated.

The dentition of Nasorostra partly resembles that of *Omphalosaurus*. In both the teeth are rounded, low crowned, and thin-walled. But there are substantial differences between the two groups in tooth root structure, tooth orientation, and the nature of the jaw symphysis. Most teeth of Nasorostra are very small, possess a root with only one tooth per tooth position suggesting lateral tooth replacement, and are arranged in multiple rows. *Omphalosaurus* has large and anteriorly packed teeth, forming so-called tooth batteries without roots, and has no distinctive rows, but shows vertical overlapping suggesting vertical tooth replacement. Though both have rounded teeth, this single character does not provide reasonable support for treating Nasorostra as a synonym of Omphalosauridae.

Funding Sources Funding for this work was provided by the National Natural Science Foundation of China (NSFC).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Inner ear morphology of a tylosaurine mosasauroid from the Upper Cretaceous of North America

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Tylosaurinae is a subfamily of fully aquatic mosasauroids with a fossil record spanning from the Turonian to the Maastrichtian that reached cosmopolitan distribution. The earliest species from the clade, *Tylosaurus nepaeolicus*, is known from the lower Smokey Hill Chalk of Kansas, US. Mosasaur locomotion and aquatic adaptations have been extensively studied through postcranial morphology, particularly the limbs and pelvic region. However, little is known about the neuroanatomical and sensorial aspects that accompanied their transition to a fully aquatic lifestyle as secondarily adapted squamates. The inner ear is not only responsible for sound recognition, but also for orientation and balance perception. Here, we present a 3D reconstruction of the right labyrinth of a subadult specimen of *Tylosaurus nepaeolicus*, based on micro-CT data. Since the specimen is disarticulated, the bones were scanned separately and digitally assembled. The reconstruction reveals two main anatomical regions: the vestibular and the lagenar systems. The three endosseus semicircular canals that form the vestibular system are preserved. The lateral semicircular canal is housed by the prootic and exoccipital-opisthotic unit, while the anterior and posterior semicircular canals also involve the supraoccipital. The latter bone includes the dorsal portion of the anterior and posterior semicircular canals, as well as the common crus. All three canals are similar in size and shape, converging at the utricular region. In comparison with the slender and thin semicircular canals of *Platecarpus* and *Plioplatecarpus*, those of *Tylosaurus* appear more robust, and are strongly arched at their base. The fenestra vestibuli is located lateral to the prootic and exoccipital-opisthotic articulation. Ventral to the vestibule lies the well-developed cochlea. Two foramina for the vestibulocochlear nerve (CN VIII) are present: the anterior branch inserting upon the utricular region, and the medial branch of the nerve inserts upon the base of the cochlea. This study contributes to the limited neuroanatomical data available for mosasauroids by presenting a detailed overview of inner ear morphology and a new 3D reconstruction of the labyrinth in *Tylosaurus nepaeolicus*. The results provide new insights into the sensory adaptations with implications for locomotion and behavior that likely played a key role in the evolutionary success of Mosasauroidea.

Funding Sources Deutsche Forschungsgemeinschaft (DFG) JI 405/1-2 to PJH.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Evidence of temporal variation in pterosaur flight style

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Pterosaur flight is well studied, but typically with a focus on one to two individual species. However, with the exception of one study, broader changes in flight style through time remain under-explored. This study analyses the glide ratio, aspect ratio (AR = wingspan^2/wing area) and wing loading (WL = weight/wing area) across the two pterosaur suborders: rhamphorhynchoids and pterodactyloids, as well as fossil age to examine temporal shifts in gliding efficiency and wing shape. Glide ratio quantifies forward movement relative to sink rate, with a higher ratio indicating better gliding efficiency. Both AR and WL are indicative of wing performance. Higher values of the former indicate a low drag gliding wing and high values of the latter, a wing more suited to fast flapping manoeuvrable flight. Fossil specimen age was the largest contributor to changes in the glide ratio, AR and WL, with all three variables increasing with decreasing specimen age. Glide ratio, AR and WL were generally higher in derived pterodactyloids than in basal rhamphorhynchoids. The rate of increase in AR and WL were 6.8 and 5.9 times higher, respectively, in pterodactyloids than rhamphorhynchoids. In contrast with previous studies, suborder alone did not have a measurable impact on AR and WL. Our findings suggest that pterosaur wing morphology evolved in tandem with shifts in ecological niche. Basal pterosaurs inhabited forests, while derived pterodactyloids occupied more open aquatic environments. A more open environment coupled with increasing body size may have driven a shift from smaller wings suitable for manoeuvrable flight to wings better suited to efficient gliding or soaring.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Traumatic face-biting in a teleosauroid crocodylomorph and implications for conspecific interactions

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Modern crocodylians display a variety of inter- and conspecific aggressive behaviors including threat, attack and submission. These behaviors, usually displayed by males, occur in fighting during dominance displays, territorial disputes and competition for mates, often leading to injury, amputation or death. One commonly recorded behavior is conspecific face-biting, with the pre-orbital regions being frequently targeted areas. While conspecific interactions are well recorded in living crocodylians, they are relatively scarce and often difficult to interpret in the fossil record, and rarely documented in fossil crocodylomorphs.

Lemmysuchus obtusidens is a large-bodied teleosauroid crocodylomorph from the Middle Jurassic Oxford Clay of the UK. The holotype specimen exhibits a total skull length of ca. 1.2 m, and has previously been reported as having a single tooth, of unknown affinity, penetrated within the cranium. To test whether this injury represents a rare instance of face-biting behavior in a fossil crocodylomorph, we reexamined the holotype of *Lemmysuchus*, looking for potential additional traumatic injuries and to assess the taxonomic affinities of the penetrating tooth. In addition to direct observation of potential bite marks, we used multiple angles and sources of light to examine the tooth puncture, as well as the visible enamel of the penetrating tooth.

Lastly, we produced a three-dimensional (3D) photogrammetric model of the skull, to further assess the bite marks using elevation (false-color depth) maps.

We documented multiple perimortem fractures and bite marks on the skull, both in the cranium and mandible (but absent in all associated postcranial elements), some of which were sequentially positioned at an obtuse angle and with a similar elevation, suggesting a single biting event. The cranial bite marks had a measured inter-tooth spacing more consistent with a thalattosuchian than another marine reptile. Due to the perceived ferocity of the attack, the size and hypothesized habitat of the afflicted individual and the relative bite force needed to inflict a deeply embedded tooth, we interpret the injuries as having been inflicted by a conspecific. The nature of the injuries, as well as the lack of healed bone, suggests that the attack may have proved fatal. This occurrence provides evidence of extreme conspecific aggression and face-biting behavior in the crocodylomorph lineage dating back at least as far as the Jurassic.

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Testing the critical failure of Paraloid B-72 under various stresses

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Paraloid B-72 is a common consolidant and adhesive in paleontological preparation. It is usually mixed with an acetone or ethanol solvent in a weight/volume ratio with <20% solutions considered consolidants and >50% solutions considered adhesives. Some testing on adhesives has been done previously, and Paraloid B-72 was found to be the strongest, most versatile, and most reversible. However, most studies tested Paraloid-B-72 only in tension. This study assesses the strengths of different solution percentages of Paraloid B-72 in acetone, and tests different types of forces to see which application each concentration was best suited for.

We made four (4) solutions of Paraloid B-72 in acetone mixed by weight/volume ratio, with a 10% solution consisting of 10 grams of Paraloid B-72 dissolved in 100 ml of acetone. We repeated these steps to make 20%, 40%, and 60% solutions.

Limestone blocks were roughly cut into 10x5cm blocks with a 2.5cm thickness to serve as fossil analogues and adhered with the different concentrations of Paraloid B-72. Weight was then added to the blocks in each loading regime until the bond failed. Each test was performed multiple times, and the results were taken as an average.

We hypothesized that the lower the concentration of Paraloid B-72, the less stress it could withstand, and that torsion would result in fastest failures, and these hypotheses are corroborated by our results. The 10% solution was on average the weakest and 60% strongest across all forces applied, and tension was by far the most likely to cause fast failures. These newly acquired data are a useful tool to aid fossil preparators and conservators to choose the best concentration of adhesive or consolidant to fail before the fossil would when met by corresponding anticipated stresses.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Digital cranial and inner ear endocasts of *Hoplophoneus primaevus* and new implications for nimravid hunting behaviour

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The Nimravidae, an extinct group of sabertooth cat-like carnivorans known from the late Eocene to Miocene, are likely the sister taxon to all other Feliformia. Despite a wealth of fossil specimens, the hunting strategy of dirk-toothed hoplophonines such as *Hoplophoneus primaevus* remains debated because their hypertrophied upper canines imply a specialized predation style with no modern analogue. Traditionally considered an ambush predator based on limb morphology, our study re-evaluates this interpretation using micro-computed tomography (microCT) of the endocranial cavity and inner ear. Serving as a proxy for balance and locomotion, inner ear morphology provides insight into agility and hunting behaviour.

We provide a detailed analysis of the endocast, inner ear, and associated structures, offering new insights into the neurosensory anatomy and ecological adaptations of *Hoplophoneus primaevus*. The brain endocast reveals an expanded neocortex and a well-developed sulcal pattern, including three major sulci and additional spurs in the auditory region. The ectosylvian sulcus is asymmetrical between hemispheres, and more complex than in the contemporary scimitar-toothed nimravid *Dinictis*. The cerebellar region is characterized by a large neocerebellum and a closed subarcuate fossa. A principal component analysis (PCA) of the inner ear endocast morphometry compared with those of extant carnivorans challenges the previous assumption of the hunting style of *H. primaevus.* Instead, the morphometry of the bony labyrinth points towards a more active hunting strategy, clustering together with extant pounce-pursuit hunters such as *Canis aureus* and *Vulpes vulpes*.

Notably, the differentiation and asymmetry of the ectosylvian sulcus—which governs the complexity of the auditory cortex in extant carnivorans—may support these findings. Lateral asymmetry has been found in another *H. primaevus* endocast, possibly reflecting a trend toward lateralization. These findings together might hint at a complex predatory behaviour in *H. primaevus* consistent with broader trends toward increased cursoriality among nimravids and other carnivorans during the transition to more open habitats in the Oligocene. The first reconstruction and analysis of a nimravid inner ear suggests unexpected agility for *H. primaevus* offering new perspectives on nimravid predation and contributing to broader discussions on the evolution of cursoriality in Oligocene carnivorans.

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

What use is a vertebra? Understanding the ecomorphological utility of isolated serial elements

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Inferring the ecology of extinct organisms from the morphology of their fossilized skeletal remains (ecomorphology) is a key objective of palaeontology. Traditionally, ecomorphology has focused on well preserved elements such as teeth for diet and ankle bones for locomotion. While complete vertebral columns are rare, isolated vertebrae are relatively common in the fossil record and have the potential to add new information to our ecological interpretations. However, some basic questions remain unanswered: Can a single vertebra be used for ecomorphological analysis? If so, which vertebrae show the best ecological signal? If not, how many vertebrae need to be preserved? To address these questions, we examine the ecomorphology of isolated and combined vertebrae in Carnivora. We quantify 3D shape in ten presacral vertebrae of 43 species (n=52, nVert=520) using geometric morphometrics in response to locomotor mode, hunting style, and running speed. The ecological signal was compared among vertebral regions (cervical, thoracic, lumbar), specific positions, and

different combinations of vertebrae, using PERMANOVA and phylogenetic generalized least squares (PGLS).

Overall, vertebral shape most strongly correlated with running speed, clearly distinguishing slow from fast runners. Surprisingly, isolated vertebrae often performed as well as, or out-performed multiple vertebrae when comparing effect sizes of ecological signal. Further, we found that ecological signal was distributed broadly throughout the column and not restricted to a single region. This is very encouraging for the potential for vertebrae as ecomorphological indicators. To demonstrate this idea, we estimate running performance from vertebral morphology using isolated vertebrae of *Canis dirus*, the dire wolf. We compare the predicted ecology from different vertebrae using Cannonical Variates Analysis (CVA) and Mahalanobis distances. This study sets out a framework for quantitatively analysing isolated vertebrae, or other serial elements, in ecomorphological studies and demonstrates their potential as an underutilized resource in paleontology.

Funding Sources This work was funded by a Royal Society University Research Fellowship awarded to KJ and a Leverhulme Early Career Fellowship awarded to JS.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The fossil vertebrate collections at the Natural History Museum, London, UK

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The vertebrate paleontology collection at the Natural History Museum, London (NHMUK) is globally important. It comprises over 500,000 fossil specimens, including more than 350,000 mammals, 100,000 fish,15,000 amphibians, 11,000 bird, 25,000 reptiles and early amniotes. These range from isolated bones to complete skeletons, natural moulds, trace fossils, eggs, and rare soft tissues, with sizes spanning from <0.05mm to >10m. Large fossil vertebrate skeletons have featured prominently in NHMUK gallery displays since its opening in South Kensington in 1881. The collection encompasses every major taxonomic group, epoch, and continent. It includes type and figured specimens as well as material from historically significant sites such as Solnhofen, Gogo, Joggins, Jarrow, Wellington Caves, Dorset, UK Triassic fissures, Fayum, Thames Valley, and European cave sites. Notable figures such as Mary Anning, Charles Darwin, Arthur Smith Woodward, Dorothea Bate and Hugh Falconer have made significant contributions to the collections. The collection continues to grow through targeted acquisitions, whilst adhering to legal and ethical frameworks. This extensive and scientifically valuable collection is in high demand, receiving over 500 visitors annually and thousands of remote enquiries from researchers, students, artists and amateur enthusiasts. However, facilitating access is not without challenges. Some specimens are fragile, difficult to move or mounted in inaccessible exhibits. Others are tied up in major institutional projects, such as gallery renovations and collection moves. To address these constraints and enhance long-term accessibility, we have launched several innovative initiatives. These include digitisation strategies that prioritise preservation and accessibility, using CT and laser/structured-light scanning and photogrammetry. These technologies support the creation of digital surrogates, improve transport planning for complex specimens, reduce handling, aid conservation, enable digital loans and reproductions for outreach. Digitisation often involves collaboration with NHMUK's Imaging Lab and visiting researchers. As of May 2025, over 800 specimens have been made available through MorphoSource and Sketchfab, with numbers steadily increasing. Additionally, new sampling projects, such as extracting nannofossils from Chalk matrix, are helping to refine the stratigraphic resolution and

provenance of historic specimens, unlocking valuable ‘dark data’.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Middle Jurassic fossils from Kirtlington, England, UK, document small terrestrial salamander

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Salamanders are model organisms for understanding life history and locomotion but the origin and early history of the total-group (Caudata) remains poorly known. The Triassic record is restricted to *Triassurus* from Kyrgyzstan, the Early Jurassic record is undocumented, and the Middle to Late Jurassic record includes *Urupia*, *Egoria*, and *Kiyatriton krasnolutskii* from Russia, *Kokartus* from Kyrgyzstan, and *Marmorerpeton* and Salamander-A from the UK. All of these salamanders were aquatic and neotenic except perhaps *Ki. Krasnolutskii* based on the appendicular material known for the Cretaceous *Ki. leshchinskiyi*. Here we investigate the small enigmatic Salamander-B: previously reported but not described. Material includes isolated 3D bones (12 atlantes, 13 dorsal vertebrae, a quadrate, three exoccipitals, a prootic, a scapulocoracoid, and a femur) from the Bathonian, Middle Jurassic (169.6–164.9 Ma), White Limestone Formation, of Kirtlington (England, UK). All of the bones can be referred to a salamander (SVL ~50 mm) distinct from other Lissamphibia known from the same locality. The atlas has oval cotyles separated by a broad prominent interglenoid tuberosity and open spinal nerve grooves. The relatively long dorsal vertebrae have centra bearing small basapophyses and dorsal parasagittal grooves, and single headed transverse processes perforated by arterial canals. The quadrate is well-ossified with a kidney-shaped articular facet. The prootic preserves the basal facet and path of CN VII and resembles that of hynobiid salamanders. The scapulocoracoid is well-ossified with a well-defined cup-like glenoid, whereas the femur is slender with a well-defined ventral crest, ventral trochanter, and posteroventral prominence. Both elements resemble those of terrestrial species from disperate crown-group families (e.g., Hynobiidae, Ambystomatidae). We employed a new phylogenetic analysis, greatly expanded from previous works (413 characters and 70 taxa: seven dissorophoids, 17 non-urodele lissamphibians, 24 fossil salamanders, and 22 extant salamanders), analyzed in MrBayes 3.2 with a relaxed MkV model of character state transitions, independent gamma branch rates, and a fossilized birth-death tree prior. Salamander B is recovered just outside the crown, as the sister taxon to *Kiyatriton*, with good support (0.80). This material confirms that there were terrestrial salamanders in the Middle Jurassic and helps inform character polarity for the crown-group (Urodela).

Funding Sources Leverhulme Research Project Grant RPG-2018-381 (Pro.550474; no.178055 to SEE and RBJB) and The Russian Foundation for Basic Research (Pro.23-24-00098 to PS).

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

Subfamily-level relationships within Nyctitheriidae (Mammalia, Eulipotyphla) illuminate patterns of dispersal and evolution in a group of Paleogene insectivores

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Nyctitheriidae are a family of small, insectivorous Paleogene mammals known primarily from Asia, North America, and Europe. Originally aligned with Chiroptera, they have since been thought to belong to Euarchonta, or most frequently, Eulipotyphla. Multiple subfamilies have been erected since the early 1900s: Asionyctiinae, Eosoricodontinae, and Praolestinae are restricted to the Paleocene and Eocene of Asia; Amphidozotheriinae and Saturniniinae are known from the late Eocene to Oligocene of Europe; and Nyctitheriinae and Placentidentinae are known from the Paleocene and Eocene of both North America and Europe. We evaluated the relationships among Nyctitheriidae using a new morphological matrix designed specifically to evaluate relationships between early Cenozoic insectivorous mammals. Included in this analysis are several previously undescribed nyctitheriid species from the middle Paleocene (Tiffanian 2) of Wyoming, USA, representing some of the oldest taxa currently known. Our results suggest that the origins of the group and earliest diverging lineages are Asian, although in contrast to previous analyses, we find a paraphyletic Praolestinae to comprise the most basal taxa. Placentidentinae and the European subfamilies Amphidozotheriinae and Saturniniinae were mostly monophyletic and nested within a paraphyletic Nyctitheriinae. We find *Leptacodon tener* and one of the unnamed early Tiffanian taxa to form a clade with some traditional members of Asionyctiinae, suggesting multiple dispersals between continents in the early Cenozoic. Asionyctiinae itself appears to be paraphyletic, with *Asionyctia gaoi* representing an early diverging nyctitheriid and such genera as *Voltaia* and *Oedolius* nested among later diverging North American and European taxa. This work constitutes a significant step in unraveling nyctitheriid relationships and taxonomy.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Vertebral functional morphology informs tail use in sthenurine giant kangaroos

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Pleistocene kangaroos reached masses far above those achieved by the largest kangaroos today, raising questions about their locomotor abilities. Previous studies have suggested that these ‘giant kangaroos’ could not have hopped and that they may have used gaits such as bipedal striding to compensate. Here, I use the vertebral column, an under-studied but important element of kangaroo locomotion, to further investigate the locomotor abilities of these Pleistocene giants. I combine *ex vivo* biomechanical experiments on extant kangaroos, comparative morphology using geometric morphometrics (GMM), and theoretical and digital modelling of extinct species to ask how does vertebral function and morphology vary among locomotor modes in extant species, and how can this inform our understanding of Pleistocene giant kangaroos, in particular the sthenurines?

Extant large-bodied hopping kangaroos use pentapedal locomotion at slow speeds, recruiting the tail as a fifth limb. I examined the functional adaptations of kangaroo tails by comparing joint range of motion (ROM) and stiffness of pentapedal kangaroos (ROM n=7, stiffness n=5) with generalist hoppers (ROM n=3, Stiffness n=2) using mechanical testing of cadaveric specimens in an instron machine. I found that pentapedal species display both greater range of motion and greater stiffness of the proximal tail in ventroflexion than non-pentapedal species, suggesting large but controlled movements during tail touch down. Similarly, comparing 3D vertebral shape of extant species (n=67), I found that pentapedal species are also distinguished from more generalist kangaroos in the proximal tail region, primarily in their reduced transverse

processes. The Pleistocene short-faced sthenurines (GMM n=6) had proximal tail vertebrae which are markedly different to those seen in today's large, pentapedal hoppers; instead, they more closely resemble the tails of the arboreal kangaroos, the only extant group known to occasionally use bipedal striding at low speeds. Further, preliminary digital modelling of vertebral mobility supports this finding, indicating lower ventroflexion ROM in the proximal tail of sthenurines than extant pentapeds. Together, my results suggest that sthenurines would not have the mobility in the proximal tail to recruit it into pentapedal gaits, providing strong support for bipedal striding as their primary slow gait.

Funding Sources Funding for this project was provided by the BBSRC, DTP Studentship grant reference number: DTP3 2020-2025 entry - BB/T008725/1

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Non-avialan theropod dinosaur mass reconstruction from bone measurements by machine learning

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The estimation of dinosaur body mass is crucial for understanding their biology, ecology, and evolution. Traditional volumetric-density or extant-scaling approach, demands high specimen completeness or relies on allometric relationships from extant taxa that may not accurately reflect dinosaur morphology or ecology, and both approaches face challenges in cross-specimen comparisons. The body mass of non-avialan theropod dinosaurs ranges across five orders of magnitude (<1 kg to ~10 tons), and modern vertebrate faunas lack similar body form with horizontal vertebral column and bipedalism. Here, different machine learning-based approaches and ensemble learning are used to address these challenges. With a dataset covering 1388 non-avialan theropod measurements from published literature, three neural networks are trained to extract patterns between osteological measurements and mass and min-max mass difference, and specimen completeness is encoded as part of the input to account for missing data. Our model reaches an accuracy of 0.97 and F-1 score of 0.84, enabling reasonable mass estimations for incomplete fossil specimens, significantly reduces the time required for three-dimensional (3D) digital model reconstruction, and provides a novel tool for inter-specimen body mass comparison. Our findings offer a broadly applicable framework for estimating body mass across extinct vertebrates, especially those where fossil completeness is limited.

Funding Sources Chengdu University of Technology.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Enamel microstructure in Eocene Sparnotheriodontidae (Mammalia, Litopterna) from Antarctica and southern South America

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This research investigates the postcanine enamel microstructure in three Eocene Sparnotheriodontidae species—*Notiolofos arquinotiensis*, *Phoradiadus divortiensis*, and an indeterminate Sparnotheriodontid—and compares them to other early-diverging South American Native Ungulates (SANUs) that exhibit vertical Hunter-Schreger bands (HSB). All examined sparnotheriodontid species display vertical HSB within a tripartite schmelzmuster

structure, including inner and outer radial enamel and thick HSB with broad transition zones—features that contrast with the narrow transition zones in most other taxa in our comparative dataset, except *Astrapotherium*. The Andean species *Phoradiadus divortiensis* shares several enamel characteristics with Antarctic *Notiolofos arquinotiensis*, such as acute-angled interprismatic matrix (IPM) in the inner radial enamel and the HSB; and prism-parallel IPM in the outer radial enamel and enamel thickness with Antarctic Sparnotheriodontidae indet. Uniquely, *P. divortiensis* displays both steep- and low-angle prism inclination in the outer radial enamel—absent in other SANU taxa—further supporting the highly derived nature of Sparnotheriodontidae within Litopterna. No significant schmelzmuster affinities are observed between Sparnotheriodontidae and other litopterns described in prior studies, despite their taxonomic allocation to the order based on gross dental morphology. Nevertheless, enamel microstructure does not contradict the placement of Sparnotheriodontidae as an apomorphic clade within South American Litopterna. On the other hand, the possible litoptern family Didolodontidae is characterized by plesiomorphic traits such as absence or transverse orientation of HSB, and therefore occupies a basal position. Comparisons with Astrapotheria, *Carodnia vieirai* (Xenungulata), and *Pyrotherium romeroi* (Pyrotheria) highlight Sparnotheriodontidae as one of the oldest litoptern lineages to evolve a schmelzmuster with exclusively vertical HSB, reinforcing their distinct evolutionary trajectory within the Eocene South American Native Ungulate radiation.

Funding Sources Carl Tryggers Foundation; Swedish Research Council; Universidad Nacional de La Plata.

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

A new species of *Dolichuranus* from the Manda Beds of Tanzania and dicynodont diversity through the Triassic

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The Lifua Member of the Manda Beds (Ruhuhu Basin, Tanzania) preserves a diverse Triassic tetrapod assemblage consisting primarily of archosauromorph reptiles and therapsid synapsids. Recent fieldwork indicates faunal variation between different levels of the Lifua Member; in particular, a rich bone bed (Z183) excavated from the lowermost Lifua Member features a unique assemblage of temnospondyl, therapsid, and reptile taxa including the early bird-line archosaur *Teleocrater*. Here we present a new species of large kannemeyeriiform dicynodont from Z183, which we refer to the genus *Dolichuranus*, a taxon previously known by the type species *D. primaevus* from the Omingonde Formation of Namibia. The new species is represented by at least six individuals, including multiple crania and postcranial elements documenting nearly the entire skeleton and constituting a growth series. These specimens show a suite of characters considered autapomorphic for *Dolichuranus*, including a trough-like depression on the dorsal surface of the snout tip, ventral extension of the interchoanal portion of the vomer, and exaggeration of the tympanic ridge on the occiput. However, the new species can be distinguished by hypertrophy of the caniniform process (to a degree similar to *Sinokannemeyeria*), anteroposterior expansion of the postorbital bar, presence of a broad, median nasal ridge, and absence of an anterior frontal process. The Manda Beds exhibit a remarkable diversity of dicynodonts and archosaurs relative to South African assemblages traditionally regarded as roughly coeval. This is likely due at least in part to time-averaging (with

multiple temporally distinct assemblages making up the "Manda Beds fauna"), but is also reflective of actual radiation following the recovery of terrestrial ecosystems after the Permo–Triassic Mass Extinction (PTME). Although the Manda represents an extreme for African Triassic assemblages, comparable kannemeyeriiform diversity is observed in Eurasian Middle Triassic faunas. Although small-bodied dicynodonts were nearly eradicated by the PTME and never recovered, large-bodied dicynodonts had recovered levels of taxonomic richness comparable to that observed in the Permian by the Anisian-Ladinian. The assembly of this diversity remains poorly understood, although renewed fieldwork in eastern Africa and China is helping illuminate the early history of the kannemeyeriiform radiation.

Funding Sources NSF EAR-1337569 and EAR-1337291, NSF EARPF-2304875, and Nat Geo 9606-14 (to S.J. Nesbitt)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A total evidence phylogeny of Carcharhiniformes sharks since the Cretaceous using dental morphological characters and genomic data

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Total evidence phylogenetics is a powerful tool allowing the inference of time-calibrated phylogenies of extant and extinct lineages utilizing both morphological and genomic data in a single framework. Historically, total evidence phylogenetics has not been used on sharks due to the limited morphological data available, with teeth being the predominant piece of anatomy preserved in the fossil record. Additionally, tooth morphology is less frequently used to infer evolutionary relationships due to the high variability of tooth features influenced heavily by changing feeding ecology. Despite the phenotypic variability, past work has demonstrated that shark dental morphological data can provide phylogenetic resolution down to the species level in some taxa. Here, we provide a new total-evidence phylogeny of Carcharhiniformes sharks that incorporates 211 sequences from 16 loci along with 226 dental characters for 174 extant and fossil taxa. The characters encompass continuous and discrete data across all tooth positions on both the upper and lower jaws. All analyses were run in MrBayes (version 3.2.7a) using variable rates with a gamma rate prior and various partitioning schemes. Mitsukurina owstoni was used as the outgroup with a fossilized-birth-death clock model, and nodes calibrated using an offset exponential distribution for each fossil taxon. The phylogeny recovers Carcharhiniformes as a monophyletic clade, but fails to resolve the included lamniforms from the squaliform species. Following recent molecular phylogenies, the genus *Carcharhinus* is paraphyletic. The inclusion of fossil taxa assigned to this genus outside of Carcharhinidae completely demonstrates the complexity of using dental traits exclusively in reconstructing the phylogenetic relationships of sharks. This result shows potential convergence among families of carcharhiniforms. However, in a specific example of clean phylogenetic resolution, the genus *Glyphis* forms a monophyletic clade and shows a diversification time between *Glyphis siamensis* and *Glyphis garricki* at about 14 mya. This is different from the recent molecular phylogenies that did not include *Glyphis siamensis* and instead show *Glyphis garricki* and G*lyphis glyphis* diverging at about 14 mya. This work corroborates the centuries of research showing that shark teeth contain diagnostic power, and, when combined with genetic information, can more accurately test

phylogenetic hypotheses of one of the oldest marine lineages.

Funding Sources Paleontological Society, North Carolina State University

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Cranial re-description of the early diverging iguanodontian (Rhabdodontomorpha) *Tenontosuarus dossi:* a case study of distinguishing biodiversity in the fossil record

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Tenontosaurus is an ornithopod dinosaur from the Early Cretaceous (Aptian-Albian) of North America represented by numerous skeletons collected since the 19th century. Due to the large sample size, *Tenontosaurus* was among the first dinosaurs to undergo studies of growth modeling, reproductive physiology, and biomechanics. Two species are recognized from three geologic formations: the type species, *Tenontosaurus tilleti*, from the Cloverly and Antlers Formations, and its sister taxon, *Tenontosaurus dossi,* from the Twin Mountains Formation. The latter is known from two specimens with nearly complete skulls and partial postcranial skeletons. In light of new specimens and taxa described in the past 30 years and to better understand the ecomorphological diversity of the Tenontosaurus clade, we reevaluated the cranial anatomy of *T. dossi*, providing a suite of cranial characters that diagnose this species. These include reniform-shaped antorbital fenestra formed by a dorsoventrally constricted maxillary dorsal process, a sinusoidal and expanded profile of the cristae tuberalis, long strap-like anterior expansion of the squamosal between the parietal and prootic, a posteroventrally tapering squamosal process of the postorbital, and club-like premaxillary lateral process, among others. Our ongoing investigation of *T. dossi* via CT imaging addresses contentious characters such as the presence of premaxillary teeth, and position of the supraoccipital nuchal crest, allowing novel comparisons to its sister species. Our reexamination of *Tenontosaurus dossi* provides key insights into the ecomorphology of these closely related species—*T. dossi* appears more robust than *T. tilleti* specimens from the laterally equivalent Antlers Formation, which when combined with postcranial autapomorphic anatomy, could indicate differing dietary preferences as suggested for some hadrosaurids. Finally, documenting spatiotemporal ranges in the *Tenontosaurus* species complex is vital as a baseline comparison for understanding changing biodiversity trends in Cretaceous ecosystems of North America before and after the Cretaceous Thermal Maximum (e.g., contrasting the seemingly wide distributions of mid-Cretaceous dinosaurs to the narrow ranges seen in Campanian–Maastrichtian species).

Funding Sources Funding provided by a National Science Foundation award #1925973 (LEZ).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

3-D modeling through a paleobiological lens: evaluating iPhone photogrammetry for assessing oral morphological complexity (via OPCr) in extant turtle skulls relative to micro-CT and DSLR techniques

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Due to substantial advancements in camera sensor technology and image processing software, three-dimensional modeling has become a staple of paleobiological research. Such photogrammetry techniques offer a straightforward and relatively low-cost method for capturing key anatomical structures for precise measurements and morphological analysis. Oral morphological complexity has been noted to strongly correlate with an animal's dietary patterns across biological, paleontological, and dental literature. Though such techniques are becoming increasingly popular, a gap persists regarding their implementation, efficacy, and accuracy for analyzing specimens compared to more traditional methods, such as micro-CT scanning. In this study, we aim to fill this gap and explore a reliable, widely accessible tool to quantify a biologically meaningful trait. For our study, we utilized 19 extant turtle skulls ranging from 1.5 cm wide *Terrapene Carolina* to 11 cm wide *Macrochelys temminckii*. We digitized these skulls using the ultra-wide lens of modern iPhones and the photogrammetry software Abound to create precise anatomical renderings. We then isolated the occlusal surface of these renderings to conduct an Orientation Patch Count Rotated (OPCr) analysis, which quantifies the oral morphological complexity of each specimen. Finally, we compared our results with OPCr values obtained using micro-CT scanning and traditional photogrammetry techniques involving DSLR cameras. Our initial findings suggest that, although both forms of photogrammetry can struggle to produce accurate surface scans of brighter or more reflective specimens, models created using an iPhone and Abound software produce results comparable to those obtained using micro-CT scans, regardless of specimen size. These findings highlight the potential for widespread adoption of accessible and affordable photogrammetry methods in paleobiological research, broadening the accessibility of 3-D data collection and analysis.

Funding Sources University of Washington Department of Biology; Stephen and Ruth Wainwright Endowed Fellowship, University of Washington; Cohen Award, Society of Vertebrate Paleontology

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A review of geological, floral and faunal changeover across Paleogene-Neogene boundary, along selected transects, Kutch Basin, Western India

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The Kutch Basin, of Gujarat, Western India, is host to a diverse species of invertebrates and vertebrate faunas, along with Palynofloras and megafloras. These fossils are all Cenozoic in age. The Cenozoic is divided into Paleogene and Neogene, and understanding the faunal and floral changes across the Paleogene–Neogene boundary (P–N boundary) is necessary to understand the change in ecology across the boundary. The integrated model (Section 1.1.5) describes how the ecosystem of the Paleogene of the Kutch basin changes towards the Neogene and uses evidence to explain the same. Our objective is to observe possible chemical anomalies across the Oligocene-Miocene boundary, create a Shallow Benthic Zonation map of the Miocene of Kutch, and proceed further to determine the age of the Miocene beds. In this work, we report a new family of Ebenaceae from the Early Miocene ferruginous beds of Kutch, the species of which are not found in the Paleogene. We also report a conglomerate that demarcates the boundary between the Oligocene Maniayarafort formation and the Miocene Khari Nadi Formation. It is observed that the Paleogene deposits were mainly carbonate-dominated and enriched with Larger Benthic Foraminifera (LBFs) of a larger test size, and the Neogene deposits are siliciclastic in nature, with fewer foraminifera and a smaller test size. Palynofloral evidence suggests that the ecosystem in the Paleogene was shallow marine, and in the Neogene it is terrestrial freshwater. In the Eocene, large

amounts of fossils of marine mammals, such as cetaceans, have been recorded. In Oligocene formations, the dominant faunas are corals and echinoids. The Miocene period is associated with a newer family of microfossils, fossilized tree roots, and land mammals. It is hypothesized that the Paleogene-Neogene transition is a two-phased process, which initiated in the Eocene–Oligocene boundary, Upper Eocene, and the second phase started in the Oligocene–Miocene boundary, Upper Oligocene. The transition consists of the migration of mammals and the appearance of a newer family of foraminifera and the occurrence of silicified trees of the Ebenaceae family, implying a change of ecology from shallow marine conditions in the Paleogene to terrestrial freshwater conditions in the Neogene.

Funding Sources Council of Scientific and Industrial Research, Junior Research Fellow.

Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

Blasting dinosaurs in Brussels: tracing the taphonomic history of Cretaceous bonebeds using µXRF and LA-ICP-MS

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High-resolution, micrometer-scale, geochemical techniques were introduced in the field of vertebrate paleontology more than 15 years ago, but their applicability remains largely underexplored. In contrast to most modern and archeological bone material, pre-Holocene vertebrate remains are often enriched in rare earth elements (REE), which provide a record of the post-mortem diagenetic history. This makes fossil bone and teeth ideal candidates for taphonomic studies using micro-X-ray fluorescence (µXRF) and Laser-Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS). Here, we present a novel, rapid workflow to investigate fossil bonebed material using an integrated approach of high-resolution (25 µm) µXRF element mapping and LA-ICP-MS profiling, combining a Bruker M4 Tornado µXRF and a Teledyne Photon Machines nanosecond 193 nm ArF* excimer-based Iridia laser ablation system coupled to an Agilent 8900 ICP-MS/MS Advanced Applications at AMGC-VUB in Brussels. We focused on well-preserved dinosaur bone thick sections from (1) a large bonebed of *Triceratops* from the Upper Cretaceous Lance Formation of Wyoming (USA) and (2) the famous Bernissart *Iguanodon* bonebed from the Lower Cretaceous Sainte Barbe Formation of Belgium.

The workflow involved selection of longbones for histological thin sections, while using the remaining thick sections for µXRF mapping to screen for diagenesis and to select optimal locations for LA-ICP-MS transects. The LA-ICP-MS transects (from the outer cortical bone inwards) yielded rapidly declining concentration profiles for all REEs throughout the *Triceratops* bonebed, suggesting that the skeletal remains experienced rapid burial with minimal pore-fluid interactions in a river floodplain setting. Combined with well-preserved bone microtextures and local sedimentology, these REE profiles provide independent evidence for a mass mortality event of a group of animals. This might hint to complex gregarious behavior in *Triceratops*, which has not been documented before. In the case of the Bernissart bonebed, similar rapidly declining REE profiles were observed, albeit lower in absolute concentrations and with lower REE ratios such as for La/Yb. This implies a rapid burial in a lacustrine environment. These datasets open opportunities to study in a rapid manner with limited sample damage a large number of fossil bone and teeth to infer the paleobiology, habitat and fossilization processes of extinct vertebrates through time.

Funding Sources Wim Borremans (VUB-AMGC) provided assistance with LA-ICP-MS measurements. BELSPO project *Iguanodon* 2.0 and FWO Hercules Program provided financial support.

Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

Visual inputs drove neocortex size increases in crown primates: evidence from a comparative analysis of extant and fossil euarchontan endocasts

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Neocortical expansion is a hallmark of crown primates compared with other euarchontan mammals and of haplorhines compared with other primates. The frontal lobe, which is associated with executive control of diverse behaviors, is commonly discussed as a target of selection during primate evolution. Here we trace evolutionary changes in neocortical size and proportions within a Bayesian phylogenetic framework. We utilize virtual endocasts of living and fossil euarchontans, including endocasts of all 83 extant primate genera, four Eocene adapoids, three Eocene omomyoids, and five stem and crown Oligocene–Miocene anthropoids, as well as plesiadapoid, scandentian, and dermopteran outgroups. The volume of each endocast and surface areas of the neocortex and its frontal lobe and non-frontal lobe components were measured. The accuracy of these measurements was validated against histological measurements from the literature. We find that neocortex size relative to endocast volume increased in all major primate clades, with the most rapid and pronounced increases occurring in tarsiers and anthropoids. Contrary to expectations, extant anthropoids and strepsirrhines have similar frontal lobe sizes for their brain sizes, and rates of frontal lobe size change have remained uniform for most primate clades since the Eocene. In contrast, non-frontal parts of the neocortex that receive and process visual information evolved at higher rates in lineages leading to crown haplorhines (tarsiers and anthropoids) compared with strepsirrhines (lemurs and lorises). In a coordinated fashion, the volume of visual input to the brain, as measured by the size of the optic foramen, and the size of neocortical regions that receive and process visual information increased in crown haplorhines compared with strepsirrhines. The changes in neocortical size and proportions that characterize extant haplorhines and fossil anthropoids are not observed in omomyoids (possible stem haplorhines), which resemble extant strepsirrhines in visual input and non-frontal neocortex size. Our results strongly indicate that visual processing has played a more significant effect on enhanced neocorticalization during primate evolution than has selection for the size of the frontal lobe. The means of acquiring and processing visual sensory inputs best explains neocortex expansion in primates, irrespective of any ultimate selective factors involving cognitive demands (e.g., sociality or feeding behavior).

Funding Sources Support: National Science Foundation grants 0851272 and 1348259 to RFK and an NSF Doctoral Dissertation Grant 1232534 to KLA and RFK.

Technical Session XVII: Dinosauria III:

Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

When the tooth clock stops ticking: ontogenetic changes in dentine production skew replacement rate estimates in Archosauria

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Estimating tooth replacement rates in dinosaurs fundamentally relies on counting daily-deposited Lines of von Ebner (LvE) preserved in dentine. This widely practiced method involves subtracting LvE counts in functional teeth from those in the replacement teeth. Such studies have shown that dinosaurs evolved a spectrum of replacement rates, from rapid replacement in dental batteries to supra-annual replacement in some theropods. The core assumption of this method is that dentine is produced at a constant rate until tooth shedding. However extreme examples of internal tooth resorption in some vertebrates hint at potential confounding factors. Crucially, potential variation in dentine formation rates in archosaur teeth is poorly understood, but could influence the accuracy of LvE-based estimates of dinosaur tooth replacement rates.

We address this issue by using a unique collection of extant crocodilian embryos, juveniles, and adults. We developed a novel light microscopy protocol to measure near-complete growth line sequences in polished thick sections of alligator teeth. Our analyses show that functional teeth with even minor resorption display a progressive decline in widths between LvEs, whereas line widths progressively increase in newly formed teeth, resulting in unequal dentine formation rates in a single tooth family. Furthermore, soft tissue histology of dental ontogeny in individuals of different postnatal stages reveals the cellular mechanisms responsible for changes in dentine production. Most importantly, odontoblasts degenerate during the tooth replacement cycle before a tooth is shed. These cellular changes are associated with a decrease in predentine production, the matrix that will mineralize into dentine. As the replacement cycle advances, this degeneration progresses from root to crown in the functional tooth, culminating in complete loss of odontoblasts and predentine, and the termination of dentinogenesis.

Our findings reveal previously unrecognized complexities in reptilian dentinogenesis that can systematically inflate tooth replacement rate estimates in extinct reptiles. LvE counts in even lightly resorbed teeth and those extrapolated from average line widths are susceptible to this error. Therefore, we suggest alternative methods for LvE-based tooth replacement rate calculations that take into account the ontogenetic stage of each tooth.

Funding Sources King's College London & China Scholarship Council via the K-CSC Scholarship (No. 202404910009).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Historical and taxonomic review of ichthyosaur specimens in the Beneski Museum of Natural History (Amherst College, Massachusetts, USA)

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Charles Upham Shepard (1804–1886), an American mineralogist, traveled to Europe and purchased many fossil specimens for the burgeoning natural history collections of Amherst College (Amherst, Massachusetts, USA). Among the specimens Shepard purchased are several ichthyosaurs from England and Germany, which are currently housed at Amherst

College's Beneski Museum of Natural History. Despite being in the collections for over a century, these specimens still remain relatively understudied. We re-examine these specimens with regards to their historical provenance and identification. We review their anatomy in comparison to known species of ichthyosaurs, as well as compare the lithology of the attached sediment matrix to historical records in order to determine their stratigraphic provenance. Some specimens compare well to known ichthyosaur taxa from their respective geographic and stratigraphic contexts, such as a specimen of *Ichthyosaurus* from the lower Jurassic of Lyme Regis, England (ACM VP 694), as well as a baracromian ichthyosaur from the Jurassic of Bad Boll, Baden-Württemberg, Germany (ACM VP 1669). However, in other cases there is an unexpected mismatch between the anatomy of the specimen and its historical provenance record. ACM VP 349, an isolated partial paddle from England, is labeled as being from the middle Jurassic Cornbrash formation, despite being very similar in morphology to the upper Triassic-lower Jurassic taxon *Leptonectes tenuirostris*. This implies either a provenance error or a roughly 20 million-year temporal range expansion of this already long-lived species. Ichthyosaurs in the collection vary in preservation quality from isolated pieces (such as ACM VP 349) to near-complete, mostly-articulated skeletons (ACM VP 678 and 665). One specimen, ACM VP 678, is a small (<1 meter total length) ichthyosaur that may preserve possible gut contents. On the whole, the Beneski Museum collection has the potential to provide significant contributions to the growing records of ichthyosaur taxonomy, ontogeny, diets, and paleoecology.

Funding Sources Amherst College Gregory S. Call Summer Research Award

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Fossil Preparation Training Program at the American Museum of Natural History

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Fossil preparation remains a niche field without a widely adopted training standard, despite the existence of previously proposed frameworks. Institutional differences in preparators, specimens, and project objectives have made standardization difficult. In the fall of 2024, the American Museum of Natural History launched the Fossil Preparation Training Program within the Department of Vertebrate Paleontology to provide structured, skills-based instruction in fossil preparation. The program offers hands-on training through ten three-hour sessions that combine lectures and practical exercises. The course covers core topics such as matrix removal, adhesives, repair, field jacketing, mold-making, casting, housing, and collections management, with an emphasis on developing manual dexterity, critical thinking, and detailed observation.

A specialized instruction guide was created to accompany the program, offering concise, visually oriented content based on peer-reviewed literature and internal resources. Designed to reinforce key concepts across sessions, the guide was refined based on participant feedback. This guide presents a replicable framework for museums aiming to train fossil preparators while strengthening public engagement. By grounding participants in both theory and hands-on technique, the program equips them to contribute meaningfully to professional fossil preparation and serves as a model for expanding institutional outreach in paleontology.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Dental defects in the late Miocene to middle Pleistocene Siwalik Perissodactyla from Pakistan

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Dental defects in fossil perissodactyls, including equids and rhinocerotids, have been known for decades. However, there are relatively few studies that have described in detail dental defects in these fossil forms. Here, we report developmental and non-developmental tooth defects in cheek teeth of Late Miocene to Middle Pleistocene equids and rhinocerotids from the Siwaliks of Pakistan. A total of 779 cheek teeth of 11 species of equids and 8 species of rhinocerotids were evaluated.

We identified three types of tooth defects: enamel hypoplasia (EH), enamel hyperplasia, and dental caries. Only four species of equids showed evidence of EH, including linear hypoplasia and pit-form hypoplasia. Although the presence of EH in our sample was overall low, the trend in the prevalence of EH we identified—*Sivalhippus theobaldi* (8.3 %) > *Equus sivalensis* (4.9 %) > *S. nagriensis* (3.8 %) > *S. anwari* (1.9 %)—does suggest that some species experienced greater systemic stress than others, possibly related to environmental changes. Four species of equids showed evidence of enamel hyperplasia: *Eurygnathohippus* sp. (4.0 %) > *S. nagriensis* (2.2 %) > *E. sivalensis* (2.0 %) > *S. anwari* (1.0 %). To our knowledge, our study is the first report of enamel hyperplasia in Late Miocene to Middle Pleistocene equids. One rhinocerotid species (*Alicornops* sp.) and three equid species (*S. nagriensis*, *S. theobaldi*, and *E. sivalensis*) had teeth with caries. We also CT-scanned mandibles of fossil equids to study their tooth eruption pattern. The eruption pattern in the Siwalik hipparionines was similar to extant equids, but one specimen of *S. theobaldi* had molars with a distinctive orientation, which could be due to a developmental defect.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

First mammal (Gondwanatheria) from the Upper Cretaceous Kallamedu Formation of the Cauvery Basin, South India

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Gondwanatherians, considered as part of Allotheria and sister taxa to Multituberculata, are an extinct group of mammaliforms, known to have been uniquely distributed throughout all Gondwanan landmasses, except for Australia. The group's temporal range is known to have extended from the Late Cretaceous up until the middle Eocene. India's gondwanatherians as of now, have been best represented by a single genus and species, *Bharattherium bonapartei*. In this study, we describe additionally collected material (DUGF/167) from the south of India, belonging to the same species, but with a distinct set of morphological characters, such as a likely transitional occlusal surface pattern consisting of an un-isolated enamel islet connected to two transverse lophs. Previous studies have considered such differences as uncertain variations within the morphology of Indian sudamericid molariforms and placed them at relatively basal phylogenetic positions. This study discusses the scope of such variations linked to different growth and wear stages, appearing distinctly according to different depths of occlusal surface exposures due to the height of the crown at different wear or growth stages, and respective molariform positioning along the jaw. It also deliberates on the scope of narrowing down the phylogenetic position of *Bharattherium bonapartei* within the superfamily Gondwanatheroidea based on molariforms.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Trotting ornithopod trackway and flood-driven taphofacies in the Lower Cretaceous Hasandong Formation of Juji Island, Korea

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A three-track ornithopod trackway from Juji Island (Aptian Hasandong Formation, South Korea) records a rare trotting gait: stride length 2.73 m, SL/h = 2.84 and an estimated speed of c. 4.95 m/s. The prints were impressed in cohesive oxbow-lake mud and rapidly buried by medium-grained sand when a trunk channel annexed the ponded wetland during an avulsion pulse. Standing water damped flow energy, allowing undeformed infill and creating natural sandstone casts that today stand proud after intertidal erosion. Field observations identifies three additional vertebrate-fragment taphofacies produced by floods of differing competence: (I) trunk-channel bone lags, (II) bone fragments deposited by unconfined overbank flow, and (III) dispersed fragments that settled from waning flow in oxbow lakes and small ponds. Progressive downstream fining and hydraulic sorting show that these units record allo-parautochthonous deposition controlled by episodic floods on a low-gradient plain. The in situ trackway casts formed at the wetland terminus of the same flood system, demonstrating that brief, high-energy sand pulses can paradoxically enhance trace preservation when mediated by ponded conditions. Collectively, the evidence indicates that episodic floods controlled the formation of both bonebeds and tracksites in this low-gradient fluvial setting, underscoring the need for detailed sedimentological context in taphonomic interpretations.

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Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Exploring ecological niche overlap among Eocene sandtiger sharks from La Meseta Formation in Seymour Island, Antarctica

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Sharks are a diverse group of predators that exhibit disparate habitat and resource use strategies, with many species being sympatric. This ecological niche overlap among extant sharks is widely documented but remains largely unexplored for extinct species from the fossil record. Recent advances in geochemical and morphometric approaches provide metrics to characterize diet and habitat preferences from fossil shark teeth. Understanding the ecological niche of sympatric taxa over geological timescales will help elucidate how sharks face

climate and environmental pressures, which is relevant for conservation today.

We investigated the ecological redundancies of *Brachicarcharias lerichei*, *Carcharias* sp. *hopei*, and *Striatolamia macrota* from the Middle-Late Eocene deposits of Seymour Island, Antarctica. These species are closely related to the critically endangered, extant sandtiger shark *Carcharias taurus*. We compared their tooth morphology using a 2D landmark approach and calibrated to a modern dataset. In addition, we measured tooth $\delta^{18}O_p$, $\delta^{66}Zn$, and crown height (n= 51) to infer habitat preferences, trophic position, and body size among and within taxa across time. Geochemical and size metrics were also compared to those of *C. taurus* to assess the closest ecological analog among fossil sandtiger species. Fossil sandtiger shark species have similar $\delta^{18}O_p$ and $\delta^{66}Zn$ values, but lower than those of *C. taurus*, suggesting preferences for higher temperatures or lower salinity and higher trophic levels. Among extinct sandtigers, *S. macrota* is the largest, whereas *B. lerichei* remained consistently small, suggesting that Seymour Island may be a nursery area. Body size does not correlate with $\delta^{18}O_p$ values of sandtigers, indicating similar environmental preferences across ontogeny within taxa. Conversely, body size often correlates to $\delta^{66}Zn$ values, reflecting dietary differences between and within taxa across ontogeny. For example, *B. lerichei* and *Carcharias sp.* fed at a higher trophic level than *S. macrota* until the latter reached larger body sizes. The distribution of $\delta^{66}Zn$ values and estimated body size of each taxon do not vary through time, but $\delta^{18}O_p$ values in *B. lerichei* and *Carcharias* sp. shifted to lower values toward the Late Eocene, suggesting adaptation to cooler conditions.

Our results provide insights into the evolutionary ecology of sand tiger sharks and can inform conservation strategies for their extant relatives amid ongoing climate change.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Dicynodonts, taxonomic pareidolia, and geomythology: a historical and ethnographic reassessment of South African cave art

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Dicynodonts, with their distinctive tusks and foreshortened bauplans, are one of the most recognizable exemplar taxa of the Permian. These animals are particularly common in the Karoo Basin of South Africa where geological units are, in part, defined by the presence of different dicynodont species. Recently, cave art within the La Belle France panel that has been attributed to the San people of South Africa has been identified as depicting an indeterminate dicynodont based predominantly around the presence of elongate tusks. If true, this would reflect an understanding of Permian vertebrate taxa from non-western people—perhaps even before dicynodonts were formally described in western literature. Paleontologically, anatomical comparisons beyond the tusks are problematic as body proportions, caudal elements, and limb ratios do not align with a dicynodont identity for the La Belle France creature. Moreover, historical and ethnographic considerations suggest either recent or cultural influences in the depiction of the proposed dicynodont are asynchronous with the South African Permian record. Here, the depicted anatomy of the La Belle France cave art is compared with dicynodonts and against the colonial history of South Africa to explore how a deep paleontological knowledge alone is not enough to separate cultural influence, art, and geomythology; thus, highlighting the importance of ethnography and historical perspectives when viewing cave art as paleontologists. Moreover, the link between artwork, culture, and ethnography are compared against interpretations of the La Belle France panel and other San artwork to highlight the importance of historical and cultural understanding in broadly interpreting geomythology.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Using µCT scanning to reinvestigate the appendicular skeletal morphology of *Confuciusornis sanctus*

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Of the numerous stem bird taxa that have emerged from Mesozoic deposits in northeastern China, fossils of *Confuciusornis sanctus* are by far the most plentiful. Most existing anatomical research on *C. sanctus* is limited to two-dimensional investigations of slab-prepared fossils, and only one comprehensive systematic description of the taxon has yet been undertaken. Despite considerable research on this iconic taxon, a meticulous investigation of its postcranial skeletal morphology has never been undertaken using modern three-dimensional imaging techniques. This project applies high resolution X-ray micro-CT (µCT) data to investigate the appendicular skeleton of *C. sanctus* to elucidate novel morphological details. Among our findings are novel observations of the morphology of the pubic bones and tarsometatarsus. Previous observations noted a fused pubic symphysis connecting the left pubis and right pubis at their distal ends. Cross-sectional analysis allows us to distinguish the individualized bones and confirm an unfused suture between these elements. In the hindlimb, the degree of tarsal fusion appears comparable to other extinct and extant avialans that have been investigated with µCT scanning. These results are among the numerous previously unappreciated details of the skeletal morphology of *Confuciusornis* that will help inform phylogenetic and functional investigations of Mesozoic avialan evolution.

Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

New late Duchesnean primates from the Tornillo Basin of Texas: implications for primate endemism in North America and the timing of the Duchesnean–Chadronian transition

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The Tornillo Basin of Texas documents time successive mammalian faunas that span the Eocene (i.e., Wasatchian through Chadronian NALMAs). Paleontological reconnaissance in the northern Tornillo Basin west of the Sierra Vieja led to the discovery of a rich microvertebrate locality named “Bone Hash Hill” (TMM 44305) in 2004. Disarticulated skeletons of rodents are particularly abundant at Bone Hash Hill, but squamates, birds, artiodactyls, metatherians, eulipotyphlans, and primates are also represented. Skeletal material is preserved in blocks of fine-grained sedimentary matrix that is resistant to acid preparation and sufficiently indurated that large-scale mechanical preparation is impractical. Renewed collecting at Bone Hash Hill in 2024 and micro-CT scanning of fossiliferous matrix samples led to the discovery of two new crown primate specimens, which we describe here for the first time. Specimen A is an upper molar of an adapoid that is very similar to the endemic taxon *Mahgarita stevensi*. *Mahgarita* is otherwise only known from earlier Duchesnean localities in the southern Tornillo Basin, and is notable for its close relationship to Eurasian adapoids. Specimen B is a smaller hemi-mandible of an omomyoid that preserves the p4–m3 crowns and alveoli for i1–p3. Specimen B represents a new taxon, and is most similar to species in the subfamily Omomyinae.

Stratigraphically, Bone Hash Hill is located between two key igneous marker beds—the underlying Buckshot Ignimbrite and the overlying Bracks Rhyolite. Here we also report new $^{40}Ar/^{39}Ar$ radiometric dates that constrain the age of Bone Hash Hill, related late Duchesnean fossil localities comprising the Porvenir Local Fauna, and overlying early Chadronian fossil localities comprising the Little Egypt Local Fauna. These dates include 37.64 Ma ($\pm 2\sigma = 0.12$) for the Buckshot Ignimbrite and 37.47 Ma ($\pm 2\sigma = 0.05$) for the Bracks Rhyolite. At present, only one other primate specimen has been recovered from this late time interval in the Tornillo Basin—the endemic stem haplorhine *Rooneyia viejaensis*. These revised dates confirm that *Rooneyia* and the two new primate specimens from Bone Hash Hill are among the latest-occurring primates from the Paleogene of North America, and provide further evidence of the provincial character of Duchesnean primate faunas from the Tornillo Basin. These dates also suggest that the Duchesnean–Chadronian transition occurs in the time interval between about 37.76 Ma and 37.42 Ma.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Endocranial shape evolution across terrestrial–aquatic transitions in caniform carnivorans

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Mammals exhibit remarkable diversity in brain size and morphology, shaped by repeated ecological, taxonomic, and body size radiations throughout the Cenozoic. Although previous studies have demonstrated the influence of phylogeny, allometry, and locomotor mode on endocranial morphology in certain mammalian lineages, the extent to which ecological specialization influences brain shape evolution remains unclear. Multiple lineages of caniform ('dog-like') carnivorans have independently adapted to aquatic environments with profound impacts on their body plans. Here, we evaluate whether the carnivore brain has also changed in response to a secondary aquatic lifestyle.

To address this question, we examine the endocranial morphology of 89 caniforms using high-density 3D geometric morphometrics, including 16 fossil endocasts representing 12 extinct genera. We test the influence of phylogeny, allometry, and ecology on brain shape using principal component analysis and phylogenetic comparative methods. The ecological shift to an aquatic lifestyle has a small but significant effect on endocranial shape across caniforms, associated with dive duration. This effect is more pronounced in pinnipeds than in other semiaquatic fissipeds, such as mustelids and ursids, likely due to their more derived ecology and greater commitment to aquatic life. Aquatic species tend to exhibit expanded neocortices alongside reduced paleocortices and olfactory bulbs, with pinnipeds displaying more globular endocasts and dorsally curved olfactory bulbs. These morphological changes likely result from selection pressures acting on both brain morphology and the surrounding cranial architecture.

Furthermore, among stem pinnipeds, the brain shape of both *Potamotherium* and *Enaliarctos* closely resembles those of extant otters, whereas *Pinnarctidion* is more similar to living pinnipeds. Among crown pinnipeds, *Neotherium* (Odobenidae), *Thalassoleon* (Otariidae), and *Allodesmus* (Desmatophocidae) each display distinct intermediate morphotypes, suggesting multiple independent transitions towards the

derived brain morphology seen in extant taxa. These findings suggest that secondarily aquatic lifestyles impact carnivoran brain morphology, most profoundly in pinnipeds, whose early evolution was characterized by brain shapes resembling those of semiaquatic mustelids. Specialised features likely evolved convergently in crown groups, alongside the development of sensory, feeding, and respiratory adaptations.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A new perissodactyl from the Eocene London Clay of England

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Perissodactyls, odd-toed ungulate mammals, first appeared during the Eocene and are represented by three extant groups: horses, rhinos, and tapirs. The order Perissodactyla was established in 1841 by Richard Owen, following the description of *Hyracotherium leporinum* from the London Clay Formation, an Eocene shallow marine unit in the London Basin. Currently, four perissodactyl species are known from the London Basin: *Hyracotherium leporinum*, *Pliolophus vulpiceps, Pliolophus barnesi*, and *Cymbalophus cuniculus*. Of these, *P. vulpiceps* and *H. leporinum* are the only perissodactyls found in the London Clay itself. Here, we describe a new London Clay perissodactyl, discovered by the late Michael Daniels at Walton-on-the-Naze, Essex. The specimen was physically prepared and subsequently subjected to high-resolution computed tomography scanning. We utilized the digital segmentations to compare them with other Eocene perissodactyls and score them for several published datasets on early perissodactyl phylogeny. Our comparisons reveal it to be the most complete perissodactyl known from the London Basin, as it includes cranial, dental, and substantial postcranial elements. The molars' proximodistal length is approximately 54% larger than that of other London Basin perissodactyls, suggesting that the specimen represents either a new species or a large dimorph of a previously known London Basin perissodactyl. Differentiating between these hypotheses is challenging due to the lack of comparative cranial and postcranial material for coeval specimens. In all phylogenetic analyses, it was determined that this specimen belongs to the hippomorph (horse-like) clade. Additionally, all analyses produced strict consensuses with polytomies. Therefore, definitive species identification varies due to missing data in many taxa. However, we interpret the phylogenetic results as indicating that this new specimen is *H. leporinum* or a close relative, as this is the taxon grouped most frequently on the parsimonious trees. This research will lay the groundwork for future studies, including biomechanical analysis of the segmented postcranial skeleton, microwear analysis of the molars, and determination of the specimen's ecological feeding habits.

Funding Sources NXCT Free Beamtime Access Scheme

Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Microvertebrate bonebeds with radioisotopic dates—bridging the gap in non-marine paleocommunities preceding the end-Triassic extinction

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Temporally-constrained microvertebrate bonebeds are powerful tools for understanding continental-scale biotic changes in deep time. Such sites are rare globally in non-marine settings during the 12 million years (Ma) preceding the end-Triassic extinction (~201.5 Ma), obscuring patterns of extinction and proliferation across this interval. A Late Triassic vertebrate assemblage from Arizona, USA, provides unique insights into community composition and ecology prior to the extinction event. PFV 393 is a macro- and microvertebrate bonebed preserved in a tuffaceous fluvial channel fill with a high-precision U-Pb zircon age of 209.187 ± 0.083 Ma. Sedimentological and taphonomic analyses of the bonebed suggest that it was deposited over a short period of time and samples a limited area, indicating that the fauna represents a contemporaneous paleocommunity.

The fossil assemblage consists of three-dimensionally preserved, delicate, and small skeletal elements of known and new taxa, including Hybodontiformes, actinopterygians, actinistians, metoposaurids, salientians, synapsids, lepidosaurs, testudinatans, trilophosaurids, *Vancleavea campi*, a doswelliid, *Revueltosaurus* sp., loricatans, phytosaurs, and a pterosaur. The newly described pterosaur, *Eotephradactylus mcintireae*, is one of the few Triassic pterosaurs found outside of Europe and currently the only one with a precise radioisotopic age, and it reveals novel aspects of pterosaur ecology and biogeography. Testudinatan material from PFV 393 suggests rapid dispersal of early shelled stem turtles across the Pangean supercontinent in the Norian and refines temporal constraints on the origin of the turtle carapace. The presence of vertebrate lineages endemic to the Triassic highlights their persistence in a mesic, fluvial paleocommunity through a prolonged interval of regional warming and aridification. These lineages co-existed with frogs, lepidosaurs, turtles, and pterosaurs- all key elements of post-Triassic Mesozoic communities. The arrival of turtles and pterosaurs in west-central Pangea therefore may have been driven by the northward drift of Laurentia from humid equatorial conditions into more arid subtropical latitudes.

A 7-million-year gap persists in temporally constrained continental microvertebrate records preceding the end-Triassic extinction. Discovery of new microvertebrate bonebeds in this gap will be essential to establish patterns of faunal change across this pivotal transition in Earth's history.

Funding Sources NSF EAR 1024196; Peter Buck Postdoctoral Fellowship; National Museum of Natural History; Petrified Forest National Park; Columbia College Chicago

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Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

The face of the oldest elasmobranch *Phoebodus* from the Moroccan Devonian

Klug, Christian[1], Greif, Merle[1], Pohle, Alexander[2], Ginter, Michal S.[3], Coates, Michael[4], Bel Haouz, Wahiba[5], Lagnaoui, Abdelouahed[6], Frey, Linda[1]

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Late Devonian strata of the Moroccan Anti-Atlas occasionally yield three-dimensionally preserved crania of most of the main groups of gnathostome vertebrate clades known from this time from other regions. Recently published examples from Morocco are the placoderm *Alienacanthus* and the chondrichthyans *Ferromirum*, *Maghriboselache*, and *Phoebodus*. Newly prepared Famennian materials of *Phoebodus saidselachus* revealed that this early elasmobranch had several characters shared with modern relatives, such as the slender head with a pointed rostrum and the likely rapid tooth replacement indicated by the subtle size changes between subsequent teeth within one tooth file and the absence of worn teeth retained on the labial side of the jaw cartilages. By contrast, the endocast displays some plesiomorphic characters such as the slender shape, where neither the mesencephalon nor the cerebellar part is markedly inflated. The semicircular canals are tightly packed lateral to the endocast and lengthened in the sagittal direction, which is likely linked with the slender skull morphology. In addition to these morphological details of the skull, some skeletons preserve the dorsal, pectoral, and caudal fins, showing great detail. The skin denticles on the dorsal and pectoral fins grew to remarkable sizes of up to 6 mm in width. They are rhomboid in shape with several parallel longitudinal ridges. Size and shape vary depending on the position on the body and within the fin surface. In contrast to an earlier reconstruction, the caudal fin did have a pronounced ventral lobe. The body was slender, although less slender than initially assumed. The Devonian *Phoebodus* and the modern frilled shark *Chlamydoselachus* share morphological aspects such as tooth shape, the slender head and jaws, the posterior jaw articulation, and the slender body, possibly suggesting similarities in predatory behaviour.

Funding Sources This research is funded by the Swiss National Science Foundation (project Nr. 200020_184894).

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Sociality and ecology drive three dimensional brain shape evolution in mammals

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Among extant tetrapods, mammals have evolved by far the most extreme diversity in body mass, ecology, and morphology. Relative brain size is highly diverse in mammals and relatively large brains have evolved several times via highly divergent pathways. Increased encephalization can tell us much about mammalian cognition due to the link between mass and function and is characteristic of famously intelligent taxa such as primates and cetaceans. The overall shape of the brain and the relative development of its major regions are linked to cognitive (e.g., social group size), sensory (e.g., activity period), and locomotory specializations that are exhibited by certain groups and highlight the adaptive diversity of mammals. Understanding the phenotypic diversity and evolution of the mammalian brain is therefore central to revealing its role in mammalian evolution, but, in contrast to brain size, shape has received little attention outside of a few well-studied groups.

Here we use three-dimensional geometric morphometrics to explore brain shape evolution across crown mammals with a dataset of ~300 mammalian digital endocasts (including ~50 extinct taxa). The first two axes of mammalian brain shape variation are the relative proportions of cerebellum and telencephalon (large, highly encephalized taxa at positive values and small-bodied taxa at negative values, 38.2% of variation) and elongation (elongate brains with prominent olfactory bulbs at negative values and globular brains at positive values, 17.4% of variation). Remarkable examples of shape convergence can be seen that may be linked to

locomotory convergence (e.g., marsupial mole, golden mole) but groups with superficially similar globular brain shapes (e.g., primates, burrowing taxa) are separated by the relative proportions of the hindbrain and forebrain. Allometry is significant ($Z = 2.76$, $p = 0.001$) and plays an important role in mediating the correlation of shape with ecological traits, e.g., sociality ($Z = 2.35$, $p = 0.008$) and activity ($Z = 2.66$, $p = 0.007$). Moreover, we find that brain shape in social taxa evolves twice as fast as in solitary taxa, supporting the 'social hypothesis' of brain evolution in mammals. Together, these results reveal that the high phenotypic disparity of the mammalian brain is a result of a combination of evolutionary allometry and selection for the relative sizes of different regions of the brain, governed by cognitive, sensory, and locomotory demands.

Funding Sources This work was funded by UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee EP/Y010256/1 – BRAIN-DRAIN.

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Orbit and scleral ring dimensions suggest nocturnality at the origin of amniotes and early diversification of diel activity patterns

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Diel activity patterns—whether animals are active during the day, night, or twilight—are an important part of their ecology and influence the evolution of sensory systems. In vertebrates, the eye's anatomy reflects diel activity patterns, with specific adaptations to bright, intermediate, or low-light environments. It has been shown that in extinct vertebrates, the relative proportions of the orbit and scleral ring can reveal to which lighting conditions the eye of a particular species was adapted. This method has been primarily applied to dinosaurs and non-mammalian synapsids, suggesting that low-light vision (scotopic adaptation) was prevalent deep in amniotes. However, the origins of this trait remain unclear, as key early tetrapod groups near the base of amniotes remain unstudied. Here, we present the first reconstructions of scleral ring and orbit dimensions in seven Permo–Carboniferous tetrapods close to the amniote stem, including diadectids as the earliest tetrapod high-fiber herbivores and *Mesosaurus* as the earliest aquatic amniote. Using CT scans of skulls from the lower Permian Bromacker locality (Thuringia, Germany), we digitally reconstructed embedded scleral ossicles. Together with data from photographs, these reconstructions allowed us to infer visual adaptation using phylogenetic flexible discriminant analysis and comparison with modern and extinct taxa. The model classifies *Seymouria sanjuanensis* (Seymouriamorpha), *Captorhinus aguti* (Captorhinidae), and *Coelostegus prothales* (Protorothyrididae) as scotopic, while confirming the previously suggested scotopic adaptation of *Orovenator mayorum*. *Diadectes absitus* and *Orobates pabsti* (Diadectidae) are classified as mesopic (i.e., adapted to intermediate or all light conditions), while *Mesosaurus brasiliensis* was likely photopic (adapted to bright conditions). Our results suggest that early amniote-relatives were adapted to varied light conditions, suggesting the full set of possible diel activity patterns found today. Ancestral state reconstruction under maximum likelihood and parsimony models reveals that the first amniote was scotopic, thus likely nocturnal. While terrestrial herbivores and omnivores remained active under dim light, herbivorous diadectids and aquatic mesosaurs were adapted to brighter conditions, suggesting that diel activity expanded as amniotes radiated into novel lifestyles.

Funding Sources This work was funded by the Federal Ministry of Research, Technology and Space (BMFTR) for BROMACKER Project 2020–2025, grant number 01UO2002A.

Symposium: Evolution of Triassic non-marine

tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

A new look at the Triassic of Queensland, Australia

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The Early Triassic Arcadia Formation (Rewan Group, Bowen Basin) of Queensland is host to well-preserved vertebrate remains from a high-latitude terrestrial ecosystem at the southeasternmost edge of the Pangea supercontinent. Palaeontological work in the area over the last half a century has revealed an assemblage rich in temnospondyl amphibians, while amniote abundance and diversity are comparatively low. This contrasts to many contemporary Gondwanan localities, such as South Africa.

Our recent, ongoing work revisits the Early Triassic Rewan Group, focusing on filling significant gaps in our understanding of: (i) the absolute and relative chronology of the fossil occurrences, (ii) reassessing the taxonomic diversity, and (iii) unravelling potential interpretation biases of these fossil assemblages. This work has drastically redefined the temporal position of the known Triassic faunas of Queensland, moving them from the Early Triassic into the Late Triassic (Carnian). The refined chronology has profound implications for the interpretation of post-Permian extinction recovery in this region, providing the means for a calibrated understanding of the assemblages and their place in a global scheme.

In addition to an improved contextual framework, newly collected, more complete material, coupled with Deep Learning segmented synchrotron micro-CT images, has revealed new data on the anatomy and diversity of both the amphibian and amniote fauna. This includes cranial and post-cranial material of at least two individuals potentially attributable to a new taxon of small archosauromorph, that is distinguishable from known Australian taxa by characters of the dentition (attachment, relative dimensions, cross-section, and curvature) and parabasisphenoid. Finally, our discovery of a new locality, seemingly sampling a different part or time-slice of the Late Triassic floodplain ecosystem, where amniotes appear more common as fossils than amphibians, has yielded the very first Triassic cynodont (cranial remains exhibiting sectorial post-canines and post-cranial material) from the Australian continent. These new discoveries hint at an ecosystem more diverse than previously appreciated and highlight the need for continued work on the context of these assemblages as well as the exploration for new fossiliferous sites.

Funding Sources Awared merit-based beamtime at the Australian Synctrotron in 2022, 2023, 2024, and 2025.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Extinction mechanisms in sharks and rays: The role of age and spatial range across 145 million years of evolutionary history

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Over the past 50 years, extinction mechanisms have been studied primarily through the marine fossil record, with a focus on invertebrates due to their abundance, diversity, and exceptional preservation. However, marine vertebrates remain comparatively understudied, biasing our understanding towards benthic ecosystems. Modern sharks, rays, and skates, along with their extinct relatives (Neoselachii), offer an ideal model for investigating extinction in marine vertebrates owing to their rich fossil record—

composed mainly of biologically informative teeth—and their deep evolutionary history.

Here, we aim to enhance our understanding of extinction mechanisms in marine vertebrates by leveraging the fossil record of neoselachians. To do so, we first created FINS, a manually curated compilation of over 30,000 global fossil occurrences, primarily identified to the species level. This dataset integrates over 50 years of published work in 16 languages and is supplemented with data from the Paleobiology Database. Using this extensive dataset, we reconstructed diversification dynamics and assessed extinction selectivity in neoselachians over the last 145 Myr.

A Bayesian framework revealed six extinction events of varying intensity, four of which were previously undocumented. We then developed and applied a novel neural network model to test for age-dependent extinction (ADE) across times of elevated and constant extinction rates. Our results indicate persistent ADE: species younger than 4 Myr consistently exhibited higher extinction risk, regardless of extinction intensity. These results indicate that age is an intrinsic predictor of extinction risk across the neoselachian evolutionary history. To explore potential drivers of this pattern, we investigated the relationship between geographic range and species age. We found a consistent positive correlation: long-lived species tended to expand their ranges early, whereas short-lived species maintained constrained distributions throughout their duration. These findings suggest that spatial restriction early in a species' lifespan may underlie its heightened extinction risk, highlighting a close interplay between geographic range and longevity.

By uncovering new extinction events and demonstrating a robust link between age, range size, and extinction risk, our study provides novel insights into the macroevolutionary dynamics of neoselachians and advances our understanding of extinction mechanisms in marine vertebrates.

Funding Sources SNF PRIMA grant (no.185798)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Dismantling barriers: grassroots inclusivity builds professional development in paleontology

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Applying to graduate school in paleontology is a complex process that requires adherence to steps and standards that are not common knowledge. To be successful, applicants must get this information from people, usually professionals in the field, who already know it. Applicants usually get to know these insiders through internships and undergraduate volunteer positions, which limits the competitive applicant pool to those who are already advantaged. For the past three years, the SVP Diversity Committee has sought to reduce barriers to graduate admissions by running a series of workshops that guide a cohort of participants through the application process. This series was designed to maximize inclusivity: it was free, hosted online, was promoted on social media, accepted all who were interested, and had no attendance requirements. Additionally, sessions occurred twice every weekend and were recorded to accommodate different time zones, schedules, and working styles. Topics were broad and included CV writing, contacting prospective advisors, and reading scientific papers, as well as finding safe labs, requesting accommodations, and managing mental health. A subset of participants have also been working on a research project through the program using freely available data and data analysis programs. This has allowed them to gain research experience and build their CVs. Through this program, participants have formed a network of peers, gained insight into how the field of academic paleontology works, developed professional and research skills, and gotten into

graduate programs. This model of inclusive professional development can be used by graduate programs, museums, and researchers to recruit and foster quality mentees and graduate students. It can also serve to future-proof research against a lean funding environment, as the program can be completed with minimal resources and no funding. Though the barriers to success in academia are many, providing a boost over the first few has proven a successful step towards increasing diversity in vertebrate paleontology.

Funding Sources None

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A high latitude Turonian dinosaur tooth assemblage from the Kaskapau Formation of northeastern British Columbia, Canada

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The mid-Cretaceous was a time of significant change in North American dinosaur assemblages. Concerted efforts to improve the sampling of this time period, particularly in Utah and New Mexico, have yielded important insights into this transition. However, Turonian-aged sites remain rare, and as such even fragmentary remains have the potential to add significant new data points. The Turonian Quality Creek Bonebed from the Kaskapau Formation in northeastern British Columbia preserves an assemblage of small- to medium-sized elements from non-marine vertebrates. Numerous bones were collected between 2003 and 2006, most of which require significant preparation given the hardness of the surrounding matrix. Here we describe the isolated teeth to provide a snapshot of this fauna. The bonebed represents a channel lag deposit over a brackish water (lagoonal) succession that is in turn overlain by a transgressive marine unit. Of the recovered teeth, two are consistent with Dromaeosaurinae. Both are recurved teeth with semi-rounded, non-hooked denticles approximately equal in size on both mesial and distal carinae. Distal denticle counts are between 3.9 and 4.2 denticles per millimeter. Another coelurosaur tooth morphotype has longitudinal ridges and an absence of denticles, like the enigmatic taxon *Paronychodon*. An indeterminate theropod tooth natural mold has an oval basal cross-section and likely has a pachydont tooth type based on overall tooth shape and curvature, lack of visible denticles, and larger estimated labiolingual width. A neoceratopsian tooth was identified by the presence of a cingulum, primary ridge separating the mesial and distal lobes, and the narrowing of the tooth towards the crown. A distinctive semi-hexagonal tooth lacking ridges on the occlusal surface is referred to the rhinobatoid elasmobranch *Cristomylus* cf. *C. bulldogensis*.

The Quality Creek Bonebed is situated between the higher latitude Matanuska Formation of Alaska and the lower latitude Moreno Hill Formation of New Mexico and Smoky Hollow Member of the Straight Cliffs Formation in Utah. Dromaeosaurine teeth from Quality Creek could represent the oldest occurrence of a dromaeosaurine dromaeosaur. The bonebed also represents a latitudinal range extension for North American Turonian dromaeosaurines, neoceratopsians, and *Cristomylus*. Further preparation of the skeletal material collected from the bonebed will provide more information on the vertebrate assemblage of this site.

Funding Sources NSERC Discovery Grant #RGPIN-2020-04012 and Discovery Launch Supplement DGECR-2020-00149.

Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

Forever young: larval fish-like bone matrix in the long bones of Permian temnospondyls *Sclerocephalus* and *Apateon*

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Developmental plasticity is a key trait of many Permian temnospondyl amphibians, often linked to environmental variability and flexible life histories. Two aquatic taxa from the lower Permian of the Saar–Nahe Basin in Germany, *Sclerocephalus* and *Apateon*, have long been model organisms for understanding early tetrapod development. New histological analyses of limb bones from two individuals—*Apateon* (SMNS 97137) and *Sclerocephalus* (SMNS 97069), both at a late juvenile stage—reveal new, intriguing insights into their bone matrix. Histological sections of the humeri from both taxa show a lamellar-zonal periosteal cortex with a unique inner composition. Under polarized light, the bone matrix of this layer does not exhibit a clear signal of collagen fiber orientation, likely due to a scarcity of mineral crystallites, which reflect light and help visualize fiber orientation. This phenomenon suggests the presence of an incompletely mineralized bone. In *Sclerocephalus*, the incompletely mineralized tissue constitutes approximately half of the thickness of the periosteal cortex and transitions outward to fully mineralized parallel-fibred bone. In significantly smaller and neotenic *Apateon*, the humerus is entirely composed of incompletely mineralized tissue.

The inner bone layer in both taxa shows prolonged retention of juvenile skeletal features, resembling an extended osteoid—a condition known in teleost fish but unknown in tetrapods. Functionally, in both taxa the low mineralization may reflect a physiological strategy to reduce the energy costs of ossification, what might be relevant for small *Apateon*. Environmental factors—such as water depth, pH, temperature, light, or oxygen—might also influence skeletal development. In *Sclerocephalus*, the transition from incomplete to fully mineralized tissue later in development could correspond to increased biomechanical demands as body size grows or habitat preferences shift. These findings demonstrate significant skeletal plasticity and developmental variability in early temnospondyls. However, it remains uncertain whether the occurrence of incompletely mineralized bone tissue in these two taxa is a rare exception or a common plesiomorphic trait of aquatic early temnospondyls. Further comparative histological studies across a broader range of taxa and developmental stages are needed to understand the evolutionary and functional significance of this unusual bone tissue.

Funding Sources DFG Research Unit 5581 ‘Evolution of life histories in early tetrapods’.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The earliest-known specimen of *Prognathodon* (Squamata, Mosasaurinae) from the middle Campanian Weskan Shale Formation, Kansas, USA, and its implications for the evolution of macrophagous, crunch-guild mosasaurines

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Reported herein is a large mosasaurine confidently assignable to *Prognathodon* sp., cf. *P. overtoni* from the upper middle Campanian (ca. 77 Ma) Weskan Shale Formation in western Kansas, U.S.A. Collected in 1930, KUVP

155838 not only represents the first record of the genus from the state but also the oldest record of *Prognathodon* to date. Its quadrate is larger than that of the *P. overtoni* holotype, the total skull length of KUVP 155838 would have well exceeded 100 cm, making it one of the largest-known specimens of *Prognathodon* from North America. Of the many key diagnostic characters KUVP 155838 and *P. overtoni* share in common, the following features are confirmed absent in *Gnathomortis stadtmani*, the oldest-known (ca. 81 Ma) mosasaurine to have possessed a skull over 100 cm in length: (1) the anterodorsal surface of the quadratic shaft broadly excavated, forming a concave anterior border of the cephalic condyle; (2) the suprastapedial and infrastapedial processes broadly fused; (3) marginal tooth crowns along the middle section of the jaws inflated at the base; and (4) marginal tooth enamel exhibiting coarse, anastomosing ridges near the apex of the crown. While unknown in *G. stadtmani*, KUVP 155838 also shares the elongate, distinctly waisted phalangeal morphology with *Prognathodon overtoni*, showing a departure from shorter phalanges of basal hydropedal mosasaurines such as *Kourisodon* and *Clidastes*. Although the exact interrelationships between *Gnathomortis stadtmani* and other derived mosasaurines including *Prognathodon* spp. remain inconclusive, the aforementioned subtle disparities in craniodental anatomy between these two, particularly large middle-Campanian mosasaurines may represent a stepwise acquisition of jaw characteristics increasingly more suited to crunch-guild feeding ecology as well as macrophagy, both of which are known to *Prognathodon*. Found in association with KUVP 155838 are several vertebrae pertaining to a small elasmosaurid individual, which could have been one of the last prey items this enormous *Prognathodon* individual consumed.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Bridging the past with the present: exploring the morphology of fossil seal ossicles with micro-CT scanning and visualization

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The study of mammalian middle ear ossicles is significant not only for understanding their role in sound transmission and amplification, but also for their potential to reveal phylogenetic relationships. Specifically, the malleus and incus in carnivorans, including pinnipeds (true seals, sea lions, fur seals, and walruses), may demonstrate strong phylogenetic signal and have been used in previous evolutionary analyses. Despite their importance, detailed anatomical descriptions of middle ear ossicles in modern pinnipeds remain scarce, with the last comprehensive visual documentation dating back to the late 1800s. The study of fossil pinniped ossicles has been even more limited, largely due to the difficulty of accessing these delicate elements embedded within fossil crania. However, advances in micro-CT scanning and 3D imaging software now allow for non-invasive examination of these structures. This study utilizes these techniques to describe and compare the ossicles from two fossil phocids: *Leptophoca proxima* (15–20 Ma) and *Terranectes parvus* (6–10 Ma). Comparisons were made with ossicles from modern specimens representing Phocidae (true seals), Otariidae (fur seals and sea lions), Odobenidae (walruses), Ursidae (bears), and Mustelidae (weasels). High-resolution macrophotography and photo stacking were employed to document modern specimens, complementing the micro-CT-based data from fossils. Preliminary results indicate that both fossil species display distinct phocid-like morphologies in all examined ossicular elements, with particular emphasis on the incus. These results suggest that ossicles may be used to support phylogenetic relationships among primitive pinnipeds, especially phocids, due to their presentation of derived auditory morphologies. Ongoing research aims to expand this dataset to encompass ossicular morphology across all

extant and extinct pinnipeds, using micro-CT scanning and macrophotography. This approach will enhance our understanding of semiaquatic hearing adaptations and provide insights into the evolutionary transition from terrestrial to aquatic ecologies for early pinnipeds.

Funding Sources Howard University Bridge Fund and Duke University SMIF grant.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

From the field to the feed: engaging the public with real-time paleontological research on the Pilcomayo megafan in Paraguay

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Successful educational outreach can improve scientific literacy and generate much-needed excitement and support for the sciences. This project provided meaningful access to science in action during a 2025 field expedition to study modern bone distribution on the Pilcomayo megafan in Paraguay. The hypothesis being tested in this research is that a megafan system is a modern analogue for much of the terrestrial fossil record.

The GRPM (Grand Rapids Public Museum) and collaborating organizations used a multi-tiered approach of digital engagement, inviting learners of all ages to follow along with the Pilcomayo Megafan expedition. Engaging across platforms allowed the team to reach: 15,000 followers on Instagram, 25,000 active monthly users on the GRPM website, and 700 teachers in a digital newsletter. A GRPM blog anchored the work with a summary overview. Instagram was used to share the bulk of real-time stories from the field through videos, photos and interviews. Content was updated daily, allowing followers to track the expedition's progress. Posts feature field techniques, scientific insights, behind-the-scenes challenges, and reflections from team members of diverse backgrounds. A live virtual event connected field crew members with an in-person audience at the GRPM; elementary kids in "Fossil Hunters" camp, as well as general visitors, interacted with field scientists through a question and answer portion. A TV reporter with evening news coverage in Grand Rapids, Michigan also spotlighted the expedition, interviewing GRPM staff before, during, and after the field season. Additional outreach methods, including a video series and a hands-on simulation of the field work techniques are in development and offer promising next steps.

The GRPM exists to inspire passionate curiosity and a deeper understanding of the world. Education and outreach have been the focus of the museum since its founding in 1854. Today, the GRPM is a national leader in Education, with significant K-12 engagement and a Public Museum School housed in its facilities. This outreach advances the GRPM mission and offers strong connections to curriculum standards and career exploration opportunities. It provides a behind-the-scenes look at field research to learners of all ages, showing a multi-national team of diverse scientists, exciting discoveries, and unexpected challenges. With this work, we aim to make science accessible, exciting, and inspiring for curious minds everywhere.

Funding Sources Key funding comes from the David B. Jones Foundation. Additonal funding from M. Sasoni, W. Verillo, the University of New Mexico, and the Grand Rapids Public Museum.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Shared growth changes in the dentary of *Cyclurus fragosus* and *Melvius thomasi* (Actinopterygii, Amiidae) from the Hell Creek Formation of Southeastern Montana: Evidence for developmental underpinnings of species differences

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The phylogeny of amiids (bowfin fishes) identifies sister group relationships but not how evolutionary changes arise. Recovering the growth series of sister taxa has the potential to uncover the changes in growth that caused evolutionary differences between taxa. *Melvius thomasi* and *Cyclurus fragosus* are amiids from late Cretaceous rocks of western North America. There are no growth studies of *M. thomasi* and *C. fragosus*; the aim of this study is to help fill this gap in knowledge. The primary goal was to recover and compare the growth series of *M. thomasi* and *C. fragosus* using cladistic analyses based on 16 specimens of *M. thomasi* and 131 specimens of *C. fragosus*. Thirty-three novel ontogenetic characters were identified for *C. fragosus*, and eight novel ontogenetic characters were identified for *M. thomasi*. It was hypothesized that size and maturity would have a positive correlation. One tree was recovered for *M. thomasi* (TL: 9, CI: 0.89, RC: 0.78) with five growth stages. Forty-five trees were recovered for *C. fragosus* (TL: 135, CI: 0.26, RC: 0.15) with 25 growth stages. Maturity and size are positively correlated (r: 0.800) in *C. fragosus*, but this is not significant (p: 0.104). Growth changes shared ancestrally between *M. thomasi* and *C. fragosus* include a coarsening of the lateral subcutaneous texture of the dentary and lengthening of the foramina along the tooth row. Novel diagnostic characters of *C. fragosus* include increased spacing between alveoli, a caudally positioned “chin” and an increased length of the dentary from the “chin” relative to the depth of the dentary at the “chin”. Novel diagnostic characters of *M. thomasi* include an increased width of the surface ventral to the Meckelian groove and increased spacing between alveoli.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Mosasaurid jaw biomechanics provide insight into the role of the intramandibular joint in squamate biting performance

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Mosasaurids were marine squamates occupying numerous predatory niches in Late Cretaceous seas. They exhibited diverse cranial and mandibular morphologies likely linked to different feeding strategies. Their similar jaw morphology and presumed close phylogenetic relationship to extant varanids allow functional interpretation of their morphology through comparative biomechanics. Both groups possess an intramandibular joint (IMJ), a flexible articulation between the dentary and posterior mandibular elements. Many mosasaurids exhibited a more pronounced IMJ, increasing the dentary’s range of motion relative to the rest of the mandible. Extant varanids have a more rigid IMJ, limiting this mobility. In vivo, the IMJ is spanned by ligaments allowing flexibility. This study applies finite element analysis to assess stress, strain, and mechanical advantage during various biting scenarios in mandibles of both groups. It investigates the functional implications of morphological variation between these two taxa, including the IMJ’s role in jaw flexibility and mechanical efficiency. Here, the

IMJ was modelled as fused to simulate ligamentous constraints. Analyses were performed on hemimandible models from both groups, allowing focused analysis of unilateral mandibular mechanics. Anterior, medial, and posterior biting scenarios were tested, comparing mosasaurids (e.g., *Prognathodon saturator*) to varanids (e.g., *Varanus exanthematicus*). Our results indicate that a fused IMJ functions as a shock-absorbing structure, reducing stress in the mandible during biting but reducing mechanical efficiency by lowering muscle force transmitted to the bite point. The mosasaurids' more flexible IMJ likely helped in handling large and resistant prey, balancing strength and flexibility. Posterior biting represented the most mechanically advantageous scenario for mosasaurids, which outperformed extant varanids. The varanids' less flexible IMJ enhances structural stability but restricts movement. Despite this, varanids showed higher stress and lower mechanical efficiency than mosasaurids. These differences reflect distinct ecological and biomechanical demands: mosasaurs adapted to marine predatory environments and varanids to terrestrial or semi-aquatic habitats. This research underlines how the IMJ contributes to functional diversity and feeding evolution among squamates, enhancing our understanding of mosasaurid feeding performance and the value of biomechanical data in paleoecology.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

An articulated hind limb of *Dromomeron romeri* (Lagerpetidae) and its implications for interpreting early ornithodiran footprints

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The study and interpretation of footprints can be a powerful tool for understanding the faunal diversity and paleoecology of Triassic ecosystems where body fossil assemblages are rare. One challenge often encountered with footprints is the difficulty of identifying specific trackmakers. The phylogenetic identities of two Early–Middle Triassic ichnotaxa, *Prorotodactylus* and *Rotodactylus*, have long been debated, though the current hypothesis is that these trackmakers belong to Lagerpetidae, a clade of Triassic ornithodiran archosaurs closely related to pterosaurs. The identity of these footprints is important because, if confirmed to be lagerpetids, this would push back the earliest occurrence of ornithodirans by several million years because *Prorotodactylus* and *Rotodactylus* occur 8–10 million years earlier than any known lagerpetid body fossil. Until now, the only articulated hind limb material of a lagerpetid to compare to the footprints has been from *Lagerpeton chanarensis*. The recent discovery of a complete, articulated right hind limb from *Dromomeron romeri*, a lagerpetid from the Upper Triassic Chinle Formation of New Mexico, provides ideal material to compare with *Prorotodactylus* and *Rotodactylus*. Here, we reconstruct and describe the hind limb of *D. romeri* using segmented μCT scans to produce digital 3D models of the pes. We also use kinematic analyses to compare anatomical differences and similarities between the hind limb of *D. romeri* and *Prorotodactylus* and *Rotodactylus*, as well as to determine if the hind limb would produce similar footprints to the ichnotaxa. We observe that the hind limb of *D. romeri* is very similar to that of *Lagerpeton* and infer that it would produce didactyl footprints. Furthermore, the hind limb would not be capable of producing footprints similar to **Prorotodactylus** or **Rotodactylus**, and therefore *D. romeri*, and close relatives such as *Lagerpeton*, can be excluded as a trackmaker.

This does not rule out Lagerpetidae as a whole, however, because some taxa lack pes fossils, and we do not know what the ancestral pes morphology was for the clade. This research not only provides new insights into lagerpetid hind limb and pes anatomy, but also highlights the importance of detailed anatomical comparisons in identifying putative trackmakers in the fossil record.

Funding Sources National Science Foundation, National Geographic Science Committee for Research and Exploration, Yale University, Westminster University, and the University of Utah.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The microscopic past: using rarefaction analysis to optimize the processing of sediment from Late Triassic microvertebrate sites

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Microvertebrate fossil sites are filled with valuable taxonomic and ecological data that provide insights into extinct communities and environments. However, sampling vertebrate microsites is a labor intensive and tedious process which often deters researchers from collecting and sorting sufficient sediment quantities. In addition, researchers have different reasons to process and collect data from microsite samples, as each site contains different organisms, sediments, diversity, and richness. Therefore, a simple standardized quantity of sediment is insufficient and misleading due to the inherent variation between microvertebrate sites. The goal of this project is to identify methods to create a more efficient sediment processing procedure. To achieve this, a small research group was formed of undergraduate students who were given subsamples of screenwashed sediment from several productive Late Triassic microsites from the southwestern U.S. to isolate and identify microvertebrate elements. The subsamples varied in grain size from coarse (2380 µm) and medium (1000 µm) to fine (710 µm and 90 µm) with corresponding masses decreasing with grain size. In addition to identifying microvertebrate elements, the students also recorded the amount of time they spent with each subsample. To determine when the group has completed sampling from a site, a rarefaction analysis was performed using the Community Ecology Package ('vegan') in the statistic program R. A rarefaction analysis allowed us to determine the level of sampling at which it becomes exceedingly timely to find any new taxon occurrences, and we can consider our sampling sufficient. We identified different site-specific trends based on grain size, depositional environment, and the varied taxonomic abundance. In the future, we plan to see if these site-specific trends apply to the broader scale of multiple microvertebrate sites. Optimizing this methodology based on an accurate quantity-to-diversity metric will allow for a more efficient and easily repeatable analysis of vertebrate microsite samples. Recording the average grain size, lithology, taphonomic characteristics, preservation of various skeletal elements, and the abundance of fossils allows for a better characterization of vertebrate microsites, and we hope to integrate this through multiple levels and chronicle the evolution of communities throughout the Triassic.

Funding Sources NSF EAR 1943286

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Mechanical insights into microwear formation: puncture experiments with alligator teeth using foods of varying hardness

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Dental microwear texture analysis (DMTA) is a powerful non-destructive tool for reconstructing the diets of extinct species. However, the mechanisms underlying microwear formation remain debated, particularly in carnivorous reptiles, where feeding behavior is difficult to replicate. This study investigates the formation of dental microwear through in vitro puncture experiments using isolated teeth of juvenile *Alligator mississippiensis*. Two food types differing in mechanical properties—crayfish (hard) and sardines (soft)—were repeatedly punctured (up to 200 times) under controlled force and speed. The same tooth region was scanned at three stages using confocal microscopy, allowing us to track fine-scale changes in surface roughness parameters. Morphological filtering was employed to eliminate intrinsic tooth relief structures, enabling precise assessment of microwear. Results showed significant increases in surface roughness (Sq, Sdr) with repeated punctures, particularly at the apex of teeth and more prominently with crayfish than with sardines. Notably, the increase in roughness at the apex was significantly correlated with the total force experienced during puncturing, establishing a quantitative link between mechanical stress and microwear development. In contrast, no significant roughness increase was observed at the tooth base, highlighting regional variation in microwear formation. Although the resulting surface roughness did not reach levels observed in prior feeding experiments, the controlled setup allowed isolation of food hardness as a key variable. These findings support previous interpretations of apex-focused microwear patterns in fossil reptiles and demonstrate the potential of controlled mechanical testing to bridge the gap between nanoscale modeling and whole-animal feeding trials. This study lays foundational groundwork for refining paleodietary reconstructions in extinct carnivorous reptiles.

Funding Sources JSPS Kakenhi grant (Nos. 22K19339 and 23H01285).

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Bone histology and synchrotron X-ray tomography provide the first glimpse into euharamiyidan life history

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Euharamiyidans, a group that spans the Middle Jurassic to Early Cretaceous, have featured prominently in debates about the origin of and evolutionary relationships among crown Mammalia. Both euharamiyidans and multituberculates exhibit procumbent incisors, hypertrophied premolars, and molars with longitudinally arranged cusp rows. Previous studies either consider those similarities homoplastic, recovering euharamiyidans outside crown Mammalia, or synapomorphic, with euharamiyidans and multituberculates part of the crown-mammal clade Allotheria. We bring new data to this question by examining euharamiyidan long bone histology using both synchrotron X-ray tomography and petrographic thin sections, allowing us to assess euharamiyidan life history and its implications for crown-mammal interrelationships. We analyzed four Jurassic species from China (*Xianshou linglong*, *X. songae*, *Shenshou lui*, and *Arboroharamiya allinhopsoni*), spanning ~40–350 g estimated adult body mass, and compared them with mammaliamorph stem mammals (tritylodontids, morganucodontids, docodontans) and multituberculates.

Euharamiyidan cortices consistently show organized endosteal and periosteal bone flanking a disorganized central region. In extant, small-

bodied placental mammals, this disorganized region reflects early bone formation that is later infilled by endosteal growth, maintained in adult cortices, and capped by organized periosteal bone. This 'sandwich' pattern is seen in placentals and multituberculates but absent in marsupials, likely reflecting their divergent life-history strategies. In contrast, small mammaliamorphs such as the tritylodontid *Oligokyphus* exhibit uniformly organized bone, reflecting a slow, prolonged life history similar to that inferred from docodont dental histology.

That euharamiyidans and multituberculates both exhibit placental-like long bone histology suggests they share aspects of placental-like life history. If euharamiyidans are stem-mammals, this would imply at least two independent origins of placental-like reproductive traits. Although possible, we favor an alternative hypothesis: Euharamiyida are united among Allotheria by a suite of distinct craniodental, postcranial, and now life-history traits. Beyond these potential phylogenetic implications, our results add to a growing body of evidence indicating that placental-like reproductive traits evolved early in stem-therian mammals and are not unique to Placentalia.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The biogeographical history of Murinae: insights from fossils and extant diversity

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The subfamily Murinae is one of the most diverse and widespread groups of mammals. It is important to know their biogeographic patterns and their evolutionary history. This study brings together knowledge about Murinae biogeography from molecular phylogenetics, palaeontology, and historical biogeography. The subfamily is found all across Africa, Eurasia, Australia, and a number of marine islands. The Indian subcontinent was a major centre of origin and dispersal during the Miocene and Pliocene periods. This long history of complicated interactions between the spread of species and geographical separation during the Neogene and Quaternary periods has influenced the distribution of Murinae. In this study, we built a comprehensive global phylogeny for the Murinae subfamily, incorporating fossil calibration through a tip-dating approach. Our analysis utilized data from six nuclear and nine mitochondrial gene fragments, encompassing an extensive dataset of 327 species from 119 murine genera across thirteen tribes. Historical biogeography reconstructions suggest that the family came from the tropics and then spread out and diversified on various continents. The subfamily expanded from its source of origin to the Philippines ~12.4 Ma and to the Palearctic ~10.5 Ma. The first dispersal into the Afrotropical region took place in the Late Miocene, ~8.9 Ma, and now includes around 25% of the species variety of the subfamily, followed by another dispersal into the Palearctic ~3.3 Ma. The Palearctic region witnessed a rapid diversification within the subfamily, making it a major center for the emergence of murine rodents. These findings allowed us to unravel their fascinating biogeographical history, understand their diversification patterns, and pinpoint the divergence times of their key branches.

Funding Sources The University Grants Commission (381/CSIRNETJUNE2019).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Age estimation of *Tyrannosaurus rex* tooth crowns using linear morphometrics

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Many dinosaur species exhibit pronounced ecomorphological differences between growth

stages. Identifying distinct semaphoronts in fossil assemblages is relevant to the study of these age-related ecological effects. Microsite tooth crown collections are an important resource for ecologic, demographic, and geochemical observation, owing to the greater preservation potential of teeth and the diagenetic resistivity of tooth enamel. However, accurately aging isolated tooth crowns for the purposes of paleoecological study has proven difficult for many dinosaurian species. I examine the tooth crown dimensions of the Maastrichtian theropod *Tyrannosaurus rex* and present a new quantitative method for age classifying isolated tyrannosaur teeth from the Hell Creek Formation. Noted for extreme ontogenetic shifts, numerous studies have estimated the age of *T. rex* tooth crowns using direct comparisons to more complete specimens. However, no consistent method has been developed to segregate tooth crowns according to age class. Multivariate models have been previously employed to generate discriminant functions for theropod species identification. I propose using these methods to predict the growth stage of isolated *T. rex* tooth crowns. I collected linear measurements of 168 maxilla and dentary teeth from 15 *T. rex* of estimable maturity. No single linear measurement can segregate the juvenile, subadult, and adult age classes. However, when projected as a multidimensional function, two distinct clusters form. A permutation multivariate analysis of variance reveals that juvenile teeth are significantly different from both adult ($p = 0.0001$) and subadult ($p = 0.0001$) tooth crowns (pseudo-$F = 91.47$, $p = 0.0001$). Subadult and adult *T. rex* teeth, however, are not significantly different from each other ($p = 0.4637$). Completing a linear discriminant analysis, 80% of jackknife resampled values were correctly classified. Juveniles were predicted with 94% precision and 100% recall. Model accuracy increases to 96% when combining adult and subadult teeth into a composite sample. The juvenile *T. rex* morphospace can also be isolated in a 3D plot of volumetric dimensions, allowing for validation of age estimates. In the context of evaluating the ecology of Hell Creek Dinosauria, this new method for identifying the ontogenetic age of teeth will allow for the accurate description and sampling of *T. rex* semaphoronts in microsite collections.

Funding Sources This project has received funding from The Jurassic Foundation and the Indiana University Bloomington Department of Earth and Atmospheric Sciences

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Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

The early evolution of beaks across Permian and Triassic

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Beaks are compound oral structures that first independently arose in multiple tetrapod clades during the Permian and Triassic. While their modern-day distribution is limited to birds and turtles, they were more widespread and diverse in the past, also encompassing forms that possessed both teeth as well as a modest rostral beak across several synapsid and sauropsid clades.

Here, we explore beak evolution through the end-Permian crisis and during the resulting recovery and diversification of feeding ecology among archelosaurs and therapsids in the Triassic. We examine the evolution of vertebrate beaks, from their first documented appearance in dicynodonts of the Middle Permian, to their widespread adoption by multiple newly emerged sauropsid clades in the aftermath of the end-Permian extinction. We captured the overall shape variation of the mandibles via an elliptical Fourier analysis and that of their beaked portions using a two-dimensional semi-landmark analysis.

We quantified key features of the jaws, teeth, and bony beaks of the Permian-Triassic clades with linear measurements of crucial functional traits—including the reconstructed position of

the corneous covering and inferred insertion points for the jaw musculature—and used multivariate approaches to quantify the variation in functionality. These functional metrics were then employed in consensus clustering analysis, establishing three distinct functional groups. Our results show that, while both convergently developed beaked jaws across Permian and Triassic, dicynodonts and archelosaurs specialised to occupy distinct niches. Cluster analysis reveals the presence of three functional groups mapping also onto the underlying phylogenetic relationships between these groups.

Dicynodonts constitute a distinct functional group of specialized, sturdy, and powerful jaws. Archelosaurs form the remaining two groups, one almost entirely composed of the highly divergent and specialised rhynchosaurs, and one including all the remaining archosauromorphs, with less specialised, gracile, and overall weaker jaws. These represent three levels of specialisation for early beaked jaws, from the more generalist archosauromorphs to the highly specialised dicynodonts.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

New cranial material and nuclear genome sequences clarify evolutionary relationships of *Haringtonhippus francisci*

Landry, Zoe[1,2], Bataille, Clément[1,3], Fraser, Danielle[2], Chauvey, Lorelei[5], Miller, Joshua H.[4], Schiavinato, Stephanie[5], Scott, Eric[6], Tonasso-Calvière, Laure[5], Zazula, Grant[7,2], Orlando, Ludovic[5]

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The reconstruction of evolutionary relationships is crucial for understanding past and present biodiversity. The development of advanced molecular techniques capable of sequencing the genomes of extinct taxa has revolutionized our understanding of phylogenetic relationships even within clades whose evolutionary relationships were previously regarded as being well resolved. Despite significant progress that has been made in rectifying the complex evolutionary relationships of equids (Perissodactyla, Equidae), the phylogenetic affinity of many species remains uncertain. Those of the Pleistocene North American stilt-legged horses are particularly contentious, with conflicting views regarding their placement within the genus *Equus*. The evolutionary relationships of *Haringtonhippus francisci* (also referred to as *Equus francisci*) to other equids has been the subject of considerable debate due to it being the only stilt-legged horse described from eastern Beringia (present-day Alaska and Yukon), and its frequent synonymization with other species in the literature. Here, we describe the first cranial material discovered from Yukon, Canada of eight *H. francisci* individuals and present the most complete nuclear genomes of the species to date. Although there exists variation among the specimens, they share several dental characters including pronounced styles, arcuate protocones, and triangular metastylids. However, overall tooth morphology is non-diagnostic and shares many similarities with other species. Genomic data place all specimens in a monophyletic clade that falls outside of crown *Equus*, indicating that *Haringtonhippus* represents a valid genus of stilt-legged horse. However, this calls into question the phylogenetic relationships of other stilt-legged horses, many of which have been placed within *Equus*. Further research is required to resolve the complex evolutionary relationships of Pleistocene stilt-legged horses, but this study has provided a critical first step in establishing that *H. francisci* represents a morphologically cryptic yet genomically distinct species. It is likely that more specimens belonging to this taxon exist in museum

collections but have yet to be recognized. We emphasize the need for further investigation into potentially misidentified specimens of *H. francisci*, which in turn will contribute to the resolution of the long-standing debate regarding the true number and taxonomic identities of Pleistocene North American horses.

Funding Sources This research was supported by a Canadian NFRF Award, a Discovery Grant (NSERC), a Research Activity Grant (Canadian Museum of Nature), and CGS-D award (NSERC).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

External cerebral morphology of *Panthera spelaea* in comparison to extant felids

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The extinct Pleistocene species *Panthera spelaea* was a large felid that was among the apex predators of the Eurasian mammoth-steppe and closely related to the extant lion. Here, an exceptionally well preserved neurocranium of a paratype of the species from the Zoolithen cave (Upper Pleistocene, Bavaria, Germany) is used to compare the external cerebral morphology of *P. spelaea* with extant felids. The brain endocasts of the *P. spelaea* specimen as well as specimens of 6 extant pantherine and 11 extant feline species were digitally extracted from µCT scans and compared via 3D geometric morphometric analysis based on 16 landmarks placed on the cerebral endocast surface. A subsequent PCA of the aligned shape data shows that PC1 indicates changes in lateral cerebrum width, which divides most of the felines in the more positive direction from the pantherines in the more negative direction of the spectrum, with only two feline species falling in the range of pantherines. A significant difference between feline and pantherine morphospaces is confirmed by a procrustes ANOVA of the aligned shape data. Linear regression analysis further shows that PC1 is correlated with the centroid size of the cerebrum, indicating that allometry has a significant influence on cerebral shape among this sample of felid species. A linear discriminant analysis using the first six principal components separates the felines almost perfectly from the pantherines, except for *Neofelis nebulosa* clustering with felines. Predicted group assignment only misclassifies the smallest pantherine species *N. nebulosa* and the largest feline species *Acinonyx jubatus* and *Puma concolor*. This finding is a further indication for the allometric influence of the increasing brain size shifting pantherines away from the feline morphospace. *P. spelaea* clusters within the morphospace of pantherines and has the largest centroid size of the sample. It is assigned to the Pantherinae with a high probability. This study confirms the significant influence of brain size on the external morphology of the cerebrum among felids using a diverse sample of 18 species, with significant shape differences being present between felines and pantherines.

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

New tetrapods from the Cretaceous–Paleogene transition in the Peruvian Amazon

Langer, Max C.[1], Batezelli, Alessandro[2], Delcourt, Rafael[1], Muniz, Fellipe[1], Fachini, Thiago[1], Iori, Fabiano[3], Ruiz, Juan[1], Silva Júnior, Julian[4], Chimpay, Elvis[5], Camus, Carolina[6]

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The record of Mesozoic tetrapods is particularly scarce in the northern part of South America. In an attempt to fill that gap, two field campaigns were carried out during 2023 and 2024 to the

area known as “Quebrada Seca Alta”, in the southern margins of the Bagua syncline, vicinities of Bagua Grande, Amazonas Region, Peru. These mainly explored deposits of the Chota Formation, which is exposed in a series of escarpments facing mainly south, the base of which is composed of marine deposits of the Celendín Formation. Vertebrate remains (especially dinosaurs) have been reported for many decades in the area, found in situ in the Chota Formation or, more commonly, scattered over the marine deposits. Among the macrofossils found during the fieldworks, there are abundant turtle shell fragments and isolated dinosaur remains, including tail vertebrae likely assigned to megaraptors (Theropoda: Tetanurae) and non-aeolosaurine rinchonsaurs (Sauropoda: Titanosauria). Yet, the most remarkable find of the 2023 field work corresponds to an isolated, almost complete crocodyliform skull, with some preserved teeth, but no articulated mandible. Preliminary evaluations of the material suggest that it corresponds to a Neosuchian, with affinities to Paralligatoridae, highlighting the broad distribution of the group towards the end of the Mesozoic. Sedimentological and paleoichnological analyses indicate that the basal portion of the Chota Formation (Rentema Member) was deposited in a fluvial context, with the aforementioned fossils concentrated in conglomeratic levels. Given that the underlying Celendín Formation reaches the middle Campanian, a Campanian–Maastrichtian age has been inferred for that stratigraphic unit, with the overlying Esperanza Member probably entering the Cenozoic. This was confirmed in the 2024 campaign, with the discovery of a sequence of four molariform teeth belonging to a native South American ungulate, most probably a pyrothere, together with abundant crocodyliform and turtle remains. Thus, it is clear that the Chota Formation hosts the Mesozoic–Cenozoic transition in the area and the continuous study of its depositional environment, age, and paleofauna will surely assist in understanding the conditions that marked this event in the northern part of South America.

Funding Sources FAPESP (2020/07997-4) to (M.C.L.)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

From slices to structures: speeding up segmentation of CT images of fossils using AI-assisted tools

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In the last five years, artificial intelligence (AI) methods have seen rapid growth in use and development. New algorithms are continually created to assist with the segmentation of computed tomography (CT) images, aiming to accelerate segmentation—the extraction of elements from images—and 3D reconstruction of scans. Many of these techniques allow automated segmentation of similar objects once the AI is properly trained. This is highly valuable in industrial, biomedical, geoscientific, and micropaleontological applications, where many similar samples are scanned and only one or two structures need to be segmented. However, their applicability remains limited when working with unique fossil and modern specimens from natural history collections. Additionally, most AI algorithms are embedded within proprietary reconstruction software, restricting accessibility and compatibility with different file formats.

Here, we present an application of Biomedisa, a freely available, online-based AI segmentation tool. This platform lets users train AI models for datasets with multiple scans of similar samples and also features a smart interpolation tool. The interpolation function can be applied to any dataset without prior training. Users input the image stack alongside a preliminary segmentation of a few slices, created in either licensed software (e.g., Avizo) or free alternatives (e.g., 3D Slicer). Biomedisa employs a random walk approach, starting from the segmented slices to progressively calculate the probability of each voxel belonging to a

label, assigning it to the one with the highest score. This generates a segmented volume with multiple labels, which can be exported for further cleaning in reconstruction software. While it cannot fully resolve low-contrast issues, it greatly simplifies the segmentation of complex, multi-part samples.

We applied this method to CT scans of heterostracans, a group of early armored jawless fishes. This approach considerably accelerated the segmentation of these difficult, low-contrast scans, which would have otherwise required entirely manual segmentation. Here, we outline the implementation steps and present results from two specimens. Wider use of Biomedisa could help improve the segmentation of complex fossil CT scans, supporting more efficient, reproducible reconstructions of fossil morphologies.

Funding Sources Leverhulme Grant RPG-2021-271 “Feeding without Jaws”.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Dinosaur fauna from a quarry in the Cedar Mountain Formation of southeastern Utah, and implications for faunal turnovers in the Lower Yellow Cat Member

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The Cedar Mountain Formation of eastern Utah is among the most renowned geological units for studying early Cretaceous dinosaur faunas in North America. The Don’s Ridge south excavation site, located roughly 10.5 km southeast of Green River, Utah, is one of many bone beds in the lower Yellow Cat Member as defined by the “caprock” dividing the lower from the upper Yellow Cat in this area. Here, we describe dinosaur bones recovered during initial excavations at Don’s Ridge south, which include iguanodontian vertebrae, polacanthine osteoderms, turiasaurian sauropod material, and a currently unidentified coelurosaur femur (possibly derived therizinosaur). The holotype of *Iguanacolossus fortis* was recovered as a partial isolated skeleton at Don's Ridge north about 125 meters to the northwest; the base of both sections is a cobble conglomerate with mostly broken sauropod bones. Analysis of the stratigraphy of the Lower Yellow Cat Mbr. suggests at least four faunas in the lower Yellow Cat Mbr. An oldest fauna associated with ferruginous paleosols (basal polcanthine), a second fauna represented by Doelling’s Bowl (new large therizinosaur, the dromaeosaurine *Yurgovuchia*, a new polacanthine, the turiasaur sauropod *Mierasaurus*, a new large allosauroid, and at least two new iguanodontians), a *Falcarius*-dominated fauna with a new giant polacanthine and sauropod material, and an uppermost *Geminiraptor*-dominated fauna with more of the giant polacanthine from the base of the “caprock.” The Don’s Ridge south excavation overlies a silicified peat layers (histosols) similar to what is seen below the Doellling’s Bowl bonebed, suggesting a close correlation to the latter site.

Funding Sources Utah Geological Survey

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Three-dimensional synchrotron imaging offers new insights into the dentition of the Devonian tetrapod *Ichthyostega*

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The transition from natatory, obligately aquatic fish to terrestrially competent tetrapod clades

during the Devonian marks a seminal phase in vertebrate evolutionary history, albeit one obfuscated by a relative dearth of material, biases inherent to the fossil record, and limitations of available tools and methods. Since its discovery in 1932, the Devonian genus *Ichthyostega* remains one of the earliest-known stem tetrapods. Such temporal proximity to the emergence of Tetrapoda lends potential value to any insight into its hitherto elusive morphology. The fish-tetrapod transition was defined by the interplay between morphology, selective pressure, and exploitation of novel palaeoecological niches. Dentition provides a natural point of comparison because the composition, structure, and mode of replacement potentially reflect phyletic relationships as well as granting inference into palaeoecological roles. Indeed, external morphology, plicidentine structure, composition, mode of attachment, and replacement patterns have been the subject of prior studies on Ichthyostegalia, osteolepiform and sarcopterygian fish, and crown tetrapods. However, some factors have limited past studies, e.g., quality of preservation, loss of detail during preparation, resolution, and access to the entire tooth and constituent attachment tissues due to reliance on destructive techniques such as thin sections limiting researchers to a small number of selected sites for each tooth. Additionally, much detail may be overlooked for sites where bone obscures root structure. Fortunately, in recent years synchrotron x-ray microtomography has emerged as a powerful new tool allowing for high-resolution 3D imaging of fossil materials, sans the need for manual preparation or destructive techniques. Here, scan data of the partial skull of *Ichthyostega* sp. from Celsius Bjerg, East Greenland, MGUH (Geological Museum of Copenhagen) f.n. 180, was used to model the 3D structure of 53 tooth sites. Analysis suggests an anterior-posterior, semi-staggered replacement pattern, a higher labial wall than in classical pleurodonty, and increasing fold complexity with tooth diameter. Migration of active sites appears associated with bone growth to accommodate larger teeth, with partial resorption at some sites. This study provides a view of early tetrapod dentition and attachment tissues at unprecedented resolution and completeness, thereby serving as a point of comparison for similar studies of other taxa.

Funding Sources ERC Advanced Grant ERC-2020-ADG 10101963 (PEA), VR Starting Grant 148500371 (DC)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Enigmatic sideritic coprolites from Madagascar

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The term “coprolites,” in a broad sense, encompasses both lithified intestinal casts (cololites) and fossilised feces. This study focuses on locally abundant sideritic coprolites characterized by elongate forms, polysigmoidal folding, and distinctive linear and circumferential cracking. These coprolites have been documented across multiple geological periods and locations, including: Late Cretaceous Maastrichtian, Whitemud Formation, Saskatchewan, Canada; Late Paleocene, Golden Valley Formation, Bear Den Member, North Dakota, USA; Eocene. unknown formation, Besiboko, Madagascar—this study; Late Miocene, Wilkes Formation, Salmon Creek, Washington, USA; Early Miocene deposits, Turów mine, Poland.

In all cases, sedimentary evidence points to a fluviatile or wetland terrestrial depositional environment. The consistent morphology of these coprolites across regions and time periods suggests a uniform mechanism of formation.

Interpretations of their mode of formation vary but include possibilities such as fossilized intestines of unknown tetrapods or giant earthworms, feces from snakes, tortoises,

lizards, or crocodiles, or non-biological sediment extrusion through knot holes in wood. Some theories, including claims of Noah's Ark-related origins, are unsupported and dismissed.

The Madagascan specimens are commercially available in large quantities under names such as "Dinosaur Poop" or "Turtle Poop," though these labels lack reliable evidence or provenance. To further investigate, a batch of over 200 specimens was purchased from a state-licensed wholesaler of Madagascan fossils at the Tucson Gem show in February 2025. These specimens closely resemble those from Salmon Creek, with many displaying slightly flattened bases, fine longitudinal striations, and/or pointed ends akin to modern reptile feces. Larger specimens exhibit a jagged surface resulting from the siderite expansion. Smaller specimens generally lacked surface cracking and longitudinal striae.

The most plausible formation mechanism involves sub-aerial desiccation of tetrapod faeces followed by rapid burial and siderite replacement within organic-rich alkaline anaerobic sediments. This hypothesis aligns with morphological and sedimentary evidence observed in the Besiboko material and other sites. Our conclusions are that the Madagascan coprolites are true coprolites, and their most likely source was reptilian. A novel interpretation of their formation based on reptilian locomotion is proposed.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Ontogenetic functional and dietary niche shifts in the basal iguanodontian *Dysalotosaurus lettowvorbecki*

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Ornithopoda is a clade of herbivorous dinosaurs with a rich fossil record and a near-cosmopolitan distribution, representing the dominant megaherbivores in most Cretaceous ecosystems. However, early members of the group are mostly characterized by just a few, small taxa in the Jurassic. Information on dietary adaptation and the biomechanical feeding capabilities of basal ornithopods and how these may have changed with ontogeny is therefore rare. However, potential ontogenetic niche shifts are of particular relevance for broader evolutionary inferences.

Here, we investigated the cranial functional morphology of the basal iguanodontian *Dysalotosaurus lettowvorbecki* from the Upper Jurassic Tendaguru Formation of Tanzania. The species is documented by thousands of bones belonging to over 100 individuals collected during the German Tendaguru Expeditions in 1909–1913. Due to the abundance of material, different ontogenetic stages of *D. lettowvorbecki* are well represented. Using digital reconstruction techniques, we created complete, fully articulated three-dimensional models of two different ontogenetic growth stages (juvenile and adult) of *D. lettowvorbecki*. These were subsequently subjected to biomechanical modelling simulations to test the hypothesis that juvenile and adult individuals had different cranial functions indicative of adaptions to separate dietary niches.

Our results demonstrate distinct functional differences between the ontogenetic stages of *D. lettowvorbecki*. The juvenile individual had an estimated bite force of ca. 35–80 N, whereas the adult individual's bite force ranged from around 80 to 160 N. Given the size difference between the specimens (adult skull length is ca. 1.5 times larger than the juvenile skull length), higher bite forces are to be expected, but a calculation of the mechanical advantage found that the juvenile was able convert muscle forces into bite forces more efficiently. Similarly, finite element analyses of different feeding scenarios demonstrated that the cranial skeleton of the juvenile individual was generally less susceptible to feeding-induced stresses. These findings suggest that juvenile individuals of *D. lettowvorbecki* were capable of accessing similar food resources and ecological niches to adults and more efficiently, hinting at a large degree of precociality.

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Body size ecometrics in global squamate communities

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Despite their high diversity and ecological importance, squamate reptiles remain understudied as proxies for reconstructing past environmental conditions. Early work demonstrated that physiological scaling models, based on maximum squamate body size, can effectively reconstruct paleoenvironmental conditions. These models showed that gigantism in fossil squamates was related to elevated Paleogene temperatures, associated with increased poikilothermic metabolic rates and enhanced floral productivity. However, a gap remains in understanding how average squamate body size, and its variation within communities, reflects a broader range of environmental conditions. To address this gap, we developed a series of ecometric models using maximum likelihood methods to quantify how squamate community-level body size distributions relate to temperature, precipitation, and vegetation-cover gradients at global and continental scales. We assembled comprehensive global datasets of modern squamate body sizes, geographic ranges, and environmental variables (representing a little over 10,500 species). We modeled the likelihood surface of environments given body size distributions within approximately 54,000 global communities. We assessed whether different squamate groups (e.g., snakes, lizards, and amphisbaenians) exhibit consistent body size–environment relationships. We then conducted continental-scale analyses to identify regional variations in these relationships to account for historical biogeography and diversification patterns. We assessed differences among models using likelihood-ratio tests and ANCOVA. As expected, most models showed strong body size–environment relationships ($R2 > 0.5$), and we found significant differences ($p < 0.01$) in body size–environment relationships among squamate clades and continents. We summarize the required conditions for these ecometric models to provide robust paleoenvironmental resonctructions. We also discuss the complexity of squamate body size as a proxy for temperature in paleoenvironmental reconstructions and the use of these models in predicting community responses under impending environmental change. These ecometric relationships provide vertebrate paleontologists with an additional method for interpreting paleoclimate and paleoenvironmental conditions from fossil squamate assemblages.

Funding Sources National Science Foundation DEB award numbers 2124836 and 2124770; Natural Environment Research Council award NE/W007576/1

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Phylogenetic relationships of *Borealosuchus griffithi* and potential challenges to the monophyly of *Borealosuchus*—insights from a new specimen from the Paleocene Ravenscrag Formation of Saskatchewan

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Borealosuchus is a clade of basal crocodylians currently consisting of six described species spanning upper Cretaceous and lower Paleogene deposits of North America. One species, *Borealosuchus griffithi*, was originally named from UALVP 40955, a partial skull and fragmentary postcrania from the lowermost upper Scollard Formation (earliest Puercan NALMA) in Alberta, Canada. Though the potential phylogenetic placement of this taxon was discussed in the holotype description, no formal analysis was conducted. The relationships of this species to other species of *Borealosuchus* remain poorly understood.

We sought out to clarify the phylogenetic relationships of this taxon by including data from a second specimen, RSKM P2906.1 from the lower "grey facies" Ravenscrag Formation (Puercan) of southmost Saskatchewan, Canada. This specimen is more complete than the holotype, consisting of a nearly complete skull, mandible and most postcranial material. Additionally, this specimen represents an extension of the spatial and temporal range of the taxon and may overlap with another member of *Borealosuchus, B. sternbergii*.

To test the placement of this taxon, we conducted two phylogenetic analyses based on two different character-taxon matrices, recovering *B. griffithi* in conflicting positions. The two matrices are similar in their sampling of characters and taxa but have some variation between them. The first recovers *B. griffithi* within *Borealosuchus*, sister to a clade composed of *B. formidabilis*, *B. wilsoni*, *B. acutidentatus*, and *B. threeensis*. The second analysis recovers this taxon as part of a polytomy with *B. sternbergi*, Planocraniidae, and Brevirostres, supported by the lingually occluding dentary teeth, with an occlusal pit between the 7th and 8th maxillary teeth, an anteriorly broad palatine process, and a short process on the postorbital bar. The rest of the species attributed to *Borealosuchus* lack these characters and are recovered as part of a polytomy which includes the previously mentioned group. This second analysis represents a possible challenge to the monophyly of *Borealosuchus*, suggesting that this genus may be paraphyletic and more appropriately split into multiple genera.

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

What is 'Bone of Attachment'? Re-discovering Tomes' histological sections and its implications for gnathostome tooth attachment tissue homology

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For 200 years, comparative anatomists have documented and debated the origins and evolution of teeth and dental tissues. Central to this debate has been the homology of different elements of the tooth module. Establishing the homology of tooth attachment tissues across major gnathostome taxa has remained particularly elusive and hotly debated. In 1874, Charles S. Tomes discovered that many non-

mammalian vertebrates fuse their teeth to the jaws via an intermediary bony tissue, produced by each tooth, that he termed ‘bone of attachment’. This differed from the fibrous attachment in mammal and crocodilian teeth, where three tissues—cementum, periodontal ligament, and alveolar bone—suspend teeth in sockets. The ‘bone of attachment’ paradigm thus provided a framework for describing how non-mammalian teeth could become fused to the jaws, whereas those of mammals and crocodilians did not. Unfortunately, the homology between ‘bone of attachment’ and the three-part attachment system in mammals and crocodilians was unanswerable for Tomes, resulting in confusing, often contradictory interpretations of gnathostome tooth attachment that have persisted for 150 years, hindering our ability to reconstruct the evolutionary history of the tooth attachment system.

Here we describe the original histological sections used by Tomes to define ‘bone of attachment’ using modern microscopy techniques and compare them to sections of extant and fossil gnathostomes. Our analysis reveals that ‘bone of attachment’ is not a single tissue but corresponds to different components of a tooth depending on the species Tomes examined. In snakes, this tissue is a semi-mineralised periodontal ligament; in fish, the tissue is sometimes a cellular bone pedicle, and other times it is dentine. We then compare these sections with emerging evidence for the presence of cementum, periodontal ligament, and alveolar bone in amniotes and early gnathostomes. These comparisons reveal two fundamental aspects of dental evolution: (1) ‘bone of attachment’ is a nomen dubium and not a distinct dental tissue; and (2) cementum, periodontal ligament, and alveolar bone are likely homologous across gnathostomes. Finally, we provide a new framework for describing tooth attachment tissues, using examples from amniotes, extant fish, and early gnathostomes, demonstrating that timing and extent of tissue mineralisation underpin the diversity of tooth attachment modes.

Funding Sources Leverhulme Trust Research Project Grant No. RPG-2024-053

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Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

The explanatory power of energetic fitness models across living amniotes and extinct non-avian dinosaurs

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Vertebrate groups have varied body size distributions. Among them, non-avian dinosaurs have uniquely large minimum and maximum sizes, but the reasons for this are not fully understood. Energetic fitness models describe how physiological scaling relationships should structure body size distributions and life history under selection to maximize the conversion of energy into offspring and provide a potential explanation of this variation. We show that the body size distributions of birds, mammals and turtles fit the expectations of energetic fitness models, but those of snakes, lizards and crocodilians do not. Moreover, no reasonable theoretical combination of physiological scaling relationships explains the up-shifted body size distribution of non-avian dinosaurs. We propose that the energetic fitness models perform well when body size distributions are governed primarily by thermodynamic considerations. However, constraints imposed by other factors, such as ecological constraints due to competition, predation or life-habit may be required to explain the patterns of species body size distributions within other amniote groups. If so, then the abrupt macroevolutionary shift from non-avian dinosaurs with minimum adult body sizes of 400 g, to birds with modal body size of 30 g cannot be explained by changes in

energetic and physiological scaling but rather may have been caused by an abrupt shift in ecological constraints, potentially related to the origin of flight.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Locomotor specialization drives patterns of evolutionary allometry in the mammalian spine

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Understanding how ecological pressures and mechanical constraints interact to produce diversity is a central challenge of evolutionary biology. The mammalian backbone functions in locomotion, respiration, and organ system protection, and these mechanical requirements vary in different ecological settings and at different body sizes. However, it is also morphologically and functionally regionalized and so makes an excellent model to investigate questions of adaptation and constraint. Here we ask how allometric and ecological pressures acting on the mammalian spine interact on a macroevolutionary scale. Dimensions of the precaudal vertebral centra of 116 mammal species, across all extant orders, were measured and used to test the influence of locomotor specialization on evolutionary allometry of the mammalian axial skeleton, using phylogenetically-informed regressions and ANCOVAs. As body mass increases, the spine becomes craniocaudally shorter, with strongest negative allometry in the lumbar region. Thoracolumbar vertebrae become more robust at larger body masses, and this relationship is modulated by ecology, with the effect strongest in arboreal mammals and weakest in digging specialists. The effects of both ecology and allometry on morphology are strongest in the lumbar vertebrae, which may be a response to the greater mechanical demands placed on this region, as it lacks the additional support of the ribcage. These results indicate that the morphological response to mechanical demands associated with larger body size is partitioned between regions, and influenced by ecological specialization, highlighting the significance of the regionalized spine in facilitating functional diversity. The strong correlations between osteology, mechanics, and ecology identified here provide a basis to explore axial function in fossils and evolution of the mammalian spine through deep time.

Funding Sources NERC ACCE DTP and University of Liverpool co-funded studentship

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Evolution of the sauropodomorph astragalus: implication for key phylogenetic characters and critical appraisal of evolutionary rates associated to the evolution of sauropod's bauplan and gigantism

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Sauropods include the largest terrestrial animals that ever walked, including numerous forms exceeding several dozens of meters and tons. This clade is known by several hundreds of species, and its diversification is tightly linked to the acquisition of a particular bauplan, characterized by key features such as obligate

quadrupedality and limb columnarity. However, sauropods are nested within sauropodomorphs, whose earliest representatives were plesiomorphically smaller, non-columnar bipedal animals. In this context, the evolution of limb traits related to the sauropod bauplan, in association with gigantism, has been increasingly scrutinized over the last few decades, with much effort focused on stylopod and zeugopod elements. Yet, autopod bones such as the astragalus, remained rather understudied, despite their critical role in foot impact during locomotion.

We therefore aimed to document how the astragalar morphology evolved across the evolutionary history of sauropodomorph dinosaurs. Using surface 3D geometric morphometrics, we comprehensively quantified the shape of a large sample of sauropodomorph astragali. Results suggest that the acquisition of sauropod-related features was rather stepwise, consistently with previous patterns observed for the tibia and the fibula, with a neat demarcation of eusauropods. Moreover, our analyses also suggest more subtle variations notably discriminating diplodocoids and brachiosaurids. We also conducted estimation of multivariate branch-specific rates of evolution of the species gathered in our sampling by performing a phylogenetic ridge regression, taking stratigraphic uncertainties into account. While our results might support a rate slowdown, associated to the diversification of eusauropods, our sensitivity analysis shows that this interpretation is highly sensitive to temporal uncertainty. Our study therefore highlights how astragalar features evolved along the evolutionary history of sauropodomorphs, implying possible revision of coding in some phylogenetic characters, and also encourages acknowledging in phylogenetically-informed studies how sensitive results can be regarding unknown parameters, eventually allowing to more robustly assess the degree of confidence one can put on interpretations.

Funding Sources This work was funded by the European Research Council and is part of the GRAVIBONE project (ERC-2016-STG-715300).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The cephalic lateral line in gars (Lepisosteidae): unique tubule structures and interspecific variations

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The cephalic lateral line system is a mechanosensory network that allows aquatic vertebrates to detect hydrodynamic stimuli, playing a vital role in navigation, prey detection, and predator avoidance. While the cephalic lateral line (sensory canals) has been depicted in both extant and fossil taxa based on exposed components, the internal morphology and their evolutionary implications are largely unknown. The family Lepisosteidae (gars), comprising two extant genera, *Lepisosteus* and *Atractosteus*, and several extinct genera, including *Cuneatus* and *Masillosteus*, presents a valuable model for investigating the evolutionary morphology of the lateral line system because of their early diverged phylogenetic position and heavily ossified skull. Using X-ray computed tomography, we examined the cephalic lateral line system across all seven extant species of Lepisosteidae and one extinct species, *Atractosteus simplex* (FMNH PF 15211, 90 mm HL), from the Eocene Green River Formation. The canal pathways (supraorbital, infraorbital, otic, postotic, mandibular, preopercular, preorbital, and supratemporal commissure canals) consistently showed the same layout across all taxa. However, tubules showed varying degrees of connectivity and complexity, indicating interspecific variation. They emerged as a unique feature of the family, characterized by a row of arch-shaped tubules with secondary, accessory tubules forming a fishnet-like pattern.

The Eocene specimen displayed comparable canal pathways, but with both incomplete and fully connected arched tubules, along with minimal secondary tubule development. While this reinforces our observation of interspecific variation, it may reflect an evolutionary or ontogenetic stage distinct from that of extant taxa because the fossil specimen is the smallest in our dataset. Although all specimens appear to be adults based on size-age estimations, larger individuals visually showed more connected arched tubules and secondary tubule structures, which may have obscured our interpretation of interspecific variation. Collectively, these preliminary results demonstrate that while the distribution and pattern of cephalic lateral line canal pathway are conserved within Lepisosteidae, tubule morphology exhibits notable variations likely associated with phylogeny and growth. The underlying causes behind this variation remain unclear, prompting future ontogenetic studies aimed at understanding how these patterns develop and when they occur.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

The devastating tail strikes in glyptodonts in the light of phylogeny and paleorobotics

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Glyptodonts, giant herbivorous armadillos endemic to the Americas (Eocene–Holocene), are a prime example of how fossils greatly expand the disparity of clades otherwise recorded solely by extant forms. Among their many morphological peculiarities is an armored tail, a unique feature in the animal kingdom without modern analogues and convergent in many traits to structures of ankylosaurs. Studies reconstructing the function of glyptodont tails have been confined to anatomical observations and mathematical models. They have converged towards the hypothesis of a tail used as a weapon in agonistic behavior, defined here as physically offensive social interactions, rather than as a means of defense against predators. Using 33 glyptodont species from the most recent phylogeny and distributed over the Neogene and Quaternary, we demonstrate that the tail anatomy of glyptodonts spans a spectrum from the most protective to the most offensive morphological features, highlighting differentiated tail functions. We argue that an offensive tail is a feature restricted to a few species, finding its most derived morphology in the largest glyptodont, *Doedicurus clavicaudatus*, a Pleistocene giant weighing over two tons with a club-like tail. Using dynamic paleorobotics with the extreme case of *Doedicurus*, we reveal the devastating and unsuspected striking force of this extinct giant, falling into the surprising estimates inherited from mathematical approaches with an impact force of 159.41 kN at a speed of 12 m/s. Whereas a tail strike during agonistic behavior is assumed to correspond to a low-damage offensive against a conspecific for intimidation purposes, our findings show that *Doedicurus* tail impact force was so deadly that its adaptive optimization is more plausible as a reflection of selection for a high-damage defensive tail strike against predators. Our discovery thus tempers the current consensus and revives the hypothesis of the use of the armored tail as an anti-predator weapon in glyptodonts. To overcome the limitations of simulations alone, our study highlights the significance of using dynamic paleorobotics for experimental validation. A robotic replica, physically embodying our theoretical predictions in motion, provides a crucial tool for understanding past systems and offers a promising direction for paleontology.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A sea of change: breaking down Sternberg Museum Science Camps as an alternative funding model in a time of crisis

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In the year 2025, US federal funding agencies for museums, science, and education have experienced unprecedented attacks on budgets and personnel. The ongoing destruction of these financial support systems necessitates consideration of operational strategy changes to continue serving our audiences such as public learners, career professionals, and pre-professional trainees. While major donor cultivation and fundraising drives can provide fiscal patches for many institutions, these approaches still require immense time investment by institutional staff to maintain evenly year to year.

Here I lay out an alternative model: establishing scaleable fee-based programs seeking public engagement in support of existing operational goals. At the Sternberg Museum of Natural History, we have spent the past 10 years building a financially robust exceptional education program outside the typically grant-based funding strategies. In 2025, the Sternberg Museum Science Camps are employing over 30 seasonal paleontology students and early-career professionals with a total payroll of over $140k, funding $50k in need-based student scholarships, and awarding our second round of alumni travel grants totaling nearly $20k so far. Our fee-based 2025 operational budget from 148 student participants, without factoring in donations, is roughly $480k, over 1.5x growth from 2024 and over 7x growth from 2021. On top of this, we are a small university museum far from any major cities.

Sternberg Museum Science Camps began in 2014 with the goal of breaking down financial barriers to pre-professional opportunity access by building a self-sustaining operation supporting earth and life science students. Two major factors have immensely aided this venture: attention to our community and culture, and creative application of well-tested entrepreneurial strategies. By creating a safe, supportive operation for students as well as staff, we have been able to sustain a robust, diverse, progress-focused community motivated and empowered to see the program continue to succeed. These efforts have been bolstered by the integration of entrepreneurial strategies borrowed from a diversity of industries that respectively inform components of the Camps' operations. These results indicate that creative institutional resource and skill-leveraging, combined with select private sector strategies, may provide novel progressive financial and operational avenues for natural history museums and science centers.

Colbert Prize Session

Vertebrate latitudinal diversity dynamics across the Permo–Triassic boundary

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Modern biodiversity is centred toward the tropics and diminishes toward the poles in a pattern recognised as the latitudinal diversity gradient (LDG). These trends in species richness are shaped by several factors, such as global climate, which are recognised to have fluctuated in deep time. One such interval was the Early Triassic, when a sustained (~5 Ma) hothouse climate forced life to abandon the tropics to escape lethally hot temperatures. However, the geographical extent of this 'tetrapod gap'—and whether it reflects a true biological signal or sampling artefact—remains the subject of debate.

We provide a focused assessment of this tropical dead zone (TDZ) by generating a series of occurrence-based palaeomaps at a fine-scale (sub-stage) temporal resolution to precisely track shifts in terrestrial and marine vertebrate LDGs from the Late Permian to Middle Triassic. We then integrated our data with state-of-the-art palaeoclimate simulations to identify the driving forces behind these patterns across the Permo–Triassic boundary. Palaeoenvironmental outputs were obtained under a 4000 ppm Induan (earliest Triassic) pCO_2 climate scenario using the HadCM3L general circulation model.

Our results show that the TDZ was more volatile than previously recognised, with expansions and contractions corroborated by recent palaeoclimate records. These fluctuations offered life brief windows to recolonise and radiate across sections of Pangaea and Panthalassa, although a full return to the tropics would not occur until temperatures had sufficiently cooled during the Spathian, approximately 5 Ma after the Permo–Triassic boundary. We also find that both terrestrial and marine LDGs in the earliest Triassic were co-driven by temperature and formation count, with terrestrial biodiversity perhaps also influenced by humidity and seasonal rainfall. The latter variables may signal the presence of extreme tropical storm events, which may have frequently attacked the equatorial coastlines and increased poleward migration.

Our work advances our understanding of deep time LDGs and the spatial responses to extreme climate warming. We also highlight the environmental factors that may have shaped these major biogeographical shifts—insights that may inform predictions of species responses to the modern climate crisis.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Bone histology reveals the life history and niche of the oldest crocodilian fossil from Taiwan

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In 2006, a crocodilian fossil was discovered in the Yuwentao Formation of the Penghu Islands, Taiwan. Estimated to be 15 to 17 million years old, dating back to the Middle Miocene, it represents the oldest and most complete vertebrate fossil currently known from Taiwan. The specimen was named *Penghusuchus pani* and assigned to the family Gavialidae, a clade now absent from Taiwan and whose bone histology remains poorly understood.

Previous research focused on its morphology and systematics. In contrast, this study aims to investigate the life history and niche of *Penghusuchus* through its bone histology. Thin sections were prepared from the midshaft of the femur, the humerus, and the proximal third of the rib. The preserved tissue is mainly composed of parallel-fibered bone lacking primary vascularization. The outermost cortex shows an external fundamental system. A high density of erosion cavities and secondary osteons are observed throughout the sections, reflecting extensive remodeling. Notably, the femur and rib sections show an outer layer of reactive periosteal tissue, which, based on comparison with previous studies, is interpreted as pathological histology.

The high density of secondary osteons, extensive bone remodeling throughout the specimens, and the frequent presence of numerous growth marks indicate that the individual was senescent at the time of death, with this conclusion further supported by the closure of neurocentral sutures in the vertebrae. Additionally, femoral tissue images were analyzed using the BoneProfilerR, and the resulting data, including a bone compactness of 77%, were incorporated into a previously established ecological prediction model. The results suggest that *Penghusuchus* was semi-aquatic.

Interestingly, the specimen exhibits unusually extensive bone remodeling, which, although possibly related to its age and lifestyle, remains

uncommon even among older or semi-aquatic crocodilians. One possible explanation is gestation, as calcium mobilization during gestation can induce increased bone remodeling to meet the calcium demands of eggshell formation. However, in the absence of other evidence, this interpretation remains speculative.

Further research, including comparisons with extant gavialids, may help clarify the ecological adaptations and possible causes of the extinction of *Penghusuchus*, and determine whether its extensive bone remodeling reflects a unique physiological trait or a broader pattern within Gavialidae.

Funding Sources National Science and Technology Council, Taiwan grant NSTC 113-2116-M-178-001 to T.-R. Yang

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

An unusual hybodontoid skull from the Middle Triassic of South China

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Chondrichthyan skulls are exceptionally scarce in the Triassic. Here we report a remarkably preserved articulated hybodontoid specimen (GZQ2208634) from the Zhuganpo Member of the 'Falang' Formation (Middle Triassic) in the Xingyi fauna. It comprises a partially preserved three-dimensional neurocranium, visceral skeleton, and dermal skeleton. The skull measures 280 mm in length, while the entire fossil block extends to 960 mm. The ethmoid region of GZQ2208634 exhibits morphological similarities with that of *Orthacanthus*. Additionally, the specimen preserves a large labial cartilage of the palatoquadrate and several branchial skeletal elements. The dermal skeleton is represented by a cephalic spine, two dorsal fin spines, 25 teeth, and numerous dermal denticles. The teeth are sharp-grasping type with multicuspid, strong-ridged and sharply pointed crown, closely resembling the dentition of *Hybodus basanus*. The material described here has important implications for our view of hybodont evolution.

Funding Sources National Natural Science Foundation of China (No. 42172009).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A new large *Nothosaurus* (Reptilia, Eosauropterygia) from the Middle Triassic of South China and the phylogeny of Eosauropterygia

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Recent discovery of many new marine reptiles from the Triassic of South China played an important role in understanding the marine ecosystem recovery after the Permo–Triassic mass extinction. Here we report a new large nothosaurian marine reptile, *Nothosaurus* sp. nov., represented by three specimens from the Upper Member of Guanling Formation (middle Anisian, Middle Triassic) in Luxi, South China. Bone histology indicates that the largest individual was adult and was close to skeletal maturation. *Nothosaurus* sp. nov. is recognized by apomorphies that include: a massive humerus with constricted mid-shaft being half the width of expanded proximal and distal ends; a distinctly elongated scapular dorsal process tapering to a relatively sharp tip; iliac blade reduced but projecting slightly beyond the posterior margin of the acetabulum of ilium. The phylogenetic analysis recovered a monophyletic *Nothosaurus* with *Nothosaurus* sp. nov. as the sister taxon to *N. jagisteus*. The monophyly of Eusauropterygia is collapsed, with Pachypleurosauria and Nothosauroidea

constituting a monophyletic Nothosauriformes. *Hanosaurus* and *Majiashanosaurus* comprise the consecutive sister groups of Nothosauriformes, together they form the monophyletic Nothosauromorpha. The discovery of *Nothosaurus* sp. nov. adds to the existing evidence for highly diversified large predators in the shallow seas of the eastern Tethys during the Anisian.

Funding Sources National Natural Science Foundation of China (42172026, 41772003), Natural Science Foundation of Anhui Province (2408085J022), China Scholarship Council (201906690046).

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

Head to herbivore: new evidence for cranial functional evolution in early-branching therizinosaurs

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Therizinosauria is a bizarre and rarely-known group of herbivorous theropod dinosaurs from the Cretaceous of Asia and North America. Marked by a dietary shift from carnivory to herbivory, therizinosaurs evolved a unique and unusual combination of morphological features not seen in typical theropods. In the past decade, combined approaches such as geometric morphometrics and biomechanical modeling have been applied to explore morphological changes and functional adaptations across the clade. However, due to the fragmentary fossil record, most studies have focused on mandibles or postcranial elements—particularly manual unguals—while cranial morphology of early-branching members remains poorly understood. Here, we present an early-branching therizinosaur specimen, IVPP V18957, from the Lower Cretaceous Yixian Formation of northeastern China. The specimen preserves a nearly complete skeleton (missing only the hind limbs), and notably includes an exceptionally complete but dorsoventrally compressed skull, typical condition for fossils from the Jehol Biota. The estimated body length of approximately 3.7 meters makes IVPP V 18957 the largest known therizinosaur from the Jehol Biota, considerably larger than the second-largest known specimen *Beipiaosaurus* (~2.2 meters). To better understand the cranial morphology and functional evolution of this taxon, we digitally reconstructed the skull using CT data and conducted biomechanical analyses. Comparisons with the closely-related taxon *Jianchangosaurus* and the later-branching therizinosaurid *Erlikosaurus*, reveal that early therizinosaurs possess a proportionally shorter snout and a relatively enlarged maxillary fenestra. CT reconstruction and finite element analysis indicate that IVPP V18957 had a lightweight skull with reduced mediolateral thickness in the cranial bones, and a lower stress resistance compared to other therizinosaurs. These features imply an adaptation for low-stress feeding strategies and highlight the lightweight construction of the skull in some early therizinosaurs. Our findings indicate that dietary specialization and cranial biomechanical differentiation began early in therizinosaurian evolution. This early onset of cranial adaptation, along with notable differences in body size, may have reduced niche overlap among coexisting taxa, and sheds new light on the ecological and functional diversification of this unusual clade of herbivorous theropods.

Funding Sources This research is supported by the National Natural Science Foundation of China (42288201).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Old turtles, new stories: Pleistocene fossils from Taiwan reveal the past distributions of extant species

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Understanding the baseline of the endangered species requires knowledge of their past distribution, which in turn allows us to face the ongoing sixth mass extinction. The taxonomy of fossil specimens plays a key role in providing evidence of their evolutionary history. Numerous fossils were dredged from the sea bottom of Taiwan Strait, in the eastern margin of the Eurasia landmass and the western North Pacific. The geological age remains problematic but can be broadly dated to the Middle to Late Pleistocene (0.78 to 0.01 Ma). Fossil freshwater turtle species, *Chinemys pani* and *Trionyx liupani*, were named, but both holotypes have long been missing and are likely lost. We found replicas of *C. pani*, reexamined the morphology, and observed the unique character of *Mauremys reevesii*: the three longitudinal carapacial keels. Further, we confirm that the original diagnostic features are polymorphic characters of *M. reevesii*. The taxonomic revision resolves the debate on whether this geoemydid is introduced or native to Taiwan. Three fossils also support a Pleistocene population of *M. reevesii* in Taiwan. Similarly, replicas of the *T. liupani* holotype are reexamined. With seven new specimens, we confirm the first fossil record of the giant softshell turtle, *Rafetus swinhoei*. The cranial features show the *Rafetus* affinity: a short, broad snout, narrow triturating area, and a short postorbital bar. The body size is estimated to be more than 1.5 m. Given the giant size and the shape of the basisphenoid, the taxonomy can further confirm its identity as *R. swinhoei*. Our fossil record shows that the Pleistocene distribution of those freshwater turtles differs from that of the Present. In addition, we also found a large, flattened humerus with a lateral process near the midshaft, and its morphology, including an oblique crest on the intertubercular side, clearly shows the affinity to the extant leatherback turtle (*Dermochelys coriacea*). The fossil record of *D. coriacea* is next to zero, and our discovery suggests that they were utilizing the waters of the Taiwan Strait at least back to the Pleistocene. Our study on turtle fossils from the Pleistocene of Taiwan shows the potential and importance of the tropical region in the Far East for freshwater turtles and sea turtles in the western North Pacific. Further analyses and fossil collecting will set a Pleistocene baseline of the extant turtle species from Taiwan and reveal their significance in conservation paleobiology.

Funding Sources This project is supported by MOST (or NSTC) 107-2621-B-002-005; 108-2621-B-002-006-MY3; 111-2621-B-002-006 and NTU FD107028 to TSAI.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Swim like a fish: vertebral perspectives on the locomotory convergence of ichthyosaurs and whales

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Ichthyosaurs and whales are amongst the few vertebrate lineages that transitioned from life on land to an obligate life in the sea. Their eco-morphological convergence towards ‘fish-like’ swimming modes seems to have followed a parallel trajectory from the modification of walking limbs into paddles, to utilizing

undulatory motion involving most of the vertebral column, and finally the development of a stiffened thunniform body with a propulsive tailfin. However, gaps in the fossil record of both ichthyosaurs and whales obscure when and where each of these landmark evolutionary steps took place.

We used a combination of micro-CT, classical thin sections and mechanical testing to analyze vertebral bone microstructure as a skeletal proxy for different locomotory modes in a sample of ichthyopterygian and cetacean taxa. Our study adopts the premise that the vertebral column is the most important part of the skeleton involved in their locomotion as it anchors the primary swimming muscles. Assessing how swimming mode is recorded in vertebral centra will also greatly expand the available data, as these bones are commonly found as fossils.

Since physical forces caused by locomotion affect the microanatomy of the vertebral column of aquatic animals, we mapped the inner bone microanatomy of two Early Triassic ichthyosaurs: the basally divergent small-bodied ichthyopterygian *Grippia*, and large-bodied basal ichthyosaurian *Cymbospondylus.* Our results show that the transition to fully oceanic lifestyles occurred within only a few million years (Ma) after the End-Permian Mass Extinction, with the *Cymbospondylus* having already achieved typically whale-like spongy trabecular bone microstructure (with some ontogenetic changes) by the mid-Spathian (~248 Ma).

Furthermore, porosity modeling and mechanical testing against the centra of a modern harbour porpoise (*Phocoena phocoena*) suggests that despite being an open ocean predator, *Cymbospondylus* had not yet evolved a thunniform body with the swimming mode of later ichthyosaurs and modern odontocetes.

In addition, we mapped the three-dimensional microanatomy of a dolphin vertebral column to determine how movements affect the different modules of the spine. This was used for comparison to equivalent CT scans of five extinct whales (*Pachycetus, Natchitochia, Zygorhiza, Maiabalaena,* and an Odontocete indet.) and a minke whale, enabling us to propose how whale swimming ability evolved through time.

Funding Sources This research is part of the ECHO project, funded by a Research Council of Norway Young Talents grant to LLD, project number 335111.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Recurrent adaptation of the Hippopotamoidea to life in water

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As they form a unique clade within Artiodactyla, it has been suggested that Hippopotamidae and Cetacea evolved from an aquatic ancestor. However, recent studies based on anatomical features have dismissed this idea, suggesting that semiaquatic habits have converged between basal cetaceans and hippopotamoid taxa. These studies have notably found evidence of convergence based on phylogenomic analyses of transcriptomics, gene loss, and skin-related genes. Given that aquatic habits evolved independently in the Hippopotamoidea and Cetacea, and probably multiple times within the Hippopotamoidea, we explore the number of terrestrial to semiaquatic shifts within the Hippopotamoidea, and their driving factors:

biotic environment, paleogeography, or climatic conditions?

For the past ten years, since the inception of the research program SPLASH from the French national agency for research (ANR), we have conducted several studies, notably on the skull, petrosal and inner ear morphology, postcranial morphology and microanatomy, and population structure of hippopotamoids for palaeoeocological purposes. These studies revealed mosaic evolution and likely several degrees of adaptation to semiaquatic lifestyle. To further explore this topic, we recently conducted a geochemical analysis focusing on the $\delta^{18}O$ ratio of fossil hippopotamoid enamel. It had already been demonstrated that the aquatic component of a fauna exhibits lower $\delta^{18}O$ values than the associated terrestrial component, because water-dependent mammals are insensitive to evaporation. We therefore investigated the evolution of the $\delta^{18}O$ values in several hippopotamoid species and compared them to other large terrestrial herbivorous associated in the same fauna. We also compiled all the available literature on hippopotamoid geochemistry. We thereby obtained results for at least one third of the 118 known hippopotamoid species.

The interpretation of those results within a constrained phylogenetic and chronological framework offers to discuss the potential congruence between the phenotypic characters associated with an aquatic lifestyle and the isotopic ratios. In addition, correlating hippopotamoid diversity with their degree of adaptation to life in water, in relation to climatic and paleogeographic factors, enables us to determine whether aquaticity is a key evolutionary feature. In fact, our analysis reveals that environmental aridification is a key driver of adopting aquatic habitat in this clade.

Funding Sources Agence National pour La Recherche, SPLASH program

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A super-sized eugaleaspiform fish (Galeaspida, Stem-Gnathostomata) from the Silurian of Yunnan, China and its palaeoecological implications

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The early Silurian eugaleaspiforms (mainly Shuyuidae and Sinogaleaspidae) are all small-sized fishes with their headshield length less than 40 mm. The late Silurian Xiaoxiang fauna has produced a diverse assemblage of early fishes, including galeaspids, acanthodians, the largest known Silurian maxillate placoderm *Silurolepis*, and the largest pre-Devonian osteichthyan *Megamastax*. Here, we describe a new super-sized galeaspid from the upper Silurian Kuanti Formation of Qujing, Yunnan Province, southwestern China. The new fish exhibits the diagnostic characters of the Eugaleaspiformes, including a triangle-shaped head shield with a blunt rostral margin, posterolaterally projecting cornual and inner cornual processes, and a slit-shaped median dorsal opening. Its headshield is exceptional, with a length exceeding 200 mm, significantly larger than that of the other Silurian galeaspids. Our phylogenetic analysis indicates that the new fish and *Nochelaspis* (another large-sized fish from the Lower Devonian) form a monophyletic group in Eugaleaspiformes. The new super-sized eugaleaspiform fish, together with the largest known osteichthyan *Megamastax* and the maxillate placoderm *Silurolepis*, from the upper Silurian Kuanti Formation of Yunnan, corroborates the high Silurian oxygen levels predicted by GEOCARBSULF.

Funding Sources National Natural Science Foundation of China (42130209, 92255301)

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Persistent body size bias in the fossil record of North American Cenozoic mammals

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Body size is a key organismal trait with profound implications ranging from individual physiology to large-scale macroecological or macroevolutionary phenomena. Among extant terrestrial vertebrates, peak diversity commonly occurs at smaller body sizes. Broad similarities in geometry between the body size distributions of fossil and extant mammals have been used to argue that body size-diversity signals in the fossil record are robust, yet preservation and collector biases disproportionately favor the sampling of large taxa and likely leave small taxa underrepresented. We quantified the effects of these biases on the body size distribution of North American mammals through the Cenozoic, and investigated sampling standardization as a potential methodology to correct it, drawing down the estimated diversity of large taxa to the less-completely-sampled level of small taxa. We also examined how these body size distributions have changed through historical research time, as an alternate method of observing sample completeness to sample coverage. Our results show body size bias in the mammal record to be persistent and severe. Across the Cenozoic, we find little consistency in the relative magnitude of recovered small- and large-sized mammal diversity, with the early Neogene notably yielding distributions where peak diversity spuriously occurs at large body size. Sampling standardization is not successful at correcting for this variability, having no consistent effect on recovered distribution shape, and we further note a stark contrast between sample completeness as detected by sample coverage metrics, which are generally high in all size categories in all time bins, and as detected by historical discovery trends, which generally show the inventory of small taxa to be increasing while large taxa have roughly asymptoted. Ultimately, historical worker interest (including publication biases), coupled with the taphonomic and sedimentological characteristics of a small pool of formations, exert major controls on body size distributions through time, changing the scope of the sampling universe and preventing the collection of species from being a "random draw" of the original population. Deriving non-artefactual fossil body size signals may ultimately depend on expanding the collection of small-sized material and/or focusing study on a smaller range of well-sampled formations.

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Royal Society University Research Fellowship (URF\R1\211571)

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Climate, Clovis, and catastrophe: hundreds of new radiocarbon dates reveal near-synchronous extinction of North American megafauna across multiple regions 13,000–12,800 BP

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The complex causes, dynamics, and consequences of the extinction of most of Earth's large terrestrial fauna at the end of the Pleistocene remains an enduring enigma in paleontology. Conventionally, it is thought that most North American megafauna (mammals weighing more than 45 kg) went extinct sometime between the start of the Younger Dryas and the early Holocene (~13,000 – 10,000 years Before Present). However, the existing geochronological record is inadequate to precisely discern the timing or tempo of these extinctions or disentangle the impacts of near-simultaneous deglacial climate changes and rising human populations on faunal declines and extirpations. Understanding how these factors played out across the continent requires well-resolved chronologies for multiple taxa in different regions. But, up until now, fewer than 300 unique, reliable, direct radiocarbon dates on extinct megafauna have been published for the entirety of non-Beringian North America outside of one locality (Rancho La Brea, California, USA).

In order to investigate the timing, tempo, and mode of megafaunal extinction, we obtained >200 new, high-quality radiocarbon dates on bone, tissue, and dung from 21 species of extinct large mammals from different regions of non-Beringian North America, and re-dated specimens that had been previously dated to the Holocene and Younger Dryas. We were unable to replicate any previously-published Holocene dates, and many specimens that had been previously dated to the Younger Dryas yielded ages hundreds to thousands of years older in our analysis. We integrated these new dates with a vetted dataset of published radiocarbon dates to reconstruct extinction chronologies for different taxa and regions. Extinctions were surprisingly coincident across the continent: densely-sampled records comprising multiple taxa reveal disappearance of megafauna by 13,000 BP in Southern California; 12,900 BP in the mid-continent, and 12,800 BP in the southwest interior. Notably, these extinctions occur contemporaneously with the Clovis culture, which is well-constrained to 13,050–12,750 years BP. The only later survival of megafauna we identified was of proboscideans in northeastern USA, where they persist until the latter Younger Dryas, suggesting possible refugia along ice sheet margins. The rapidity and temporal coincidence of megafaunal extirpations across regions with disparate environmental histories suggests an anthropogenic driver of these extinctions.

Funding Sources The North Star Archaeological Research Fund at the Center for the Study of the First Americans, Texas A&M University

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The Coniacian dating game: Niobrara predatory behaviour and the dangers of swiping right revealed by palaeopathology

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Palaeopathology, as the study of ancient injuries and diseases, examines anomalies in the development of fossilised tissues. Vertebrate injuries recording predation predominantly relate to bites, but other forms of attack can be preserved. We here report on an actinopterygian specimen from the Coniacian of the Niobrara Formation in Kansas, USA, that exhibits unusual patterns of damage and subsequent repair, with breaks only occurring on one side of a caudal lobe. The specimen consists of an articulated ichthyodectid caudal peduncle: 7 vertebrae preserved with haemals and neurals, together with a partial fin, the distal portions of each lobe having been lost to erosion. Of the possible candidate taxa, morphology and stratigraphy are consistent with and constrain diagnosis to *Gillicus*, *Ichthyodectes,* or a small *Xiphactinus*. The left side of the upper lobe of this caudal fin preserves an area where the caudal rays are

completely severed in a line. The initial injury does not appear to have sliced through the midline and affected the adjacent fin rays on the right side. Extensive remodeling of the severed ends of the bones gives each a bulbous appearance; however, they show no indication of having healed back together. The right rays, which may have acted as a splint stabilizing the wounded tail afterwards, exhibit a slight thickening opposite the pathology, possibly as a result of increased stress on the undamaged rays while swimming. The location of the wound on the upper lobe of a pelagic fish makes it unlikely to have resulted from impact damage from terrain and instead suggests an attempt to disable the ichthyodectid's propulsion and means of escape by a predator. Although many varieties of predators are known from the Western Interior Seaway, the nature of the wound as a lateral gash on only one side and the lack of any foreign material or teeth lodged in the slash appears to eliminate the possibility of it being the result of a bite from mosasaurs, sharks, or most bony fish present. The pursuit predator *Protosphyraena* is, however, commonly found in these sediments and the nature of the trauma is consistent with a slashing attack by this animal's lance-like rostrum during active hunting, similar to some contemporary istiophorids. Such evidence of an attack is unique in the fossil record and shows how the historically heavily sampled Niobrara Chalk continues to provide striking new specimens to enhance our understanding of local and global ecosystems.

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Opening a window to a warm Earth: age and growth of catostomid fishes from the Eocene Okanagan Highlands in North America

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The Early Eocene Climatic Optimum (EECO, 50–52 Ma) is among the most extreme instances of global warming in Earth's history. Analyses of freshwater fish growth during the EECO provide a window into how these environmental indicators adapt to changing temperature regimes and extreme climate. We investigated organismal response to EECO by assembling and interrogating a new age and growth dataset of two catostomid species, *Amyzon aggregatum* and *Wilsonium brevipinne*, from lacustrine and fluvial deposits of the Eocene Okanagan Highlands that spanned a 1000 Km transect in British Columbia of Canada and Washington of US. We photographed specimens showing growth lines and measured annuli width on scale transverse radial distance and opercle radial distance. Then we performed von Bertalanffy growth function analysis using 'fishmethods' package in R. We found that 1) the asymptotic size of lacustrine *A. aggregatum* is higher than that of fluvial *W. brevipinne* for both opercles and scales; 2) the Brody growth coefficient of the lacustrine species have no significant difference in scales; 3) the growth incremental width in the form of dark and light annuli bands are similar in width for the same year, indicating relatively warm but prolonged winters. These interspecific differences in growth characteristics align with microclimatic variations between lacustrine and fluvial habitats, as well as the broadening altitudinal gradient resulting from the uplift of the Okanagan paleo-highlands. Both species exhibited rapid, near-continuous growth during warm winters, underscoring the role of temperature in shaping life history patterns. Fossil fish growth responses during past temperature peaks thus offer a valuable model for understanding how aquatic organisms might respond to modern global warming trends. These findings highlight the importance of considering paleoclimatic analogues when assessing the resilience and adaptability of contemporary aquatic ecosystems to climate change.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A new hupehsuchian (Reptilia: Ichthyosauromorpha) with widely spaced autopodium from the marine Lower Triassic of South China

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Hupehsuchia is a group of marine reptiles from the uppermost Lower Triassic of South China, known for their segmented neural spines covered by dermal ossicles and polydactyl forelimbs. Although five genera and species are currently known for this group, our understanding of their true diversity is limited. In this study, we report a new genus and species of hupehsuchian based on the combination of unique characters in the trunk region and forelimb. These include widely spaced autopodial elements, an extra distal carpal and metacarpal, and a two-layered dermal armor. Phylogenetic analysis recovered the new species as a sister taxon to Parahupehsuchinae within Hupehsuchidae, supporting the gradual addition of extra carpal and digital elements in hupehsuchians. The widely spaced autopodia of the new taxon represent previously unknown morphologies in hupehsuchians. The wide spacing of the proximal autopodia, along with hyperphalangy, may help smooth the paddle surface to reduce vortices during wrist and proximal digit flexion and extension while swimming. Alternatively, it could result from reduced ossification of manual elements due to diminished muscular control in the manus.

Funding Sources National Natural Science Foundation of China (42172026 and 41772003); Natural Science Foundation of Anhui Province (2408085J022)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Ontogenetic dietary partitioning in a Triassic sauropterygian: implications from a new juvenile specimen of *Brevicaudosaurus jiyangshanensis* (Reptilia: Diapsida)

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During the first 10 million years of the Triassic, sauropterygians diversified rapidly into a variety of marine predatory niches. Adults of the late Middle Triassic eosauropterygian *Brevicaudosaurus jiyangshanensis* from southern China exhibit fang-shaped premaxillary teeth that resemble those of some nothosaurids and are adapted for feeding on large prey. Here, we report a juvenile example of the species, about one-third the length of the adult. The new juvenile shares apomorphies of the adult, like the posteriorly constricted parietal table, broadened humeral mid-diaphysis and short tail. However, its juvenile status is confirmed by unfused contralateral neural arch halves and developing epiphyses of the humerus. The small, smooth, conical premaxillary teeth of the juvenile differ from the ornamented fangs of the adult. The differences in the tooth morphology between the juvenile and adult suggest that this is an example of ontogenetic dietary niche partitioning, a common strategy for reducing intraspecific competition.

Funding Sources China Geological Survey; National Natural Science Foundation of China;

Natural Environment Research Council of UK; European Research Council; China Scholarship Council

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The external and internal anatomy of the cervical vertebrae of the sauropod dinosaur *Lingwulong shenqi* and its implications for pneumaticity in Diplodocoidea

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Lingwulong shenqi is known from several partial skeletons from the Middle Jurassic of northern China, with much of its cranial and postcranial anatomy represented amongst these remains. Initial phylogenetic analyses recovered it as a dicraeosaurid diplodocoid, whereas more recently it has been placed in an earlier-diverging position within Diplodocoidea, as a stem-flagellicaudatan. Regardless, *Lingwulong* currently represents the stratigraphically earliest known diplodocoid and neosauropod, challenging previous hypotheses of the center of origin and diversification of these clades. Its phylogenetic position extends the spatiotemporal distribution of Diplodocoidea and implies a number of unsampled ghost lineages. Dicraeosaurids are characterized by a number of anatomical specializations across their skeleton that distinguish them from other sauropods. This includes several features of their presacral vertebrae, with their elongate, bifid neural spines, the most striking feature. The cervical vertebrae of most dicraeosaurids are comparatively less pneumatized than other contemporaneous groups, with only shallow lateral fossae and spongious internal tissue structures, presenting ‘procamerate’ conditions. Although abundant fossil materials of *Lingwulong* exist, only limited anatomical information has been published so far. Here, we present new anatomical data on the cervical vertebrae of *Lingwulong* based on their external morphology and, for the first time, their internal anatomy, using CT scan data. Our preliminary analysis reveals that *Lingwulong* possesses deep fossae penetrating the vertebral corpus, and the internal bone around these fossae is spongious, thereby indicating a ‘procamerate’ condition, the same as dicraeosaurids, but also early-branching members of Diplodocidea, including *Haplocanthosaurus*. Our surveys of previously and newly prepared materials also documents a greater morphological variation in cervical vertebrae of *Lingwulong*, which includes both bifid and unbifurcated neural spines. These new data, along with anatomical information from the remainder of the skeleton, will help to elucidate the phylogenetic relationships of *Lingwulong* and early diplodocoids more broadly, as well as shed light on the evolution of pneumaticity within the clade.

Funding Sources China Scholarship Council-UCL Joint Research Scholarship.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A new long-snouted Early Jurassic (Pliensbachian) ichthyosaur illuminates a complex faunal turnover following the Triassic–Jurassic extinction

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Our understanding of ichthyosaur diversification in the Early Jurassic has changed significantly over the last few decades. Although ichthyosaurian faunas before and after the Pliensbachian stage of the Early Jurassic are known from numerous, often complete fossils,

Pliensbachian ichthyosaurs are rare. In fact, the two faunas are very different taxonomically, with only one of the pre-Pliensbachian genera, but none of the species, persisting into the post-Pliensbachian (Toarcian). The Pliensbachian interval represents a critical and poorly understood time in ichthyosaurian evolution just ~10 Myr after the end-Triassic mass extinction. Thus, a new ichthyosaur from the mid-Pliensbachian of the Dorset coast of the UK, the most complete ichthyosaur known from that stage, is significant. The new genus and species is characterized by a distinct combination of characters, including several autapomorphies of the skull and postcranium. Phylogenetic analyses reveal that the new genus is more closely related to the late Pliensbachian-Toarcian genus *Hauffiopteryx* than to earlier genera that continued into the Pliensbachian (e.g., *Leptonectes*, *Ichthyosaurus*), and forms a distinct clade within a monophyletic Leptonectidae. This indicates that a substantial faunal turnover in diversity occurred towards the end of the lower Pliensbachian, leading to a major shift in composition towards a more typical Toarcian ichthyosaur fauna.

Funding Sources The Royal Commission for the Exhibition of 1851 Research Fellowship (D.R.L.).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Reconstruction of the Neogene paleoenvironment in central Myanmar, using ecometric analysis of the artiodactyl calcaneus

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Ecometric analyses of modern fauna enable us to understand the relationships between the functional traits studied and environmental conditions at the community level. Once these relationships have been established, ecometric analyses can estimate the type of paleoenvironment in which fossil organisms lived. Previous analyses of modern artiodactyl communities have demonstrated relationships between locomotor morphology, represented by the calcaneal gear ratio, and mean annual precipitation (MAP), and tree cover. In this study, we analyzed fossil artiodactyl communities from two sites from central Myanmar representing the early Late Miocene (9–8 Ma), 44 specimens of Suidae, Bovidae, and Anthracotheriidae, and the latest Miocene/early Pliocene (6–4 Ma), 43 specimens of Bovidae, Hippopotamidae, and Giraffidae, to predict paleoenvironment (MAP and tree cover). These paleoenvironmental reconstructions help to better understand the changes in flora, landscapes, and fauna between 9 and 4 Ma that occurred in response to climatic variations during this period. Fossil community gear ratio values were determined from linear measurements of individual specimens and assessed using ecometric models constructed from extant data. Bootstrap analyses were performed to statistically test for differences between the two Neogene communities. These analyses indicate a shift from a forest-dominated environment with very high MAP to a more open environment with less vegetation cover and lower MAP (MAP 95% IC: -3.35; -0.33). These results are broadly concordant with previous findings using stable carbon and oxygen isotopes at these regions. Building on these findings, it is worth noting that ecometric approaches offer specific methodological advantages: they allow for rapid data acquisition, are non-invasive to fossil specimens, and are relatively cost-effective in implementation. Studying the environmental context with functional traits can provide valuable insights into faunal changes and the ecological dynamics that may have driven them.

Funding Sources JSPS KAKENHI (JP22KK0048, JP22H02708), Mitsubishi

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Biochronological insights from a new Early Pleistocene karstic site complex in eastern Iberia: the rodent assemblages from *Els Saldonets* (Vilanova d'Alcolea, Castellón, Spain)

López-García, Juan Manuel[1], Meseguer-Despons, Esteban[3], Oliva-Simó, Juan José[3], Canals-Salomó, Antoni[1], Martínez-Navarro, Bienvenido[4,1], Rook, Lorenzo[2], Madurell-Malapeira, Joan[2]

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The karstic outcrop of *Els Saldonets* is located in the eastern Iberian Peninsula, within the municipality of Vilanova d'Alcolea (Castellón, Valencian Community), at approximately 258 m above sea level (UTM: 31T0254554 4455109). The construction of the CV-13 regional road, which connects Castellón airport to the coast, exposed a group of sinkholes along the roadside slope with a high potential for preserving fossil remains. The discovery of this karstic complex is of great significance for understanding the Pleistocene of eastern Iberia, where the paleontological record is notably scarce. A small sediment sample was recovered from two different karstic infills (labeled as ALC-3b and ALC-2), both initially attributed to the Middle Pleistocene, to evaluate the potential for chronological inference based on fossil faunal remains. However, the taxonomic identification of the rodent assemblages indicates an Early Pleistocene age for both cavities. In ALC-3b, the glirid *Eliomys* sp. and the murines *Apodemus* sp. And *Stephanomys progressus* were identified. The presence of *S. progressus* suggests an age between 1.8 and 2 Ma, corresponding to the Gelasian stage of the Early Pleistocene. ALC-2 site yielded two murine species *Castillomys rivas* and *Apodemus* sp., one glirid *Eliomys* sp., one sciurid *Sciurus* sp., and one arvicoline *Manchenomys orcensis*. The presence of *M. orcensis* points to an age between 1 and 1.4 Ma, placing this infill in the Calabrian stage of the Early Pleistocene. Moreover, the occurrence of *M. orcensis* at *Els Saldonets* represents the northernmost record of this species in the Iberian Peninsula to date, as previous occurrences are restricted to more southern regions, such as Murcia and Andalusia.

Funding
Sources MCIN/AEI/10.13039/501100011033/FEDER, EU project PID2021-122533NB-I00. GENCAT 2021 SGR 01238.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Isolated theropod teeth from 'Lo Hueco' site, Upper Cretaceous, Cuenca, Spain

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The paleontological site of 'Lo Hueco' (Cuenca, Spain) is one of the most exceptional Upper Cretaceous sites of Europe. The fossil record of theropod dinosaurs in this site is represented by scarce isolated postcranial material. This material has been preliminarily attributed to abelisaurids and maniraptorans, including dromaeosaurine and velociraptorine eudromaeosaurid and avialans. The main remains of theropods correspond to a great number of isolated teeth assigned preliminarily to different maniraptoran clades. Isolated teeth are usually the best-preserved and most

abundant remains of theropods, thanks to the hardness of the enamel, which facilitates their preservation, and the continuous replacement of their teeth throughout the life of the individual. One hundred and fifty theropod teeth were studied in this work using different methodologies. The teeth were studied using a qualitative approach performing morphological comparisons of their characters. Afterwards, a quantitative approach was used performing multivariate and cladistics analyses. The results obtained from the different analyses were consistent and allowed us to assign this dental material mainly to Velociraptorinae indet., Dromaeosauridae indet., cf. *Paronychodon*, cf. *Richardoestesia*, cf. *Pyroraptor olympius*, and Theropoda indet. The faunal composition is consistent with the fauna found in other Iberian and European localities of the Upper Cretaceous, providing a clear perspective of the composition and diversity of the theropod faunas in the site. This faunal assemblage aligns closely with those documented in other Iberian and European localities of the Upper Cretaceous. This pattern indicates that European theropod assemblages may have experienced little change throughout the last stages of the Cretaceous. These findings support previous research and contribute to a better understanding of the composition and evolutionary history of the European theropod at the end of the Mesozoic.

Funding Sources Proyecto Consolidación Investigadora 2023 CNS2023-144950 and Project PID2023-148083NB-I00.

Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

An exceptionally well-preserved maxilla of *Komba walkeri* (Galagidae, Primates) from the Early Miocene of Rusinga, Kenya

López-Torres, Sergi[1], Hall, Abigail S.[2], Jenkins, Kirsten E.[3], Lehmann, Thomas[4], Michel, Lauren[5], Muteti, Samuel[6], Peppe, Daniel J.[7], McNulty, Kieran P.[8]

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The African Miocene record of strepsirrhines (lemurs, lorises, and bushbabies) is relatively poor but represented by two families, the slow-moving Lorisidae and the fast-moving Galagidae, together forming the superfamily Lorisoidea. Comparatively, galagids (bushbabies) have a richer fossil record than their lorisid counterparts, which spans geographically from Namibia to Egypt and chronologically from the Early Miocene to the Early Pleistocene. However, the remains are often fragmentary; usually consisting of dentognathic remains and isolated postcranial elements. The galagid Miocene record is represented by the genera *Progalago* (Early Miocene, Kenya and Uganda), *Komba* (Early and Middle Miocene, Kenya and Uganda), and *Galago* (Late Miocene, Egypt).

Here we present new galagid material from R106 on Rusinga Island (Early Miocene, ~18 Ma), Lake Victoria, in western Kenya, represented by an exceptionally well-preserved maxilla of *Komba*. The new maxilla preserves dental positions unknown for this genus, including a canine, and the second and third premolars. The canine is oval in cross-section and is of similar area to the P2. The P2 is double-rooted and shares with modern *Galago* the presence of a small crestiform talon, and the presence of a mesiolingual cingulum. However, *Galago* has a mesially inclined P2, which is not seen in this *Komba* specimen. The P3 is three-rooted and triangular in shape. It is not as buccolingually compressed, and it is not distally invaginated, as in modern *Galago*. A very strong

mesiolingual cingulum is present, also seen in *Galago*, although less developed than in the extant genus. The fossil also differs from modern *Galago* in not having a protocone on P3. The P4–M2 sequence is consistent with the dental morphology of *Komba walkeri*, but the M3 differs from specimens previously referred to *K. walkeri*, particularly in having a small M3 compared to M2, a more lingually located metacone, a smaller hypocone shelf, and the presence of a parastyle. Additionally, the height of the maxilla is greater than in modern *Galago*, which suggest that *Komba* did not have orbits as large as in modern galagos.

In sum, the presented *Komba* material represents the most complete maxilla of the genus and provides a new look into the similarities and differences between the Early Miocene galagids and its modern relatives. This includes the less extreme adaptations to nocturnality seen in *Komba* (likely smaller orbits), relative to modern bushbabies.

Funding Sources National Science Centre (Cracow, Poland) (2022/45/NZ8/03585) to S.L-T. National Science Foundation (0852609, 1241807) and Leakey Foundation to K.M.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Neck deep in bite forces: a multibody dynamics pilot study of *Tyrannosaurus rex* feeding mechanics

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Multibody dynamics (MBD) is commonly used to evaluate the mechanical performance of engineered systems and has recently gained interest in biomechanics to study the function of biological organisms. In this study, we apply MBD to examine the feeding biomechanics of *Tyrannosaurus rex* by simulating a simplified motion involving activation of all jaw adductor muscles and one neck muscle, M. splenius capitis. Previous studies have shown that the cranium and lower jaw of *T. rex* can withstand the forces generated during biting. However, the structural limits of the neck remain less understood. Our goal is to assess whether the first three cervical vertebrae can tolerate the muscle and reaction forces involved in feeding. This pilot study serves as a foundation for more comprehensive simulations. Future work will incorporate all 13 cervical vertebrae and a broader set of neck muscles to better understand the full biomechanical capabilities of *T. rex* during feeding. Results indicate that both cranial and cervical stress did not exceed the stress limits of *Alligator mississippiensis*, which was the material properties used for the model.

Funding Sources Department of Mechanical Engineering, University of California, Merced, CA

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Tooth function and mastication in Paleogene Hyracoidea

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Hyracoidea were predominant herbivores in the Paleogene faunas of Africa ranging from rabbit to rhino size. Examination of the masticatory process and dental features of extant and Paleogene hyraxes provides insight into their dietary adaptations and ecological role in the environments. Based on the mapping of wear facets and orientation of striations, a digital simulation of the masticatory cycle is reconstructed using the Occlusal Fingerprint Analyser software. The existence of a buccal cutting edge along the upper molar-premolar

row as a key character of extant hyraxes can be determined as a functional element in all studied fossil hyracoids to a varying degree. As evident from a predominant phase I of the power stroke, with contact between the buccal cutting edges of lower and upper molars, this structure is utilized in extant hyraxes for a lateral ingestion of the food. This mode of food ingestion by the buccal edges of the molars is unique to hyraxes and has not been observed in any other herbivores so far. A similar function can be inferred for most Paleogene hyracoids by introducing a shear-cutting function of the molars into the mastication process, irrespective of differing dietary adaptations in the remaining dentition. This usage is further supported by the observed wear stages and microwear patterns on the buccal cutting edges, supporting a continuous self-sharpening function through all wear stages, as established for extant hyraxes. The superficial morphological resemblance of hyracoid cheek dentitions with plesiomorphic lophodont cheek teeth of Paleogene hyracodont rhinocerotoids is apparently not indicative for a functional similarity.

Funding Sources Deutsche Forschungsgemeinschaft (DFG) - Project number 523494435

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Assessing changes in North American mammalian diversity and habitat suitability since Last Glacial Maximum based on ecological niche models

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Climate change after the Last Glacial Maximum (LGM, ca. 21 ka) drastically altered North American landscapes, causing mammal species to migrate to remain within suitable habitats. Investigating past changes in habitat suitability may provide insight into species' responses to modern global warming. Here I compare ecological niche models (ENM) of 498 North American mammal species to observed taxonomic and functional diversity, and assess patterns in habitat suitability since LGM using modern occurrences from GBIF, fossil occurrences in the U.S. and Canada from the Neotoma Paleoecology Database, and six climate variables for eight time intervals since LGM from the PaleoClim and CHELSA databases. For each species I recorded three categorical ecological variables: size, diet, and locomotor mode. I trained MaxEnt ENMs on modern data, and tuned models for each species using the kuenm R package. Habitat suitability was projected onto the climate models without extrapolation to novel climates to identify high suitability regions in a 100 x 100 km^2 grid. Using base functions and the FD package in R, I calculated four diversity metrics from taxa with high suitability in each grid cell: species richness, functional richness (the number of unique functional roles), functional dispersion (the dissimilarity of functional roles), and functional redundancy (how many species share functional roles). Modern continental trends in the modeled diversity metrics generally match trends in observed diversity metrics, though modeled species richness and functional richness are greater than observed due to biotic interactions and dispersal barriers limiting species distributions. During the LGM, regions with high values of each diversity metric are restricted to lower latitudes and coasts, which served as refugia. These regions expand northwards with time, but maximum and minimum values of each metric do not vary much between intervals, indicating that species' habitat suitability may have expanded rather than shifted. Grid cells in which no species have suitable habitat are common in older time intervals, predominantly at high latitudes and altitudes that were glaciated. However, fossil occurrences in some of these grid cells reveal species' tolerances of non-analog climates. These findings have implications for our understanding of the intersection of climate, biotic interactions, and dispersal ability in shaping biodiversity gradients through time.

Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Dinosaur of the round table: a redescription of the Late Triassic dinosaur *Camelotia borealis* highlights its importance to our understanding of sauropod origins

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Camelotia borealis was named in 1985, but the holotype material of this taxon was collected nearly a century earlier from the Rhaetian (Upper Triassic) marine deposits of the Westbury Formation in Somerset, southwestern UK. The description of *Camelotia* separated the partial postcranial skeleton of a sauropodiform from two problematic tooth-based taxa, *Avalonianus sanfordi* and *Picrodon herveyi*, to which these remains had previously been referred. The Late Triassic is considered a key period in the evolutionary history of dinosaurs, which witnessed the initial radiation of the clade and the origin of many major groups including sauropodomorphs and possibly sauropods. *Camelotia* is known from well-dated marine strata, unlike most other British Upper Triassic dinosaurs, which are from 'fissure fill' deposits with poorly-constrained dates. *Camelotia* is also significant for its large size (femur length of ~1 m) relative to other Late Triassic sauropodiformes and its consistent recovery in phylogenetic analyses as somewhere close to the origin of Sauropoda. Our understanding of sauropodiform evolution has advanced considerably in recent years driven primarily by work on taxa from the southern hemisphere, but *Camelotia*'s possible phylogenetic position and northern hemisphere provenance suggest it is important for understanding this topic. Surface scanning of the material, which is currently split between two museums, has enabled its anatomy to be described in detail. This suggests that *Camelotia* exhibits the earliest occurrence of several 'key' sauropod traits, e.g., a straight femur and a postzygodiapophyseal fossa divided by an accessory lamina, highlighting its importance to our understanding of sauropod origins. Preliminary phylogenetic results based on a data matrix of 80 taxa and 419 characters suggest that *Camelotia* might represent one of the earliest diverging sauropods. The recovery of two European Late Triassic taxa, *Camelotia* and *Schleitheimia*, as early diverging sauropods suggests that the northern hemisphere might have been more important to sauropod origins than previously suspected. Comparisons with the European ichnotaxonomic record might allow the appearance of "*Camelotia*-grade" taxa to be correlated across the continent. This project highlights the importance of reexamining and redescribing overlooked historic taxa.

Funding Sources Natural Environment Research Council (NE/S007729/1) and a Paleontographical society Richard Owen research fund grant.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Silurian–Devonian osteichthyans from South China illuminate early sarcopterygian evolution

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IVPP, Beijing, China

The Silurian to Early Devonian represents a critical interval in the evolutionary history of sarcopterygians, encompassing their origin, divergence from actinopterygians, and initial diversification toward tetrapods. Until recently, limited fossil evidence constrained our understanding of these pivotal events. However, discoveries over the past four decades—particularly of transitional forms from China—have placed the origin and early evolution of osteichthyans at the forefront of vertebrate paleontology. Despite this progress, key morphological disparities between stem osteichthyans and early sarcopterygians remain

unresolved, leaving the acquisition of defining sarcopterygian traits unclear. During the past ten years, extensive new osteichthyan material from South China—spanning the Silurian to Early Devonian—has begun to fill crucial gaps. These include a *Janusiscus*-like braincase from the Xitun Formation (Lochkovian, Early Devonian), offering new perspectives on braincase evolution in stem osteichthyans; small *Meemannia*- and *Psarolepis*-like specimens from the Yulongsi Formation (Pridoli, Late Silurian), elucidating early diversification of sarcopterygians and actinopterygians; and stem sarcopterygian and basal dipnomorph material from the Xujiachong Formation (Pragian, Early Devonian), providing insights into the early evolution of sarcopterygians. Together, these findings significantly narrow the morphological gap between stem osteichthyans and sarcopterygians, offering a more complete view of early sarcopterygian diversification and reshaping our understanding of early osteichthyan phylogeny.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A microtaphonomic assessment of Pleistocene fossiliferous cave sediments: implications for skeletal preservation of *Gigantopithecus blacki* in Guangxi, southern China

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Gigantopithecus blacki–the largest known ape that ever lived–is only recognised from dentognathic fossils, and to date, no post-cranial material has been recovered. Reasons for this taphonomic issue remain unresolved. In this study, we seek to understand this discrepancy from a sedimentological perspective by investigating the taphonomic history of fossiliferous breccia and conglomerate deposits at three karstic caves in southern China. As such, we provide the first-ever microtaphonomic application to examine *G. blacki*'s post-cranial taphonomic bias. Bapeng and Queque are *G. blacki*-bearing caves, but show a bias in favour of dentognathic preservation in the sampled horizons. In contrast, Xiaokou Cave, albeit chronologically too young to host *G. blacki* fossils, yields a comparatively higher number of post-cranial materials. Representative sediment blocks were sampled from each cave; after which these were assessed with regards to their 'post-cranial-preservation potential' (PCPP). Four locally distinct microfacies (MF1–4) were identified utilising field observations combined with microsedimentological and geochemical techniques. All microfacies are sandy muds, of which those at Bapeng (MF2 and 3) and Queque (MF4) Caves comprise finer silty clays, while the one at Xiaokou Cave (MF1) comprises a slightly coarser clayey silt. Our results suggest MF1 has the highest potential of preserving post-cranial material, indicating a higher energetic (potentially fluvially driven) instantaneous death event, while the facies at the other caves suggest lower energy and redoximorphic depositional environments that facilitated time-averaged attritional assemblages with lower PCPPs. Our research reveals that deposits with facies of medium grain sizes, high in calcite and apatite, and with little diagenetic alteration, less evidence of redoximorphism, bioturbation, and guano-induced phosphatisation, hold the highest potential of finding *G. blacki* post-cranials in this area. Our interdisciplinary micro-analytical approach also offers a blueprint to test the PCPP of other fossiliferous karstic cave sediments across mainland Southeast Asia. This study could provide useful sedimentary characteristics for future quests on finding the giant ape's first post-cranial evidence.

Funding Sources Royal Anthropological Institute (UK), W. V. Scott Estate Charitable Trust Fund, Chinese Academy of Sciences and Australian Research Council.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The taphonomy of a nodosaur bonebed in the Yellow Cat Member of the Cedar Mountain Formation (Barremian), south-eastern Utah

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Bonebeds provide valuable taphonomic insights. The Cedar Mountain Formation of eastern Utah has yielded many Early Cretaceous bonebeds. The MayRae Dinosaur Quarry, excavated from 2022–2024, in mid-eastern Utah, exemplifies this. The recovered fauna includes a minimum of six individuals of the armored nodosaur *Gastonia*, bones from two sauropods (*Moabosaurus* and *Cedarosaurus*), *Utahraptor*, one large undescribed theropod, and conchostraca.

The quarry is in the Yellow Cat Member of the Cedar Mountain Formation, several meters below sandstone channels of the Poison Strip Member. The interfingering of these members indicates they were contemporaneous facies. The former represents floodplain environments, primarily splays, and the latter, adjacent meandering river channels.

The bone horizon of the quarry is ~0.75 m thick and >100 m long. The matrix is a diamictite, consisting of chert granules in a silty mudstone, and multiple, thin horizons of bone, each representing separate splays of splay distributaries. Root casts are widely spaced and shallow, indicating plant occupation was short-lived between flooding events that transported and buried the bones and plants. Conchostraca indicate ephemeral ponds were present on the floodplain.

Bones are commonly modified with scratches and breaks, indicating trampling. Dermal ossicles with wide, shallow pits are consistent with ulcerative dermatitis. Insect mandible marks and burrows are rare. Theropod scavenging is evidenced by several shed teeth and a tooth mark on a sauropod rib. Conical pits and breaks on *Gastonia* elements are evidence of crocodilian scavenging.

Most of the bones were minimally transported, based on some articulated *Gastonia* limbs and numerous examples of close association of individuals. Bone pebbles, however, indicate some bones were transported in river channels before exiting in splays or were partially digested bone fragments. It is likely that most of the animals died on the floodplain, where their carcasses were trampled and scavenged before moderate transportation and burial by splays during stream flood stages.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Assessing relationships between ungual morphology and terrestrial ecology in pterosaurs

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Pterosaurs were Mesozoic archosauromorph reptiles that appeared in the Late Triassic (ca. 215 Ma) and became extinct at the end of the Cretaceous (66 Ma). Pterosaur ecology is a crucial aspect for understanding Mesozoic ecosystems and food webs, yet their modes of terrestrial locomotion remain poorly constrained. Here, the terrestrial ecology of pterosaurs is reviewed using a novel methodological approach based on ungual and claw sheath morphometrics. Claw morphology presents an understudied yet promising model system for understanding the palaeoecology of extinct amniotes through comparisons with the ecomorphospace occupied by extant taxa. To facilitate a comprehensive ecomorphospace comparison, a dataset of pterosaur claw images encompassing a broad range of pterosaurs was compiled. This data reveals a hitherto unrecorded morphological diversity in pterosaur manual and pedal unguals, as well as variable relationships between ungual and claw sheath

morphologies in different taxa. Furthermore, a strong link between pterosaur clade content and claw morphology is established in linear discriminant analyses. This information greatly furthers our understanding of the ecological diversity within Pterosauria, as well as the morphological diversity present in amniote claws.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Re-description of the Triassic cynodont *Cistecynodon parvus* and reassessment of its phylogeny

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Cynodonts are an important clade of non-mammaliaform therapsids that first occurred in the late Permian and include the subclade Mammaliaformes, the latter ultimately giving rise to modern mammals. The systematics of non-mammaliaform cynodonts have been extensively studied and are relatively well-resolved; however, many problematic taxa are still difficult to identify and place confidently into the cynodont phylogenetic tree. *Cistecynodon parvus* is one such taxon, known only from a single specimen, the holotype skull, which was found in the Middle Triassic Burgersdorp Formation of South Africa, in strata assigned to the *Trirachodon–Kannemeyeria* Subzone of the *Cynognathus* Assemblage Zone. Over the past century, *Cistecynodon* has been variously referred to the Probainognathia, Cynognathia, and non-eucynodont cynodonts, without any emerging consensus. Here, the holotype of *Cistecynodon parvus* is described using CT scans of the skulls to produce digital 3D models. This new data is used to score a phylogenetic matrix, which supports that *Cistecynodon parvus* is a basal, non-eucynodont. This basal position reflects on the anatomy of its secondary palate, which is not closed despite the specimen being a subadult. The inner ear, trigeminal canal, parietal foramen, and carotid foramina are uniquely derived, likely as adaptations to an obligate fossorial lifestyle, confirming the validity of the taxon and its subterranean ecology.

Funding Sources GENUS (DSI-NRF Centre of Excellence in Palaeosciences), Palaeontological Scientific Trust (PAST), Sepkoski Grant (The Palaeontological Society)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Postcranial anatomy of a rare Emydopoidea: insights from *Compsodon helmoedi*

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Emydopoidea is one of the most morphologically disparate major clades of dicynodont therapsids, ranging from notably gracile morphologies to the intricate anatomy associated with advanced fossoriality. The taxon *Compsodon helmoedi* is a uniquely enigmatic emydopoid species. Recent collecting efforts have enhanced the understanding of *C. helmoedi* morphology and facilitated a reassessment of the taxon. A specimen collected in 2009 (NHCCLB211) includes significant postcranial material directly associated with an exceptional skull of *C. helmoedi*, making it the first

definitive postcrania known for the genus and species, which we describe and interpret here. NHCCLB211 was collected near the southern end of North Luangwa National Park, Luangwa Basin, Zambia. Scans were conducted at the University of Chicago's micro-CT facility on two associated partially prepared blocks. The data reveal a collection of tightly associated elements, including both scapulocoracoids, a left clavicle, numerous vertebrae and ribs, at least one radius and one ulna, left and right humeri, manus, a right innominate, and a partial femur.

The material exhibits a mosaic morphology with features indicative of both emydopoid and non-emydopoid affinities. While the glenoid presents a standard semi-lunar morphology, the scapular blades are proportionally strap-like. The metacoracoid is curved and bears a distinct posterior expansion, and the acromion process is extensive and prominent, which is mirrored in the enlarged clavicles. Distally, the humerus possesses well-defined articular surfaces, with the entepicondyle forming a small, squared projection that is more expanded than in other anomodonts. Similarly, the proximal humeral morphology is narrower, only slightly recurved, with proportions bearing a strong resemblance to *Dicynodontoides recurvidens*. The pelvic girdle morphology is especially noteworthy for its large obturator foramen. While the ischium and pubis are still connected, the joining of these elements is accomplished through a dramatically reduced bony ridge. This may represent an intermediary step toward the development of the uniquely expanded non-acetabular portion of the ischium that has been described from *D. recurvidens.* This material provides the first insights into the postcranial anatomy of *C. helmoedi*, expanding our understanding of emydopoid morphological disparity and providing new context for interpreting functional and evolutionary trends within Permian dicynodonts.

Technical Session II: Paleozoic Fishes
(Wednesday, November 12, 2025, 8:00 AM)

Unexpected characters in a Pennsylvanian ray-finned fish

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Ray-finned fishes (Actinopterygii) are extraordinarily successful, with over 35000 extant species. Their history extends to the Paleozoic, and it is during the latter half of this era that the group experienced its first major evolutionary radiation. However, the relationships of these early, sometimes morphologically disparate, late Paleozoic ray-fins are uncertain, with little agreement on the temporal origin of major extant clades. *Sphaerolepis* is a genus known from the Pennsylvanian of central Europe and eastern North America., With an anatomically generalized postcranium, *Sphaerolepis* was historically allied to 'paleoniscoids,' a paraphyletic grouping of early ray-fins. Study of museum specimens and newly collected material from the Appalachian Basin via micro-computed tomography scanning revealed an unexpected set of features in *Sphaerolepis*. This includes a palatal bite, with enlarged prearticular and coronoid teeth opposing those on the ectopterygoid, entopterygoid, and dermopalatines. The postcranium of *Sphaerolepis* includes small, heavily ornamented ossifications associated with the postbranchial surface of the shoulder girdle. These resemble the so-called serrated appendages of neopterygians. This surprising feature is joined by a 1-to-1 association of fin rays and radials in the posterior portion of the dorsal fin, a trait also associated with neopterygians. Initial incorporation of *Sphaeroelpis* in phylogenetic analyses destabilizes early ray-finned fish interrelationships, generating a large polytomy

composed mostly of Paleozoic members. *Sphaeroelpis* emphasizes that many poorly known, apparently generalized, Paleozoic actinopterygians are likely riddled with unexpected characters. This reinforces the need for detailed examination of these taxa as a first step in developing a stable phylogenetic hypothesis for early ray-fins.

Funding Sources NSF EAR 2219007; University of Michigan Department of Earth and Environmental Science Turner Grant

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Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Computed tomography (CT) data reveals new insights into the evolution of herbivory in bolosaurian reptiles

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During the late Carboniferous and early Permian, tetrapods had only recently colonized the land. In this time frame many key innovations of tetrapod evolution appeared, including herbivory. The ability to process and consume plant material unlocked a completely new source of food for early tetrapods and would be instrumental in their continued conquest of land and the evolution of modern-style terrestrial ecosystems. One of the earliest reptile groups to make use of this innovation was Bolosauria, a clade of small reptiles that are known from fossil localities across the world, ranging from North America to Europe and Asia. Most bolosaurian taxa exhibit various adaptations for an herbivorous lifestyle, the most prominent of which is their distinctive dentition. By examining numerous bolosaurian specimens, using computed tomography (CT) scanning in combination with traditional approaches, we reveal new insights into the evolution of herbivory within the clade. Our results show that there is a stepwise acquisition of herbivorous adaptations over the course of bolosaurian evolution. Most of these adaptations are related to their dentition, specifically tooth shape, tooth implantation, presence of tertiary dentine, and patterns of tooth replacement. Primitive bolosaurian taxa, specifically *Erpetonyx*, exhibit few if any adaptations for herbivory, whereas we observe a cascade of increasing complexity of dental adaptions in more derived taxa, such as *Eudibamus, Bolosaurus*, and *Belebey.* The importance of the evolution of herbivory in early reptiles, and other amniotes, cannot be overstated. Gaining new insights into this innovation is critical for our understanding of the complexity and evolution of terrestrial vertebrate trophic structure.

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

Experimental investigation into the physical feeding envelope of saber-toothed felids (Felidae: Machairodontinae) from the Pliocene–Holocene of Africa

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Saber-toothed cats (Felidae: Machairodontinae) have long been regarded as large-prey specialists, preying upon megafaunal herbivores (≥ 1000 kg) using a distinctive killing bite. Recent studies highlight that the saber-toothed predation method is likely a complex, multifaceted system, one key somewhat underexplored aspect of which is functional gape angle. Previous studies have approached investigations of gape angle with simplified or geometrical methods. In this study, we used an

experimental approach combining laser scanning, x-ray reconstruction of moving morphology (XROMM), and 3D printed models to investigate gape angles and feeding envelope in a suite of African cats from the Pliocene to the Holocene (including both conical- and saber-tooth species). We tested whether skulls could physically fit the jaws around the neck, upper throat, and muzzle of high-quality ungulate (bovids, equids, suids, hippopotamids, rhinocerotids) and proboscidean taxidermies. To account for soft tissue constraints (unavailable for most extinct taxa), we used XROMM imaging to visualize gape angle *ex vivo* of four African felids (serval, cheetah, leopard, lion) and then compared maximum gape angles of fully fleshed vs. defleshed heads. Gape angles (both at collision with zygomatic arch and at temporomandibular joint disarticulation) were higher across all four specimens when de-fleshed than when fully fleshed, allowing us to establish a correction factor for gape based on soft tissue. We toured museum collections and measured gape angles against the neck, throat, and muzzle of over 40 prey species, representing a range of body sizes, *Bauplanae*, and phylogenetic groups—these modern taxidermies acted as a viable proxy for the range of prey species present in Plio-Pleistocene Africa. Results suggest a comparable feeding envelope between similarly sized African conical- and saber-tooth cats. Our experimental results suggest that saber-toothed felids from Plio-Pleistocene Africa would not have been capable of throat bites on megafaunal herbivores, and would likely have targeted prey only up to ~300 kg. Due to their much greater head size, lions were found to be able to predate much larger prey than African machairodontines. Assuming minimal differences in the mechanical properties of cranial soft tissues between felids, we propose that saber-toothed cats in Plio-Pleistocene Africa dispatched prey within a comparable size range as medium through large modern cat species.

Funding Sources Fonds Wetenschappelijk Onderzoek (Flemish Scientific Research Foundation) (12A0Y25N)

Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

New species of large gorgonopsian from the *Eodicynodon* Assemblage Zone of South Africa and the diversity of middle Permian carnivores

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Gorgonopsians dominated the end-Paleozoic era and became the top predators of late Permian terrestrial ecosystems, with several representatives in both Southern and Northern Hemispheres. Despite this, only two taxa are recognised as earliest gorgonopsians in the middle Permian, which include the large-bodied *Phorcys dubei* and the small-bodied *Eriphostoma microdon*. This implies a low diversity of middle Permian gorgonopsians. Here, we describe two new gorgonopsians, specimens BP/1/9301 and BP/1/8260, which were found at the lower part of the *Tapinocephalus* Assemblage Zone of the Main Karoo Basin in South Africa. The size of both specimens and the vertically oriented occiput resembles that of *Phorcys dubei*. However, they do not display the diagnostic basioccipital knobs of the latter. Phylogenetically, the two specimens are recovered amongst the basal taxa of the African Clade of gorgonopsians, branching as a sister-clade to *Phorcys dubei*. Their low stratigraphic position also supports this position. They may represent a whole new genus of Middle Permian African gorgonopsians. The descriptions of these new gorgonopsians contribute to the refinement of the biostratigraphy of the lower Abrahamskraal

Formation in South Africa, a work undertaken by the Wits Karoo explorer's team.

Funding Sources The Palaeontological Society Trust (PAST), the University of the Witwatersrand (via Postgraduate Merit Award) and AOP grant (BENO025).

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Captorhinid premaxillary dentition reveals the pathological phenomenon of tooth socket closure

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Captorhinid eureptiles are the most commonly found amniotes within the cave deposits of the Richards Spur locality in Oklahoma, making them ideally suited for examining dental characteristics and identifying abnormalities and pathologies. To gain a better understanding of their feeding behaviors, we undertook a detailed study of 577 premaxillary bones through comparative dental histological analyses of both pathological and healthy elements, in combination with neutron computed tomography. We were able to identify morphological alterations of the dentition, alveoli, and internal dental canals, with two types of pathologies observed that had tooth sockets enclosed by secondary bone either due to: (1) infection, which resulted in modification of the internal and external premaxillary bone morphology; (2) breakage of the tooth crown, with partial roots retained under the secondary bone growth. We suggest that the latter is a reactive behavior when a younger tooth, recently ankylosed to the jawbone, breaks and the sequential replacement cycle has not begun; thus, it appears to be a reparative response by the alveolar bone to trauma, preventing any other form of illness, such as infections, since the blood vessels of the pulp cavity would have been exposed. While we found that this type of pathology is present in each type of jawbone (premaxilla, dentary, and maxilla), 29% of the premaxillary bones had at least one enclosed tooth socket, with the first tooth position exhibiting the pathology most frequently. This phenomenon, where the first tooth has an enclosed socket due to a higher chance of breakage, may be related to the unique captorhinid feature of a greatly enlarged, posteriorly bent tooth crown that was likely exposed to the external environment. There is consistent external wear on the labial surface of the first tooth (65% of specimens had a wear facet), which is not associated with a tooth-on-tooth grinding or chewing feeding behavior. The pattern of scratches on the wear facets supports the hypothesis that these large anterior teeth were not covered by labial scales, as is common in the vast majority of terrestrial vertebrates, but instead extended beyond the ventral lip of the mouth. We propose that a heavy price was paid for the exposure of these teeth and the unique, characteristic features of captorhinids in the form of widespread wear on the labial surface of the premaxillary teeth and exceptionally frequent dental pathology.

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Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

Ceratopsian dinosaurs were widespread in the Upper Cretaceous of Europe

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Ceratopsian dinosaurs were ubiquitous and widespread elements of Upper Cretaceous faunas in Asia and North America, but their presence in Europe is equivocal and based on highly fragmentary and controversial fossils. *Ajkaceratops kozmai* from Hungary was described as the only definitive European ceratopsian, but was based only on a partial snout, and the absence of a separate rostral ossification has led to its ceratopsian affinities being strongly questioned. The apparent absence of ceratopsians in Europe is puzzling because many paleogeographic scenarios for the radiation of Ceratopsia require dispersal of the group from Asia to North America via Europe. During the Late Cretaceous, Europe was an island archipelago that was home to the rhabdodontids, an endemic clade usually considered to be iguanodontians, which appear to have been diverse but are generally known from fragmentary remains. A new specimen of *Ajkaceratops kozmai* from the type locality includes much more cranial material than the holotype, including in situ teeth. These demonstrate that *Ajkaceratops* and the sympatric rhabdodontid *Mochlodon vorosi* are actually a single taxon, the latter a junior synonym of the former. To establish whether *Ajkaceratops* is a ceratopsian or a rhabdodontid, we carried out phylogenetic analyses on two different ornithischian matrices using parsimony and Bayesian analyses. We also rescored several other rhabdodontid taxa based on their holotypes alone due to concerns over unsafe referral of bone-bed material. Our results demonstrate that *Ajkaceratops*, but also the 'rhabdodontids' *Zalmoxes shqiperorum* and *Z. robustus* are ceratopsians. The recently described 'K2 rhabdodontid' also includes material bearing ceratopsian synapomorphies. Rather than being absent, ceratopsians appear to have been diverse in Europe during the Late Cretaceous, and re-examination of all 'rhabdodontid' material is now required to determine its true affinities. Our analyses result in a fundamental reorganization of the ornithischian evolutionary tree, and overturn existing hypotheses on ceratopsian and iguanodontian evolution as well as on Late Cretaceous paleobiogeography.

Funding Sources MTA ELTE Lendület Dinosaur Research Group (Grant no. 95102), National Research, Development and Innovation Office (NKFIH K 131597), The Jurassic Foundation.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Reevaluating the phylogeny of the enigmatic Late Jurassic Portuguese theropod *Lourinhanosaurus antunesi* Mateus, 1998: allosauroid, megalosauroid or coelurosaur?

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The holotype of *Lourinhanosaurus antunesi* is a partial associated skeleton of a theropod, discovered in 1982 near Peralta, Lourinhã (Portugal), in sediments of the Sobral Member of the Lourinhã Formation (upper Kimmeridgian–Tithonian). It consists of six articulated cervical vertebrae with associated ribs, five dorsal vertebrae with ribs, five sacral vertebrae, 14 caudal vertebrae (some articulated) with eight chevrons, two ilia, the proximal parts of both ischia and pubes, parts of both femora, the proximal right tibia and fibula, and possibly the proximal end of a metatarsal. The specimen was deposited at the Museum of Lourinhã under the catalog number ML370 and was subsequently described in 1998. This specimen has been interpreted as a subadult based on the

degree of fusion of the neural arches, and histological analysis of the ribs has estimated its age at death to be between 14 and 17 years. An accumulation of 32 pebbles, interpreted as gastroliths and including at least one possible ungual phalanx from a small sized ornithopod, was found in the ribcage region of the dinosaur. Besides, an egg accumulation found at Paimogo, also at Lourinhã municipality, including over 100 eggs and several embryonic remains, has been attributed to *Lourinhanosaurus* based on the proportions of the limb bones and presacral vertebrae of the embryos, as well as the presence of a maxilla distinct from that of *Allosaurus*. Despite the considerable interest in this taxon and its frequent inclusion in several character matrices over the years, its phylogenetic placement remains remarkably unstable. The specimen was initially interpreted as an allosauroid closely related to metriacanthosaurids, based on the presence of an enlarged gap in the pubic blade, considered analogous to the enlarged obturator foramen in *Sinraptor*. Subsequently, it has been alternatively recovered as a member of Allosauroidea, Megalosauroidea, or Coelurosauria, depending on the character matrix used. New surface and CT scans of the specimen have the potential to uncover previously unseen anatomical details. Combined with a reassessment of its codification using updated morphological datasets, this information could significantly clarify the phylogenetic placement of this dinosaur. It may also shed light on other aspects of its ontogeny and paleobiology, including its possible relationship with the Paimogo egg clutch and the putative gastroliths found within its ribcage.

Funding Sources FCT, I.P./MCTES through a PhD grant 2020.05395.BD and CEECIND/01770/2018.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

New information on the postcranial skeleton of *Rhodotheratus parvus*, supporting the interpretation that it is a miniaturized adult and smallest adult member of the basal eureptilian family Captorhinidae

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The eureptilian captorhinid reptile *Rhodotheratus parvus* was based on recently restudied materials previously designated as *"Captorhinikos" parvus* from the lower Permian Hennessy Formation, Cleveland County, Oklahoma. That study concluded *Rhodotheratus* was a fully mature but extremely small adult and represented the earliest example of miniaturization within the clade Amniota. The study was based on nearly two dozen specimens, and limited to cranial material. Postcrania are reliably associated with cranial material from the same locality, providing new data on the axial skeleton and humerus. Length and width of the vertebral centra range from two to three mm, but in all cases the neurocentral sutures are indistinguishably fused. At least some of the isolated vertebral series display variability in neural spine height, a feature common to many basal amniotes and their close relatives. In all cases, both shorter, narrow neural spines and taller more conical neural spines are smoothly finished and completely ossified. One well-preserved humerus measures only eleven mm in length, only 33% and 14%, respectively, the lengths of mature specimens of the well-known basal captorhinids *Captorhinus* and *Labidosaurus*. Despite its small size, the humerus preserves a well-developed deltopectoral process and capitulum for the ulnar articulation. Although confidently identified appendicular elements are rare, these humeral and vertebral data correspond to an adult versus a juvenile, supporting the original interpretation of *Rhodotheratus* as an extremely small but mature adult.

Funding Sources David B. Jones Foundation.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Cranial osteology of the large rubidgeine *Dinogorgon* from the upper Permian upper Madumabisa Mudstone Formation of Zambia

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Recent fieldwork has yielded well-preserved gorgonopsian fossils from the upper Madumabisa Mudstone Formation of Zambia, including material that has shed light on their systematics and paleobiology. Two tetrapod assemblages characterize the upper Madumabisa Mudstone Formation in the Luangwa Basin, both of which are Lopingian (Wuchiapingian) in age, and preserve at least 11 gorgonopsian genera (*Arctops, Lycaenops, Smilesaurus, Scylacocephalus, Cyonosaurus, "Dixeya", Arctognathus,* and the rubidgeines *Aelurognathus, Sycosaurus, Rubidgea,* and *Dinogorgon*). Additionally, the genus *Gorgonops* occurs in the Zambezi Basin in Wuchipingian strata. Of the Zambian gorgonopsian material recently described, little attention has been paid to the rubidgeines, with the exception of a single specimen of *Aelurognathus* that revealed new details of sternal morphology and evolution in gorgonopsians. Indeed, the vast majority of historically—as well as recently-collected rubidgiene material remains undescribed and of uncertain systematic position.

Here we revisit the anatomy and systematics of a series of large rubidgeine skulls from the upper assemblage of the upper Madumabisa Mudstone Formation that were previously noted as having affinities to *Dinogorgon*: three skulls collected in the 1970s (NHMUK R 37549a, NHMUK R 37535, NHMUK R 37081) as well as a specimen collected in 2019 (NHCC LB1080). These skulls share similarities, including: the presence of 5 postcanines, a single long row of teeth on the palatal boss, a relatively tall snout, and a relatively short parasphenoid. Slight differences in the development of pachyostosis around the orbital margins can be attributed to a combination of acidic-overpreparation of historic specimens, individual variation, and likely ontogeny.

Parsimony-based phylogenetic analysis finds all four specimens to cluster with the South African rubidgiene *Dinogorgon*, with relatively minor anatomical differences. NHCC LB1080 provides the best anatomical record for the Zambian *Dinogorgon*, allowing for the first anatomical descriptions of the interior regions of the braincase and the internal midline septum system in the large-bodied Rubidgieni. More qualitatively, the Zambian material appears to possess a slightly lower snout and so the possibility remains that they represent a distinct species, following previously suggested patterns of local endemism among the therapsids (cynodonts, dicynodonts, gorgonopsians) of the Luangwa Basin.

Funding Sources National Geographic Society 158R-18

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Brains or brawn? Endocranial and neuroanatomical changes during the evolution of ceratopsian dinosaurs

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Ceratopsians (Dinosauria: Ornithischia) are a charismatic group of non-avian dinosaurs. They are famous for their elaborate cranial ornamentation, exemplified by the iconic *Triceratops*, which has been linked to socio-sexual display. However, much less is known about their neurological and sensory anatomy, and how it changed over time and across phylogeny, due to a lack of suitable fossil skulls and the difficulty of CT scanning enormous specimens of the largest taxa. Here, we use CT scan segmentations to describe six new ceratopsian endocranial casts (endocasts, *Archaeoceratops oshimai, Leptoceratops*, *Zuniceratops*, c.f. *Pentaceratops*, *Centrosaurus*, *Triceratops*), and investigate their sensory and cognitive abilities in a phylogenetic context by incorporating specimens already in the literature (*Psittacosaurus*, *Yinlong*, *Auroraceratops*, *Liaoceratops*, *Pachyrhinosaurus*). We identify two endocast morphologies in Ceratopsia. The plesiomorphic morphology typically exhibits large olfactory bulbs, a short mid- and hindbrain, and distinguishable brain regions in the endocast. Contrarily, the apomorphic morphology has much smaller olfactory bulbs and a longer endocast, with only the cerebrum otherwise easily distinguishable. Notably, this derived morphology appears before the evolution of the Ceratopsidae, as it is present in their outgroup *Zuniceratops*. Based on phylogenetically informed indices of cochlear length and olfactory bulb size, respectively, the hearing and olfactory capabilities of ceratopsians generally are consistent with findings from previous research, with larger more derived ceratopsians exhibiting lower hearing ranges and olfactory acuity than early-diverging taxa. We calculated the phylogenetic encephalization quotient (PEQ) as a phylogenetically corrected measure of brain size compared to body size. Ceratopsians exhibit remarkably consistent PEQs throughout their evolution (0.84–1.27). This is in contrast to ornithopods, a closely related and coexisting group of plant-eating ornithischians, which exhibit much higher and more varied PEQs throughout their evolution (1.12–2.93). These findings suggest that compared to other dinosaurs, ceratopsians did not overly invest in brain size throughout their evolution. Instead, they underwent a dramatic increase in both body and head size, indicating that they prioritized brawn over brains. The reason for this remains unclear, and remains to be tested by ongoing broader studies of dinosaur neuroanatomy.

Funding Sources NERC Doctoral Training Partnership grant (NE/S007407/1) / a NERC National Productivity Investment Fund PhD studentship (NE/S007407/1).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Body mass reconstruction and new in-vivo restoration of *Parasaurolophus cyrtocristatus* (Dinosauria, Hadrosauridae)

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Famous for its elongated crest, *Parasaurolophus* was one of the stoutest hadrosaurid species that lived in the Late Cretaceous. As of now, three species are recognized in North America and Canada, namely *Parasaurolophus walkeri*, *P. cyrtocristatus*, and *P. tubicens*. Altogether, they are included in the Parasaurolophini tribe, together with a different genus from China, *Charonosaurus jiayinensis*. Despite not reaching the same size of larger hadrosaurids (e.g.

Edmontosaurus, Shantungosaurus), *Parasaurolophus* exhibits relatively massive bones and thicker proportions. The body masses of the three *Parasaurolophus* species have never been measured accurately, and variations among them are unknown. Here, we propose an estimate of the body mass (BM) for FMNH P 27393—the holotype of *P. cyrtocristatus* exhibited at The Field Museum in Chicago (U.S.)—by a digital reconstruction via photogrammetry. We sculpted the volume following standard reconstruction. The skeleton is estimated to be about eight meters long. We assigned three different densities for living tissues of 0.99, 1.00, and 1.01 kg/1,000 cm^3, a range of values used for large vertebrates without dermal armor or pachyostotic condition. We calculated the body masses of three variants ("slim," "medium," "robust") considering the minimum and maximum tissue volumes. The "slim" model rendered a BM of 3,175 kg, 3,208 kg, and 3,240 kg. The "medium" model rendered a BM of 3,965 kg, 4,006 kg, and 4,046 kg. The "robust" model rendered a BM of 4,784 kg, 4,833 kg, and 4,881 kg. Considering the average model to be the most plausible reconstruction, we propose a body mass of 4,015 kg for this individual *Parasaurolophus cyrtocristatus*, an estimation in line with previous hypotheses. Finally, we propose a new in-vivo reconstruction of the species, adding the results of recent analyses for neck thickness and skin morphology. Preliminary comparison to *P. walkeri* shows little body mass variation in adults between the two species. Our results will contribute to a comprehensive analysis of body mass variations between the hadrosaurid species, either coexisting or occupying the same habitat but in different time and stages, e.g., the hadrosaurid species in Dinosaur Provincial Park, which will provide new perspectives on niche partitioning.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Night and day: synchrotron micro-CT scans illuminate scleral ring anatomy and diel activity patterns in stem reptiles

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Characterizing diel activity patterns is critical for interpreting reptile ecology and behavior. However, the ancestral condition of the crown reptile common ancestor is not understood and empirical data is absent for extinct reptiles. Nonetheless, correlations exist between the scleral ring and diel activity in extant species; scleral ring apertures in scotopic (≈nocturnal) taxa are generally larger, forming a narrower ring of bone. In comparison, photopic (≈diurnal) and fossorial taxa tend to have a broader ring with smaller apertures. As such, the scleral morphology of fossil reptiles can be used to reconstruct their diel activity based on the anatomy and behavior of living lepidosaurs, birds, and turtles.

To investigate the ancestral diel activity patterns for crown Reptilia, we used μCT scans to reconstruct the scleral rings of two parapleurotan stem reptiles from the late Permian of South Africa: the millerettid *Milleropsis pricei* and a new species of younginid neodiapsid. Both are known from aggregation specimens with complete scleral rings visible in the scans, allowing for direct measurements of orbital geometry. The scleral ossicles in these specimens are mostly articulated, minimizing error in our reconstructions. Previously, the early Permian stem-reptile *Orovenator* was quantitatively assessed for estimated diel activity and found to be scotopic with high posterior probability, although the preserved scleral ring of this taxon is fragmentary. Importantly, the two taxa quantitatively assessed here have remarkably distinct scleral anatomies and modeled activity patterns; the younginid has a narrow scleral aperture, strongly implying photopic diel activity, while *Milleropsis* has a proportionately larger aperture, but ambiguous modeled activity.

At this stage it is premature to draw evolutionary conclusions for the ancestral crown reptile condition, but it is worth noting that Permian stem-reptiles likely exhibited both diurnal and nocturnal diel patterns. These preliminary data suggest that the sensory repertoire of Permian stem-reptiles was more diverse than previously recognized, in agreement with recent studies highlighting the prevalence of impedance-matching hearing in this grade. The inclusion of more Permian reptiles and other amniotes into our dataset will allow further investigation into drivers of this diversity, but the prevalence of burrowing ecologies and concomitant adaptation to low-light habitat may complicate interpretations.

Funding Sources European Synchrotron Radiation Facility LS 3248.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The latest Cretaceous fish fauna from the Mocuio Formation of Bentiaba (Namibe Basin, Angola)

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The Maastrichtian was punctuated by the Mid-Maastrichtian Event (MME), as manifested by carbon isotope excursions, the disappearance of inoceramids, and notable shifts in—amongst others—the mosasaur fauna. The exact nature of the drivers underlying the MME, however, are still a matter of debate.

The well-preserved fossil fauna of the Bentiaba site in southern Angola offers a rare window into the development of Late Cretaceous (Maastrichtian) marine ecosystems of the South Atlantic. Upwelling of cold, nutrient-rich water supported a rich marine ecosystem, which hosted a wide diversity of mosasaurs, plesiosaurs, and turtles.

To evaluate to what extent the diversity of the fish fauna at Bentiaba was impacted by the MME, we sampled and identified fish material from two fish-teeth enriched horizons at the Bentiaba site. We present a description of the osteichthyes and elasmobranch assemblage, and compare the assemblage to the previously described Cretaceous record from the Namibe Basin.

The fauna includes principally *Squalicorax* (notably *S. pristodontus*), *Cretolamna* sp., *Carcharias* sp., various batoids, dermal denticles, and abundant Ginglymostomatidae teeth. In total, at least nine shark families are represented in Bentiaba: Rhombodontidae, Anacoracidae, Odontaspididae, Otodontidae, Ginglymostomatidae, Chlamydoselachidae, Sclerorrhynchidae, and possible fragments of Hexanchidae and Triakidae. Osteichthyes remains include Pycnodontiformes, cf. *Melvius* sp., *Enchodus* sp., cf. *Hadrodus*, bony fish jaws, fish vertebrae and associated microfossils such as coprolites, gastropods, coral fragments and small mosasaur teeth. Overall, the sampled layers are significantly richer and more diverse than previously reported from the Bentiaba area. Ginglymostomatidae teeth are present in large numbers. *Squalicorax pristodontus* is particularly common in the tetrapod-rich Bench-19 layer, which is probably linked to their presumed scavenging ecology.

The composition of the elasmobranch assemblage shows strong resemblances with Maastrichtian faunas described from Morocco. While bony fish assemblages remain more consistent between layers, shark fauna shows notable changes, indicating plausible environmental shifts.

Funding Sources Fieldwork funded by ISEM at SMU, and Fundação para a Ciência e Tecnología

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Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

The emergence of the surrogate forelimb: correlated evolution of the neck and forelimb across the theropod-bird transition

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The evolution of powered flight has necessitated a dramatic and coordinated evolutionary response of multiple anatomical units across the theropod-bird transition. However, we currently do not understand the role of a critical component of the vertebrate skeleton, the vertebral column, in this response. The neck is an important region of the vertebral column as, in extant birds, it operates in tandem with the head as a surrogate forelimb and facilitates a diverse array of behaviors and functions. Despite the neck's critical function, the role of the neck in avian macroevolution and the forces that underly these processes remain elusive. We collected linear measurements of the neck, forelimb and head from 110 species of non-avian theropods and 112 species of birds and used a Bayesian multi-regime Ornstein-Uhlenbeck modelling approach to investigate shifts in adaptive optima and evolutionary rates to test whether these modules co-evolved. We observe a co-occurrence of adaptive optima shifts for neck and forelimb proportion at the base of Avialae, and these shifts display high support values (posterior probabilities between 0.82 and 0.58). The observed shifts correspond to vertebral adaptations for stability and forelimb proportions that are better adapted for flight. These patterns are associated with shifts in neck and forelimb allometry and suggest that heterochrony is an important factor in avian neck and forelimb evolution. Additionally, we find lower rates of both neck and forelimb evolution in birds compared to their non-avian theropod ancestors. This axio-appendicular co-evolution has contributed to theropod and avian macroevolutionary dynamics by facilitating the emergence of a novel, forelimb-dominated locomotory mode without sacrificing the grasping capability afforded by forelimbs.

Funding Sources The Leverhulme Trust (Research Project Grant award number: 182676), UCL Bogue Fellowship Award.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The origin and early evolution of amniotes in phylogenetic context: step 2

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So far, all phylogenetic analyses of early limbed vertebrates have either (1) spanned from the origin of limbs to that of Amniota, barely reaching into Amniota; or (2) covered amniote phylogeny and barely reached beyond. Since I presented on this at the 2023 SVP meeting, several 'type 2' studies using many new characters and new μCT data have supported Diadectomorpha outside Amniota, araeoscelidians and captorhinids closer to but outside Amniota, paraphyletic 'parareptiles' close to Neodiapsida, and Varanopidae in Pan-Mammalia but some presumed varanopids very close to Neodiapsida instead. Some studies sampled 'microsaurs' and found them farther outside Amniota than the above. All this is, at best, difficult to test without more outgroups. Which taxa are best suited as outgroups depends on 'type 1' problems: are temnospondyls or anthracosaurs closer to Amniota, and how close to Amniota are the chroniosuchians, the 'gephyrostegids' and *Casineria*?

To test these and other questions, I greatly enlarged my dataset with characters and data from, e.g., the mentioned works, forgotten fossils, and ancient Soviet literature. It now

spans the range from before the origin of limbs to the origin of neodiapsids. I find that many characters so far used only for amniote phylogeny are also informative far outside Amniota, and vice versa. Current results indicate a long pan-amniote stem (support ~ 15 steps) with diadectomorphs, *Opisthodontosaurus*, captorhinids including *Petrolacosaurus*, and various small Carboniferous tetrapods. The paraphyletic 'parareptiles' are sauropsids; some form a clade with *Araeoscelis* (~ 30 st.). *Varanops* is a pan-mammal grouped with the caseasaurs (~ 10 st.) while the other sampled "varanopids" are close to Neodiapsida and *Milleropsis* (~ 20 st.). All 'microsaurs' are outside Amniota (~ 50 st.) and far from *Opisthodontosaurus* (~ 30 st.), possibly farther than Seymouriamorpha (3 st.). Temnospondyli is close to all the above (~ 40 st.), in a "gephyrostegid"-chroniosuchian-*Casineria* grade, followed by Anthracosauria (incl. *Ossirarus*), a baphetoid-colosteid-*Gaiasia*-adelospondyl(-?aïstopod ~ −5 st.) clade and a long well-resolved Devonian/Mississippian grade.

I point out taxa that should be redescribed and characters that support or contradict my trees. I also discuss the evolution of costal lung ventilation, the timing of the origin of claws and the origin of Amniota, and the hypothesis of a size squeeze involved in the origin of the amniotic egg.

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Expected and unexpected features of the oldest crown lepidosaur

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Lepidosauria is the most species-rich group of land-dwelling vertebrates, including ~12,000 species of lizards and snakes (Squamata) and one species of Rhynchocephalia, the Tuatara *Sphenodon punctatus* from New Zealand. Squamates owe their success to their generally small size, and a highly mobile skull that enables them to manipulate large prey. These key features of the lizard and snake skull are not seen in *Sphenodon*, which makes it important to understand the nature of their common ancestor. Lepidosaurs originated in the Triassic, 252–201 million years ago, but confusion has arisen because of incomplete fossils, many of which are generalized lepidosauromorphs, neither squamates nor rhynchocephalians. Here we report a reasonably complete skull and skeleton of a definitive rhynchocephalian from the Middle Triassic (Anisian) Helsby Sandstone Formation of Devon, some 3–7 million years older than the oldest currently known lepidosaur. The new species shows, as predicted, a non-mobile skull, but open lower temporal bar and, unexpectedly, no large palatine teeth. The new animal seems to have been a specialized feeder on insects, and it helps us understand the initial diversification of Lepidosauria as part of the Triassic revolution, when modern-style terrestrial ecosystems emerged.

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Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Preliminary histotaphonomic analysis of pterosaur-bearing concretions from the Romualdo Formation in Jardim, Porteiras and Santana do Cariri (Araripe Basin, Brazil)

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In recent years, the widely known pterosaur bones from the calcareous concretions of the Albian/Aptian Romualdo Formation (Araripe Basin, Brazil) have been studied extensively from a histological perspective. Nonetheless, the taphonomic modifications that could affect the microstructures of these remains have received limited attention. Here we present preliminary results of a histotaphonomic analysis on 75 thin sections prepared out of six pterosaur-bearing concretions from the localities of Porteiras, Jardim and Santana do Cariri, all belonging to the Romualdo Formation. All samples were viewed using petrographic microscopy. Some samples were analyzed with Scanning Electron Microscope (SEM) with Energy-Dispersive X-ray Spectroscopy (EDS), and matrix fragments of two concretions were submitted to X-ray Diffraction (XRD). Histologically, most specimens are early to young adult pterodactyloids, with well-vascularised fibrolamellar tissue. There is evidence of remodeling (secondary osteons and resorption lines) in some cases, but no signs of Internal or External Fundamental Systems nor Lines of Arrested Growth. Regarding taphonomy, the pterosaur bones from the Romualdo Formation show high microstructural preservation, protected by a smectite-rich outer matrix and filled by blocky calcite or prismatic barite. The SEM-EDS analysis of the bone bioapatite reveals a percentage of calcium and phosphorus close to that of present-day skeletons. Granular remnants of organic matter can be found in many cavities, and most fractures show no or low displacement, commonly extensional. The clay mineralogy of the outer matrix (according to the XRD), type of fractures, presence of barite and some paleoclimatic studies, indicate a lagoon with an alternating climate and eventual marine influence. Thus, a general histotaphonomic history is proposed: fast burial in an anoxic, oversaturated lagoon bottom, two to four calcite precipitation phases related to alternating arid and humid conditions with extensional fracturing due to desiccation, consolidation of the concretion (embedding fish scales or bivalves) and modern damage by extractors. Additionally, episodic marine incursions would have led to the precipitation of barite in bones from Porteiras and Santana do Cariri. This study provides a deeper understanding of the processes that allowed the pterosaur remains from the Romualdo Formation of Brazil to be some of the best preserved in the fossil record of the clade.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Developmental mechanisms of axial evolution in stem and crown cetaceans (Mammalia, Artiodactyla)

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The land-to-sea transition of cetaceans is one of the major events in the evolution of mammals, as it conveyed profound changes in the mammalian body plan. The changes in the backbone are among the most important ones, as it became the main thrust generator in the aquatic environment. However, the spine is a complex structure made up of serially homologous units, the vertebrae, which develop from the somites that appear in the vertebrate embryos. As a consequence, the backbone can change in different ways, such as varying the number of vertebrae (somitogenesis), their identity (thoracic, lumbar, etc. related to homeotic changes) and their length (somatic growth). In this study, we have quantified these three developmental mechanisms in a phylogenetic context of stem and crown cetaceans. The data on the number and anteroposterior length of vertebrae has been obtained from the literature. We have performed two comparisons: (i) thoracic vs. lumbar regions and (ii) caudal vs. precaudal regions (removing cervical region as its number is fixed and its length is highly reduced in cetaceans). Our results indicate that the main mechanism involved in the evolution of the thoracic length relative to lumbar length is the somitogenesis (changes of the number of vertebrae), more specifically the increase of the number of lumbar vertebrae. In contrast, for the caudal region, the changes in the relative length is caused by a combination of somitogenesis and somatic growth (caudal vertebrae change in length and number). In addition, our results demonstrate that archaeocetes tend to reduce slightly the number of precaudal vertebrae and keep constant the number of caudal ones while they possess a fused sacral region. However, when the hindlimbs are reduced and the sacral region is lost, both counts (precaudal and caudal) evolve in a very similar fashion, especially within Neoceti. These results demonstrate that different developmental mechanisms can be involved in the evolution of different regions of the backbone. Finally, they highlight the key role of the sacral region influencing axial patterning.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Taxonomy, taphonomy and phylogeny of a historical *Stromerius nidensis* specimen (Cetacea, Basilosauridae) and other archaeocete material from the collection of the Natural History Museum Vienna

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The shallow marine fauna of Al-Fayoum in Egypt, dating from the Middle to Late Eocene (41.2-33.9 mya), has been renowned since the late 19th century for its archaeocete fossils, which have significantly contributed to our understanding of cetacean evolution. The Natural History Museum in Vienna houses a historical convolute of archaeocete material from this location, including two previously unpublished crania. In this study, one of the crania undergoes a detailed examination. Using measurements and morphological analysis of the bones and teeth, supplemented by µCT scans, the species and ontogenetic stage of the specimen are identified. Additionally, through comparison of the lithology with various references, the stratigraphic layer of the find is determined with greater precision. The characteristics of the species are further explored by comparing it with other basilosaurids, also discussing a possible dimorphism in the tooth size. Furthermore the bone modifications are analysed for evidence of the cause of death. The specimen most likely originates from the Upper Eocene Qasr-El-Sagha formation (late Priabonian) and most likely represents the first technically complete cranium of a dentally mature individual of the medium-sized basilosaurid *Stromerius nidensis*. It probably died during a *Basilosaurus isis* attack which followed a typical cetacean hunting pattern, representing the first evidence of *B. isis*

occurence in this temporal and spatial context and extending the prey spectrum of this species to adult cetaceans as well.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Endocasts and associated neurovascular systems of two mosasaurines: *Plotosaurus bennisoni* and *Mosasaurus missouriensis* (Squamata, Mosasauroidea), from the Upper Cretaceous of North America

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Endocranial casts of fossil vertebrates can provide useful evidence regarding their neuroanatomy, as well as their possible ecological adaptations associated to their neurological traits. Historically, endocranial studies of squamates mostly focused on taxa with completely ossified brain capsules such as snakes and amphisbaenians. Endocranial data on non-serpentiform squamates, although representing a major proportion of the clade diversity, are up still scarce due to brain capsules that are not fully ossified and low endocranial resolution. Mosasauroidea, a clade of large and cosmopolitan lizards, is unique within Squamata with adaptations to a fully aquatic lifestyle. Endocranial data on mosasauroids are highly limited but they could provide valuable evidence regarding their lifestyle.

Based on computed-tomography scans, we created three-dimensional digital endocranial casts of the endocranial cavity and associated neurovascular structures of the closely-related mosasaurines *Plotosaurus bennisoni* and *Mosasaurus missouriensis*. We identified similarities to the few published endocasts. Striking morphological differences include for example the shape of the dorsal optic tectum area as well as an extensive cartilage, covering the cerebellum. The particular large parietal eye observed in *P. bennisoni* is also a defining element of its corresponding endocast. A notably ossified orbitotemporal chondrocranium is completely visualized for the first time and allows for a much more precise anteroventral delimitation of the endocast in *P. bennisoni* as typically expected for a non-serpentiform squamate. Several endocranial characters can be linked to the varying ecologies of *P. bennisoni* and *M. missouriensis.* In addition, morphometric comparisons with extant squamate endocasts grants further neuroanatomical evidence on the still debated position of Mosasauroidea within Squamata. Our study triplicates the amount of available three-dimensional virtual endocast data for Mosasauroidea and provides new insights into their paleobiology, neuroanatomy, and ultimately their phylogenetic history.

Funding Sources Deutsche Forschungsgemeinschaft (DFG) JI 405/1-2 to PJH.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Uncovering Los Bastos: new titanosaur specimens and paleoecological insights from the Santonian of Argentina

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New sauropod material from the Bajo de la Carpa Formation (Santonian, Upper Cretaceous) is reported from the Los Bastos locality, Neuquén Province, Patagonia. Although the Bajo de la Carpa Fm. is well known for its vertebrate fossil record, Los Bastos has only recently been subjected to systematic paleontological exploration. The locality preserves fluvial to lacustrine deposits and is proving increasingly relevant for understanding

regional faunal composition and ecosystem dynamics. The new material includes skeletal elements from different individuals, most notably a procoelous anterior caudal vertebra (MMS-PV-39), a series of seven associated caudal vertebrae (MMS-PV-75) exhibiting both procoelous and opisthoplatyan features, a middle caudal vertebra (MMS-PV-76), and fragmentary elements of the pelvic girdle (MMS-PV-82). Moreover, the ilium of MMS-PV-82 preserves three distinct types of feeding traces, interpreted as evidence of scavenging by multiple individuals, and possibly from different taxa. Such traces are relatively rare in the Santonian fossil record of South America, providing valuable data on trophic interactions within the paleoecosystem. The vertebral elements display a combination of features observed in other titanosaur taxa from the Neuquén Basin, with some morphologies of potential taxonomic interest. Finally, a cladistic analysis was conducted to better understand the phylogenetic relationships between some of the newly described specimens within the clade Titanosauria. These discoveries expand the known distribution of titanosaur specimens from the Bajo de la Carpa Fm., highlighting the growing paleontological significance of the Los Bastos locality.

Funding Sources Research Abroad Grant N° 13/2024, Dipartimento di Scienze della Terra, Sapienza Università di Roma.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A brief history of the penguins of Zealandia, focus on late Oligocene *Platydyptes* new phylogenetic position and fourth species

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Penguins are birds uniquely adapted for marine life; dense bones helpful for diving predispose penguin skeletons to fossilization. New Zealand has one of the most complete and extensive records of fossil penguins in the world. The first named fossil penguin (*Palaeeudyptes antarcticus*) was discovered in Kakanui, North Otago by Huxley in 1859. The specimen, a single tarsometatarsus, was donated to London's Natural History Museum. The earliest known penguin, *Waimanu* (~60–62Ma), found within the Waipara Greensand of the Waipara River, Canterbury. Currently there are two named species of *Waimanu*, *W. manneringi*, named in acknowledgment of Al Mannering who discovered and prepared the specimen, and *W. tuatahi*, from the Maori for first, as this holotype was the first specimen found. Extant species can still be found along the coastlines of Zealandia today.

Platydyptes, first described by B.J. Marples in 1952, remains one of the few described late Oligocene genera and is one of the most crownward of the basal penguins. The last major review was in 1971 by Simpson on taxonomy but not including phylogeny or function. Since then, new material has been collected of the named species *P. novaezealandiae*, *P. amiesi* and *P. marplesi*. This material, including partially articulated skeletons, as well as isolated bones, has allowed for a review of the genus, new phylogenetic analysis including improved coding, and revealed a possible fourth species (OU22804).

Recovered from the Otekaike Limestone (Waitakian, latest Oligocene), specimen OU22804 is a semi-articulated, partially-complete skeleton including humerus and tarsometatarsus as well as several rarer elements, for example the quadrate. Specimen OU22116, a referred *P. amiesi*, is a partial skeleton that includes the tarsometatarsus, taxonomically diagnostic and not known in the holotype. Similar size to *Platydyptes*, *Aptenodytes* (modern King and Emperor penguins) have allowed for greater understanding of skeletal structure. This has been particularly valuable in interpolating incomplete vertebral columns helping to reveal information useful in elucidating insight on structure, systematics and lifestyle of *Platydyptes.*

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Understanding vertebrate faunal change through time in the Early Jurassic (Toarcian) Posidonienschiefer Formation

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The Posidonienschiefer Formation of southwestern Germany is a classic Early Jurassic (Toarcian) marine Lagerstätte, characterized by a diverse and exceptionally preserved vertebrate fauna. Stratigraphic provenance of fossils within this unit has historically been neglected, with many finds denoted simply as 'Posidonia Shale', without associated bed numbers. However, new analyses indicate that the Posidonienschiefer Formation was deposited over ~3.2 Ma, and represents a period of rapid global environmental change, known as the Jenkyns Event. How marine species diversity and abundance responded to these abiotic changes can only be understood in a detailed taxonomic and stratigraphic framework, an opportunity uniquely provided by the Posidonienschiefer Formation.

We comprehensively reviewed species occurrence per bed in the Posidonienschiefer Formation, based on a survey of specimens from the Southwest German Basin in existing museum collections. We recognize 12 chondrichthyan, >25 actinopterygian, and 2 sarcopterygian fish species, as well as 19 marine and 4 non-marine tetrapods in the assemblage; several new actinopterygian species were identified during this process. Raw abundance data were scaled for each species to account for between-taxon differences in collecting and preparation effort, body size, and degree of skeletal completeness required for species-level identification. Data were visualized using a principal component analysis to relate species co-occurrence patterns to potential underlying drivers.

Variation in relative taxon abundance by bed resulted in the recognition of four loosely defined faunas, the separation and taxonomic composition of which appear to be controlled primarily by water depth and bottom water oxygenation. Rare taxa inferred to have had more demersal, less offshore habitat preferences occur more frequently lower in the section, during the first million years of the depositional interval and prior to the Jenkyns Event; higher up in the section they are replaced by larger-bodied, more pelagic species.

These data provide a useful point of comparison with other Toarcian marine vertebrate faunas, and can help predict taxonomic composition, extinction, and extirpation susceptibility in other Mesozoic marine vertebrates. Moreover, identifying co-occurrence patterns is essential to reconstructing vertebrate trophic network structure in the Early Jurassic epicontinental seas.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The ecology of Late Jurassic turtles from Europe revealed by oxygen isotope compositions ($\delta^{18}O$)

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In Europe, coastal marine sediments dated from the Late Jurassic have yielded a great assemblage of turtles known as Thalassochelydia. This group represents the first radiation of turtles into marine environments, with more than 30 species known during the Kimmeridgian–Tithonian interval when the group reached its peak. However, thalassochelydians show little morphological adaptations to life at sea and the precise ecology of the different species still needs to be clarified. Given their taxonomic and morphological diversity, it is likely that thalassochelydians exploited various ecological niches.

Isotopic analyses have successfully been used to decipher the ecology of numerous extant and extinct species. Oxygen isotope compositions ($\delta^{18}O$) can be used as a tool to estimate the salinity and temperature of the water in which vertebrates, especially ectotherm vertebrates, lived. In the past 20 years, several batches of oxygen isotope analyses were run on thalassochelydians from French, German, and Swiss localities, but most of these results remained unpublished. As part of a larger study on thalassochelydian paleoecology, these unpublished results were recently completed by a set of more recent analyses run on specimens with confirmed taxonomic identifications.

The results show that thalassochelydians seem to have lived in various coastal environments with salinity ranging from a clear marine signal to more intermediate ones, indicating an inflow of freshwater in varying proportion depending on the localities and period. However, none of the thalassochelydians analyzed to date show a pure freshwater signal, hence confirming the marine ecology of the group. The temperatures estimated for the water in which the thalassochelydians lived also vary between localities, indicating that these turtles possessed a tolerance for thermal variations. These different signals could indicate a wide range of habitats for thalassochelydians, going from open ocean to closed lagoons, including estuaries or salt marshes. Additional isotopic systems will now be investigated to help us precise the partitioning of different ecological niches between the different species of thalassochelydians.

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Proboscidean postcranial morphometrics and ecomorphololology and their utility in reconstructing past environments: the case of the Koobi Fora Area 123 *Elephas atavus* skeleton

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Proboscideans have been central ecological agents throughout the Cenozoic, yet their postcranial adaptations remain underexplored compared to craniodental traits. This study investigates the postcranial morphology of a nearly complete *Elephas recki atavus* skeleton preserved in situ at Area 123, Koobi Fora, Kenya, within the broader framework of morphometric variation and ecological adaptation across extinct and extant proboscidean taxa. The Area 123 specimen's cranial and molar morphology confirms its classification as *Elephas r. atavus*, distinct from later Pleistocene *Palaeoloxodon*. Morphometric analyses indicate that the skull of *E.r. atavus* shares greater similarity with extant *Elephas maximus* than with *Loxodonta* or *Palaeoloxodon*, particularly in having a taller skull, elongated neurocranium, shorter face, and narrower rostrum. Forelimb proportions of the Area 123 individual closely resemble *E. maximus*, though it possesses a relatively longer ulna, possibly reflecting an adaptation for more efficient movement in open landscapes. Comparisons across proboscideans reveal that taxa adapted to forested environments, such as *Mammut americanum*, have proportionally shorter distal limb elements, particularly in the manus, whereas species adapted for traversing open landscapes, like *Loxodonta africana*, exhibit elongated manus. Notably, *Deinotherium proavum* possesses an exceptionally long manus, potentially facilitating efficient locomotion in open savannas or enhancing canopy-level browsing. Standard morphometrics and body size-corrected analyses were employed using measurements from both museum collections and 3D photogrammetric scans. These findings suggest that variation in limb segment proportions among proboscideans reflects ecological strategies beyond body size differences. The Area 123 specimen provides a critical datapoint for understanding early Pleistocene proboscidean ecology and demonstrates that postcranial morphology can serve as a valuable proxy for reconstructing past environments. This study establishes a framework for linking functional postcranial anatomy with paleoecological contexts and highlights the importance of including postcranial data in ecomorphological assessments of extinct megaherbivores.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The impact of insects on the fossil record: examples of insect-modified bones from the Yellow Cat Member of the Cedar Mountain Formation of Utah, USA

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Modification of bone by insects is common in the fossil record, but only recently recognized. Research is ongoing as to how Mesozoic insects have influenced and biased the terrestrial vertebrate fossil record. Examination of dinosaur bones from the Yellow Cat Member of the Cedar Mountain Formation has yielded additional examples of insect-modified bone.

The Yellow Cat Member is an Early Cretaceous (Barremian–Albian) terrestrial rock unit consisting of floodplain deposits in central and eastern Utah, USA. While reports of insect-modified bones from this member have been made before, this study highlights the abundance and diversity of insect traces in the Yellow Cat Member and examines them in greater detail.

Bones from seven sites within the Yellow Cat Member were examined for insect traces. All preserved insect-modified bones. While the number of insect marks and the degree of modification varies from site to site, all were likely made by the same trace maker based on mandible marks.

Mandible marks occur as arcuate grooves on the bone, created by the apices of the trace maker's mandibles. These marks range in length (side to side) from 2.75–5.8 mm and in width (thickness of an individual groove) from 0.34–0.9 mm. The range in sizes of these marks is attributed to

different ontogenetic stages of the trace maker. These mandible marks occur inside larger traces. Traces include large swaths of modified bone (facets), especially on articular surfaces; shallow furrows and channels in cortical bone; and holes and borings that range from surficial pits restricted to the cortical bone to deep penetrations into the trabecular bone.

These traces were created as the trace maker foraged and fed on the bone for proteins, showing a preference for articular surfaces and trabecular bone. Traces also occur on cortical bone but are not as extensive. In some cases, bones exhibit only minimal modification, while in others, the bone is almost destroyed by the consumption of trabecular bone.

Recognizing and identifying insect traces on bone is essential to better understanding the taphonomic history of a site, while also offering insights to unpreserved fauna and trophic interactions. Additionally, the impact of insects on the fossil record by modification and destruction of bone is more common and influential than previously recognized.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Description of the first hadrosaurid dinosaur maxilla reported from Arizona, USA, from the Upper Cretaceous Fort Crittenden Formation

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A partial right hadrosaur maxilla (MSM P7725) has been recovered from the Upper Cretaceous (Campanian?) Fort Crittenden Formation in southeastern Arizona. Hadrosaurs have been previously reported from Cretaceous rocks in Arizona, however this specimen is the only reported maxillary material currently known from the state. MSM P7725 consists of a robust maxilla with teeth in various states of eruption and a complete alveolar margin. The hadrosaur synapomorphy of densely packed batteries of median-ridged teeth within the maxilla is revealed by X-ray imagery. The maxilla is incomplete, lacking the dorsal process and all of the bone anterior to the ectopterygoid shelf; these preservational shortcomings limit our ability to gather useful measurements and identify MSM P7725 precisely. In contrast, the specimen appears to be mediolaterally intact, allowing us to observe that it is notably wide in relation to its craniocaudal length. Many of the external anatomical features used to discriminate between saurolophine and lambeosaurine subfamilies are absent from the specimen or are ambiguous, precluding a taxonomic identification beyond that of Family Hadrosauridae at this time. Circumstantially, kritosaurin-grade saurolophine fossils (cf. *Gryposaurus*) have been identified in coeval sediments in neighboring Sonora, Mexico.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A pathological description of a Late Cretaceous teleost vertebra: evidence of spinal trauma reveals Schmorl's node

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The Lance Formation, located in the north-central USA, provides exceptionally well-preserved vertebrate microfossils detailing Late

Cretaceous ecosystems. These Maastrichtian vertebrate microfossil beds have long been a source of data to test hypotheses surrounding the Cretaceous-Paleogene (K–Pg) mass extinction, alongside coeval rocks of the Hell Creek Formation. While these fossils provide uniquely precise insights for macroevolutionary research, they also provide more nuanced data into the biology of the individual animals of these ecosystems. Here, we present a pathology of a trunk vertebra, from a large Lance Creek teleost actinopterygian.

This large centrum measures 9 mm in length along the mediolateral axis and 7.5 mm along the dorsoventral axis. The pathology presents as a cylindrical hole located on a lateral edge. This opening extends from the articular surface of the centrum deep towards the notochordal opening. Further, there is no sign of overgrowth around the hole or other similar holes in the vertebra. Several probable etiologies include: 1) Schmorl's node, the herniation of the nucleus pulposus through the cartilaginous intervertebral disc as well as the bony articular surface of the centrum, causing holes to form; 2) genetic deformities, such as spinal curvature and congenital weakness; 3) predator injury or postmortem scavenger activity; and 4) arthritis, the swelling of joints, or compressive stress, that cause bone overgrowth on an injury.

Based on micro-computed tomography, we conclude that the likely cause of this pathology is a Schmorl's node. Continued stress on the vertebra, genetically weak muscles surrounding the spine, or unusual swimming patterns following a traumatic impact are all possibilities as to why the Schmorl's node formed. The occurrence of this pathology has potential implications in the examination of large-bodied teleost biomechanics. Additionally, it allows for a better understanding of the potential interactions these fish had in their Late Cretaceous ecosystems.

Funding Sources David B. Jones Foundation.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Flying reptiles of the forgotten paleocontinent: revision of the pterosaurs of Appalachia and Eastern North America

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Pterosaurs are known from every continent, though in North America, enormous attention has been paid to the pterosaurs of the Western half of the continent, whereas the pterosaurs from the Eastern part of the continent (corresponding to the paleocontinent of Appalachia in the Late Cretaceous) have received comparatively little attention. Pterosaur body fossils are known from New Jersey (Navesink and New Egypt Formations), Delaware (Merchantville Formation), North Carolina (Peedee Formation), Georgia (Eutaw and Blufftown Formations), Alabama (Mooreville Chalk), Mississippi (Coffee Formation), and Tennessee (Ripley and Sardis Formations). A review of what fragmentary material is known from Appalachia in the context of modern knowledge of pterosaurs allows for a better understanding of these rare specimens. Much of the pterosaur record of Appalachia consists of poorly preserved fragments that are not phylogenetically informative, but the better preserved specimens can be assigned to either Azhdarchomorpha or Pteranodontia. The pterosaur taxon from the Merchantville Formation, which has been variously treated as *Pteranodon*, an 'ornithocheirid', or azhdarchid, represents a pteranodontid distinct from *Pteranodon* with a unique cervical morphotype, though the previously reported pterosaur humerus is actually non-pterosaurian. A cervical vertebra from the Ripley Formation has been likened to *Arambourgiania* from Jordan, though it is subtly different from the type species. It represents a unique morphotype belonging to the *Arambourgiania-Infernodrakon* clade.

Additional azhdarchomorph material includes a *Quetzalcoatlus lawsoni*-like ulna (previously misidentified as a cervical) from the Navesink Formation, morphologically distinct azhdarchid femora from the Peedee and Coffee Formations, and a jaw fragment from the Sardis Formation.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Recent discovery of a skeleton of the Pan-American sloth, *Eremotherium laurillardi*, in Honduras: new insights into its distribution and paleoecology

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The recent discovery of a major portion a partial skeleton of the extinct sloth, *Eremotherium*, near San Esteban, Department of Olancho, Honduras adds to our knowledge of the Pleistocene fauna of this country. Currently *Eremotherium* is the only extinct sloth known from Honduras and most earlier discoveries consist of a single bone or lack locality information. The new discovery includes significant parts of a single individual excavated *in situ* and so has contextual information on its paleoecology that can be compared with other individuals of the species. The skeleton was preserved in a sandy blocky clay suggesting preservation in a pond or at least standing water. The massive clay had no natural breaks or erosional surfaces, and all bones recovered were within the top 50 cm of the bone bearing layer. During excavation of the primary specimen, fragments of abraded megathere teeth with different preservation were recovered, suggesting transport into the "pond" of parts of other weathered sloth carcasses on the landscape and perennial standing water. The distribution of *E. laurillardi* in the late Pleistocene extended from 40.3N in the United States to 30.51S in southern Brazil, a latitudinal range greater than any other sloth, and the species is often referred to as the Pan-American sloth. The new discovery in Honduras was found at 15.24N, at an elevation of 823 m asl. The elevation of the new record is within the range of previous records of *Eremotherium* in the country between 600 and 1167 m. While the elevational range of *Eremotherium* generally extends from sea level to higher elevations over most of its latitudinal range, there is a general trend of an increased presence at higher elevations on either side of the Equator roughly between 5 and 25 north and south and this includes the sites in Honduras. Between 5 north and south there is a significant gap of records for *Eremotherium* preventing any inferences on this pattern near the midpoint of its latitudinal range. Temperatures tend to be lower at higher elevations and latitudes and like modern sloths the extinct species had low metabolic rates and body temperature. Ambient temperature probably played a major role in the distribution of the sloth. Mean annual temperatures and seasonal extremes based on temperature derived from the combinations of elevation and latitude may have controlled both the distribution of *Eremotherium* physiologically as well as the plants in its diet.

Funding Sources Funding provided by Fulbright Grant to HGM, with additional support by the Instituto Hondureño de Antropología e Historia and the city of San Esteban, Honduras

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Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Cranial osteology and evolutionary relationships of the Middle Triassic pachypleurosaur *Neusticosaurus edwardsii* revealed through high resolution synchrotron radiation micro-computed tomography scanning

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Evolutionary radiations are characterized by rapid expansions in morphological disparity that can obscure phylogenetic relationships of early taxa, and this is especially true for radiations like marine reversions. Importantly, the anatomy of conserved regions of the skull made accessible via high-resolution imaging can provide powerful evidence amongst competing hypotheses. Pachypleurosauria is either a clade or grade of early sauropterygians with unresolved relationships with other members of Eosauropterygia (Nothosauroidea + Pistosauroidea). Pachypleurosaurs are exceptionally abundant in the Middle Triassic Monte San Giorgio Lagerstätten of Switzerland and Italy. The pachypleurosaur *Neusticosaurus edwardsii* is the largest and stratigraphically youngest of the *Neusticosaurus* species in the region, and is known from many specimens, including complete articulated individuals. However, these specimens are often highly compressed, particularly in the skull, leading to difficulty in reconstructing and interpreting phylogenetically informative regions.

We synchrotron micro-CT scanned the skull of PIMUZ T 4761, a partially three-dimensionally preserved specimen of *N. edwardsii*, allowing for refinement of the cranial osteology and novel observations on the poorly known braincase and palate. These include observations on the supraoccipital and otic capsule, revealing a poorly ossified inner ear, exoccipitals with a single metotic foramen, a prootic with a distinct anterior inferior process, and an elongate cultriform process of the parabasisphenoid. The exceptionally high resolution of the scan further reveals considerable detail on the dentition of *N. edwardsii*, including the presence of replacement teeth that develop to the lingual side of the functional tooth, but within the functional alveolus, contrasting with the tooth replacement seen in *Nothosaurus* where the crypts for the replacement teeth open through dental lamina foramina separate from the functional alveolus.

These new data in conjunction with the recent scanning of *Keichousaurus hui* from the Middle Triassic Falang Formation of southwestern China, and other Triassic sauropterygians provides a growing reference base for understanding the phylogenetic relationships between the early members of Sauropterygia and the position of the clade inside of the larger Neodiapsida radiation of the late Permian and Triassic.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Fossil deformation and alteration as seasonality and residence time indicators in the Upper Jurassic Morrison Formation

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Understanding the conditions under which fossil deposits are formed is critical for evaluating the paleoecology and depositional environments of an extinct ecosystem. Environmental conditions at the time of burial or fossilization may or may not be indicative of the larger ecosystem as a whole and need to be parsed carefully with other geological and geochemical indicators to fully understand a fossil assemblage. Here, we describe indicators found on vertebrate fossils using materials from multiple sites Upper Jurassic Morrison Formation from the American West. Identified indicators include cortical surface condition/weather, post-mortem deformation, and invertebrate decomposer traces. The Morrison Formation is a famously fossiliferous unit with numerous institutions boasting large holdings of its material, making it an ideal unit for analysis. Surveying the Morrison collections housed at the Museums of

Western Colorado, we identified several common environmental indicators among fossil specimens. High levels of water saturation, be it surface or subsurface water, is indicated by "green" breaks and plastic/ductile deformation in specimens, while brittle fracture patterns show low levels of water saturation. A variety of invertebrate actors consume and/or modify bone surfaces leaving distinct traces behind. These invertebrates often decompose carcasses in successive patterns as they process different parts of a carcass under differing conditions. As many invertebrates have been shown to operate in specific climatic conditions, we can thus use this type of ichnological record to assess the paleoenvironmental conditions at the time the actors were present. Acutalistic studies have robustly demonstrated the patterns of organic decay and decomposition due to abiotic factors, such as exposure and weathering. Aspects of these processes are also visible on fossils, such as surface flaking, cracking and displacement. These pre-fossilization alterations give insight into UV exposure, aridity, and bone residence time between deposition and burial. Results from the Morrison survey at the Museums of Western Colorado indicate a variety of environmental indicators, even within individual sites. This suggests that when determining the taphonomic origins of a fossil assemblage, care must be taken to ensure that all indicators are observed and accounted for prior to assuming a homogenous origin for an assemblage.

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

First associated ornithomimid (Theropoda, Coelurosauria) skeleton from the Upper Cretaceous Straight Cliffs Formation of southern Utah, USA

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Ornithomimids were a diverse clade of Late Cretaceous theropod dinosaurs that had widespread distribution across Laurasia. However, their earliest appearance and initial diversification is poorly understood. The earliest definitive ornithomimids are known from Asia and date to the Turonian Stage. However in North America, the earliest uncontested members of the clade are no older than the Campanian Stage. Because western North American sedimentary basins were largely marine during the early Late Cretaceous, ornithomimid and other terrestrial vertebrate assemblages are rare from this time. One important exception is the Straight Cliffs Formation, exposed across several plateaus in southern Utah. From this unit in Cedar Canyon we report on new material representing the oldest known ornithomimid from Laramidia, preserved in John Henry Member-equivalent strata, underlying a volcanic ash $^{40}Ar/^{39}Ar$ dated to 87.28 ± 0.58 Ma. The specimen's arctometarsalian pes places it within Coelurosauria. The gracile humeri in conjunction with metatarsal lV lacking a distinct scar for the *M. gastroccnemius lateralis*, excludes an affinity with Tyrannosauroidea, metatarsal lll being wider mediolaterally than anteroposteriorly supports its placement outside of Troodontidae, and the distinct articular face of metatarsal lV for metatarsal lll lacking fusion places it outside of Elmisauridae. The combination of character states is diagnostic for Ornithomimosauria. The arctometatarsalian foot, with an obscured view of the most proximal anterior surface of metatarsal lll, enclosed by metatarsals ll and lV, supports the specimen's placement within Ornithomimidae. Scoring the specimen in recent ornithomimid-focused phylogenetic analyses recovers it within an unresolved polytomy of all included members of Ornithomimidae, except *Archaeornithomimus* which is sister group to this polytomy. This late Turonian–Coniacian ornithomimid narrows the temporal disparity of the earliest North American and Asian ornithomimids and provides insight into a poorly-understood time interval in dinosaur evolution that resulted in the

iconic later Campanian–Maastrichtian dinosaur communities of western North America.

Funding Sources University of Utah Undergraduate Research Opportunities Program

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Influences of locomotor mode and prey-capture strategies on upper cervical vertebral morphology in extant carnivores

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Among terrestrial mammalian carnivores, different strategies are utilized to obtain prey. These strategies have previously been categorized in the literature based on key differences in the approach and capture of prey items. Each of these strategies differs in the mechanical stresses and demands placed on the postcranial anatomy, including the neck. The upper cervical region (C1 and C2) includes attachments for muscles which aid in movements of the neck relative to the head and thorax, and provide postural support to the head. The degree of torsion and flexion of the neck utilized by active predators may differ considerably based on the exact method used by a predator for the capture and dispatch of prey. In addition, forces generated by struggling prey during prolonged close-encounter acquisitions pose an increased risk of injury to a predator, which may drive an evolutionary advantage for increased joint stability in the cervical region. This study sought to capture the morphology of the first and second cervical vertebrae of a wide range of mammalian carnivores using three-dimensional geometric morphometrics and identify osteological features which may correlate to prey-capture behaviors. The sampled taxa included members of most of the major families of Carnivora, as well as multiple species from the marsupial family Dasyuridae. Species were classified into discrete categories of prey-capture strategy. Meshes of museum specimens were generated using a surface scanner and corresponding software. Traditional landmarks and semilandmarks were placed on each individual vertebra to capture overall morphology, with a focus on features of functional significance (e.g., transverse processes, the spinous process of C2, and joint surfaces). Landmarks were aligned using Procrustes superimposition to remove the effects of translation, rotation, and size. These were then visualized in a principal component analysis (PCA), which showed some clustering by prey-capture strategy. However, the phylogenetic relatedness of sampled taxa also clearly had a major influence in how taxa clustered. Future directions will include increasing the number of taxa sampled to more clearly disentangle behavioral signals from those which are phylogenetic, as well as the potential for inclusion of fossil clades, like Hyaenodonta, to hypothesize the prey-capture behaviors of these taxa.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Estimating visual performance in metriorhynchoid thalattosuchians and other Mesozoic marine reptiles using preserved scleral rings

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During the transition to an obligately aquatic lifestyle, one of the most important adaptations involves a shift in visual performance. This is necessitated by the differing transmission speeds of light between air and water. This also corresponds with a difference in the importance of vision to marine tetrapods as they forage for prey in the marine environment. An osteological correlate to the eyes of marine reptiles is the

scleral ring. This structure is comprised of overlapping scleral ossicles, which form a bony ring embedded in the eye. This structure is found in a range of vertebrate taxa including birds, reptiles, and non-avian dinosaurs. Most Mesozoic marine reptiles preserve scleral rings, with metriorhynchoid thalattosuchians being one of the few crocodylomorph clades to retain a bony scleral ring. This ring supports the structure of the eye and provides a source of muscle attachment. In marine birds, this ring also aids in maintaining the shape of the eye as it is subjected to water pressure. Because of the relationship between the scleral ring and the pupil, the maximum pupil diameter can be estimated, which can be thought of as a minimum f-number. A lower minimum f-number correlates with an eye that can capture more light, suggesting increased visual performance in lower light conditions, such as deep water. Thus, a higher minimum f-number suggests a preference for brighter conditions, higher in the photic zone. Minimum f-number can be estimated from linear measurements of preserved scleral rings, and scaling relationships of eye dimensions derived from living taxa. Using preserved scleral rings from a sample of ichthyosaurs, plesiosaurs, mosasaurs, and metriorhynchoid thalattosuchians, a range of minimum f-numbers were estimated. These results show distinct differences between ichthyosaurs (hypothesized deep diving taxa) with low minimum f-numbers, and sampled metriorhynchoids, mosasaurs and pliosaurs displaying a higher minimum f-number, suggesting a preference for habitats higher in the water column

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Exploring the Endothermic Brain Hypothesis: did neuron numbers and the metabolism co-evolve?

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Endothermy evolved independently at least twice in amniotes: once in the bird stem lineage and once in the mammal stem lineage. Along with similarities in thermophysiology, extant birds and mammals show remarkable convergence in their enlarged brains, including a 20- to 21-fold increase in neuron number compared to similarly sized non-avian reptiles. It has therefore been suggested that complex cognition could be linked to the origin of endothermy. Both elevated metabolic rates and high neuron numbers are extremely energetically costly to maintain. The Endothermic Brain Hypothesis posits that large brains pay for the energetic demands of both higher numbers of neurons and the elevated metabolic rates associated with endothermy by increasing an organism's total energy intake via optimised foraging. We begin to explore this hypothesis by assessing whether neuron numbers and metabolic rates are correlated in extant amniotes using phylogenetic comparative techniques. We built a dataset of neuron numbers and metabolic rates (basal metabolic rate for endotherms, standard metabolic rate for ectotherms) for 77 species of amniotes from the literature and analysed this using phylogenetic generalised least squares (PGLS) regressions. Although there is a correlation between neuron number and metabolic rate in both the telencephalon and the brain as a whole, this is no longer supported when body size is included as a covariate in PGLS models. It is likely this correlation instead results from the covariation of both neuron number and metabolic rate with body size. Body size miniaturisation in the fossil ancestors of both birds and mammals has been linked to the evolution of both whole-body endothermy and increasing encephalisation. We propose body size miniaturisation, elevated metabolic rates, and the elaboration of the brain evolved according to a correlated progression model in the extinct stem lineages of birds and mammals. Next steps are to assess whether shifts in the

allometric scaling relationships of both neuron number and metabolic rate occur at the same points in phylogeny using data from extant animals to further investigate whether these variables co-evolved, while explicitly including the influence of body size. Developing better proxies for predicting actual brain volumes and neuron numbers from fossil endocasts will help determine if there is support for the Endothermic Brain Hypothesis in extinct species that do not preserve brain tissue.

Funding Sources Swedish Research Council grant 2021-02973

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

A climbing carnivorous eutriconodont mammal exceptionally preserved from the Middle Jurassic of Skye, Scotland

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During the Middle Jurassic key groups along the lineage to therian mammals (marsupials + placentals) diversified taxonomically and ecologically within dinosaur-dominated ecosystems. However, their articulated fossil remains are particularly rare during this interval, coming from sites of exceptional preservation such as the Yanliao Biota of northeast China and the stratigraphically older Kilmaluag Formation of the Isle of Skye, Scotland (Bathonian, about 166 million years ago)—an increasingly significant locality for small tetrapod fossils of ecological and evolutionary importance.

Here, we present an exceptional specimen from the Kilmaluag Fm, imaged and studied in three-dimensional detail using micro-CT (uCT) and synchrotron phase-contrast uCT scanning, revealing the articulated anterior half of a new taxon that represents the earliest well-preserved eutriconodont mammal.

The skull of this new mammal is complete and has a distinctive molar morphology similar to that of the enigmatic taxon *Dyskritodon*, though with trenchant posteriorly recumbent cusps that may align it with Volaticotherini. A reduced incisor count, prominent sharp canines, and a jaw morphology adapted for shearing suggest it was carnivorous. Provocatively, it is accompanied by the isolated head of the cynodont *Stereognathus*—immediately anterior to the eutriconodont's open jaws and associated with its left hand. Localised lower density material comprising small broken bone fragments and amorphous mineralization in the trunk region of the specimen potentially represents preserved stomach contents that may provide direct insights into dietary ecology.

Initial comparisons based on linear measurements of the forelimb and manus suggest it was capable of climbing, as adaptation towards arboreal or scansorial locomotion. The preserved forelimb of the eutriconodont will serve as an impetus to investigate locomotory adaptation and ecomorphology, analyzing geometric morphometric data with phylogenetic statistical comparative methods and machine learning, to better understand the ecological context of early mammals along the therian lineage. Additionally, preservation of the hyoid apparatus, middle and inner ear, and osteological detail down to the level of individual sesamoid ossicles in digit joints, promises to reveal a suite of important insights into mammalian morphological evolution in a poorly represented time interval, one critical to the origins of modern mammals.

Funding Sources Leverhulme Trust Research Project Grant RPG-2024-352

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Do all mesotheriids move alike? Functional signals from morphospaces and angular kinematics profiles

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Mesotheriids, a widespread and long-lived family of South American native ungulates, are often portrayed as generalist terrestrial mammals with fossorial adaptations. However, they span over 25 million years, from the Early Oligocene to the Early Pleistocene, and their fossils occur from southern Patagonia to northern Chile, Bolivia, and Peru, highlighting significant temporal and ecological diversity. Fossil evidence shows that these taxa represent distinct points within the mesotheriid lineage, suggesting substantial functional variation.

To test whether mesotheriids shared a common locomotor profile, we compared four taxa—*Trachytherus spegazzinianus*, *Plesiotypotherium casirense*, *Caraguatypotherium munozi*, and *Mesotherium cristatum*—to extant mammals using three morphospaces based on forelimb (38 species, 13 orders), astragalus (41 species, 9 orders), and calcaneus (55 species, 9 orders) data. All measurements were taken from scaled published images, including direct examination of the *C. munozi* holotype. Biological traits such as body mass, posture, speed, and locomotor habit were assigned to estimate the most likely functional profiles.

Principal component analyses revealed divergent locomotor affinities. *Mesotherium* aligned with large-bodied terrestrial mammals with high hindlimb efficiency, while *Caraguatypotherium* grouped with fossorial analogues. *Trachytherus* and *Plesiotypotherium* occupied intermediate positions. These findings were tested against 182 in vivo kinematic observations from 77 extant species across 16 orders. Total angular excursion (TAE, representing joint mobility) and angular efficiency index (AEI, reflecting mechanical economy) varied across biological traits. *Caraguatypotherium* matched fossorial trends, while *Mesotherium* resembled efficient walkers.

Our findings support the hypothesis that mesotheriids evolved distinct locomotor strategies shaped by ecological pressures and anatomical regionalization. This integrative approach provides a comparative framework for inferring function in extinct lineages.

Funding Sources Agencia Nacional de Investigación de Chile (ANID). Proyecto FONDECYT de iniciación en investigación N°11231111.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

First feather inclusions digitally extracted from a coprolite

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Preservation of delicate structures like feathers in the fossil record requires gentle burial and fine-grained matrix. Coprolites can offer these special criteria and themselves can survive harsher burials and coarser sediments, providing protective encapsulation of fragile inclusions within. A large coprolite, likely from the Pliocene of Morgan River, South Carolina, and probably from a shark or a whale, exhibits a feather impression on its surface and another on the face of a break exposing part of the coprolite's interior. Although birds are part of the diets of some sharks and whales, there are various accidental ways feathers could be ingested and thus inclusion in a coprolite is not proof of habitual ornithophagy. The feathers in this coprolite encouraged CT scanning to hunt for more inclusions. Surpringly, several other feathers were easily recognizable within. These are the first feather inclusions to be digitally extracted from a coprolite and should inspire other searches for delicate endocoprolitic

inclusions. Future studies aim to identify the feathers and maybe the coprolite maker.

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Bite-sized scanning: small object digitization using intraoral scanners

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The critical role that digitization plays in the documentation and preservation of natural history collections is becoming increasingly important. Current methods include photogrammetry, laser surface scanning, and computed tomography (CT), with each having distinct benefits and drawbacks. For example, photogrammetry is relatively quick, easily accessible, and low-cost but often does not capture small details and is prone to artifactual error. In contrast, CT scanning generates high-resolution 3D models, but it is size-limited, and the associated high costs can be prohibitive for many researchers. One application of digitization has been for the use of dental topographic analyses. These studies frequently use dozens of jaws and hundreds of teeth, which exhibit extremely small morphologies (<1 mm). In this case, photogrammetry and laser scanners often have difficulty capturing detailed morphology and CT scanning presents cost barriers. Intraoral scanners, handheld 3D scanners used by dental practices to capture patients' external tooth shape, offer a potential solution to this issue. To document the benefits and limitations of intraoral scanners, we studied the crania and jaws of Permian vertebrates from the Richards Spur locality of central Oklahoma and casts of extant squamate jaws that had been previously microCT scanned. Specimens vary in size (1–15 cm), color, and medium. We find that at least one brand of intraoral scanners digitizes nonhuman objects extremely well. Extant and extinct skeletal material is rapidly modeled with objects of different color (e.g., black, white, orange, red) all being detected. Specimens under 5 cm can be scanned in approximately 1–3 minutes and most 3D models are rendered in under 5 minutes. Details smaller than 0.1 mm are consistently reconstructed accurately and models are broadly comparable to those generated from microCT data. Nonetheless, there are notable limitations to intraoral scanners. Scanning objects larger than 10 cm results in significant (>30 minute) processing time and casts made from clear epoxy are poorly detected. The benefits of this approach include accurate, rapidly produced 3D models that include color information. Additionally, these scanners are portable, offering an exceptional option for researchers who travel to collections. Intraoral scanners represent a novel approach for the generation of 3D models for small to medium-sized natural history objects.

Funding Sources University of Central Oklahoma Faculty on Campus grant, 2024.

Colbert Prize Session

First crocodyliform fossils from the Eocene of Indonesia

Mendez, Oscar A.[1,2], Head, Jason[3], Zonneveld, John-Paul[4], Smith, Thierry[5], Brochu, Christopher A.[6], Zaim, Yahdi[7], Aswan[8], Rizal, Yan[8], Hascaryo, Agus[9], Bloch, Jonathan I.[1]

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The Paleogene crocodyliform record is rich in taxonomic diversity, preserving crown and stem-eusuchians alongside late-surviving neosuchians and notosuchians. This richness is mainly known from the extratropical latitudes of the New World and Eurasia, contrasting a poorly sampled tropical record. Within the tropics, the Paleogene of low-latitude southeast Asia is comparatively undersampled, with the Eocene Krabi Formation of Thailand representing the southernmost fauna. This crocodyliform fauna is composed of orientalosuchins and gavialoids, consistent with more northern records from southern Asia.

Here we describe the first crocodyliform fossils from the Eocene of Indonesia, collected from the middle-late Eocene Talawi Member of the Sawahlunto Formation, west Sumatra. The Talawi Member represents a coastal swamp environment, preserving invertebrates, fish, and turtles along with rare frog, snake, and mammal fossils. Recovered crocodyliform fossils are often isolated and disarticulated, consisting of cranial remains including a partial braincase and jaw fragments, as well as relatively abundant teeth and osteoderms, vertebrae, and at least two autopodial elements. Procoelous vertebrae indicate eusuchian affinities. Osteoderms are diverse, with keeled and keelless squared and subrectangular forms. High and low-crowned fluted tooth morphotypes compare favorably to coeval gavialoids and orientalosuchins. A ziphodont form is present, potentially a planocraniid or sebecosuchian. External morphology of the braincase, such as narrow basioccipital tubera, a basioccipital plate bearing a crest, and a large basisphenoid exposure suggest a non-gavialoid identity. This is supported by preliminary observations of high-resolution microCT scans, which imply a lateral carotid foramen ventral to the metotic foramen and laterally aligned medial and lateral eustachian foramina.

The Sawahlunto fauna extends the southernmost geographical range of the Eocene southeast Asian crocodyliform fauna and represents the first multitaxon crocodyliform fauna from equatorial Asia. The ziphodont teeth either represent the last-occurring Asian planocraniids in a tropical refugium, or an incursion of Gondwanan sebecosuchians from India into the Asian tropics.

Funding Sources National Geographic grants to Gregg F. Gunnell, R.C. and J.P.Z. (grants 9525-14 and CP-040R-17); Three NSERC Discovery Grants to J.P.Z.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

New data on the homology of the midline elements of the turtle shell exemplified by *Glyptochelone suyckerbuykii* (Ubaghs 1879), an enigmatic fossil sea turtle (Pan-Chelonioidea) from the Late Cretaceous of Europe

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A number of bony midline elements of the turtle shell, in particular the preneural, neurals, interneurals, postneurals, and suprapygals, are subject to strong variability, especially among sea turtles. For example, the neural series completely disappeared in the leatherbacks (*Dermochelys coriacea*), but additional interstitial elements are found in the shells of some modern hard-shelled sea turtles. We here document the morphology of interneurals based on the first description of the visceral face of the shell of *Glyptochelone suyckerbuykii*, an enigmatic Late Cretaceous sea turtle which displays an unusually high number of midline elements due to the presence of interneurals. The interneural plates of this taxon are midline elements that differ from regular neural plates of

turtles by not representing neural arch expansions but rather interstitial elements that develop between two consecutive neurals. The presence of interneural plates has otherwise been reported in extant sea turtles, in particular in *Lepidochelys* spp., and in some Cenozoic fossils such as the Miocene *Procolpochelys grandaeva*. We provide an updated classification for the midline column of the turtle shell based on novel homology criteria as consisting of neurals, which are expansions of the neural arches, by contrast to preneurals, interneurals, and postneurals, which are independent bones that form anteriorly, within, and posteriorly to the neural column, respectively. The presence of interneurals in fossil and extant sea turtles leads us to raise caution about the simple counting of neurals in the shell of turtles, as is widely done in phylogenetic characters, as the presence of interneurals can bias the count. We suggest use of our novel nomenclature in future descriptions and phylogenetic analyses. As the visceral face of the shell is needed to employ our nomenclature, we present guidelines for the recognition of interneurals based on the morphology of the dorsal face, which may be of use in fossils.

Funding Sources Swiss National Science Foundation (SNF 200021_207377) to W.G.J.

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Evolutionary history of tooth attachment systems in Archosauromorpha: understanding the origin and ontogeny of archosaurian thecodonty

Mestriner, Gabriel[1,2], LeBlanc, Aaron[3], Funston, Gregory F.[4,5], Evans, David[6], Casali, Daniel[1], Nesbitt, Sterling J.[7], Rytel, Adam A.[8], Herter, Stefanie[9], Marsola, Júlio[10], Langer, Max C.[1]

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Tooth attachment (of marginal teeth) by means of a soft periodontal ligament (gomphosis) is traditionally considered a derived feature of mammalian and crocodylian dentitions. However, recent histological studies on extinct taxa have shown that the evolutionary history of tooth attachment is far more complex in terms of distribution and convergences. For example, dinosaurs appear to share a gomphosis with crocodylians, but whether this attachment mode evolved only once within archosauromorphs or multiple times remains unclear. To tackle this issue, we histologically sampled the tooth root of 18 genera of archosauromorphs, aiming to hypothesize the tooth attachment evolutionary history within the group. According to our observations, tooth attachment was coded as three states based on the timing of tissue mineralization: 0 (rapid ankylosis), 1 (delayed ankylosis), and 2 (permanent gomphosis). We conducted ancestral state estimations for Amniota by combining our new data with tooth attachment information from the literature. Our results recovered “rapid ankylosis” as the ancestral state for Archosauromorpha, and “delayed ankylosis” as a synapomorphy of Archosauria. We found that “permanent gomphosis” arose early in the evolutionary history of pseudosuchians, although convergently in phytosaurs and other pseudosuchians. Surprisingly, our results show that early dinosauriforms/dinosaurs retain ankylosed teeth—alongside gomphosis—at the last stage of tooth ontogeny. It differs from both non-crown archosauromorphs, which ankylose their teeth faster/earlier, and from more nested dinosaurs, which never ankylose their teeth. Thus, our results suggest that “permanent

gomphosis" evolved independently at least three times in the major groups of Dinosauria—in Theropoda, Sauropodomorpha, and Ornithischia. As in synapsids, differences in the tooth attachment of archosauromorphs arise from heterochronic changes in the timing and extent of mineralization of the periodontal ligaments, with gomphosis being the paedomorphic condition relative to the ankylosed attachment seen in early amniotes. Shifts in tooth attachment are therefore not related to the acquisition of novel dental tissues. The tooth attachment system of archosauromorphs comprises tissues—cellular cementum, alveolar bone, and periodontal ligament—that are homologous to those of other amniotes, and gomphosis arose independently via heterochronic changes during reptilian dental evolution.

Funding Sources FAPESP (2022/00171-9 and 2022/12395-9; 2020/07997-4, and 2022/00044-7); NSERC and Vanier-Banting Comm.; NSF EAR-1337291; and Nat. Geo. Res. & Exp. (9606-14).

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

The anatomy of the carpus and tarsus of squamates provides novel morphologic support for key molecular clades

Meyer, Dalton

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Squamates (lizards, including snakes) are the most speciose clade of extant tetrapods, are found nearly globally, and have a history stretching to at least the Late Triassic. However, their origin and early evolution remains obscured by persistent conflict in phylogenies generated by morphologic and molecular data. Among the largest of such discordances in amniotes, this has major implications for understanding how squamates acquired their immense diversity and disparity. One potential contributing factor is that postcranial characters are relatively under-sampled in major squamate datasets. This is especially true for the carpus and tarsus (wrist and ankle). Despite their importance to other major clades (e.g., mammals and archosaurs), they make up only 3–5% of characters in the largest squamate datasets. To address this, I used 3D μCT imagery of modern lizards from every limbed-family (n = 84) to generate comparative images (>10,000) of the individual carpal and tarsal elements across Squamata, creating the first 3D atlas of their anatomy.

I used 3D geometric morphometrics to verify phylogenetic signal in these elements, and test for the confounding influence of locomotor function. Using pseudolandmarks to sample the surfaces of one carpal and three tarsal elements, I performed Procrustes analyses and generated morphospaces via PCA in Geomorph. Major clades (eg., Acrodonta, Gekkota) are separated in morphospace, and tests of phylogenetic signal (ANOVA & K_{mult}) find significant ($P < 0.01$) association of morphology with phylogeny. Habitat use strategies overlap in morphospace, and PhyloANOVA tests find inconsistent association between function and morphology, indicating phylogeny is the main driver of squamate carpal and tarsal anatomy.

I then identified 163 new characters (159 discrete, 4 continuous) that I incorporated into my morphologic dataset. Analyses under equal- and implied-weights parsimony recover similar topologies to prior morphologic work. However, the distribution of carpal and tarsal characters tells a different story. They are generally more parsimonious under the molecular topology, and critically provide novel support for major molecular clades such as Unidentata and Toxicofera. For some (e.g., amphisbaenians + lacertids), they are the only morphological support. This is a crucial step in bringing multiple data types into congruence, and illustrates that holistic character sampling is integral to understanding macroevolution over deep time.

Funding Sources Yale Department of Earth and Planetary Sciences, Yale Institute for Biospheric Studies, Bryan Patterson Memorial Grant.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

The complex evolutionary history and developmental trajectory of the neoichthyosaurian pelvic girdle and the second potential non-ophthalmosaurian ichthyosaur from the Cretaceous

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Due to the ever-increasing adaptation to pelagic life, the pelvic girdle of ichthyosaurs was progressively reduced. The morphological changes included the acquisition of a more elongated, plate-like shape of the ischium and pubis, reduction of the pubis size compared to the ischium, and fusion of the ischium and pubis. Many ophthalmosaurs closed the obturator foramen entirely, making it difficult to differentiate the ischium and pubis. These drastic changes as well as the likely presence of several reversals of morphology make it hard to pinpoint the exact evolutionary trajectory of the ischiopubic complex in baracromian ichthyosaurs. To assess this problem, we qualitatively assessed the pre- and postnatal ontogenetic trajectory of the ischiopubis in the Early Jurassic ichthyosaur *Stenopterygius*. In *Stenopterygius*, medial fusion is seen early in prenatal development (fetal stages 1 and 3), followed by the contact between ischium and pubis (fetal stage 4) at the acetabulum. Acetabular fusion of the ischiopubis follows postnatally (postnatal 1). In this way, the obturator foramen is open at the acetabulum for most of prenatal development. The trajectory in *Stenopterygius* and several other taxa show that baracromian ichthyosaurs have lost the pubic contribution to the acetabulum. Even though reversals are present, often resulting in the loss of medial fusion of the ischium and pubis, we argue that this developmental trajectory is likely plesiomorphic for Ophthalmosauria. With this knowledge in mind, we identify a potential non-ophthalmosaurian from Barremian rocks of eastern Switzerland. The specimen is an ischiopubic complex ca. 25 mm in length, exposed in dorsal view. The obturator foramen is large and fusion between the ischium and pubis is established medially, but although there is proximal contact at the acetabulum, complete fusion is not observed. Cortical bone smoothness suggests a postnatal ontogenetic stage for this specimen. The morphology is most reminiscent of fetal stage 4 *Stenopterygius*. Moreover, no known postnatal ophthalmosaurian displays such weak acetabular fusion between ischium and pubis. On the basis of this morphology, we deem this new specimen to be closely related to *Stenopterygius* or near the base of Ophthalmosauria. If true, this would indicate a ghost lineage of this taxon of around 40 million years. This potentially represents only the second non-ophthalmosaurian ichthyosaur occurrence after the Middle Jurassic.

Colbert Prize Session

Variable effects of endocranial volume on sulcal lengths in the mammalian Order Carnivora: an analysis of virtual endocasts based on micro-computed tomography.

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Gyrification, the process that creates folds and sulci in the brain, is relatively understudied in mammalian groups other than primates. In general, as mammalian brains increase in size, the degree of gyrification tends to increase. While sulcal length is often discussed

qualitatively in descriptions of brain endocasts, few analyses have quantitatively assessed the influence of brain size on the lengths of individual sulci. Within Carnivora, there is considerable diversity in brain size and degree of gyrification, making carnivores an ideal group to study the relationship between brain size and sulcal length. Here, we examine the relationship between endocranial volume (ECV) and the lengths of the lateral, cruciate, and suprasylvian sulci in a sample of 27 extant species representing 8 carnivoran families. We also include previously published endocasts of the carnivoramorph Quercagyle and amphicyonid Gustafsonia. For all extant taxa, virtual endocasts were generated and measured using micro-CT scans in 3D Slicer 5.8.1. PGLS regressions reveal a significant positive relationship between ECV and the lengths of both the suprasylvian sulcus and cruciate sulci in extant carnivorans. In contrast, the lateral sulcus is not significantly correlated with ECV. Quercygale and Gustafsonia lack cruciate sulci, and have lateral sulcus lengths that are similar to those observed in a range of extant carnivorans with much larger ECVs. Quercygale and Gustafsonia also have relative suprasylvian sulcus lengths most similar to those of mustelids, nandiniids, and procyonids, which tend to have short suprasylvian sulci for their ECVs. Despite the general expectation of increasing sulcal length and gyrification with increases in brain size, our findings suggest that the influence of brain size on sulcal length is not uniform across sulci. These results may be explained by regional patterns of neocortical expansion over the course of carnivore brain evolution. Clear clade-specific differences are also evident in our sample, such as the relatively long cruciate sulci present in procyonids. Our observations for Quercygale and Gustafsonia further suggest that the relatively short suprasylvian sulci of mustelids, nandiniids, and some procyonids may represent a retention of the plesiomorphic condition in stem carnivorans.

Funding Sources This work was supported by Undergraduate Research Fellowships from the Office of Undergraduate Research and the Jackson School of Geosciences at the University of Texas.

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Criteria for improving the educational content of extinct organisms in children's print media at the Department of Paleobiology, National Museum of Natural History (NMNH), Smithsonian Institution

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For nearly two decades, Smithsonian Enterprises, a division of the Smithsonian Institution, has partnered with children's book publishers to develop Smithsonian-branded books. Publishers pay fees or royalties to license the Smithsonian name and logo, while Smithsonian experts review and approve the educational content for accuracy. This collaboration enables higher-quality educational products to reach consumers, improves publisher profit margins, and funds Smithsonian scholarship and research.

The Department of Paleobiology at the NMNH values this partnership and created rubrics for editing content. When reviewing content, two sets of criteria based on age categories are recognized: under 5 years old and 5+. Life reconstructions for both age groups have the same criteria: that the organisms must feature morphologies that are within the last decade of scientific understanding (e.g., integument, posture). While up-to-date morphologies are desirable, publishers prefer to use art they have already bought or licensed. Giving publishers a ten-year timeframe in which to update their artwork provides them with flexibility and also allows the scientific community to reach consensus.

For the <5 bracket reconstructions of taxa may have human-like expressions or be "cute" and

animals from different time periods may appear in the same image. For media with a target audience of 5+ all artwork must be accurate, no anthropomorphism is acceptable, and taxa appearing within the same image must have co-existed. Negative adjectives (e.g., stupid, blood thirsty) are avoided in favor of words that more properly describe inferred behaviors.

The benefits of this partnership have led to global sales of 4.6 million books over the last 7 years, many of which are held in libraries and seen by a wider audience. Despite these successes, publishers are still very risk-averse, often wanting to focus on taxa already known by the public and reducing an organism to a series of factoids, with few exceptions. Pushes by the authors to explore other educational frameworks, such as teaching about whole environments or using dinosaurs as a tool to talk about larger biological or geological concepts, have gone unheeded. The paleontological community has a role to play in how the children of the world are educated about our science. The authors urge more members of our community to write for children and to work with publishers to improve the diversity of content available to today's youth.

Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Genomic evidence combined with time-integrated biosignatures applied to new fossils suggests an archosaurian origin of avian endothermy

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Birds evolved the highest metabolic rates amongst extant animals, a trait that defines their ecological niches. However, the drivers, timing, and origin of their metabolic endothermy is obscured in deep time; here we interrogate avian-style metabolic evolution via directional genomic insights and complimentary geochemical fossil data. We surveyed 22 amniote genomes for evidence of selection across n = 7 protein-coding orthologous genes of enzymes involved with mitochondrial aerobic respiration. Gene sequences were collected from NCBI, multi-aligned with PRANK, trimmed with Gblocks, then converted to codon format via PAL2NAL, and screened for selection via Datamonkey analyses (BUSTED, aBSREL). Increased substitutions were found to coincide with major metabolic strategy shifts in the archosaurian, varanid, and mammalian stem lineages. To directly observe geochemical evidence for these inferred metabolic shifts, we subjected 80 Paleozoic to Recent amniote fossils with carbonaceous preservation to Raman (500-3000 cm-1, NIR excitation, 10 replicates) and Fourier-Transform Infrared Spectroscopy (100–3000 cm-1, 30 replicates). While mammalian and varanid stem group representatives support previous assessments of metabolic upregulation, our analysis of new archosauromorph fossils reveals a significantly earlier origin of avian-style endothermy which has previously been suggested as an ornithodiran innovation: genomes and geochemistry indicate that avian-style endothermy evolved in the Archosauria, following the aftermath of the Permo–Triassic mass extinction. Further exploration of the spectroscopic data via supervised machine-learning (Support Vector Machine, Python) revealed novel chemical signatures that robustly ($p < 0.05$) distinguish convergent biochemical approaches to metabolic upregulation of mammalian- versus avian-style endothermy—corroborating that the biochemical upregulation mechanism in archosaurs is homologous to that found in birds. By tracing changes of time-integrative molecular metabolic signals over an amniote phylogeny, our analyses indicate an archosaurian origin of avian-style metabolic endothermy and therefore a shared metabolic legacy for secondarily ectothermic crocodiles and endothermic birds. Geochemistry allows for the direct testing of mechanistic hypotheses inferred from modern genomes and complimentary molecular physiological insights provide an opportunity to deconvolute the

drivers of metabolic change we observe through time.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The Substation Quarry (earliest Jurassic Moenave Formation): infrastructure development results in the discovery of important bonebeds through the cooperation of city government and city museum

Milner, Andrew[1], Buchwitz, Jaleesa C.[1], Carter, Hunter A.[1], Anduza, Danny[2], Suarez, Celina A.[3], Martz, Jeffery W.[6], Gay, Robert J.[5], Lively, Joshua R.[4], Irmis, Randall[7], Kirkland, James I.[8]

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On January 2nd, 2025, the City of St. George (City) informed the St. George Dinosaur Discovery Site (SGDS) staff that a much-needed electrical power substation was to be constructed on City property adjacent to the SGDS museum. SGDS had previously informed the City that important fossil resources at the site would be impacted by bedrock disturbance. Additionally, large rock piles covering a portion of this ~1-acre (~4047 m^2) property contained fossils that had been moved during the construction of a nearby school. With the City's permission, SGDS began excavation of the 'Substation Quarry' on March 4th with the stipulation that excavation would halt on April 30th.

Due to the short window of time available to complete such a massive excavation, the SGDS team focused its efforts on two known fossiliferous horizons: the 'lower fish bed' (LFB) and 'upper bonebed' (UBB). Three local excavation companies assisted in exposing in-situ surfaces and sorting through rock piles. A plea for volunteers from universities, museums, and the general public resulted in 772 individuals filling out the SGDS application forms. Approximately 500 people, as well as 14 museums and universities, assisted with the excavation. Publicity reports greatly assisted in this recruitment effort, especially live streaming from the field, and news by local, regional, and national media. With this came significant donations of money, field equipment, and curation materials.

During early excavation, a previously unrecognized track horizon was discovered below LFB and a new plant locality above UBB. By April 30th, 1,097 specimens were inventoried, including fishes (sharks, semionotids, palaeoniscoids, coelacanths), rare theropod dinosaurs and crocodylomorphs, vertebrate tracks, plants, invertebrate body fossils, and invertebrate traces. Therefore, this site is one of the most diverse fossil localities following the end-Triassic extinction in western North America, providing an unusually detailed look at ecological diversity during the Early Jurassic recovery. However, approximately two-thirds of the property remains unexcavated.

Through public awareness and City cooperation, the electrical substation has been relocated to a nearby section of City property that will have a minor impact on paleontological resources. The Substation Quarry is now fenced off and will be excavated as an ongoing SGDS project.

Funding Sources St. George Dinosaur Discovery Site, City of St. George, Handy Excavation, Canyon Crest Contractors, AB Excavation, and hundreds of volunteers and donors.

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Bringing paleontology to remote communities in Mongolia

Minjin, Bolortsetseg[2,1], Munkhbat, Binderiya[3,2], Tumen, Undrakhsaikhan[2,4], Munkh-Ochir, Badamkhand[3,2], Batbayar, Enkhjin[3,2], Ulziitogtokh, Munkhchimeg[5,2], Eren, Uranchimeg[4,2]

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Mongolia is internationally recognized for its remarkable dinosaur fossil record since the 1920s. Yet public understanding of these discoveries remains limited due to insufficient educational infrastructure and the historical removal of fossils by foreign-led expeditions. This lack of engagement has contributed to the ongoing problem of illegal fossil collection and trafficking. To address this, the Institute for the Study of Mongolian Dinosaurs (ISMD) was established in 2008 to raise public awareness, build local scientific capacity, and protect Mongolia's fossil heritage. From the beginning, ISMD has prioritized outreach to remote and underserved communities, emphasizing science education and youth engagement. The ISMD conducted its first educational outreach in the Gobi in 2009, and this was followed four years later by a major milestone. In 2013 the American Museum of Natural History donated a moveable dinosaur museum (MDM) titled Dinosaurs: Ancient Fossils, New Discoveries to the ISMD. This 37-foot, wheelchair-accessible MDM features 250 square feet of exhibit space, including scientifically accurate fossil casts, educational videos, and displays highlighting iconic Mongolian dinosaurs such as *Velociraptor* and *Protoceratops*.

Since 2015, the MDM has traveled more than 30,351 miles across all 21 provinces of Mongolia, reaching approximately 6300 visitors, primarily K–12 students experiencing a paleontology exhibit for the first time. Each museum visit is paired with an interactive, hands-on workshop designed to engage students and assess their understanding of paleontology. Workshops begin with a pre-assessment to evaluate students' baseline knowledge, often revealing minimal familiarity with fossils or Mongolia's paleontological significance. Educators then introduce key concepts and guide students through activities using fossil models. Students rotate between two stations: one explores the MDM while the other participates in hands-on learning in the classroom. Sessions conclude with a group discussion to reinforce concepts and encourage critical thinking. Post-workshop assessments consistently show significant gains in knowledge. ISMD's mobile outreach model demonstrates how accessible, place-based science education can connect remote communities with their natural heritage and cultivate future generations of scientists and stewards.

Funding Sources Gerry Ohrstrom and other private donors

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Comparing ancient & modern gut contents: how do major groups differ in predatory style?

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Occasionally, spectacular fossils are found containing gut contents. Each such fossil is an extremely valuable piece of ground-truthing, documenting an actual ecological interaction that occurred, allowing ecological hypotheses based on morphology to be tested against extrinsic ecological evidence. However, there are severe biases that plague inferences from these gut-contents finds. Specifically, some prey items are more likely to show up as gut contents,

so if a given animal's diet was 99% termites and 1% minnows, the only fossils you'd likely ever find would be minnows, even though they were a minor part of the predator's diet.

The approach I've taken is to directly incorporate these biases by finding modern samples comparable to what is preserved in the fossil record. Specifically, ecologists studying the dietary habits of predators may collect scat, observe predation events, or occasionally assess stomach contents directly. Historically, this was done after sacrificing the predator, but modern studies often use regurgitation techniques and, rarely, X-ray data. Regardless of technique, these stomach content studies directly link a specific vertebrate predator with a prey represented in their stomach by bony remains.

For my study specifically, what I've done is built a large database of dietary studies on modern tetrapod carnivores. I've transcribed the specific prey found for each predator, as well as the type of study (gut contents, pellet, observational, etc.) to estimate body size biases for different ecological study type. I also recorded or determined where possible the body mass of the predator and prey pairs. This allowed me to estimate a hierarchical Bayesian model that estimates the predator-prey size difference we'd expect to see fossilzable for different groups (Carnivora, Crocodylia, Squamata [Serpentes, Varanidae], various avian clades).

I also collected data on over a dozen theropod specimens with known gut contents, and collated osteological measurements for both the therpod and its prey. This dataset on extinct species, combined with the extant species gut content data and the model should allow us to search for evidence of shifts in predatory style along the theropod phylogeny.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

High-flow heart tract and increased ventilation in stem gnathostomes

Miyashita, Tetsuto[1], Janvier, Philippe[2], Tietjen, Kristen[4], Coates, Michael[3]

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Modern gnathostomes have trunk-derived elements in the skull (e.g., occipitals), head-derived structures extending to the trunk (e.g., vagal nerve), and organs at the interface that, in certain taxa, seemingly have their cellular origins in both regions (e.g., cucullaris, branchial skeleton). Comparatively, the head-trunk interface is simple in lampreys and hagfishes. The gnathostome head-trunk interface is therefore considered a product of complex character transitions toward the implied active lifestyle of early jawed vertebrates.

Here we present a new interpretation of the head-trunk interface in the sister group of jawed vertebrates, osteostracans. Using a Synchrotron radiation scan of a head shield of *Norselaspis glacialis*, we identified osteological correlates for the crown gnathostome-like organization of the interface in this jawless fish. These traits include paired venous drainage, cavernous sinus venosus, and cardiac branch of the vagus nerve. However, osteostracans lack the cucullaris and hypobranchial muscles that delineate this interface in crown gnathostomes. Due to this absence, the pectoral fins belong in the trunk domain but are derived from more anterior position than in jawed vertebrates. Comparison with cyclostomes reveals that jawless and jawed vertebrates share a passive pumping mechanism to aid the myocardiac contraction. Altogether, these characters indicate a high-flow heart tract in osteostracans, a feature previously considered as a later innovation by jawed vertebrates.

These findings in *Norselaspis* suggest that the complex head-trunk interface arose in a stepwise fashion along the gnathostome stem, heralded by a high-flow heart tract and pectoral fins. Interestingly, jawless stem gnathostomes show a trend of increasing branchial space, which in

osteostracans accounts for greater than 90% of the head volume. Increasing capacities in both the branchial circulation and ventilation implies that, as in modern lampreys, branchial pumping dominated in jawless stem gnathostomes. The branchial space is proportionally much smaller in jawed vertebrates, where powerful ventilation is generated by dual pumps in oral and branchial cavities. Given the jaw function in driving the oral pump, we propose that the origin of jaw (and the assembly of the gnathostome head-trunk interface with the neck and hypobranchial musculature) marks a shift from the branchial dominance to the dual pump system in generating feeding and respiratory currents.

Funding Sources National Science and Engineering Research Council, Canada; Canadian Museum of Nature; University of Chicago; National Science Foundation

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New fin material from the Devonian of Ellesmere Island, Arctic Canada and radial diversity in tetrapodomorph fishes

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The paired fins of tetrapodomorph fishes have been examined in great detail to understand both the phylogenetic framework of early tetrapods and the functional context of the fin-to-limb transition. Attention has predominantly been focused on a few exemplar taxa with well-preserved fin endoskeletons (e.g., *Eusthenopteron, Panderichthys, Tiktaalik*, and *Elpistostege*), and macroevolutionary investigations on individual fin elements have thus far been attempted on the humerus alone. As a result, the evolution of the more distal fin skeleton (e.g., the radius, ulna, and intermedium) is largely unanalyzed in this group, potentially hindering our ability to estimate taxonomic and functional diversity at the fin-to-limb transition. Here we present new fin material from the Late Devonian of Arctic Canada that we identify as the radius and an intermedium of a tetrapodomorph fish. The specimen was collected on Ellesmere Island, Nunavut, at NV2K17, the quarry that produced most of the *Tiktaalik* material. The new material was scanned using micro-computed tomography and compared to known tetrapodomorph fins. Both elements are characterized by canonical elpistostegalian features, such as the blade-like shape of the radius and a prominent ventral groove on the intermedium; nevertheless, we cannot attribute the new material to any known taxon. Geometric morphometric analyses of tetrapodomorph radii show the new specimen occupies a region of morphospace populated by elpistostegalian fishes, and it is closest to *Tiktaalik*. However, the new radius has a sub-rectangular proximal articular facet that is distinct from the rounded facets found in other elpistostegalians (e.g., *Tiktaalik* and *Qikiqtania*). This unique articular morphology implies a movement pattern at the humeroradial joint not previously observed in tetrapodomorphs, expanding the predicted diversity of fin functions in this clade, and highlighting the importance of incomplete fin material for understanding morphological and functional disparity in the closest relatives of limbed vertebrates.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Walking with giant dinosaurs: new brachiosaurid fossil sites from the Upper Jurassic of Pombal (Portugal)

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The evolutionary history of Late Jurassic brachiosaurids from Europe is still relatively unknown, being represented by scarce fossil record, including four established taxa: *Lusotitan* (Portugal), *Galveosaurus* (Spain), *Vouivria* (France), and *Europasaurus* (Germany). The dinosaurian fossil record of the Iberian Peninsula is well-known, with many sauropod occurrences identified in the Kimmeridgian–Tithonian deposits of the Lusitanian Basin. In recent years, new specimens have been tentatively attributed to Titanosauriformes, some of which display brachiosaurid synapomorphies. These findings offer an opportunity to evaluate the little-known phylogeny of European brachiosaurids. Herein, we present a preliminary overview of three new sauropod localities under study and found in the Upper Jurassic deposits of Pombal, Portugal: Junqueira, Monte Agudo, and Mouriscas, which are characterized by their enormous size, being among the largest specimens found in the Upper Jurassic of Europe. At the Junqueira quarry, a partial sauropod skeleton was collected, including a set of disarticulated axial elements (dorsal vertebrae and ribs) from a single individual. At Monte Agudo site, an articulated series of poorly preserved anterior dorsal vertebrae and several dorsal ribs were recovered. Finally, the Mouriscas locality yielded a fossil assemblage comprising multiple disarticulated axial elements (dorsal and caudal vertebrae, and ribs), as well as pelvic, and appendicular elements (forelimb and hindlimb bones), which might belong to more than one individual. All these specimens are attributed to Titanosauriformes due to the presence of several synapomorphies of the clade (e.g., camellate internal bone tissue and plank-like distal end in the anterior dorsal ribs). The specimens from Junqueira and Mouriscas display a combination of features that support their attribution to Brachiosauridae, including a divided spinopostzygapophyseal lamina in the middle and posterior dorsal vertebrae; strongly dorsoventrally compressed dorsal centra; slightly opisthocoleous posterior dorsal centra; short anterior caudal neural spines; posteriorly directed caudal ribs; slender humerus with lateral straight profile; and a round and developed pre-acetabular process of the ilium. These new brachiosaurid specimens will provide important data for understanding the evolutionary history of this group in the Iberian Peninsula, where, until now, only *Lusotitan* and possibly *Galveosaurus* were known.

Funding Sources FCT, I.P./MCTES through the CEECIND/00726/2017/CP1387/CT0034 and CEECIND/01770/2018.

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

The stem-tetrapod *Glyptopomus kinnairdi*: redescription and phylogenetic implications close to the 'fish-tetrapod transition'

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The tetrapodomorph fish *Glyptopomus kinnairdi* Huxley, 1859 is one of the first 'osteolepiforms' described and illustrated in the early vertebrate literature, but has surprisingly remained among the least cited and least surveyed taxa in recent studies relating to the 'fish-tetrapod transition'. *Glyptopomus kinnairdi* occurs in the Upper Devonian (middle Famennian) of the famous Dura Den sandstones of Scotland, represented by several relatively complete specimens preserving the skull and the postcranial skeleton, including the paired and median fins, as well as the squamation. Previous descriptions focused

on the dermal skeleton and the dorsal surface of the palate, solely based on external observation of the fossil material. *Glyptopomus kinnairdi* displays rhombic scales lacking cosmine and a diphycercal caudal fin, with a notable posterior displacement of the pelvic and median fins. All of these features are shared with the relatively more derived 'elpistostegalians' and tetrapods, hinting at a possible affiliation of *Glyptopomus kinnairdi* either close to or within Eotetrapodiformes (i.e., the clade containing 'tristichopterids', 'elpistostegalians', and tetrapods). Here, we present previously unknown hidden details of the palate, lower jaw, and pectoral girdle revealed through the use of µCT scanning, providing new and important morphological information to better reconstruct the anatomy and interrelationships of *Glyptopomus kinnairdi* among tetrapodomorphs. Our phylogenetic analysis incorporating these novel anatomical details resolves *Glyptopomus kinnairdi* as an osteolepiform-grade taxon, sister to all other Eotetrapodiformes. The new phylogenetic attribution of *Glyptopomus kinnairdi* is thus informative on conditions at the early divergence of the closest relatives of tetrapods, shedding light on the evolutionary sequence of morphological changes approaching the 'fish-tetrapod transition'.

Funding Sources Louis Gentil-Jacques Bourcart Grant, French Academy of Sciences.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Optimizing fossil repair: white graphite, pipe cleaners, and scaffold with adjustable 'finger'

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Repair is integral to fossil preparation. While selecting and applying adhesives is critical, positioning and stabilizing joined elements is equally important for success. Over nine years, staff and volunteers at the American Museum of Natural History have conducted hundreds of vertebrate fossil repairs, providing valuable insights into optimizing this process.

The technique illustrated here has been helpful in obtaining better repairs for elongated fossil elements, which are difficult to support using only gravity and sand, and which are especially vulnerable to misalignment during joining. This technique employs a simple, easily fabricated, versatile support requiring white graphite pencil for easily removable visual alignment, a custom-made wood scaffold and height-adjustable 'finger' for applying controlled pressure and stability, and pipe cleaners to support fossil elements without causing surface damage during set-up. When used with a sandbox to leverage gravity, this technique improves stability, alignment, and the overall quality of repairs.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Osteology of palaeorhynchids from the Eocene Habib Rahi formation of Pakistan

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Members of the extinct family †Palaeorhynchidae, putatively related to modern billfishes (Istiophoriformes), are characterized by a high number of vertebrae (60+ in some cases), the presence of neural and haemal lamellae on the vertebral spines, a wide downturned flange of the maxillae, and elongated upper and lower jaws of equal length, among other characters. †Palaeorhynchids have been described from Eocene and Oligocene formations of Europe, western Asia, New

Zealand, and the United States. An assemblage of teleostean fishes from the middle Eocene (Lutetian) Pakistan Habib Rahi Formation produced †palaeorhynchids. Seven †palaeorhynchid fossils are in this collection, consisting mostly of impressions with some remaining bone. A few features preserved among the fossils that stand out include the presence of teeth, a downturned flange of maxillae, and vertebral spinal lamellae, which, in addition to high vertebral counts, are features that can be used to assign them to the genus *†Palaeorhynchus.* We describe the osteology of these specimens through CT reconstruction, light and fluorescence imaging, and Reflectance Transformation Imaging (RTI). It is noteworthy that teeth are preserved along the premaxillae and dentaries and are ankylosed to a spongy bone of attachment; this is a similar condition to the dentition of modern billfishes.

Funding Sources National Science Foundation DEB 2016120, 2017822.

Colbert Prize Session

Detailed anatomy of the neotype of *Amphibamus grandiceps* (YPM 794) revealed by high contrast micro-CT analysis

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The spoil piles of Mazon Creek produce rare and informative fossils from the Carboniferous period that shed light on the early evolution of stem lissamphibians. Among the rarest of these fossils are the amphibamiforms, including the name bearing taxon, *Amphibamus grandiceps*. *Amphibamus* is a historically important species for establishing the relationship between Paleozoic temnospondyls and modern lissamphibians. *Amphibamus* was first described by Edward D. Cope in 1865, but the holotype material was later lost in a fire. Subsequent specimens were found from Mazon Creek, including the neotype of *Amphibamus*, YPM 794. Since then, many new amphibamiform fossils have been recovered from Mazon Creek, but identification of these newer fossils hinge upon a needed modern anatomical reinterpretation of the neotype.

Mazon Creek vertebrate fossils are preserved as natural molds that are often secondarily infilled with kaolinite, lacking fossilized bone. Historically, this kaolinite infill was carefully prepared away and latex peeling methods were applied to study the osteology of the vertebrate fossils. While latex peels can be high resolution, this method can be destructive, and is limited to the exposed surface of each half of the concretion. The lack of mineralized bone that would normally provide contrast, has made conventional CT scanning methods challenging. Here, we provide a new protocol for applying micro-CT scans to Mazon Creek vertebrate fossils and apply it to the restudy of the neotype of *Amphibamus grandiceps*. Both halves of the concretion are placed back together during the scanning process, creating a negative space that represents the fossil anatomy. The CT scan is optimized to highlight the contrast between the matrix and the void space created by the fossil. Using this scan, we segmented out the specimen using the 3D visualization software, Dragonfly.

The results of our CT analysis reveal and clarify several anatomical features in YPM 794, including the incomplete distal ossification of the caudal vertebrae, a presacral count of 18 vertebrae, lack of an interclavicle, and presence of a short and rounded snout. This last feature appears to differ from several other specimens referred to as *Amphibamus*, including FMNH UC 2000, which has a narrow and blunt snout. The further application of this CT method to additional specimens of *Amphibamus* will clarify the morphological and taxonomic diversity within this species complex.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The role of climatic constraints on dinosaurian faunal transitions during the mid-Cretaceous in the Western Interior Basin of Utah

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Accurately assessing abiotic constraints on ecosystems is vital to interpreting eco-evolutionary biotic transitions. During the early Late Cretaceous in the North American Western Interior Basin (WIB), there were dynamic geological and environmental changes caused by the regional Sevier Orogeny and related transgression of the Western Interior Seaway compounded by global climatic shifts such as the onset of the Cretaceous Thermal Maximum (KTM) and subsequent climatic cooling. These abiotic events coincided with documented dinosaurian faunal transitions in the central WIB, such as regional extinction of sauropods, replacement of early diverging iguanodontians with hadrosauriforms, extinction of allosaurians with tyrannosaurs evolving to fill the large carnivore niche, and establishment and diversification of ceratopsians.

To more accurately identify the climatic constraints acting on the faunal transitions in dinosaurs during the mid-Cretaceous, we analyzed the terrestrial paleoclimate in a small region between ~99.5 Ma to ~83 Ma (upper Cedar Mountain Formation, Naturita Formation, and the Straight Cliffs Formation of Utah). The paleoclimate data was produced using proxy relationships associated with bulk and carbonate B-horizons of paleosols, which were analyzed using both a dual inlet isotope ratio mass spectrometer (DI-IRMS) for clumped isotope values (Δ_{47}) and an XRF for bulk elemental compositions. Corresponding climofunctions to provide mean annual temperature (MAT) and mean annual precipitation (MAP) show that MAT increased by ~9°C from 13°C to 22°C and MAP also increased by ~700 mm/yr from 900 to 1600 mm/yr, indicating that mid-Cretaceous Utah was progressively becoming warmer and wetter over time. Within the paleo-Köppen framework, this increase in MAT and MAP caused a shift in the environment from a relatively humid subtropical environment to a more temperate rainforest through these ~16.5 million years. Overall, with the significant increase in both MAT and MAP in Utah coinciding with faunal turnover, climatic shifts may have played a role in species sorting and other eco-evolutionary dynamics. Finer resolution of faunal and climate data will aid in identifying the timing of the turnover and potential role of climate in these Cretaceous ecosystems.

Funding Sources NSF Award #1925973 to E.G.H. and L.E.Z.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Future fossils on fans: a four-year time-series of bone degradation in megafan environments from the Pilcomayo Fan, Paraguay

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All modern sedimentary basins are dominated by megafan deposition, so the majority of the

geological record of life on land was likely preserved in megafan environments of one variety or another. Therefore, examining megafan taphonomy will be critical to understanding the temporal, spatial, and compositional fidelity of terrestrial fossil assemblages, among other paleoecologically important variables. To date, however, there haven't been any modern taphonomic studies that have been explicitly investigated in a megafan geomorphological framework. For the last four years, our research group has been gathering taphonomic data from the vertebrate assemblages forming on the world's largest megafan: the Pilcomayo Fan, which starts in Bolivia and currently deposits along a ~250km length of the Paraguay-Argentina border.

We have two study areas in the Pilcomayo, one proximal to the fan apex (Pozo Hondo) and one distal (General Diaz), whose bone assemblages are being surveyed and taphonomically quantified yearly. To assess the scale of preservational patterns that will be most relevant to paleontological studies, we have broken the Pilcomayo's surface into six subenvironments, designed to capture the range of fluvial environments that are identifiable in the rock record: exposure surface, channel, levee, floodplain, avulsion lobe, and avulsion flood apron. A total of 271 localities have been surveyed across the duration of the project, providing key time-series data of bone degradation.

Here we will present a summary of a four-year preservational time-series from the Pilcomayo and build a Generalized Linear Model to quantify the influence of subenvironment, fan position, and taxon on bone preservation. We will also compare our taphonomic data with comparable data from two other deep-time fossil assemblages: the Triassic Chinle Formation of Petrified Forest National Park and the Eocene-Oligocene White River Group of Nebraska and South Dakota. Preliminary analyses show that the overall patterns of taphonomic modification seen in the rock record mirror those from the modern in Paraguay. This strengthens our confidence in making paleoecological comparisons between vertebrate assemblages from different areas/times. However, taphonomic patterns by subenvironment are less well conserved, possibly suggesting our ability to assess megafan subenvironment in the rock record requires some further refinement.

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Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

Bioapatite geochemistry reveals paleoenvironmental conditions in Lower Keuper (Middle Triassic) fossil sites of Baden-Württemberg, Germany

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Temnospondyls, relatives of modern amphibians, comprise a significant part of Triassic vertebrate ecosystems, providing valuable insights into the climatic and environmental dynamics of the Triassic. Their diverse fossil record in both paleogeography and stratigraphy makes them ideal proxies for investigating ecological resilience and habitat adaptation during the Middle Triassic. Here we present an integrative geochemical investigation of temnospondyl fossils from two prominent Lower Keuper fossil sites in Baden-Württemberg, Germany. We elucidate how stable isotope analyses refine our understanding of temnospondyl paleoecology within evolving lacustrine ecosystems of Vellberg-Eschenau and Kupferzell.

Isotopic analyses reveal significant variations in the composition of oxygen isotopes between the fossil localities, which are interpreted as reflecting distinct paleoenvironmental settings. Kupferzell exhibits signatures consistent with a relatively stable lacustrine setting, whereas Vellberg-Eschenau, shows evidence of greater

seasonal and hydrological fluctuations, indicating a more dynamic environment. Analysis of intra-tooth isotopic profiles further support these interpretations, highlighting the physiological responses of temnospondyls, such as *Mastodonsaurus giganteus* and other associated faunas to these environmental gradients.

These findings emphasize the ecological plasticity of temnospondyls, demonstrating their ability to inhabit variable habitats with diverse climatic conditions. By integrating geochemical proxies with detailed stratigraphic data, this study sheds light on temnospondyl adaptation strategies amid Middle Triassic lacustrine ecosystems. We demonstrate how high-resolution stable isotope analyses embedded within a holistic paleobiological framework can reveal nuanced paleoecological narratives from fossil bioapatite.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

Insights into the origins of migratory and maternity colony behaviors in the free-tailed bat, *Tadarida brasiliensis*, from an exceptional Pleistocene fossil record in Inner Space Cavern, Texas

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Tadarida brasiliensis, the extant Brazilian free-tailed bat, forms the largest bat colonies on Earth in caves on the Edwards Plateau of Texas. Those caves are occupied during the spring–summer when pregnant females migrate into the region to give birth and raise pups. Adults and newborn pups in these maternity colonies rely on warm temperatures and abundant insect prey to facilitate rapid postnatal growth prior to autumn migration. Colony behavior is linked to temperature–moisture dynamics. Yet not all populations assemble vast maternity colonies and climatic conditions varied throughout the late Quaternary, raising questions about the origin and driver(s) of extant behaviors. How long have caves on the Edwards Plateau served as maternity roosts? Here, I use fossils from a newly discovered Late Pleistocene site, Bat Breakdown, in Inner Space Cavern, Texas, to reconstruct prehistoric colony behavior. Thousands of articulated skeletons of *T. brasiliensis* coat the undersides of large (e.g., 6 x 4 m) limestone slabs in Bat Breakdown. Those slabs collapsed during a roof fall event and the articulated fossils occur in a single, dense, monotaxic layer only at the boundary between the slabs and underlying sediment. The articulated skeletons comprise a globally unique catastrophic Lagerstätte representing a portion of a free-tailed bat colony killed by the roof fall. Underlying sediment contains disarticulated, fragmentary fossils of *T. brasiliensis* and three species of Vespertilionidae, accumulated through attritional mortality. Abundance estimates for the catastrophic assemblage indicate a colony with a minimum of 660,000 individual free-tailed bats, on the scale of extant maternity colonies. In the catastrophic and attritional assemblages of *T. brasiliensis*, juvenile bats make up 51% and 53% of all individuals, respectively. Patterns of skeletal ontogeny indicate that those juveniles were 7–28 days old at death and too young to fly, forage, or feed themselves. Radiocarbon ages on bone bioapatite and organic sediment establish that the bat remains accumulated from ~31,500 cal BP until the roof fall event at ~29,000 cal BP, placing the fossils within Marine Isotope Stage 3, a warm, dry interval of the Late Pleistocene. Together, the data document the earliest, and only, known fossil maternity colony of *T. brasiliensis* and extend extant patterns of behavior into deep time with implications for understanding the response of *T. brasiliensis* to climatic change.

Funding Sources Geological Society of America Graduate Student Research Grant, Jackson School of Geosciences, and the Texas Academy of Science.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Convergent evolution in endocranial morphology of pterosaurs and birds: how the brain shapes locomotory behaviors in archosaurs

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Only three known groups of vertebrates have evolved the extensive suite of anatomical features necessary for powered flight—bats birds, and pterosaurs. Carrying out the motor functions necessary to navigate through an aerial environment that fully encompasses three dimensions, requires a complex integration of multiple sensory sources. It is only by comparing these volant groups that we can parse out the neurosensory demands and structural constraints that shaped the brain in the only extinct lineage among these three. Although Pterosauromorpha has been the subject of extensive biomechanical research and foundational studies have outlined the basic features of their endocranial anatomy, until now no one has brought together a large comparative dataset to understand how their neuroanatomy compares to that of other archosaurs, including crown-group birds. Although the fidelity of endocranial morphology to neuroanatomical structure varies widely in extant archosaurs, we found that the pterosaur endocast, like those of birds, better reflects the morphology of the brain than those of crocodylians. The pallial cerebrum and the cerebellum are two regions of particular interest because of their important role in avian flight. Both regions function to process and integrate afferent visual, somatosensory, auditory, and vestibular information. In addition to detailing their structure, we tested if, and how, the size of these regions coevolved with traits that are functional correlates for various types of sensory input (e.g., wing length as a proxy for incoming somatosensory information, orbit size for visual input). Both our qualitative and quantitative results suggest that, although the avian and pterosaur lineages evolved powered flight independently and using drastically divergent wing morphologies, their neuroanatomy converged extensively. It is likely that this convergence is a product of both the cognitive demands of using similar sensory information to navigate a three-dimensional environment as well as constraints imposed by the architecture of the archosaur brain.

Funding Sources NSF DEB 1801224

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The functional morphology and evolution of the avian cranial kinetic ‘hinge’ apparatus

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In modern birds, cranial kinesis describes the independent motion of the upper beak (the premaxilla, maxilla, and nasals) relative to the braincase around a ‘hinge’ region near the naso-frontal intersection. The morphology of the hinge is diverse, from a single narrow bending zone of flexible bone or fully synovial joint, to more extensive or even multiple flexible bending zones across the upper jaw. The number, position, and morphology of these hinges represent distinct forms of cranial kinesis, and many features of the upper jaw are seemingly adapted to facilitate or restrict bending motion during cranial kinesis, including bony retractor-stop mechanisms and the expansion of particular fenestrae. Relatively little work has been done to describe or explain this variation, or examine how these morphologies have evolved together as suites of functional characters.

Here we present a comprehensive, genus-level review of the morphology of the kinetic upper jaw and craniofacial hinge structure using photographs of 1,208 genera (~58%) of extant

birds. We compare key morphologies as character states for ancestral state reconstruction to elucidate the patterns by which key morphologies related to discrete forms of cranial kinesis emerged during the evolution of modern birds. We test the hypotheses that hinge morphology is tightly linked to phylogeny, and that the evolution of different kinds of cranial kinesis is driven by the emergence of a suite of features at once, rather than by their appearance piecemeal. We observe a series of clusters of repeated traits previously assumed to be independent, and note that a number of repeated traits we observed, both those that appear individually or as part of functional suites, appear to be convergent morphologies associated with feeding styles. The collected morphological data presented here present a valuable comparative dataset for comparison with the often fragmentary fossil record and provide insight into the evolution of the kinetic morphology of the upper jaw in birds.

Funding Sources BBSRC BB/X014479/1.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Out of the frying pan, into the fire: actualistic taphonomy of heat-induced bone damage and implications for Quaternary assemblages

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Fire as a taphonomic agent influences paleontological and zooarchaeological assemblages alike. While it is nearly impossible to determine the source of the fire (i.e. anthropogenic or natural), a wealth of information on temperature and duration of a burn can be gained from looking at burning patterns in a death assemblage. Previous work in fire taphonomy has found that during the burning process, there are distinctive alterations that occur in bone ranging from color, size, shape, surface texture, and inorganic mineral composition and phase. However, most actualistic taphonomic experiments to date have focused on large mammals. Small mammals (< 1 kg) make up a large portion of Quaternary fossil assemblages but are often overlooked in favor of their more charismatic megafaunal counterparts. Because of their higher surface to volume ratio, small mammal bones differ from large mammal bones in percentages of cortical to spongey bone, thus we expect fire to impact them differently than bones from larger animals.

To fill this gap in our understanding of the taphonomy of fire, I am conducting actualistic experiments in which I burn small mammal bones for different combinations of temperature (200 to 750°C) and duration (30 minutes to 48 hours) in order to recreate the range of fires a bone can encounter during its deposition. I am tracking changes in surface conditions (cracking, fissures, flaking), color, and mineral composition, phase, and crystal size (via μXRD and μFTIR). Thus far, long duration but low temperature fires, such as a sustained hearth for cooking, primarily result in surface modification to bone, while higher temperature fires, regardless of their duration, causes changes to the bone mineral structure itself. This can be applied to faunal fossil assemblages where bones with similar physical appearances can have vastly different depositional histories. Future work will aim to include the additional variable of burial within sediment to see if radiative heat from fires is also affecting bone material entombed within sediment as opposed to sitting on the surface.

Funding Sources Oregon State University Integrative Biology Research Award; NSF DEB 2228632.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Ontogenetic and spatial dietary partitioning as the ecological mechanism for high sympatric theropod diversity inferred from dental microwear texture analysis

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The sympatry of megatheropod dinosaurs (taxa <500 kg) in many Mesozoic biomes such as the Morrison, Bahariya and Huincul Formations raises questions regarding inter- and intraspecific competition and community structures. However, sympatry declined dramatically after the Cenomanian—Turonian faunal turnover with most later dinosaur faunas including only a single theropod taxon or clade. Constraining the diets of these taxa has often been based on tooth morphology and/or stomach contents, both of which are qualitative lines of evidence that can be affected by the quality of the fossil record. Here, we use three-dimensional dental microwear texture analysis (DMTA) to constrain the diets of 25 neotheropod species from all dentulous clades including sympatric Allosauroidea, Megalosauroidea, Ceratosauria and Tyrannosauroidea taxa from the Jurassic to the Late Cretaceous. We performed DMTA of extant crocodylians and varanids with known diets to place extinct microwear within a modern dietary framework. We show that megalosaurids were likely piscivorous and exhibited similar degrees of piscivory as some spinosaurids. Contemporaneous allosaurids show a different dietary signal, thus allosaurids and megalosaurids may have exhibited dietary partitioning via faunivory and piscivory, respectively. There is also evidence of piscivory in *Ceratosaurus*. Ontogenetic dietary differences vary between megatheropod clades with *Gorgosaurus, Spinosaurus*, and *Allosaurus* all exhibiting marked shifts through ontogeny as the compositions of softer food items increases with age. In contrast, *Majungasaurus* juveniles may have consumed food items with similar material properties as those consumed by conspecific adults. The dietary shift in *Allosaurus* may explain its abundance in the Morrison Formation as a predatory generalist, while *Torvosaurus* and *Ceratosaurus* are both rarer, which may be due to having more specialized diets. These findings support previous hypotheses that ceratosaurs had a wider dietary range than other megatheropod clades, which may have allowed them to coexist with other sympatric megatheropods. Allosauroidea and Megalosauroidea likely exhibited spatial and dietary niche partitioning within the same ecosystems. After the faunal turnover event, only faunivorous taxa and clades survived and piscivorous niches were not re-occupied by theropods in the Latest Cretaceous, potentially due to the diversification of Neosuchia.

Funding Sources Paleontological Society Richard K.Bambach Award, The Palaeontological Association Sylvester-Bradley Award, European Association of Vertebrate Palaeontology Research Grant

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Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

Revisiting the Triassic in the Central European Basin: evolution of terrestrial tetrapod communities and their environments

Mujal, Eudald[1,2], Miralles-Carreras, Albert[2], Sues, Hans-Dieter[3], Moreno, Raphael[1,4], Schaeffer, Joep[1,4], Sobral, Gabriela[1], Chakravorti, Sanjukta[1], Spiekman, Stephan[1], Schoch, Rainer R.[1,4]

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For 200 years, the Central European Basin (CEB) has been an important region for the

study of Triassic terrestrial tetrapods and continues to deliver new finds. This fossiliferous basin, with multiple localities covering almost the entire Triassic Period, provides an ideal scenario to study the evolution of ecosystems. We reviewed all non-marine tetrapod remains, including body and trace fossils, locating them in their paleoenvironments. Statistical analysis, accounting for presence/absence of each taxon and ichnotaxon in their depositional settings and habitats allowed to recognize new patterns of diversity for various clades. Novel functions that measure this diversity, as well as within and between formation dissimilarity, while accounting for taphonomic and effort biases have been developed. The lowermost Triassic strata are almost entirely devoid of tetrapod fossils, contrasting with coeval deposits in other regions. Temnospondyls are present in many Olenekian horizons, diversified in the earliest Anisian and attained their greatest diversity in the late Ladinian. Ichnofaunas complement the body fossil record, especially in Olenekian successions, which yield abundant and highly diverse tetrapod ichnofossils, especially those of archosauromorphs. The recent finds of body fossils in lower Anisian strata, with three temnospondyl and seven amniote taxa, approach the rich and diverse track record. Differences between Middle and Late Triassic faunas are not as profound as traditionally assumed. Whereas temnospondyl taxa were almost completely replaced, the composition of terrestrial amniote assemblages changed more gradually from the Anisian to the Norian. The Ladinian of southern Germany yields a wide range of taxa, including several lepidosauromorphs, a colognathid, a trilophosaurid, a stem-turtle, an owenettid, a procolophonid, and four different archosauriforms. Diverse Early and Late Triassic microvertebrate assemblages recently described from Poland will undoubtedly lead to the discovery of many additional small-sized tetrapod taxa. Robust statistical analysis of the new diversity indices suggests that osteological diversity increases throughout the Triassic, while ichnological diversity and discrepancy between skeletal and track data are mainly affected by the paleoenvironment. In summary, the CEB provides an excellent record for studying the evolution of Triassic terrestrial tetrapod faunas along with environmental changes over much of that period.

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Synchrotron histology of Norian theropod from the Elliot Formation of South Africa

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Non-avian theropods, the iconic carnivorous dinosaurs, are arguably the best-studied extinct reptiles during the last three decades. During this time, theropod research has emphasised later-branching Jurassic and Cretaceous taxa, with earlier forms from the late Triassic to the Early Jurassic receiving less attention. Paradoxically, these earlier forms have great utility for understanding the early radiation of dinosaurs and turnover in carnivore communities around the end-Triassic extinction event. One of the reasons for this research bias is the scant theropod fossil record between their first appearance in the Carnian and their radiation at the start of the Jurassic. South Africa's Elliot Formation is a global standard for fossils of the Triassic–Jurassic transition, and can potentially address this shortcoming, but so far it has produced very few theropod fossils overall and none from its Triassic strata. Here we present a new theropod (BP-1-9081) from the Late Triassic (mid-Norian) lower Elliot Formation of South Africa. The material comprises a

diagnostic partial skull and a hind limb of a relatively large individual of a new taxon. With a femoral circumference of 135 mm, and an estimated body mass of 83 kg, BP-1-9081 is over three times the size of a mature *Coelophysis bauri* (~25 kg), but still slightly smaller than a mature *Liliensternus liliensterni* (~110 kg). Osteohistology of the femur and tibia using classical and synchrotron approaches reveal highly vascularized, rapidly forming bone tissues, similar to immature coelophysoids and that it was a young individual not over two years of age. The absence of growth marks in the cortex suggests that BP-1-9081 was actively growing and had not yet reached skeletal maturity. Although not skeletally mature, BP-1-9081 had already attained a body size that is relatively large for contemporaneous coelophysoids and may have grown to attain adult sizes that rank amongst the largest known coelophysoids from the Late Triassic. Additionally, BP-1-9081 was recovered from a single quarry immediately below the skeleton of a gigantic pseudosuchian predator, strongly indicating the co-existence of large bird-line and croc-line carnivores in the Norian. Its large size, along with its distinctive anatomical features and the fact that it is the first Triassic theropod specimen recovered from South Africa highlights the potential for novel Elliot discoveries to continue to elucidate the early diversification of dinosaurs.

Funding Sources National Research Foundation GENUS, Palaeontological Scientific Trust (PAST), and the Jurassic Foundation

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Archaeopteryx color and paleoecology illuminated by synchrotron X-ray Fluorescence and spectroscopy

Mulder, Edgar A.[1], Bijl, Sifra[2], Ignatyev, Konstantin[3], Geraki, Tina[3], Schulp, Anne S.[1,4]

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Feather coloration in birds is one of their most distinctive features, relating to their lifestyles, mating habits, and ecologies. However, the appearance and paleoecology of most stem Avialae remain unknown. Over the past two decades, the emerging field of paleocolor has advanced our understanding of the ecology of extinct organisms, including stem avians, by enabling reconstructions of their appearances. Geochemical analyses such as Synchrotron X-ray Fluorescence (XRF) elemental mapping and sulfur X-ray Absorption Near Edge Structure (S-XANES) spectroscopy allow us to identify degradation products of pigments and soft tissues, or 'chemical ghosts'—leaving elemental or molecular components of organics that have degraded. Thus, even fossils that lack organic residues, but retain imprints of their structures, can still provide valuable insights into the in vivo coloration and soft tissues of the extinct organism. This study applies synchrotron XRF and S-XANES to the Haarlem specimen, which preserves feather imprints but lacks an organic film, to test for chemical ghosts of pigments and soft tissues. The obtained XRF data supports the identification of the chemical ghost of eumelanin, as elevated concentrations of copper are found within the outer vane of the secondary remiges and distributed throughout the greater and median coverts. Additionally, phosphatized rachides of the primary remiges were identified. The analysis suggests highly conspicuous coloring of dark brown to black and non-eumelanic inner vanes of the secondary remiges, though further research is needed to establish the likely coloration of these inner vanes. Such coloration likely conferred both functional and ecological advances, including structural reinforcement against abrasion, UV protection and antimicrobial resistance. The highly conspicuous coloration possibly served as a form of aposematism, akin to displays in pugnacious extant birds.

Funding Sources Teylers Museum, Diamond Light Source, and the Utrecht University Fund

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Discussing *Eldaaspis miklii* (Osteostraci) dermal hard tissue and vascular histology

Mulligan, Max[1,2]

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Thyestiid osteostracans are understood to bridge the phylogenetic gap between jawless and jawed vertebrae. Fully articulated specimens have been diagnosed using gross topological characteristics, although disarticulated specimens have been more difficult to characterise. Analysing dermal hard tissue vasculature has shown clear morphological differences between many Thyestiid osteostracan species, suggesting it may be used to identify disarticulated specimens. Two scale specimens of *Eldaaspis miklii* were excavated between 1970 and 2010 from the Elda cliff, Estonia. They then underwent synchrotron radiation microtomography at the ESRF centre (Grenoble, France) and were segmented using VG Studio Max.

In the context of Thyestiid osteostracans, *Eldaaspis* shows large tubercles with an extensive hypermineralised cap. *Eldaaspis* also shows more evidence of determinate than superpositional growth and has ascending canals with a pulp structure divided into many small vessels, contributing to intertubercular pore fields. The mesh canal of the middle layer shows a honeycomb pattern, and no clear upper mesh canal was observed. Basal canals varied in shape from slim to globular, and a distinct, slim horizontal canal was present between two basal canals in one case. There are clear similarities in the dermal vasculature between *Eldaaspis* and historical examples of *Oeselaspis*, although with larger tubercles closer to examples of *Procephalaspis* and *Thyestes*.

Funding Sources NHS Bursary, NHS Business Services Authority.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

New information on dinosaur diversity in Mongolia's Nemegt Basin based on isolated teeth

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We report 18 isolated dinosaur teeth from four Cretaceous sites in Mongolia's Nemegt Basin: Ukhaa Tolgod, Little Ukhaa, Khulsan, and Zos Wash. Ukhaa Tolgod and Little Ukhaa have exposures of the Djadochta Formation, whereas Khulsan has exposures of the Baruungoyot Formation. Zos Wash is located northwest of Ukhaa Tolgod, and the unnamed stratigraphic beds there have been correlated with Santonian–Campanian strata of the Eastern Gobi based on the presence of the ornithischian *Haya griva*. Most of the isolated teeth are small, serrated, possess a strongly concave distal margin, and can be referred to the Dromaeosauridae. This is not surprising given the diversity and abundance of dromaeosaurids from these localities. Of greater interest are teeth of larger dinosaurs; one of the most notable differences between the Baruungoyot and Djadochta Formations on one hand, and the Nemegt Formation on the other, is the average body size of the dinosaur faunas. While the former formations are characterized by numerous species of small theropods and the ceratopsian *Protoceratops*, the latter is dominated by large dinosaurs (e.g., *Tarbosaurus*, *Saurolophus*). Hypotheses that explain these differences suggest that these formations differ in age, environment, or a combination of both. Therefore, the discovery of larger dinosaurs from the Djadochta Formation provides

important new data. Four of the teeth from Ukhaa Tolgod are assigned to the Tyrannosauridae based on their large size, crown shape, crown height to base width ratios of 2.18 to 1.7, and crown base width to apicobasal length ratios of 0.79 to 0.63. The one tooth from Zos Wash and another from Khulsan are identified as sauropod teeth. The tooth from Khulsan measures 40 mm long and 9 mm wide, has a pencil-like shape except for a slight lingual curve, and is truncated by a highly oblique wear facet. The enamel is incomplete, but what is preserved is smooth. The sauropod tooth from Zos is missing all but the base of the crown, where its enamel displays anastomosing ridges resembling those of *Nemegtosaurus*. The rarity of Asian sauropod skulls and the similarity among the teeth of different species of tyrannosaurids complicate efforts to assign these teeth to species, but consistent efforts to collect isolated teeth from across the Nemegt Basin may enhance the known diversity of these sites. Ultimately, this could help disentangle the effects of age and environment on the observed differences of faunas in the Nemegt Basin.

Funding Sources Department of Vertebrate Paleontology, American Museum of Natural History, New York, NY.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A 3-D reconstruction of the pelvic musculature of *Riojasuchus tenuisceps* (Archosauria, Ornithosuchidae)

Munro-Flanagan, Connor R., Hutchinson, John R.

Comparative Biomedical Sciences, Royal Veterinary College, London, United Kingdom

Riojasuchus tenuisceps was an ornithosuchid pseudosuchian archosaur from the Late Triassic of Argentina. Several aspects of its anatomy, including a “crocodile reversed” ankle joint, shortened gracile forelimbs and a lesser trochanter on the femur (shared with dinosauriformes) leave it mired in controversy regarding its locomotor function. To help answer questions about the animal’s life habit and ecology, a 3-D model of the pelvic musculature of *R. tenuisceps* was created using an existing 3-D whole-body skeletal reconstruction of *R. tenuisceps.* The model was built using Maya and OpenSim software following the method outlined by previous authors that used two overlapping restriction models: the estimated outer envelope of *R. tenuisceps*, and cross-sectional cuts of extant relative *Crocodylus niloticus.* The Lines of Action (LoAs) of each muscle are estimated for use in future biomechanical analyses.

Reconstructed muscle volumes were compared with modern taxa. The modeling methodology is outlined in detail for use in future research. This reconstruction of *Riojasuchus*, whose ecology is presently poorly understood, is part of a larger project headed by John Hutchinson at Royal Veterinary College on archosaurs of the Late Triassic and Early Jurassic, informing if and how differences in locomotor function affected the survival and extinction of various archosaur clades across the Triassic–Jurassic boundary.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Hydrodynamic advantages of tandem flipper phasing in plesiosaur swimming: insights from an advanced robotic model

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Plesiosaurs are distinguished by their unique four-flippered propulsion strategy, a configuration unparalleled among marine vertebrates. The primary goals of this study are 1) to investigate the hydrodynamic benefits of plesiosaur propulsion and 2) to explore how variations in flipper morphology influence swimming performance across the clade.

Previous research demonstrated high thrust and efficiency through constructive vortex interactions between the anterior and posterior flippers, but suffered from simplifications of kinematics and morphology due to limitations in the experimental setup. This latest experimental campaign overcomes these challenges through the use of an advanced robotic plesiosaur model featuring realistic three-dimensional body morphology and more accurate flipper kinematics.

Using this state-of-the-art robot, we conducted comprehensive hydrodynamic experiments to systematically assess the impact of flipper phasing and aspect ratio on propulsive performance. Our findings confirm that plesiosaurs benefitted from increases in thrust due to the four-flipper swimming method and reinforce the importance of precise flipper phasing in achieving optimal performance. Furthermore, variations in flipper aspect ratio were found to affect these increases, offering new insights into the adaptive significance of locomotor performance within pleisosauria.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A new chasmosaurine (Ornithischia, Ceratopsidae) skull from the Judith River Formation (Campanian) of Montana, USA

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Chasmosaurine ceratopsids (Dinosauria, Ornithischia) were widespread through western North America during the late Campanian (~77–72 Ma). Recent studies hypothesize pronounced endemism in this and other megaherbivore clades, with distinct northern and southern lineages containing *Chasmosaurus* and *Pentaceratops*, respectively. Researchers have debated the nature of this endemism, whether it consisted of latitudinally discrete faunal zones or a more graded transition between northern and southern extremes (e.g., Alberta to the north and Texas to the south). New specimens collected from between these two extremes are critical to testing the nature of this endemism. To date, relatively few chasmosaurines have been reported from this zone.

In 2023, a new chasmosaurine skull (Museum of the Rockies [MOR] specimen 11940) was excavated from the Campanian Judith River Formation (JRF) of southcentral Montana. In contrast to other JRF chasmosaurines (e.g., *Judiceratops*, *Mercuriceratops*, *Spiclypeus*), MOR 11940 is a nearly complete, three-dimensionally preserved, articulated cranium. It exhibits short, dorsolaterally-directed postorbital horncores and a large, posteriorly-placed nasal horncore. Reassembly of the fragmented parietosquamosal frill reveals the presence of relatively large fenestrae and an embayed posterior parietal bar adorned by large, triangular P2 and P3 epiossifications. The cranium is thus reminiscent of the more southerly *Utahceratops* and *Pentaceratops*, despite its northern proximity. This observation may be consistent with a graded faunal transition across latitudes but work is still ongoing.

Funding Sources Museum of the Rockies (MOR), Canadian Museum of Nature (CMN), Montana Department of Natural Resources and Conservation (DNRC).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Bone histology of *Gallotia* revisited: new insights into the growth and life history of the giant lizards from El Hierro (Canary Islands, Spain) obtained from paleohistogical analysis

Nacarino-Meneses, Carmen[1], Álvarez Nieto, Paula[1], Cruzado-Caballero, Penélope[2,3], Castillo, Carolina[2], Köhler, Meike[1], Fortuny, Josep[1]

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The genus *Gallotia* comprises an endemic group of lizards that inhabits the oceanic and volcanic archipelago of the Canary Islands. It includes both extant and extinct species that exhibit a remarkable range of body sizes, from dwarfs to giants. Previous studies have primarily focused on clarifying their taxonomy, evolutionary history, and various aspects of their paleobiology. A previous paleohistological study described the growth and development of all known *Gallotia* species except *Gallotia simonyi*. In this study, we analyzed an ontogenetic series of twelve fossil femora of the giant species *G. simonyi* from the island of El Hierro to provide information about its life history strategy. Additionally, we examined three femora attributed to the extinct *Gallotia goliath*, the other giant lizard that co-habited the same island. Our results show that both species present an avascular bone cortex composed of parallel-fibered bone, consistent with the predominant bone tissue type found in Lacertidae. Bone growth marks are visible in all specimens, enabling a preliminary skeletochronological analysis that revealed a minimum longevity of 12 years for *G. simonyi* and 15 years for *G. goliath*. These findings align with previously published data on *G. goliath* and contribute to a broader understanding of the paleobiology of *Gallotia* species from the Canary Islands.

Funding Sources PID2020-117118GB-I00, RYC2021-032857-I (MCIN/AEI/10.13039/501100011033); CERCA Programme, 2021 SGR 01184, 2021 BP 00078; Grupo de investigación EFFAC, ULL.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Not so fast, rodents: hystricomorphy also occurs in extinct felids

Naples, Virginia L.[1], Haji-Sheikh, Misty H.[2]

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Hystricomorphy in rodents has frequently influenced hypotheses of their taxonomic relationships. This arrangement occurs when the typical facial structures, i.e., the infraorbital nerve, artery, and vein that infiltrate the infraorbital foramen, passing anteriorly to occupy the lateral wall of the maxillary part of the rostrum, are joined by a slip of the deep masseter also passing through this opening. This phenomenon was thought to occur only in rodents until we found that *Barborofelis fricki* displayed hystricomorphy. Here, we show that *Smilodon fatalis* was also hystricomorphic. Inspection and measurement of the infraorbital foramen of *S. fatalis* distinctly show hystricomorphy. In most mammals, this foramen is small and allows passage of the infraorbital nerve, artery, and vein. There are no indications of the attachment of muscle fibers, a tendon, or aponeurosis within this passage or anterior to it on the facial region of the maxilla. In hystricomorphous rodents, this opening is highly enlarged and allows passage of a slip of the deep masseter muscle. In 2000, we identified this condition in a dirktooth sabertooth cat, *Barbourofelis fricki*, a significant discovery. This finding expands the implications of hystricomorphy and also has profound implications for masticatory function in sabertooth cats. That *Barborofelis* and *Smilodon*, the sabertooth cats with the longest maxillary canines, also exhibit hystricomorphy, further underscores the significance of this study. A hystricomorphous deep masseter has a more anterior insertion that would increase the mechanical advantage of the muscle in initiating mandibular closure from maximum gape. The advantage to these rodents is an increased ability

to move the mandible anteriorly, something these animals rely upon to use their ever growing incisors to gnaw. *Smilodon* could use hystricomorphy to initiate anterior translation of the mandible from maximum gape. Hystricomorphy does not affect mandibular mediolateral movement in rodents which have highly complex masseter muscles with additional and sometimes partially divided divisions that enhance mediolateral jaw movements. Likewise, hystricomorphy in the sabercats *B. fricki* and *S. fatalis* would have little effect on mandibular movement. Our findings have generated a new approach for research. It is worth exploring whether other sabertooths also exhibit hystricomorphy, and if so, if it is limited to the dirktooth morph or if it also occurs in scimitar tooth cats.

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

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Napoli, James G.[2,1], Zanno, Lindsay E.[3]

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-EMBARGOED-

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Evaluating the contributions of phylogeny and substrate preference on intracranial morphology in extant and extinct Xenarthra

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Xenarthrans (anteaters, armadillos, and sloths) are a New World radiation that are today represented by 31 species classified in 14 genera, but the fossil record of this group extends back at least 53 Ma, with an impressive diversity of >200 genera. They have a broad range in body mass from 0.12 to ~4,000 kg, diets that include carnivory, insectivory, myrmecophagy, omnivory, and folivory, and locomotor behaviors including subterranean, aquatic, graviportal, arboreal, and suspensory. To better understand brain evolution in this context, I created the first comprehensive 3D cranial atlas, including virtual intracranial models derived from 69 microCT scans representing 26 of the 31 extant and 18 extinct species of Xenarthra. I used 3D geometric morphometrics to characterize endocranial shape, defining and placing 30 biologically relevant and repeatable landmarks on the models, and performed Procrustes superimposition. A Principal Component (PC) Analysis on Procrustes shape variables showed phylogenetic relationships primarily influencing morphospace with a secondary signal of substrate preference. The 1st PC axis demonstrated clear separation in endocranial shape between cingulates (armadillos) and the two groups of pilosans (anteaters and sloths). This also correlated with separation between burrowing versus aquatic, terrestrial, and arboreal taxa with an additional divide between arboreal versus aquatic and large (i.e., >100 kg) terrestrial taxa along the 2nd and 3rd PC axes. Cognitive changes through time were further investigated with comparisons of intracranial canals (e.g., veins, arteries, inner ears) and encephalization quotients (EQ) using direct cranial measurements for body mass estimations. As expected, EQ increased through time, remaining lowest in the armored and burrowing cingulates and higher in arboreal taxa traversing complex habitat. Unexpectedly, EQ is low in the aquatic, terrestrial Caribbean Island, and mylodont ground sloths with megatheroid ground sloth EQs higher than those of other extinct taxa. This comprehensive dataset suggests a strong correlation between phylogeny, ecology, and intracranial morphology (e.g., size and shape of the olfactory bulbs, cerebra, cerebella, and inner ear canals). Additionally, these observations are consistent with results from recent molecular phylogenies for Xenarthra with broader implications for the roles phylogeny and substrate preference play in mammalian intracranial morphology and evolution.

Funding Sources NSF GRF DGE-1842473; NSF EAR-0639307; NSF DBI-1203222; NSF DBI-1701714; FLMNH; FL Paleontological Society; UF Biology Dept.; Tampa Bay Fossil Club; Michael Stallings.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The secrets behind continuous tooth replacement in reptiles

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While humans only replace their teeth once, most reptiles have the ability to continuously replace their teeth, known as polyphyodonty. One of the limitations behind tooth replacement is the amount of available space in the jaw, regulated via mechanical feedback that determines whether the next tooth generation will initiate or not. This spatial pattern in polyphodonts is not random, with teeth generations appearing in “wave-like”

formations. Polyphyodont reptiles, such as snakes and lizards, provide an opportunity to quantify spacing between tooth positions and tooth families, to identify whether the identity or size of the tooth correlates with spatial patterns. Using 3D scanning and modelling, we have measured the 2D interfamilial and intergenerational distances between teeth of adult specimens of the ocellated lizard (*Lacerta lepida*), ocelot gecko (*Paroedura picta*), and corn snake (*Pantherophis guttatus*), as well as 3D volumes of teeth as a proxy for tooth size. In addition, the veiled chameleon (*Chamaeleo calyptratus*) was used as an out group as, unusually for lizards, it has no tooth replacement. We found that intergenerational and interfamilial distances between teeth followed linear size patterns, but that tooth size did not strongly correlate with spacing. Having recognized these patterns, we can now use them to estimate tooth position and number of tooth generations in fossil taxa, for example, to predict when continuous tooth replacement was lost in early mammals.

Funding Sources Biotechnology and Biological Sciences Research Council

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Evolution of gigantism in ichthyosaurs as revealed by volumetric modelling

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Among the tetrapod clades with the largest recorded body sizes in the fossil record—cetaceans, sauropodomorphs, and ichthyosaurs—the latter remain the most elusive and poorly understood. This is largely due to the incomplete nature of most giant ichthyosaur remains, as well as the limited emphasis on rigorous quantifications of their body mass and prevalent focus on the extrapolation of total length. We estimated the body mass of a diverse and disparate sample of ichthyosaur species spanning a stratigraphic range from the Olenekian to the Cenomanian. Body shapes were modelled on the basis of well-preserved fossil material and/or previously published skeletal reconstructions, and body volumes were then estimated using a modified graphic double integration (GDI) approach, incorporating available information about body cross-sectional geometry (e.g., rib shape and articulation) wherever possible and testing different assumptions about soft tissue extent. Results show that an extreme spectrum of body size (ca. 10^1 – 10^5 kg) evolved early in ichthyosaur evolution, but narrowed considerably, especially after the Early Jurassic. Some previous estimates of the body masses of large-bodied ichthyosaurs appear to have been overestimates, due to excessively robust body shapes being assumed for specimens whose closest relatives were slender-bodied forms such as *Cymbospondylus*, *Besanosaurus*, and *Guizhouichthyosaurus*. Nonetheless, body masses exceeding 10 tons appeared in multiple lineages of Triassic ichthyosaurs, although such large-bodied forms appear to have disappeared completely after the Toarcian. The largest ichthyosaurs based on substantial skeletal material are the Carnian *Shonisaurus popularis* and the Norian *Shastasaurus sikanniensis*, reaching masses in excess of 20 and 30 tons, respectively. More fragmentary fossils—isolated jaw and vertebral elements from the Late Triassic—suggest that body sizes much greater than this may have been achieved, with allometric regressions and isometric extrapolations indicating body sizes exceeding 100 tons (the typical adult mass of *Balaenoptera musculus*, the largest reliably known metazoan). The reliability of these estimates, but also the ecological implications of a possible presence of such rorqual-sized giants in the trophic system of the Late Triassic, remain hampered by a lack of reliable insights into their ecomorphology, with both raptorial and suspension-feeding lifestyles being plausible.

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Evolution of avian vestibular apparatus morphology is highly controlled by foramen magnum orientation

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The origin of birds from non-avian dinosaur ancestors involved major evolutionary transitions in morphology, ecology, and sensory capabilities. The semicircular canals (SCCs) of the vestibular system play important roles in spatial awareness, balance, and gaze stabilization, and their endocasts show prominent morphological changes through the dinosaur-bird transition, with a hypothesized functional relationship to the origin of powered flight. However, an alternative hypothesis, that the architecture of the braincase influences SCC shape independent of functional adaptation, has not been tested. We use 3D geometric morphometrics and phylogenetic comparative methods to evaluate the relationship of SCC shape to flight ability and braincase geometry across a large dataset of 150 living and recently extinct crown birds, including 25 evolutionarily independent flightless taxa, together with Mesozoic stem birds, non-avian dinosaurs and pterosaurs. We find that even major evolutionary changes in locomotor capabilities, such as the total loss of flight, have only weak effects on bird SCC shapes. In contrast, variation in braincase geometry has significantly greater effects, and evolutionary changes in the orientation of the craniocervical joint (the brain-to-spinal column connection) among extant birds are associated with similar SCC shape changes to those that occurred during the dinosaur-bird transition. These findings indicate that the reorganization of the cranial architecture, including the brain and the main sensory organs, had a much greater impact in the origin of bird-like SCC geometries than any direct functional adaptation related to the biomechanical demands of powered flight. Our study exemplifies the need to holistically consider the interplay between head structures during macroevolutionary transitions to draw robust paleoecological inferences from neuroanatomy, and ultimately to understand the effects of function on sensory system morphology.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The 'squalodonts' of the Belluno sandstones: an updated study of systematics, taphonomy, and paleobiology of *Squalodon bellunensis* and *Squalodon peregrinus* (Cetacea, Odontoceti)

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The cetacean fossil record of the earliest Miocene is still poorly understood; this is due to many factors including a possible paleobiological bias towards offshore environments in baleen whales (Mysticeti) and a sampling bias in toothed whales (Odontoceti). Even in well-sampled localities, our understanding of the cetacean fossil record is constrained by understudied taxa and specimens. Here, we present an overview of our ongoing work: the study of the Squalodontidae of the Belluno sandstones (northern Italy). The Squalodontidae is a speciose family of

heterodont odontocetes with three species known from Belluno: *Eosqualodon latirostris, Squalodon bellunensis*, and *Squalodon peregrinus.* Our taxonomic revision demonstrates that *S. bellunensis* and *S. peregrinus* are distinct species separate from the other known species in the genus *Squalodon*; to our present knowledge both species are restricted to the Mediterranean. Our preliminary phylogenetic analysis supports the findings of earlier research: both *S. bellunensis* and *S. peregrinus* are within a monophyletic Squalodontidae and likely form their own subgroup within *Squalodon*.

Taphonomically, shark tooth marks on the occiput of *S. peregrinus* offer evidence of scavenging behaviors upon the bodies of large odontocetes in a deltaic paleoenvironment. Furthermore, bioerosion is present on the mandible of a specimen of *S. bellunensis*, strongly resembling the traces of the ichnogenus *Osspecus*. This ichnofossil is left on fossil cetacean bones mostly likely by the bone-eating worm *Osedax*. From a paleobiological standpoint, the multiple specimens of *S. bellunensis* offer an uncommon glimpse into the range of interspecific variation present in a derived stem odontocete such as *Squalodon*. Moreover, we observe significant degrees of tooth wear in *S. bellunensis*, including wear facets on the mesial and distal surfaces of the posterior, multi-cusped teeth. Such wear is not observed in other species of *Squalodon* or in other heterodont odontocetes. These preliminary findings provide not only a modernized vision of the morphology and diversity of heterodont toothed whales, but also a more robust picture of the marine ecosystems present in earliest Miocene.

Funding Sources Paleontological Society student research grant (MDN).

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

The western Gondwana as a window into archosauromorph diversification following the end-Permian mass extinction

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The Sanga do Cabral Sequence (SCS; *Procolophon* Assemblage Zone—Induan/Olenekian) crops out in the southernmost part of Brazil and is a key unit for reconstructing the biotic recovery of terrestrial communities in South America following the end-Permian mass extinction. Some of the most abundant vertebrate fossils include the procolophonoid *Procolophon* and a yet poorly understood diversity of temnospondyls. Furthermore, it contains a surprisingly high and previously underappreciated diversity of archosauromorphs. These are primarily represented by isolated vertebrae assigned to proterosuchids and tanysaurs, alongside a few rare but informative articulated specimens of non-archosaurian archosauromorphs (*Teyujagua* and *Elessaurus*). This study presents new skull fragments and a

quantitative assessment of over 90 archosauromorph vertebrae from five natural history collections. Sixteen linear measurements and 38 discrete characters were sampled for each vertebra. We added data from other Early and Mid-Triassic archosauromorphs across the globe, comprising a total of 132 taxa (total sample size = 611). A Principal Coordinate Analysis (PCoA) was conducted for each subset of cervical (n = 349) and trunk vertebrae (n = 308). The skull fragments and nine cervical, eight dorsal, and nine caudal vertebrae, and several neural spines, had been previously attributed to indeterminate proterosuchids. From the remaining cervical vertebrae, nine had been tentatively assigned to tanysaurs, seven to *Teyujagua*, and 10 to new morphotypes. Our results using PCoA based on linear measurements revealed that the vertebrae attributed to Proterosuchidae from the SCS do not fall within the morphospaces of erythrosuchids or the South African proterosuchid *Proterosuchus*, but overlap with the morphospace of the chasmatosuchine *Samsarasuchus* from India. Several vertebrae plot closer to the morphospaces of tanysaurs, *Mesosuchus* (Rhynchosauria), and small crocopods; suggesting they do not belong to proterosuchids and some of them may potentially represent new taxonomic groups for the assemblage zone. These results unveil a previously unexpected early archosauromorph diversity in the Early Triassic of Brazil, with significant faunal distinction from other coeval and synapsid-dominated units, such as those of South Africa, India, and Antarctica. It highlights that the poorly studied SCS may be a hotspot of archosauromorph diversity following the end-Permian extinction.

Funding Sources Harvard Lemann Brazil Research Fund; CNPq 316811/2021-1, 406902/2022-4.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The oldest dinosaur fossils ever collected in the Triassic of Brazil

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The oldest known Triassic dinosaur material collected in Brazil was described by Friedrich von Huene after the summer expeditions of 1928 and 1929, in the Santa Maria Formation, in Rio Grande do Sul state. These dinosaur remains were mixed with other archosaur material, under the *Hoplitosuchus raui* hypodigm, being recently identified as pertaining to herrerasaur remains. The Alemoa region, particularly the Sanga da Alemoa site, has been pivotal in these discoveries. In 1936, the first unequivocally identified Brazilian dinosaur, *Staurikosaurus pricei*, a herrerasaurid, was described from this locality. However, we report a series of specimens, collected either prior or around this time, that have remained unknown to science since then. The oldest among these materials are articulated and isolated caudal vertebrae (MCT.LE.2632) collected in the Alemoa Area by Alex Loefgren, during the same period of the von Huene expedition (1928–1929). In these vertebrae, the postzygapophysis ends in the second third of the subsequent vertebra, a diagnostic feature for herrerasaurs. Herrerasaurs were subsequently found in the Alemoa Area, including a large undescribed femur, MVP 04.853, collected by priests before the 1990s. Additionally, a nearly complete sauropodomorph specimen (MCT.R.308) was also recovered by Lewellyn Ivor Price from this same area during

the 1940s, remaining unprepared since. This 'new' specimen exhibits affinities with *Eoraptor* and *Saturnalia* and may represent a new dinosaur species. From older strata, silesaurs were also found by Price in the Pinheiro region (MCT.R.2108), in Candelária; and by the priest Daniel Cargninin at a now unknown site in Vera Cruz municipality (MPDC 132). These specimens represent the forgotten 'first' dinosaurs to be collected in Brazil, prior to the recovery or publication of *Staurikosaurus pricei*. These findings highlight the enduring value of meticulously curated historical fossil collections for future research.

Funding Sources FAPERJ - Programa Pós-Doutorado Nota 10 (E-26/200.121/2024); INCT-PALEOVERT CNPq 406902/2022-4.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New occurrences of eutherian mammals in the Judith River Formation of north central and central Montana: implications for eutherian biogeography in Laramidia during the Late Cretaceous (Campanian)

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The Judithian North American Land Mammal Age (NALMA) of the Late Cretaceous (Campanian) was a pivotal interval in the evolutionary history of mammals. It captures the diversification of multituberculates and therians and the decline of more archaic lineages (e.g., eutriconodontans); it provides the backdrop to the end-Cretaceous mass extinction; and it previews the Paleocene diversification of placentals. Nevertheless, despite a long history of vertebrate microfossil collecting in upper Campanian deposits of the Western Interior Basin of North America (WIB), aspects of the Judithian mammalian fauna remain poorly known. Eutherians are known by relatively few Judithian species and by many specimens that are not diagnostic below the genus level. Here we describe new fossils that improve our understanding of eutherians from the Judith River Formation (JRF) of north central and central Montana.

The well-studied deposits of the JRF in Hill, Blaine, and Fergus counties of Montana preserve much of the Judithian age (~79–75.5 Ma) and have been temporally correlated with other Campanian formations exposed across the WIB. Field work (1980–2024) in the study area was conducted by crews from the Smithsonian's National Museum of Natural History, the University of Chicago, Macalester College, the University of California Museum of Paleontology, and, most recently, the University of Washington. We recovered a large collection of vertebrate microfossils (>10,000) by sampling >30 new and existing localities from ~16 distinct stratigraphic horizons in the JRF. We surface collected all localities and bulk-sediment sampled the 20 most productive localities (>2,000 kg). Bulk sediment samples were sieved with #18 and #30 mesh screen boxes, and the resulting concentrate was picked for fossils using 10x magnification. We have thus far recovered over 1,000 mammalian fossils, including 65 eutherians.

We document the presence of *Gypsonictops lewisi*, *Paranyctoides sternbergi*, the first occurrence of *Avitotherium utahensis*, and a possible new species of *Paranyctoides* and other eutherian taxa in the JRF. Prior to this study, *G. lewisi* was the only eutherian species reported from the JRF; specimens were only tentatively referred to the genus *Paranyctoides*. These new occurrences increase JRF eutherian richness by at least three species and document the first and oldest occurrence of *Avitotherium* outside of the Kaiparowits Fm.

Funding Sources The University of Washington– Department of Biology, The Burke Museum of Natural History and Culture, The National Science Foundation

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Assessing the utility of enamel micro-structure in ziphodont crocodyliforms for taxonomy with applications to the fossil record

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Research on enamel micro-structures has long been focused on the highly organized prismatic enamel found in mammals, informing both systematic and functional studies of these structures. Most studies have also suggested that such prismatic enamel was solely mammalian, with reptiles only demonstrating simplistic columnar, aprismatic enamel. However, some preliminary work has shown the presence of radial and pseudo-prismatic enamel in lepidosaurs and archosaurs, including an Eocene sebecid crocodyliform from South America. Sebecids, along with planocraniid eusuchians and the Oligocene–Pleistocene mekosuchine *Quinkana*, are all considered ziphodonts due to their laterally compressed tooth crowns that bear serrations. Much of the fossil record of these crocodyliforms is represented by isolated teeth, so taxonomic referrals are usually based on biogeographical or temporal inferences rather than the morphology of the teeth themselves. As such, descriptions of enamel micro-structure of the isolated teeth could play a key role in evaluating their relationships. Utilizing collections of known planocraniid and sebecid teeth, we created CT and SEM imaging datasets to describe the enamel micro-structure. CT scan results were generated with a new phase-contrast enabled nanoCT scanner, from which we attempted to produce three-dimensional models of the enamel prisms. Despite the fine scale resolution, we were unable to image the enamel micro-structures with this method. To create two-dimensional cross-sectional images of these teeth, the fossils were sonicated to remove debris before being ablated using ion ablation. Finally, the teeth were graphite coated to eliminate charging of the specimen under SEM. This method is minimally destructive compared to traditional thin-sectioning and the graphite coating can be removed after imaging, unlike traditional gold-coating. Preliminary SEM results show differing enamel structure between planocraniids and sebecids, consistent with previous research exhibiting sebecids having more well-structured enamel. To test this method in deposits that contain isolated ziphodont teeth with unknown affinities, we created SEM images of fossil teeth from the Paleocene and Eocene of Colombia, the Miocene of Cuba, and the Eocene of Indonesia.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New information and a three-dimensional digital atlas of an unusual stapes of *Dimetrodon* (Amniota, Synapsida, Sphenacodontidae) from a remarkably well-preserved specimen from the early Permian Clear Fork Formation of north-central Texas

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The external cranial anatomy of the iconic pelycosaurian-grade synapsid *Dimetrodon* is amongst the most thoroughly documented of

basal synapsids. Recent work benefiting from digital scanning technology has now amplified our knowledge of the internal middle ear as well. Now, a well-preserved stapes from the famous north-central Texas Craddock bonebed adds to our knowledge and diversity of stapedial structure. The bonebed is interpreted as early Permian, lowest Clear Fork Formation (formerly "Arroyo" Formation), Leonardian in age. Known pelycosaurs from the locality include the ophiacodonts *Ophiacodon* and *Varanosaurus*, *Edaphosaurus*, the caseid *Trichasaurus*, and a number of sphenacodontids. The size of the complete left stapes compares most closely with mature specimens of *Dimetrodon*, and isolated teeth with denticulate mesial and distal carina associated with the specimen conform to the condition recently assigned to *D. grandis*. Fortuitously, the stapes is complete, isolated, and undistorted—facilitating examination in all views as well as three-dimensional surface scanning, allowing presentation in unlimited views. The condition of the dorsal and ventral processes are markedly different from previous reconstructions of the stapes. Unique features include: (1) the dorsal process is extremely large and has an articular surface that appears to extend a much as 25% down the length of the posterior surface of the stapedial shaft; (2) a distinct ridge extends from the articular surface of the dorsal process down the posterior surface of the shaft; (3) there is no evidence of a stapedial foramen associated with or near the ventral process; and most significantly (4) a distinct bridge of bone extends between the dorsal and ventral processes. It is not known if these features are unique to this single specimen, or specific differences given that most interpretations of the stapes in *Dimetrodon* are based primarily on *D. limbatus*.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

New notosuchian phylogeny elucidates the complex evolutionary history of sebecid crocodyliforms

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Notosuchians are an extinct, morphologically diverse clade of largely terrestrial crocodyliforms known predominantly from the Cretaceous of Gondwana. The internal systematics of this group are in flux, most notably concerning the phylogenetic placement of Sebecoidea, which is found to have affinities with either Baurusuchia or Peirosauria in competing analyses. Much of the uncertainty surrounding the placement of Sebecoidea stems from the highly fragmentary nature of specimens of its constituent taxa, particularly those from the Paleogene of Europe and Africa. To resolve these issues, the largest and most comprehensive notosuchian dataset to date is created, comprising 540 morphological characters scored for 125 species, including several taxa previously unassessed in a phylogenetic context. All characters formerly utilised in notosuchian systematics are critically appraised, and a large proportion of these are extensively modified. 113 novel characters are constructed, many of which focus on undersampled regions of the skeleton (postcrania and the endocranium), and 86 continuous characters are formulated and utilised for the first time in the context of Notosuchia. All characters are illustrated to ensure future reproducibility of the character-taxon matrix. Analyses conducted under maximum parsimony, using both equal and extended implied (k = 3 and 12) weighting schemes, reveal strong nodal support for a monophyletic Sebecosuchia (Baurusuchia + Sebecoidea), with higher k-values recovering the greatest internal phylogenetic accuracy. The taxonomic content of Sebecidae is expanded in several analyses via inclusion of *Eremosuchus elkoholicus* from the Eocene of Algeria, as well as *Doratodon* and *Ogresuchus furatus* from the Late Cretaceous of Europe. Despite long held views that the group originated in South America, the presence of a diverse, deeply nested sebecid clade containing taxa from outside this region could suggest a more nuanced biogeographic history: either sebecids represent an extended, independent African lineage previously obscured by pervasive under-sampling, or they signify a Paleogene emigration

of European taxa to Gondwana. Multiple analyses also recover two traditional sebecids, *Lorosuchus nodosus* and *Sahitisuchus fluminensis*, both from the early Paleogene of South America, within Peirosauria. This hints at the potential survival of an additional crocodyliform lineage, and a second notosuchian lineage, across the K-Pg boundary.

Funding Sources The Royal Society (RGF\R1\180020).

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Trunk anatomy of American white pelican (*Pelecanus erythrorhynchos*) suggests exhalatory function of unusual sternal rib flange in the long-tailed Early Cretaceous bird *Jeholornis prima*

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The avian ribcage contains two sets of ribs: the dorsal vertebral ribs, and ventral sternal ribs. In most fossil and extant birds, the sternal ribs are relatively uniform in morphology, but the Early Cretaceous bird *Jeholornis prima* (from the Jehol Biota, of northeast China) presents a striking exception. The caudalmost sternal rib bears a large flange near the proximal end, giving the rib a paddle-shaped appearance. When the flanged sternal ribs were first correctly identified, their shape was hypothesized to have increased the mechanical advantage of some component of the ventilatory musculature. However, specifics were unclear, particularly given that no analogue to the flanged sternal ribs had been identified among extant birds.

Here we report the presence of rib expansions analogous to those of *Jeholornis* in the American white pelican (*Pelecanus erythrorhynchos*), and examine their form, soft tissue associations, and possible function. An American white pelican was dissected for this study, and a chicken (*Gallus gallus*) and owl (*Bubo virginianus*) were dissected for comparison.

In *P. erythrorhynchos* the flange projects caudoventrally from the proximal end of the sternal rib. The flange is rounded (convex caudally), and fringed by a caudoventral cartilaginous margin. The dorsal and ventral ends of the rounded flange are strongly anteriorly notched. The broad, sheetlike M. obliquus internus abdominis originates on the cranial part of the ventral margin of the pubis and inserts on the caudal margin of the caudalmost vertebral rib and caudalmost sternal rib, the flange of the caudalmost sternal rib forming the ventralmost part of the insertion area. The insertions and morphology of the internal oblique are universal among birds. However the rounded flange in the sternal rib is unique to pelicans.

Studies of avian ventilation (in chickens, *Gallus gallus*) have demonstrated that the internal oblique is activated during exhalation. It draws the sternal and vertebral ribs caudally towards the pelvis, decreasing the volume of the rib cage. How the flange increases the efficacy of this action remains unclear, but is an avenue for future biomechanical investigation. At present, analogy to pelicans suggests that the unusually sternal rib expansion seen in *Jeholornis* would have formed part of the insertion area of the M. obliquus internus abdominis, which likely acted during exhalation, as in modern birds.

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The anatomical evolution of the urostyle, a novel structure formed from caudal vertebrae in anurans

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Developmental data informs our understanding on the formation and genetic controls of novel features, but not necessarily their origins. The fossil record, however, provides context for the origins of novel structures, including timing of first appearance. Together, developmental data and the fossil record can clarify the evolutionary formation of novel structures. The urostyle is a unique and novel structure found only in anurans (living frogs and their extinct relatives). The urostyle results from a fusion of caudal vertebrae and a hypochord, a rodlike structure that lies dorsal to the notochord in embryonic fish, amphibians, and lamprey, which ossifies in anurans. Among extant frogs, variation in the urostyle includes differences in the width and length of the shaft, singular or biconvex articulations with the sacrum, and fusion with the sacral vertebra into a sacrococcyx, and the size of a dorsal crest. Recent developmental data showed that the ossification of the hypochord facilitates tail loss in froglets by reorganizing the dorsal aorta. Here, we ask: when did the urostyle evolve, and how did the urostyle diversify? We examined the oldest 3D urostyles from the Upper Triassic Dockum Group using μCT and osteohistological data to understand the timing and order of acquisition of morphological features and help us predict locomotion in early anurans. The Dockum urostyles preserve a crest on the dorsal surface that extends partway down the structure. On the ventral surface, a groove extends the entire length of the urostyle. A biconvex cotylar surface is present for articulation with a separate sacrum. The urostyle is wider anteriorly at the point of articulation with the sacrum and gradually tapers posteriorly. CT scans reveal the neural canal extends almost the entire length of the urostyle. Osteohistological and CT scan data show repeated areas of lower density between centra suggesting that the vertebrae are not yet fully fused into a single structure and maintain intervertebral foramina, either related to skeletal immaturity or the adult morphology at this point in anuran evolution. These new Late Triassic fossils provide the first histological and three-dimensional internal data on this novel frog structure. By understanding the evolutionary history of the urostyle, we can gain insight into frog evolution, locomotion, development and diversification.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Molar opposites: using radiography and micro-computed tomography to reveal unique dental morphologies and a previously unknown diversity of mixosaurid ichthyosaurs of the genus *Phalarodon* from the Middle Triassic of Svalbard

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The Permo-Triassic extinction event erased approximately 81% of marine species and set the stage for significant evolutionary radiation during the Early Triassic. Over the past 11 years, the Spitsbergen Mesozoic Research Group has gained new insights into this biodiversity expansion by collecting fossil material from the Svalbard archipelago. During the Early and Middle Triassic, this region was part of the Boreal Sea, a large northern bay of the Panthalassa Ocean. At an estimated latitude of 42°N, this region was isolated from the Tethys Ocean cropping out in the rest of Europe. The mixosaurids, an early cosmopolitan and diverse group of ichthyosaurs, was part of this Early and Middle Triassic radiation and are common in the Middle Triassic Botneheia Formation localities of Flowerdalen in Spitsbergen and the eastern island of Edgeøya. The mixosaurid family, previously consisting of seven species in two genera worldwide, now sees the addition of new diversity and species revisions from Svalbard. Specimens from both collections of the Natural

History Museum of Oslo and the Museum of Evolution in Uppsala are redescribed together with new material. This has been made possible through radiography and micro-computed tomography, examining detailed tooth morphology across mixosaurid specimens, revealing previously unknown taxonomic distinctions. This study challenges earlier assignments of specimens as previously thought ontogeny and intraspecific variation instead show consistent interspecific patterns corresponding to the different tooth morphologies.

Analyses have led to the identification of two new species distinguished by unique dental characteristics, supported by other morphological differences. The first possesses an 'every other'-pattern of small pointed and large crushing teeth in the mandible, and the other has anteroposteriorly posterior elongated cutting teeth. These are morphologies highly unusual in the animal kingdom. Additionally, two previously identified species exhibited greater morphological divergence to the same assumed species of other geographical regions than previously thought, warranting taxonomic reassessment. All four species were firmly placed within the genus of *Phalarodon*. These findings refine our understanding of the problematic and complicated mixosaurid phylogeny and suggest more complex trophic partitioning within the Middle Triassic marine ecosystems of Svalbard.

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

Implications for feeding behavior in Upper Cretaceous albertosaurines based on stable calcium isotopes ($\delta^{44/40}$Ca) from tooth enamel

Norris, Liam

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Tyrannosaurids were the dominant large predators in Late Cretaceous North American ecosystems and underwent major morphological changes as they grew, becoming increasingly more robust with age. These morphological changes have been suggested to correspond to changes either in the dietary preferences of solitary tyrannosaurids or in the strategic role of tyrannosaurids within a hunting group. To test these hypotheses, stable calcium isotope composition ($\delta^{44/40}$Ca) of tooth enamel for 17 individuals representing an ontogenetic series of the albertosaurines *Albertosaurus sarcophagus* and *Gorgosaurus libratus* were analyzed. Calcium isotopes are ideal for reconstructing diet as they are primarily sourced from food and differ between food sources. All specimens are curated at the Royal Tyrrell Museum of Palaeontology (RTMP) in Drumheller, Alberta. Enamel samples were collected on site at RTMP and transported to The University of Texas at Austin for chemical processing and analyses on a thermal ionization mass spectrometer.

Results reveal no significant change in calcium isotope composition across the different growth stages. *Gorgosaurus* $\delta^{44/40}$Ca values vary from - 0.08‰ to - 0.94‰ with an average value of - 0.56 ± 0.14‰, and *Albertosaurus* $\delta^{44/40}$Ca values range from - 0.1‰ to - 0.72‰ with an average value of - 0.50 ± 0.19‰. Adult tyrannosaurids, which could more easily consume bone, should be depleted in Ca isotopes relative to juveniles and subadults, but no such variation is recorded.

Given that previous studies of calcium isotope tooth composition for sympatric ornithischian megaherbivores have reported different signatures between species (i.e., ceratopsids and hadrosaurids), the homogeneity of calcium isotope tooth composition in tyrannosaurids of different growth stages suggests three possibilities: 1. tyrannosaurids did not have strong dietary preferences and fed on the same food sources throughout their lives, potentially through collaborative hunting and sharing of resources between individuals of multiple sizes and morphologies, 2. smaller prey (i.e., caenagnathids, ornithomimids) had the same Ca signature as megaherbivores, obscuring ontogenetic dietary shifts, 3. juveniles/subadults commonly scavenged the carcasses of megaherbivores. The utility of $\delta^{44/40}$Ca as a

proxy for diet in the fossil record is highlighted, and multiple possibilities for tyrannosaurid ecology and its implications for their dominance of Late Cretaceous ecosystems are addressed.

Funding Sources SVP Cohen Award for Student Research, American Museum of Natural History Theodore Roosevelt Memorial Grant, Lundelius Endowment for Vertebrate Paleontology.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

An adaptable inverse model for recovering seasonality signals from serial mammalian tooth enamel isotopes

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Serial sampling of faunal enamel for isotopic analysis is a popular paleoseasonality proxy. The variability in the isotopic composition of tooth enamel records changes in the food and water consumed by an animal on a temporal scale frequently elusive in the fossil record: years and sub-annual seasons. However, interpretation of serial enamel isotope data is complicated by the complex nature of enamel mineralization, which variably compresses, lengthens, and dampens the input isotopic signal during growth, resulting in measured isotope profiles that do not strongly resemble the input signal. To more accurately recover trends in environmental seasonality, models of enamel mineralization and the incorporation of mineral content with specific isotopic composition through time must be applied—through a process called 'inverse modeling.' Here we present a set of models to execute this process. These models are based on the enamel mineralization patterns of plains zebra (*Equus quagga*) though the parameterization of these models makes them adaptable to the growth patterns of any specified mammalian tooth. Model sensitivity testing and the application of the inverse model to serial enamel isotope data from modern zebra from Ol Pejeta Conservancy in central Kenya demonstrate the capacity of these models to recover a highly accurate seasonality signal from preserved enamel. The models we present, and their adaptability to other taxa of interest, make them a valuable expansion of the existing toolkit for the analysis of enamel isotope data as a paleoecological proxy.

Funding Sources National Science Foundation Grant 2403566

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The great Gondwanan adventure: mapping the dispersal of metatherian mammals in the Palaeocene

Nuttall, Harriet E., Flannery-Sutherland, Joseph T.

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Modern marsupials occupy a divided range. While they are famously dominant and diverse in Australia and Wallacea, approximately a third of extant species are native to South America, and one is a recent immigrant to North America. The fossil record implies that the main dispersal events responsible for this spread occurred during the early to middle Paleogene while Antarctica still held connection with both those southern continents. An upper temporal constraint is provided by the Tingamarra Local Fauna (Boat Mountain deposit), where the earliest Australian marsupial fossils are found, at approximately ~54.6 Ma. Recent advances toward molecular phylogenetic consensus regarding the extant marsupial orders provide the basis for reconstructing the biogeographic distribution of their Palaeocene ancestors. Here, we use a supertree of fossil metatherians, constrained to a well-supported molecular

scaffold, to infer their ancestral biogeographic origins from their first known occurrence in South America up until the middle Eocene. We then estimate intervening dispersal routes as least-cost pathways using the R package TARDIS (Terrains and Routes Directed in Spacetime), taking into account palaeogeographic and palaeoclimatic constraints. By modelling the movements of early metatherians in their ecological context, we provide unprecedented insight into the historic adaptability and resourcefulness of this beguiling mammal radiation.

Funding Sources H.E. Nuttall is supported by supported by NERC CENTA2 grant NE/S007350/1

J.T. Flannery-Sutherland is supported by Dorothy Hodgkin Research Fellowship (DH160098: Sam Giles)

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

CT-derived morphological data reveals early musculoskeletal adaptations in *Archaeopteryx*

O'Connor, Jingmai[1], Hu, Han[5], Clark, Alexander[2], Kuo, Pei-Chen[3], Fabbri, Matteo[6], Zhang, Heming[5], Shinya, Akiko[4], Van Beek, Constance[1], Wang, Min[5], Lu, Jing[5]

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Due to the low-density contrast between fossil and matrix, the Upper Jurassic Solnhofen fauna has remained primarily interpreted in two-dimensions, including the iconic *Archaeopteryx*. Here we present new morphological data from the first scan of the nearly complete, exceptionally well-preserved Chicago specimen of *Archaeopteryx*. Our reconstruction reveals the skull is proportionately longer than previously recognized. 3D evidence indicates the cervical vertebrae were incipient heterocoelic. Differences in the proatlas compared to terrestrial theropods likely reflect demands to dorsally flex the skull during flight. Furcular morphology supports a close relationship with *Anchiornis* and suggests a cartilaginous sternum was present. Pedal morphology reflects the mixed ecology of this early bird. Large medullary cavities visible in most postcranial elements indicate the skeleton was hollow and lightweight. This information further elucidates skeletal modifications associated with the transition from terrestrial dinosaur to volant bird.

Funding Sources None

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Contrasting conventional with synchrotron-based µCT in North America's oldest ceratopsian

Obuszewski, Kyle D.[2,3], Napoli, James G.[4,6], Drakopoulos, Michael[5], Vo, Nghia T.[5], Zhong, Zhong[5], Zanno, Lindsay E.[1,3]

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Paleobiologists and systematists increasingly rely on non-destructive imaging techniques to derive data from fossil specimens. Frontier

approaches, such as phase-contrast synchrotron radiation microtomography (SRμCT), are particularly exciting, owing to the potential for exceptional image resolution and high density penetration. However, few studies have attempted to quantify phylogenetic information gain from scanning fossils with different tomographic modalities, including SRμCT. The effect of common taphonomic alteration (mineral replacement and/or occlusions) within fossil materials on information loss is also poorly understood. Here we reconstruct the internal morphology of the holotype skull of *Aquilops americanus*, OMNH 34557, from the Himes Member of the Cloverly Formation, using tomographic image datasets derived from two different scanning modalities, three machines, and three different scanning parameters—traditional μCT and synchrotron μCT. We utilized two traditional μCT protocols from a ZEISS Xradia 510 Versa [140 kV, 71.6 μA, HE3 filter, 15.727 μm pixel size and resolution] and Nikon XT H 225 ST [220 kV, 439 μA, 1 mm thick copper filter, 25.795 μm pixel size and resolution], and one synchrotron μCT protocol from a HEX beamline [monochromatic beam, at 100 kV, using an in-house-build dual-camera system with a pixel size of ~17 μm]. *Aquilops* (~109–98 Ma) currently represents the oldest-known North American ceratopsian and has been argued to display a mosaic of juvenile and mature features, despite the skull's incredibly small size, resulting in varying degrees of character conflict and phylogenetic uncertainty. Our comparison of CT scanning methods provides an exceptional opportunity to quantify phylogenetic information gain and assess phylogenetic impact. We also coupled tomographic data of OMNH 34557 with X-ray fluorescence (XRF) to chemically fingerprint sources of data loss during preservation and diagenesis within terrestrial ecosystems. We found that the oral margin and rostrum of OMNH 34557 (rostral, premaxillae, nasals, and maxillae) contain dense inclusions rich in barium, causing significant particle scattering and hindering penetration using conventional μCT approaches, even with varying energies. Penetration and information gain were improved with SRμCT, leading to increases in phylogenetic confidence metrics.

Funding Sources NSF award #1925973 (L.E.Z.); Brookhaven National Laboratory, National Synchrotron Light Source II proposal 317407 (L.E.Z. and J.G.N.); and the Jurassic Foundation (K.D.O.)

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

3D rendering of the aïstopod *Dolichosomatites emersoni* from the Jarrow Coal Seam (Bashkirian, Pennsylvanian) of Ireland

Ó Gogáin, Aodhán[1,2]

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Aïstopods are a clade of elongated limbless early tetrapods that were first described from the Bashkirian Jarrow Coal Seam in southeastern Ireland. Two aïstopods were named from this assemblage, the blunt snouted larger *Ophiderpeton brownriggii* and the smaller narrow snouted *Dolichosoma emersoni*, now named *Dolichosomatites emersoni*. This initial description highlighted the triangular shape of the skull but did not describe which bones were present. Despite its importance in understanding aïstopod taxonomy and early tetrapod evolution, *D. emersoni* has not been studied since its first description. This is due in part to the holotype being missing and possibly being destroyed by pyrite disease, as well as the poor nature of specimens from Jarrow, which do preserve near-complete bodies, including scalation, but have undergone metamorphic alteration, making them blend with the surrounding matrix. The lack of a detailed description of *D. emersoni* has led to it being compared to other narrow snouted aïstopods, including *Phlegethontia* from the coal assemblages of Linton, Ohio, and Nýrany, Czechia. Here, micro-computed tomography is applied to specimens of *D. emersoni,* and 3D models are rendered using SPIERS. While the data is hindered by the alteration of the specimens, a more detailed anatomical description can be provided. The skull of *D. emersoni* possesses midline cranial elements,

including paired frontals, parietals, and postparietals, that cover the occipital complex. The jugal contacts the quadratojugal to give the skull closed temporal fenestrae. The jaws are more robust than previously described and articulate with the cranium at the level of the occipital condyle. An S-shaped pectoral girdle is present, and vertebrae have typical aïstopod morphology and possess K-shaped ribs. A full suite of scalation is also observable. 3D rendering of the specimens shows that the morphology of the skull of *D. emersoni* indicates that it is different from that of *Phlegethontia*, and it is more similar to that seen in the earlier aïstopod *Lethiscus*.

Funding Sources TCD Scholarship.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A new fossil whale (Cetacea: Odontoceti) from the Lower Pliocene of the western North Pacific

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A well-preserved fossil skull of an odontocete whale (NMNS-PV 25108) was discovered from the Lower Pliocene Hatsuzaki Formation in Hitachi City, Ibaraki Prefecture, central Japan. NMNS-PV 25108 belongs to the family Delphinidae because its premaxilla is about half the width of the maxilla, the nasal is located at the highest point of the skull, the left premaxilla ends further forward than the right premaxilla and does not contact the nasal, and the maxilla completely covers the lacrimal. It is considered to belong to the subfamily Globicephalinae because the skull length exceeds 40 cm, the snout is wide, and the width of the premaxilla is almost constant from the tip of the snout to its center. Many species of the globicephaline dolphins have relatively large, but less than 10 teeth on both sides of the maxilla, but NMNS-PV 25108 is estimated to have had more than 20 teeth on one side.

These characteristics are derived features shared by the extant melon-headed whale *Peponocephala electra* and the Pliocene *Hemisyntrachelus* spp., but NMNS-PV 25108 is considered to belong to the former genus based on the size of the skull, the spacing of the alveoli, and the presence of a gap in between the left and right premaxillae. This is the first fossil record of this genus in the world, and therefore, it is the oldest record of the genus.

It is known that the delphinids underwent rapid speciation during the Pliocene, hence the fossil record is extremely important for improving the accuracy of phylogenetic analysis using molecular evidence. However, there are very few fossil records of delphins before the Pleistocene, and most of them are concentrated in Europe. Therefore, this specimen, which was discovered in a well-preserved state in the Pacific coastal area, is extremely valuable.

The geologic age of NMNS-PV 25108 is estimated to be the Early Pliocene based on the diatom biostratigraphy for the fossiliferous bed in the Hatsuzaki Formation. According to the results of previous molecular phylogenetic analyses, the lineage leading to the modern melon-headed whale was thought to have appeared approximately 3 to 3.5 Ma. However, the new fossil from the Hatsuzaki Formation is clearly older than this estimation. Therefore, the divergence dates of the species within the Delphinidae as a whole that have been estimated so far based on molecular phylogenetics are likely to be fundamentally revised based on the age of this new fossil discovery.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Keeping grounded: podathecae, feature scales, and feathers—tracks, simple-minded cladistic thinking, and the insulated ancestral state condition in the Avemetatarsalia

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A simple-minded, cladistic hypothesis posits that the avemetatarsalian ancestral state conditions for integument were filamentous insulation and pebbly reticulae on the podothecae (PRP), based on organically preserved remains. The Early Jurassic ichnite *Anomoepus* reveals PRP and filaments distal to proximal tail scutellate scales, supporting an origin of these bird-like features at the Triassic origin of dinosaurs, providing the group is monophyletic.

Ichnocladistic analysis of silesaur (*Atreipus*) and chirotheroid tracks show that PRP originated prior to the Dinosauria/Pterosauria node, and are possibly primitive for Pseudosuchia+Avemetatarsalia. This is inconsistent with the argument that dinosaur/bird PRP are modified feathers, which would require feather origins at the Archosauria node or earlier. We instead default to the hypothesis that these scales are simply homologous to reptile scales.

Apomorphies of their respective clades, derived from the ancestral PRP condition for Pseudosuchia+Avemetatarsalia, are: 1) coarse autopod scales of extant crocodyliforms (a semi-aquatic adaptation), evidenced by PRP in the terrestrial crocodyliform track *Batrachopus*; 2) angular scales of phytosaurs seen in the ichnite *Apatopus*, plausibly also a semi-aquatic adaptation; and 3) proportionally large, polygonal pedal scales of the track *Otozoum* observed in undoubted sauropod footprints and neosauropod integument.

Maximum likelihood models favoring a scaly ancestral state condition for avemetarsalian integument rely on negative evidence from large dinosaurs. However, their size and thermoregulatory needs (analogous to nearly hairless low-latitude megafauna) plausibly drove filament reduction. Instead, we hypothesize that at least sauropods and hadrosaurs, actually retained filament homologues as their median feature ‘scales’ (MFS) composed of conjoined filaments. Indeed, hadrosaur MFS have been described as, “…evocative of rhinoceros horns … composed of an arrangement of hair-like keratinized tubules …”. If borne out by desperately needed additional analysis, recoding of sauropods and hadrosaurs as having ‘reduced filaments,’ as opposed to scales only, would reverse the maximum likelihood outcomes. The primitively present, filamentous integument in pterosaurs+dinosaurs was a key innovation that allowed them thrive in polar regions and survive multiple episodes of Mesozoic, volcanic winter-induced, terrestrial mass extinctions.

Colbert Prize Session

Ontogenetic and evolutionary implications of gigantism-related morphology in *Deinocheirus mirificus* (Theropoda: Ornithomimosauria)

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Deinocheirus mirificus is a gigantic ornithomimosaur that evolved a suite of unique morphological traits not seen in other ornithomimosaurs. Two relatively complete skeletons have been discovered: an adult individual (MPC-D 100/127) and a subadult individual (MPC-D 100/128), which are thought to represent different ontogenetic stages. However, the subadult specimen has

traditionally been referred to as *Deinocheirus* based on a single femoral character (a dome-like tubercle on the anterior edge and a pronounced vertical hook on the posterior edge of the femoral head), and detailed comparative studies between the two specimens have been lacking. The objectives of this study are: 1) to reassess the taxonomic assignment of the subadult specimen through detailed morphological observation, and 2) to clarify ontogenetic changes by comparing it with the adult individual. Our analysis identified five diagnostic features in the subadult specimen of *Deinocheirus*, confirming its assignment to the genus. Morphological differences between the two specimens were observed in the caudal vertebrae, femur, and tibiotarsal complex, and are interpreted as reflecting ontogenetic variation rather than taxonomic separation. To contextualize these patterns, we compared ontogenetic trends of *Deinocheirus* with those in *Gallimimus bullatus*, a cursorially adapted ornithomimosaur from the same formation, as well as in other theropods and sauropods that also attained large body sizes. The result of the comparisons reveals that *Deinocheirus* followed a growth pattern broadly consistent with other ornithomimosaurs, but it exhibited developmental modifications, particularly in postcranial proportions, that parallel those seen in sauropods. These findings suggest that the gigantism of *Deinocheirus* resulted from a unique interplay between phylogenetic constraint as an ornithomimosaur and convergent morphological strategies associated with large body size.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The Morrison Fm. (Late Jurassic, USA) Sauropoda diversity: a blink into the (global) past

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The Upper Jurassic Morrison Formation in the western US has long been a rich source of paleontological discoveries. These continental sediments were deposited across 1.2 million square km of alluvial plains with rivers, floodplains, and seasonal lakes. Its wide extent and exceptional fossil preservation have made the Morrison Fm. one of the most intensively studied geological units globally. Although dinosaurs from the Morrison Fm. have been known since the late 19th century, discoveries continue to enhance our understanding of Late Jurassic biodiversity. Although the high diversity in the Morrison Fm. is generally accepted as genuine, the extent to which sampling bias and fossil record limitations may distort diversity estimates remains unclear. Sauropod dinosaurs are especially abundant in the Morrison Fm., with genera such as *Camarasaurus*, *Diplodocus*, *Brachiosaurus*, and *Apatosaurus* among its most iconic. Many sites within the formation have produced fossils from multiple coexisting sauropod taxa. The global peak in sauropod diversity during the Late Jurassic, often cited in the scientific literature, appears to be largely driven by discoveries from the Morrison Fm. However, reconstructing the true sauropod diversity in this formation is challenging. Factors such as stratigraphic variation, taphonomic processes, ontogenetic changes, evolutionary dynamics, and environmental influences may obscure accurate diversity estimates. Paradoxically, despite the formation's extensive fossil record and long depositional history, some researchers argue that its sauropod diversity is still underestimated. This raises caution about using formations like the Morrison Fm. as the basis for extrapolating global diversity patterns. In light of this, we investigated whether a *Lagerstätten* effect associated with the Morrison Fm. might be influencing global Late Jurassic Diplodocoidea diversity patterns. We estimated global diversity for this clade both with and without Morrison

Fm. occurrence data and used a GLM-based modeling approach to evaluate the roles of abiotic factors, sampling biases, and preservational biases in shaping these paleodiversity trends (e.g. tetrapod bearing formations and collections, emerged land area, paleotemperature, sea level, stage length). Preliminary results from our best-fitting models support the hypothesis that the Morrison Fm. exerts a *Lagerstätten* effect, identifying it as a significant influence on global Diplodocoidea diversity curves.

Funding Sources FCT Portugal: UI/BD/151441/2021 (PhD grant) and CEECIND/00726/2017; Spanish Ministry of Science, Innovation and Universities: JDC2023-050836-I (Juan de la Cierva grant).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Recent data on the enigmatic family Raoellidae: how aquatic…how cetacean?

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At the beginning of the 21st century, the discovery of an involucrum on the auditory bulla of *Indohyus*, a small raoellid artiodactyl from the Indian subcontinent, triggered the phylogenetic gathering of Raoellidae with the Cetacea clade, making them pivotal in addressing questions surrounding the land-to-water transition in Artiodactyla. Micro CT scan investigations and newly collected material from the Kalakot area (Jammu and Kashmir, India), recently greatly increased our knowledge of the cranial and dental features of this group. Here we present new data on cranial morphology of Raoellidae deriving from micro CT scan investigations of *Indohyus indirae* and *Khirtharia inflata*. This new body of data comprises investigations of the endocast of the braincase, the complete middle ear including the ossicles and auditory bulla, the petrosal bone, and the cast of the bony labyrinth. It also includes the reconstruction of the complete anterior dentition. This study gives us a comprehensive picture of the features of the Raoellidae head and improves our understanding of their semiaquatic habits. This increased knowledge of raoellids further extends the list of features they share with the first archeocetes, calling into question the definition of the clade Cetacea.

Funding Sources This research received funding from the FYSSEN foundation, the Institut des Sciences de l'Evolution Montpellier ISEM, and the Royal Belgian Institute of Natural Sciences.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Taxonomy versus ontogeny—variation in the snout morphology of Early Permian trematopids at Richards Spur, Oklahoma

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Trematopids were an impressive group of Late Pennsylvanian and Early Permian terrestrial temnospondyls from North America and central Germany. These impressive predators have a largely unresolved phylogeny and poorly understood ontogeny due to a lack of substantially informative fossils representing several taxa. Recent discoveries of numerous

skulls of trematopids at the famous Richards Spur (Fort Sill) locality have allowed for the use of non-invasive imaging analysis, known as 'neutron computed tomography' (The Dingo Beamline at ANSTO, Australia), for taxonomic and ontogenetic analysis on these new, well-preserved partial and complete trematopid skulls from the cave infills at the Dolese Brothers Limestone Quarry, Richards Spur, Oklahoma. Hydrocarbon impregnation of these skulls make them ideally suited for neutron tomography, resulting in very high quality data for segmentation. Representing various ontogenetic stages, these skulls can be used to address interesting challenges that can arise from distinguishing ontogenetic variation from taxonomically relevant features. We have already been able to produce detailed anatomical reconstructions of these skulls and have identified features that are both ontogenetically variable and ontogenetically independent among these specimens. This new dataset will create a more accurate representation of both the taxonomy and ontogeny of this clade at Richards Spur. It will also resolve some of the questions regarding whether or not ontogenetically influenced characters were appropriately considered in previous taxonomic interpretations of juvenile and adult specimens of trematopids from this famous locality. Our preliminary data indicate that at least two, possibly three, distinct trematopid taxa can be identified based on the combined features of skull shape, internarial fontanelle size and shape, and the presence of lateral exposures of the palatine and ectopterygoid bones beneath the orbits. This pattern conforms well to the level of taxonomic diversity found among various tetrapod taxa in the Richards Spur terrestrial vertebrate faunal assemblage, including multiple species of dissorophid and amphibamid temnospondyls, recumbirostran microsaurs, acleistorhinid parareptiles, and captorhinid eureptiles.

Funding Sources NSERC DG -2020 - 04959

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Perinate hadrosaurid bones and associated eggshell fragments from the Upper Cretaceous (Upper Campanian) Oldman Formation of southeastern Alberta, Canada

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In North America, hadrosaurid nesting sites are currently known from the Upper Cretaceous deposits of Alberta and Montana. A nesting site attributed to the lambeosaurine *Hypacrosaurus stebingeri* is known from exposure of the upper Campanian Oldman Formation at the Devil's Coulee locality in southernmost Alberta, whereas several nesting site localities, mainly of the saurolophine *Maiasaura peeblesorum*, have been discovered in the time-equivalent Two Medicine Formation of Montana. These nesting sites occasionally preserve perinatal or embryonic hadrosaurid specimens in association with eggs, which can shed light on the early developmental stages of the hadrosaurids. Here we report on the discovery of perinatal hadrosaurid bones associated with eggshell from a new locality in the Oldman Formation of southeasternmost Alberta.

The specimen (UC 16624) is preserved in multiple calcareous nodules and consists of numerous skeletal elements belonging to at least two individuals associated with eggshell fragments, likely representing part of a nest. The skeletal remains include the semi-articulated right side of a skull, a portion of an articulated left hindlimb, a partial disarticulated braincase, as well as other disarticulated elements. The skull of UC 16624 displays an anteriorly tapering rostral ramus of the jugal and an anterodorsal process on the maxilla, two cranial features considered diagnostic of Saurolophinae. However, the associated eggshell displays a stipple-like surface texture similar to lambeosaurine eggshell (*H. stebingeri*) rather

than the net-like ridges of saurolophine eggshell (*M. peeblesorum*).

The body mass of one of the UC 16624 individuals is estimated at 4200 g, based on an embryonic body mass estimation method using femur volume. A hadrosaurid embryo of that size could potentially have been accommodated within lambeosaurine eggs (3900–4190 ml), but not within saurolophine eggs (900 ml). As such, UC 16624 individuals would likely represent either embryonic/perinatal lambeosaurines or very large saurolophine hatchlings.

Although two cranial features suggest an affinity of UC 16624 with Saurolophinae, the skulls of hadrosaurids are known to have undergone considerable morphological changes during ontogeny. With conflicting taxonomic indications between the eggshell (i.e., lambeosaurine) and skull features (i.e., saurolophine), further comparative work with other embryonic hadrosaurid specimens is necessary to determine the identity of UC 16624.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Turnover means your turn's over: biogeography, paleobiology, and the differing fates of Mississippian tetrapod clades

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Past descriptions of a united Carboniferous Euramerican tetrapod fauna have primarily been based on Pennsylvanian localities. With recent improvements to the Mississippian record, we can now start to evaluate the Mississippian tetrapod assemblage along similar lines and, hopefully, understand why and which lineages persist from the Mississippian into the Pennsylvanian.

Whatcheeriidae and Colosteidae are both known from the Tournaisian, but only Whatcheeriidae is present in both North America and Britain at that time. In the Serpukhovian, when substantial North American and British tetrapod records again become available, Whatcheeriidae and Colosteidae are solely North American. Only Colosteidae survives into the Pennsylvanian. Among embolomeres, Proterogyrinidae and Eogyrinidae are exclusive to North America during the Mississippian, though eogyrinids subsequently expand across Britain and Eurasia.

Tournaisian and Serpukhovian whatcheeriids can be distinguished on the basis of not only morphology (*Pederpes*-type vs. *Whatcheeria*-type) but also paleoenvironment (estuary and coastal floodplain vs. less saline lake and river channel). The absence of gastralia in *Whatcheeria* and elaboration of the lateral line system relative to *Pederpes* suggests increased aquatic specialization and narrowing habitat tolerance in Serpukhovian whatcheeriids, possible facilitated by relatively stable environmental conditions during the intervening Visean. Whatcheeriids are conspicuously absent from Serpukhovian sites with evidence of strong seasonality. The greater geographic and habitat distribution of colosteids and embolomeres is consistent with greater tolerance for environmental variability that could have facilitated their survival through the Mississippian/Pennsylvanian transition (MPT). This may also be the reason for the differing fates of the two limbless Carboniferous groups: adelospondyls (apparently exclusive to the late Mississippian) and aistopods (middle Mississippian-early Permian).

The lack of data from the Visean of North America remains an impediment. Ongoing and future descriptions of colosteid and embolomere records from the Mississippian and Pennsylvanian will clarify the internal relationships and biogeography of these groups. Most of all, detailed paleotectonic reconstructions for Euramerica are needed to test hypotheses of connectivity and tetrapod dispersal between North American, British, and European basins.

Funding Sources This work was funded by a National Science Foundation Postdoctoral Research Fellowship in Biology (DBI-2209043).

Colbert Prize Session

Beak and occipital morphology reveal feeding and biogeographic patterns in ankylosaurs

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Ankylosaurs were herbivorous dinosaurs with extensive cranial ornamentation and dermal armor, widely distributed during the Cretaceous. While ankylosaurids inhabited both North America and Asia, nodosaurids were largely confined to North America. Previous studies have investigated ankylosaur chewing mechanics and beak shape in a limited number of taxa, particularly focusing on individual species such as *Ankylosaurus* and *Euoplocephalus*. However, comprehensive comparative studies across multiple taxa and continents remain scarce. In this study, we analyzed the morphology of the beak and occipital condyle across 25 ankylosaur taxa from North America and Asia to assess broader patterns in feeding adaptation. Three-dimensional skull models were obtained via photogrammetry and existing digital datasets. Geometric morphometric analyses were performed using curve landmarks along the beak margins and surface landmarks on the occipital condyles. Morphological variation was evaluated through principal component analysis (PCA), with comparisons made by clade and region. The results show that ankylosaurids generally possess rounded beaks and broad, shallow occipital condyles, while nodosaurids exhibit angular beaks and narrow, deeper condyles. Among ankylosaurids, North American species tend to have shorter, more rounded beaks and wider condyles, whereas Asian taxa display longer, more angular beaks and narrower condyles that approach the nodosaurid condition. These findings may suggest that the beak and occipital condyle morphology reflect different feeding strategies. Ankylosaurids may have used rounded beaks for multidirectional cropping close to the ground, constrained by limited head mobility. In contrast, nodosaurids may have employed more directional feeding, supported by greater cranial flexibility. The occurrence of nodosaurid-like cranial traits in Asian ankylosaurids may indicate functional convergence or ecological specialization. This study expands upon prior research by incorporating a wider taxonomic and geographic sample, highlighting how specific cranial structures relate to feeding behavior and niche differentiation across ankylosaur clades.

Funding Sources Research expenses for the Hokkaido University Ambitious Doctoral Fellowship; JSPS KAKENHI grant no. 24KJ0288.

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Brain size dependent speciation and extinction rates in birds and the cognitive buffer hypothesis

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The evolution of “key innovations” is thought to shape species’ potential for diversification. One of the most important traits thought to shape the evolution of many vertebrate groups are larger brains. Birds (Aves) are an excellent group for studying the link between phenotypic evolution, speciation and extinction, with over 10,000 living species and a long evolutionary history represented in the fossil record. In birds, increased relative brain size is thought to facilitate diversification in two ways, either by driving increased speciation (behavioral drive) or by making lineages more resilient to extinction (cognitive buffer). To separate these two effects, our approach combined continuous

and discrete quantitative state speciation and extinction models (BiQuaSSE) with a sample of endocranial volume data for 2,260 extant bird taxa and 31 fossil species.

We confirm a positive correlation between diversification rate and relative brain size across birds, with the largest-brained lineages diversifying 200% faster than the smallest-brained lineages. Positive correlations between brain size and speciation rate were also supported by tip-rate measures based on the equal-splits (ES) metric of the same sample (p-value 0.016). In the best-supported models, increasing relative brain size primarily increased diversification rate through decreasing extinction rate, supporting the cognitive buffer hypothesis and suggesting that larger brains in birds promote diversification by making species more resilient to extinction. Relative brain size dependent patterns of speciation and extinction differ between the perching birds and other groups. In perching birds, the highest diversification rates are found over a narrow range of relative brain sizes, in contrast to other bird groups which show lower diversification rates over a broader range of relative brain sizes.

Our results reveal the complex effect of brain size evolution on diversification patterns within birds, showing the importance of separately modelling speciation rate and extinction rate when testing evolutionary hypotheses using models. Fossils also play a vital role in diversification studies, through sampling subclades which show distinct dynamics and in more accurately estimating extinction rate. The discovery of new fossils, as well as digitization of endocasts of existing fossil specimens, therefore, has the potential to reveal much about diversification dynamics in birds.

Funding Sources UK Research & Innovation (UKRI) Horizon Europe Guarantee Grant EP/Y010256/1

Natural Environment Research Council (NERC) Grant NE/X012395/1

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Brain size and sensory tradeoffs in carnivoran evolution: insights from fossil and extant Caniformia

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Birds and mammals, two major tetrapod radiations, are both characterized by a relatively large brain size compared to their body size. Within mammals, several clades are characterized by increased encephalization, including carnivorans, an ecologically and phylogenetically diverse group.

Carnivorans display different levels of specialization in major sensory systems, reflecting adaptations to their ecological niches. According to the Principle of Proper Mass and the high metabolic cost of neural tissues, greater investment in sensory modalities (e.g., vision, olfaction, tactile) requires either proportional increases in brain size or tradeoffs with other systems. Therefore, sensory investment should correlate with overall brain size and the relative size of different sensory regions.

We test these hypotheses using CT-derived metrics from caniform crania and endocasts, including olfactory bulb volume, orbit width, and infraorbital foramen area as proxies for olfaction, vision, and somatosensory investment, respectively. Sensory metrics (measured as volumes or linear measurements) were analyzed as residuals corrected for body size to determine 'relative' investment.

Among the most noteworthy results, the combined sensory morphospace of these residuals shows that *Eoarctos vorax*, a stem ursid, exhibits reduced olfactory but increased visual investment relative to extant ursids. *Potamotherium vallentoni*, a stem pinniped, shows generally intermediate sensory tradeoffs but relatively high encephalization and somewhat reduced olfaction.

In addition, the strongest correlation observed between sensory modalities was a negative correlation between vision and olfaction. Our study further demonstrated a significant positive correlation between relative brain size and average sensory investment (i.e., residuals of sensory metrics averaged), consistent with the Principle of Proper Mass. However, the modest correlation coefficient suggests that this trend may not be characterized by a particularly strong development or functional constraint. This also suggests that, in the context of mosaic patterns of brain evolution, vision and olfaction are correlated, while other senses can change independently of each other.

Funding Sources Paleontological Society, Leverhulme Trust Early Career Fellowship

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A hesperornithiform bird from the Campanian Dinosaur Park Formation of western Saskatchewan, Canada, and the diversity of small mid-grade hesperornithiforms in Late Cretaceous North America

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Hesperornithiforms are foot-propelled diving birds that inhabited marine to freshwater environments during the Cretaceous. They constitute one of the most speciose and well-known groups of Mesozoic birds, and account for a large part of the avian fossil record of North America. Although abundant basal hesperornithiform material is known from Cenomanian deposits in the Pasquia Hills of eastern Saskatchewan, the Campanian and Maastrichtian dinosaur record of western Saskatchewan is dominated by non-avian taxa. However, an isolated hesperornithiform thoracic vertebra from the Lake Diefenbaker Bonebed (LDB) in the Campanian Dinosaur Park Formation of Saskatchewan Landing Provincial Park has been described and attributed to *Baptornis*, and several other hesperornithiform elements have been briefly reported from the bonebed, which represents a coastal deposit. In addition to the isolated vertebra, the LDB hesperornithiform specimens include an incomplete series of hesperornithiform thoracic vertebrae and an associated fused pelvis and synsacrum. The thoracic vertebrae differ from those of the basal hesperornithiforms *Chupkaornis, Enaliornis*, and *Pasquiaornis* in lacking a sharp shelf at the ventral margin of the lateral concavity on the centrum, and further differ from those of *Pasquiaornis* in being heterocoelous rather than amphicoelous. By contrast, the pelvis differs from its counterparts in the hesperornithids *Parahesperornis* and *Hesperornis* in having a widely open acetabulum and a more posterodorsally placed antitrochanter. The LDB specimens are most parsimoniously interpreted as representing a single “mid-grade” taxon within Hesperornithiformes, falling close to but outside Hesperornithidae as do *Baptornis* and *Fumicollis*. However, the LDB pelvis differs from that of *Baptornis* and *Fumicollis* in that the antitrochanter is less laterally prominent, and craniocaudally narrower in proportion to its dorsoventral height. Accordingly, the Saskatchewan material appears to represent a hesperornithiform that is of similar grade to *Baptornis* and *Fumicollis* but is not referable to either genus. Documentation of the LDB hesperornithiform adds to a growing body of evidence that small mid-grade

hesperornithiforms were diverse in continental and marginal marine environments during the Campanian, in a distinct niche from large fully marine taxa such as *Hesperornis*.

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Birth and growth in Jurassic mammals: synchrotron data from Scottish fossils provide life history insights

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Life history evolution remains challenging to study in early mammals. Data regarding growth, age of sexual maturity, life span, and the emergence of viviparity are among the most elusive to obtain, hampered by a fossil record mainly comprising individual teeth and isolated bones. Digital paleohistology using synchrotron X-ray micro-computed tomography (SRμCT) provides a new, non-destructive method for understanding life history from rare and exceptional fossils. We applied this technique to the near-complete skeletons of an adult and juvenile docodontan mammaliaform, *Krusatodon kirtlingtonensis* from the Middle Jurassic (Bathonian) Kilmaluag Formation, Isle of Skye (An t-Eilean Sgitheanach).

We used SRμCT at each tooth locus in the juvenile to visualise cementum increments, which capture a record of annual growth. These revealed significantly prolonged development in terms of chronological age, compared to extant mammals of a similar body mass, suggesting slower growth rates and delayed sexual maturity may have been common in early-diverging mammaliaforms. This fits with previous studies indicating early mammaliaforms were long-lived, but represents the first time this method has been used to estimate tooth replacement sequence against body size and chronological age, providing unprecedented detail regarding growth and development.

In addition, we present new digital histology data from the limb bones of docodontans, alongside an unnamed eutriconodontan, from Skye. Consistent with cementochronology, the femoral cortex of the docodontans comprises well-organized, parallel-fibered to lamellar bone tissue, with numerous lines of arrested growth (LAGs), indicative of a slow pace of life. The eutriconodontan femoral cortex, in contrast, exhibits a ‘sandwich’ pattern, characteristic of extant small-bodied placental mammals, with the inner- and outermost portions of the cortex comprising lamellar-bone bracketing a mid-cortical layer of fibrolamellar/compact coarse-cancellous bone. This reflects perinatal bone formation that is later buttressed endosteally and periosteally by lamellar bone. Where the eutriconodontan differs from placentals of similar body mass, is in exhibiting >3 LAGs. These preliminary results suggest that while both mammaliaforms and early crown mammals attained greater chronological ages, Jurassic crown mammals may have produced relatively larger, more precocial neonates, thus requiring less time, ultimately, to reach adult size.

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ESRF ES587, LS3244 and LS3441

TOMCAT 20182126

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Computer-aided dinosaur footprint detection of the Era del Peladillo tracksites (Igea, La Rioja): state of the art

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Dinosaur footprint and trackways digitizing has become a normal practice in the study of dinosaur tracks. It has been incorporated in the typical workflow as a mean to visualize, conserve the track and extract valuable information that support the discussion of the morphological and extramorphological features. Despite several advancements that have been made in the last decades towards computer-aided automated footprint detection, it is still a challenge due to the large amount of noise caused by the extramorphological features and the very own geomorphology where the tracks are preserved.

In this work in progress, we introduce the use of several computer vision methods already in use in the industry for feature extraction and prototyping. We used a 3D digital model of Era del Peladillo (Igea, La Rioja) tracksites 1 and 7 (1PL and 7PL) as a well-known setup for both theropod and ornithopod computer-based footprint detection. We used two different methods, objective footprint outline generation and salient feature extraction, to assess the differences and the strengths of each one. Both methods of image segmentation can benefit the use of the 3D triangular meshes to obtain the features based on the vertex point cloud heights or the changes in the face normal directions respectively. These track sites also preserve several structures that may help assess the potential of each method to extract sedimentary or dynamic information apart of the possible footprint outlines or masks (i.e., 1PL ornithopod footprints exhibit a light convex epirelief encirclement probably due the presence of algae in the mud surface where the dinosaur walked; previously incorrectly interpreted as an interdigital membrane in the ornithopod foot).

With the preliminary results, geometric morphometric techniques were used to analyze the landmarks and contours in order to assess the feature extraction capabilities for classification of theropod and ornithopod tracks compared to the already published studies. The raw output was also manually analyzed to assess the power of each method filtering 3D noise (e.g., loose boulders, exposed strata fractures) and capturing putative footprint extramorphological information regarding the dinosaur dynamics.

Funding Sources Instituto de Estudios Riojanos (IER) research plan ‘PaleoComp 25’.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Body size plasticity in *Puma concolor*: morphological variation across time and ecosystems

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Understanding how *Puma concolor* (cougar) survived and adapted following the Pleistocene megafaunal extinction remains an important ecological question, offering insights into how these former mesopredators evolved into apex predators. This study investigates cougar morphological variation by comparing modern populations from diverse ecosystems to fossil specimens from Rancho La Brea, California (RLB). Using 19 felid mandible measurements and carnassial M1 tooth dimensions, we assess shifts in body size and functional morphology across ecosystems and time. Body size in carnivores is influenced by dietary specialization, territory size, predator competition, and potentially Bergmann’s rule (i.e., larger size in colder climates). One hypothesis is that cougars declined in body size,

a trend detected in *Canis latrans* at RLB when comparing Pleistocene to modern specimens. Alternatively, mesopredator release may have led to body size increases as cougars became apex predators. A third hypothesis is size stasis, as some studies suggest that species did not undergo rapid body size shifts due to environmental change. To test these hypotheses, we applied principal component analysis, linear regressions, Wilcoxon rank-sum tests, and permutation tests to compare mandible and tooth morphology across modern ecosystems (desert, rainforest, grasslands, and mountains), within latitudinal groups (low, mid, and high across both hemispheres), and between modern ecosystems and fossil specimens from RLB. Results reveal significant morphological variability across ecosystems, with the largest body sizes occurring in grassland cougars. Additionally, RLB specimens were generally smaller-bodied than most modern taxa, exemplifying a shift from small to large body size consistent with mesopredator release, possibly due to the competitive dynamics of a predator-rich landscape. As for the potential influence of Bergmann's rule, we found weak positive correlations in both hemispheres. Body size variability in cougars appears shaped by multiple ecological factors, including the interplay of ecological pressures, resource availability, and competition release. These findings support the hypothesis that cougars' survival was facilitated by a generalized diet, while our study provides additional evidence that body size plasticity, both reduction and expansion, also played a critical role in their continued success across shifting ecological pressures, ecosystems, and time periods.

Funding Sources Vanderbilt University's evolutionary studies initiative pilot grant (to J.P.-J.).

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

New morphological evidence of the gravid *Myobradypterygius hauthali* (Reptilia, Ichthyosauria) from the Hauterivian (Early Cretaceous) of southern Chilean Patagonia revealed by CT scan analysis: the 'Fiona' ichthyosaur

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Ichthyosaurs were globally distributed marine reptiles that thrived throughout the Mesozoic. Although their Early Cretaceous record is relatively sparse, it is notably richer in the Southern than in the Northern Hemisphere. An Early Cretaceous fossil Lagerstätte (131.07 ± 0.07 Ma) at the edge of the Tyndall Glacier in Torres del Paine National Park, southern Chilean Patagonia, has yielded nearly one hundred ichthyosaur specimens, many of which are remarkably well-preserved, complete, and articulated. Among them is a unique specimen informally named 'Fiona,' representing the only known gravid ichthyosaur from this period worldwide. Fiona is completely articulated and exceptionally preserved, including fully intact forefins that have enabled its identification as *Myobradypterygius hauthali* von Huene, 1927. This taxon was previously known only from fragmentary material in the Barremian of Neuquén, Argentina, making Fiona the most complete representative of the species to date. However, mechanical preparation has been

hampered by exceptionally indurated sediment and lack of contrast between the bone and the matrix. Computed tomography (CT) analysis was undertaken to attempt a digital preparation of the specimen. The scan was exceptionally high-contrast, revealing skeletal elements still embedded in the surrounding matrix, including a complete rostrum, orbital ring, dentition, paired forefins, a hind fin, ribs and gastralia, the caudal-most vertebrae, and a second fetus approximately 20 cm in length, preserved in full articulation. The CT analysis also identified a forward-slipped caudal vertebra, possibly indicating an anterolisthesis caused by trauma during the animal's life. While the relationship between this pathology and the death of the individual remains uncertain, it cannot be dismissed. This discovery not only provides the first evidence of a gravid ichthyosaur from the Early Cretaceous but also significantly enhances our understanding of the anatomy, reproductive biology, and paleobiogeography of ichthyosaurs in southern Gondwana. The Tyndall Glacier site represents one of the most important Early Cretaceous ichthyosaur assemblages from the Southern Hemisphere and offers new insights into the evolutionary history and dispersal of this clade during a period of global environmental change. Concurrently, digital preparation offers a promising avenue to deal with both the exceptional number of specimens and the difficulties with mechanical preparation.

Funding Sources Convocatoria Nacional Subvención a la Instalación en la Academia (PAI7720036) and FONDECYT de Iniciación 11240506 of ANID, (Chile) to JP-P.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New data on the evolution of delphinids in the southern hemisphere

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Oceanic dolphins (delphinids) comprise 38 species inhabiting all major oceans and seas. Their current diversity is rooted in an adaptive radiation beginning in the Miocene, which has been well documented in molecular analyses. By contrast, fossil evidence documenting early delphinid evolution remains sparse. This is particularly true for the Southern Hemisphere, which so far has yielded just one described species: the enigmatic *Australodelphis mirus* from the Pliocene of Antarctica. As a result, much remains unknown about the tempo and mode of delphinid diversification and dispersal.

Here, we describe a new species of delphinid from the late Pliocene (3.4-3.1 Ma) shallow marine Tangahoe Formation of Taranaki, New Zealand. The holotype consists of an essentially complete longirostrine skull with articulated mandibles. Preliminary phylogenetic analysis of a dataset comprising 149 taxa groups the new species with the extant delphinine genus *Stenella*. Members of the latter tend to inhabit tropical waters today and likely also did so in the Pliocene of New Zealand, given current palaeoenvironmental reconstructions. Interestingly, the Taranaki dolphin appears to have coexisted with other presumed warm-water animals like boxfish and monk seals, but also relatives of crested penguins that today are associated with cooler climates. Overall, our new specimen provides a globally rare insight into the emergence of the modern dolphins and will help inform future biogeographic hypotheses.

Funding Sources TP was funded by an Australian Research Council DECRA Fellowship (DE220101296)

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Specialized canine teeth correlate with the deep-time evolution of pinniped mating systems

Parker, William M.[1,2], Pollock, Tahlia I.[3,2], Marx, Felix G.[1], Loch, Carolina[4], Velez-Juarbe, Jorge[5], Paterson-Crisp, Lochlan[2], Park, Travis[2], Fitzgerald, Erich M.[6], Evans, Alistair R.[2,6], Rule, James P.[2,7]

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Eared seals and walruses (otarioids) are some of the most polygynous and sexually dimorphic of mammals alive today. For males, reproductive success is highly differential and shaped by combat. Here, we show that the extreme selective regime of otarioids correlates with a unique pattern of continuous 'cone-like' canine growth that prolongs root extension. This contrasts with the majority of mammalian canines in which the full length of the root is established rapidly and subsequent addition of secondary dentine gradually infils the pulp cavity. Evidence for this otarioid growth pattern comes from digital and physical histology and extends deep into the fossil record: *Eotaria* sp., the oldest known otariid (16.5–14.5 Ma, California) and *Proneotherium repenningi*, the oldest odobenid (17.3–16.6 Ma, Oregon), both show 'cone-like' canine growth. By contrast, all fossil phocids, enaliarctids, and desmatophocids retain the ancestral pattern of root growth.

A combination of 3D geometric morphometrics, mechanical properties testing, and finite element analysis shows that otarioid canines resemble those of other carnivorans in cusp shape, elasticity, hardness, and biting performance, but are markedly more resistant to lateral impacts. This is directly related to 'cone-like' growth altering the infilling of the pulp cavity, providing reinforcement to the tooth. We interpret this as an adaptation to high levels of intraspecific fighting associated with polygyny. A lack of dextrous forelimbs, particularly when compared to other carnivorans, may increase the reliance on, and risk to, the canines during these bouts. Phylogenetic Generalised Least Squares analysis including fossil data reveals that fracture-resistant canines and, thus, polygyny have ancient origins among otarioids. This may have direct implications for the evolution of walruses, with ever-growing canines being a plausible precursor to the evolution of tusks.

Funding Sources This work is funded by Marsden Grant 22-MNZ-001.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Fossil camels from the Miocene Punchbowl, Crowder, and Cajon Valley formations of the Transverse Ranges, California

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Fossil camels from the middle–late Miocene units of the Transverse Ranges have never been precisely identified beyond 'Camelidae' in the literature because the alpha taxonomy of Miocene camels was poorly understood. With the complete revision of North American Camelidae now completed, it is possible to identify them for the first time. The type Punchbowl Formation in Devil's Punchbowl State Park has produced Clarendonian mammals like *Borophagus*, *Plioceros*, and *Pliohippus*. Its fragmentary camel jaws and teeth closely match the distinctively hypsodont Barstovian–Clarendonian *Procamelus occidentalis*. The

Cajon Valley Formation around the Cajon Pass (long misidentified as the 'Punchbowl Formation') has produced a diverse fauna that ranges from the late Hemingfordian to the early Barstovian. The camels recovered from this unit include a nice skull and jaws of *Protolabis saxeus* (typical of the late Hemingfordian) and a skull of *Miolabis fricki* (previously only known from the late Hemingfordian of the Cuyama Badlands of Ventura County, California). In addition, it produces limb bones of a giraffe-like camel, probably *"Aepycamelus" priscus* of the late Hemingfordian. The Crowder Formation along Highway 138 east of the Cajon Pass is thought to be late Hemingfordian based on fossil rodents. It produces fragmentary jaws of a small camelid that best matches the late Hemingfordian taxon *Paramiolabis tenuis*. Thus, there was extensive sedimentation in these fault-bounded basins during the late Hemingfordian and Barstovian, and many of the camels found in the Cajon Valley and Crowder formations are similar to those of the Barstow Formation and Cuyama Formation, as well as taxa best known from the High Plains.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Osteoderms represent a major component of the fossil record for Upper Triassic tetrapods

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Osteoderms, ossified elements embedded in skin, are present in most major tetrapod lineages, including both extinct and extant forms. Commonly interpreted as "dermal armor," osteoderms are often structurally durable, and can make up a major component of the skeleton. These two characteristics uniquely prime osteoderms for preservation in the fossil record. Previous studies have documented that different tetrapod skeletal regions are over and underrepresented in the fossil record. In certain groups (e.g., squamates) one of the most overrepresented skeletal elements include osteoderms. However, few phylogenetic datasets include a significant number of osteoderm characters, even when osteoderm morphological diversity is well documented. To assess the degree of osteoderm skeletal preservation bias, we quantify the parts of the skeleton preserved in various tetrapod clades from the extremely rich Hayden Quarries (Upper Triassic, Chama Basin, NM). We binned collected specimens with verified field identifications (n=2309) by 1) taxonomic identification, and 2) general anatomical region. When considering taxonomic diversity, phytosaurs make up the majority of fossils collected at the Hayden Quarries (38.2%), followed by unspecified archosauromorphs (36.1%). The highest percentage of fossils collected from this site are osteoderms (28.7%), followed by vertebrae (21.3%), and manus/pes elements (15.9%). These results demonstrate that osteoderms account for at least one quarter of the skeletal elements found in the Hayden Quarries. However, for the groups found at Hayden Quarries with osteoderms (phytosaurs, aetosaurs, rauisuchids, *Vancleavea*, and unspecified archosauromorphs), osteoderms make up a small component of the characters used in their phylogenetic analyses. Of seven datasets assessed, osteoderm characters make up only ~1–3% of all characters. A notable exception to this trend is seen with species-level aetosaur data matrices. Osteoderm characters in these datasets make upwards of 37% of all characters. These results, from a targeted survey of a productive fossil horizon bearing several groups possessing osteoderms, illustrates a potential bottleneck in understanding the evolutionary relationships of these important taxa. The discrepancy between the available fossil data, and the underuse of these data in current phylogenetic analyses, warrants consideration of how osteoderms can be incorporated to better infer relationships among Late Triassic tetrapods.

Colbert Prize Session

Tracing docodontan origins: a new Triassic–Jurassic mammaliaform from East Greenland

Patrocinio, Sofia A.[1,2], Panciroli, Elsa[3], Rotatori, Filippo Maria[1,4], Mateus, Octavio[1,4], Milàn, Jesper[5], Clemmensen, Lars B.[6], Crespo, Vicente D.[1,4]

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The earliest evolutionary origins of mammaliaforms in the Late Triassic are still poorly understood, largely due to the limited fossil record from this time. Docodonta are among the earliest-branching clades, and display an unusual degree of ecomorphological diversity, likely linked to their complex molar cusp arrangement. Although principally known from the Middle to Late Jurassic, the group appears to have much earlier origins. Uncovering the emergence of docodontans and their molar complexity informs our understanding of similar changes that took place later in Mammalia, and particularly Therian mammals, which underpins their success and diversity into the present day. We describe a new specimen from the Rhætelv Formation (Rhaetian–Sinemurian) of the Kap Stewart Group in central East Greenland *Nujalikodon cassiopeiae* gen. et sp. nov., the first mammaliaform recovered from this geological context. It is likely Hettangian in age and comprises a partial dentary with a single molar. After micro-CT scanning and digital visualisation, we determine that it belongs to a docodontan, making it one of the oldest members of the group. Phylogenetic analysis places *N. cassiopeiae* at the base of Docodonta. This finding extends the origin of the group to the Latest Triassic-Early Jurassic. The molar exhibits similarities to both the putative Early Jurassic docodontan *Delsatia* and confirmed Middle Jurassic docodontan *Dobunnodon*. The more median placement of its principle cusp complements previous arguments for the docodontan molar cusp pattern emerging from an early ‘tricodonodont’ alignment. Furthermore, its occurrence in Greenland, along with other early taxa in Europe, suggests docodontans emerged in present-day Europe and Greenland, with subsequent dispersal throughout Laurasia in the Middle to Late Jurassic.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The anatomy of a rhenanid placoderm, *Jagorina pandora*, revealed by synchrotron radiation microtomography

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Placoderms (stem-group jawed vertebrates) are central to debates on the evolution of early gnathostome anatomy. One of the major obstacles to resolving the origin of key gnathostome characters such as jaws, paired appendages, and girdles is the scarcity of preserved endoskeletons, which were only weakly ossified in most placoderms. Furthermore, known examples are largely confined to specific subclades (e.g., arthrodires) or are severely disarticulated, preventing phylogenetic generalisations. Here we reinvestigate the anatomy of *Jagorina pandora*, a rhenanid placoderm from the Late Devonian of Germany, known for three-dimensionally preserved shoulder girdles, as well as jaws and the branchial skeleton in articulation with the

endorcranium. *Jagorina* is represented by a single articulated specimen and anatomical investigations have been impeded by the dense matrix and challenging preparation. To resolve the anatomy of *Jagorina* we used propagation phase contrast synchrotron radiation microtomography to develop three-dimensional models of both the exoskeleton and endoskeleton to visualise the anatomy. We provide the first clear three-dimensional description and reconstruction of rhenanid pectoral girdles and fins, revealing previously unknown portions of the dermal and endoskeletal shoulder girdle, which differ significantly from past reconstructions. We also present an updated description of the jaws, branchial skeleton, and endocranium, contrasting these with previous descriptions. We show that similarities to acanthothoracids, an outer-branching ('basal') assemblage of placoderms are more than superficial, extending to details of the brain endocavity. Consistent with this, phylogenetic analyses places *Jagorina* and other rhenanids as a remote sister group of other jawed vertebrates along with acanthothoracids. However, unlike acanthothoracids, they lack any kinetic head-shoulder linkage—an absence we show to be a derived condition. We highlight specific similarities between the shoulder girdles of rhenanids and acanthothoracids relative to crown-group gnathostomes, hinting at areas of conflict in existing phylogenies and challenging current theories about the shared ancestral condition of crown-group gnathostome and placoderms.

Funding Sources Natural Environment Research Council (NERC) NERC Reference: NE/X015335/1.

Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

Successive assemblages of upper Permian vertebrates in the upper Madumabisa Mudstone Formation of the Luangwa Basin, Zambia

Peecook, Brandon R.[1], Kammerer, Christian F.[2], Sidor, Christian A.[3], Smith, Roger M.[4], Tolan, Stephen[8], Viglietti, Pia A.[5], Whitney, Megan[6], Angielczyk, Kenneth D.[7]

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Patterns of upper Permian terrestrial ecosystem evolution are best understood in southern Pangean basins (in present-day Africa, South America, and India), with the Luangwa Basin of Zambia the second richest in terms of collected specimens. The vertebrates of the upper Madumabisa Mudstone Formation (MMF), best preserved in the mid-Luangwa Basin, include diverse therapsids with accompanying pareiasaurian reptiles, a captorhinid, temnospondyl amphibians, actinopterygians, and elasmobranchs. In recent analyses of biogeography and ecosystem structure, the MMF fauna has been treated as a single operational unit, biostratigraphically correlated to the therapsid-dominated *Cistecephalus* and/or *Daptocephalus* assemblage zones of the South African Karoo Basin.

Here, increased sampling, a revised stratigraphic framework, and substantial geological observations in 2018–19 now allow us to delineate at least two distinct vertebrate assemblages from the upper member of the MMF. We also identify four lithofacies, including fluvial, floodplain, lacustrine, and alluvial plain facies. Importantly, the biostratigraphic assemblages are consistent across these lithofacies and are interpreted to represent true temporal signals.

The assemblages mirror turnover events seen in the Karoo Basin between the upper subzone of the *Endothiodon* Assemblage Zone and the overlying lower subzone of the *Daptocephalus* Assemblage Zone (AZ), which brackets a shorter and relatively less well-defined *Cistecephalus* AZ. The lower assemblage is dominated by cryptodonts such as *Oudenodon* and contains records of *Endothiodon*, *Odontocyclops*, the burrowing cistecephalid *Kembawacela*, charassognathid cynodonts, and a small moradisaurine captorhinid. In contrast, the upper assemblage preserves the biostratigraphically significant cynodont *Procynosuchus*, the dicynodontoids *Daptocephalus* and two species of *Dicynodon*, and two novel lystrosaurid species, alongside large-bodied rubidgeine gorgonopsians and diverse therocephalians.

Future work aims to better constrain the loosely *Cistecephalus* AZ-equivalent units in the Luangwa Basin, as well as explore up section to establish the likely presence of truly Changhsingian end-Permian fossils equivalent to the upper portion of the Karoo Basin *Daptocephalus* AZ. Successive vertebrate assemblages in the Luangwa Basin offer a geographically distinct study system for ecosystem changes leading up to the end-Permian mass extinction.

Funding Sources National Geographic Society 158R-18.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Integrated analyses reveal complexity of ecomorphology and reoccurring convergence in non-avialan coelurosaurians

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Coelurosauria, the largest and a late-diverging theropod lineage within which avialans originated, is the most diverse theropod group taxonomically, morphologically, and ecologically. Extensive studies have documented significant disparities in bauplan, locomotion, diet, and ecological niches among non-avialan coelurosaurians. Beyond these divergent traits, evolutionary convergence has been recurrently identified throughout the history of non-avialan coelurosaurians. This study supplements prior work by integrating enhanced sampling of discrete and continuous morphological data, as well as geometric morphometrics of crania, dentition, and limb bones from newly reported theropod specimens. Multivariate analyses are employed to investigate the divergence/convergence of non-avialan coelurosaurian lineages, and key ecomorphological traits are tracked using an updated phylogeny. Preliminary results indicate that the morphospace distribution of major theropod lineages reflects both phylogenetic constraints and ecological signals. Large hyper-carnivores (e.g., late-diverging ceratosaurians, allosauroids, tyrannosauroids, etc.) occupy a clustered morphospace, all featuring heavily built crania as expected. Smaller hyper-carnivores (e.g., early-diverging tyrannosauroids, late-diverging dromaeosaurids, etc.) align with large hyper-carnivores in cranial morphospace but some groups diverge when postcranial morphology is considered. Early-diverging members of compsognathids, dromaeosaurids, and troodontids occupy clustered morphospace along with other early-diverging paravians. Non-avialan coelurosaurian lineages primarily composed of omnivorous or herbivorous members show a more expanded morphospace than hyper-carnivorous theropod groups, possibly indicating the complexity of their ecological niches and foraging strategies. Paedomorphoses have been frequently detected in stem-coelurosaurians approaching avialans, whereas peramorphoses occur deeper within most lineages. Most hyper-carnivorous coelurosaurian lineages converge in body size increase, frequently accompanied by elongate rostrums and forelimb reduction. However, dromaeosaurids deviate by having proportionally long forelimbs, suggesting divergent ecological strategies from early predatory coelurosaurians. The mechanisms

behind the complexly shifting ecomorphological traits in non-avialan coelurosaurians require further investigation integrating phylogenetic, ecological and environmental information.

Funding Sources International Partnership Program of CAS (052GJHZ2024029GC) and the National Natural Science Foundation of China (42372031, 42288201)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Investigating the effects of sample size on diversity and disparity measures in fossil assemblages of the John Day Basin, Oregon, USA

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Species richness is a metric used frequently to describe the biological diversity present in an assemblage. The utility of richness in describing biological variety in an assemblage has been questioned and remains poorly tested thus far. This is especially true in the fossil record, where fossil localities can offer a fragmentary view of the true diversity of an assemblage. In this study, we examine species richness (i.e., diversity) alongside morphological disparity to assess how these metrics change with varying sampling completeness. We perform this study in the remarkably complete mammalian record of the John Day Basin, which offers a unique opportunity to closely examine changes in mammalian diversity across a geographically constrained region. We leverage this record to reconstruct mammalian diversity and disparity patterns across sites of the John Day Basin. We do this by gathering a broad dataset of mammalian occurrences across 11 sites in the John Day Basin and collect M/m1 area for each occurrence, followed by rarefaction analyses to assess sampling completeness. We then perform sequential downsampling of the most well-sampled sites until they exhibit the same sample size as sites which are more incompletely sampled. We find that poorly- and moderately-sampled sites can have skewed distributions of diversity and disparity when compared to the sites with the most complete sampling. This suggests that sample size has an effect on diversity and disparity patterns, and calculations of diversity and disparity should be made and interpreted with caution at sites with poor sampling.

Funding Sources Scientists-in-the-Parks, National Park Service

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Building a future for Ancient Biomolecular research & researchers

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The study of ancient biomolecules has had a phenomenal impact on archaeology and palaeontology over the last few decades, providing exciting new insights into the past that were unachievable through other datasets. It is at its best when it is fully integrated with complementary specialisms, and we have been lucky in attracting the attention of the leading journals. It is an exciting time to be a researcher in ancient biomolecules; now the field is starting to become established, how can we build the best future for our talented researchers?

This field has attracted researchers from a huge range of disciplines; they may have done their undergraduate degrees in physics, chemistry, biology, genetics, archaeology, anthropology, geology, environmental science, computing…the list goes on. This diversity brings new perspectives and expertise, and enormously strengthens the generated research. But this also

brings its own challenges in career development, where in many countries the stable careers are in the single-discipline-focused academic departments, still organised predominantly by teaching. How do we best support not only the individual researchers, but also influence the funding and job landscape so our interdisciplinary researchers can progress? Papers in high-impact journals strengthen portfolios, but the growing discomfort in the increasingly high cost of the big profit-making publishing houses and the move towards open access provide an opportunity for change. These are easier decisions for established researchers to make, but the potential detriment of not publishing in particular journals for early-career researchers is high; how can we improve publishing practices without risk to individual researchers? And ancient biomolecular research is still dominated by the Global North—how can we rebalance the field? As individual researchers, reviewers, editors, colleagues, and members of societies, we have a golden opportunity to shape this important research area—the time is ripe to start discussing what we want the field to look like for these next few decades.

Funding Sources This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (No. 865222 - EQuaTe)

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The evolution of the genus *Pachycrocuta*: current status and future perspectives

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The lineage leading to the living brown hyenas begins in the late Miocene or early Pliocene from somewhat smaller forms with less specialized scavenging dentition. Despite the discontinuities in the fossil record, there is a gradual evolution from the first representatives of the lineage, which can be divided into two successive chronospecies: *Pachycrocuta pyrenaica* (Zanclean) and *Pachycrocuta perrieri* (Piacenzian and middle Gelasian). At this point the lineage splits in two: in Eurasia it evolves towards larger forms specialized in scavenging, giving rise to *Pachycrocuta brevirostris*, while in Africa the lineage practically remains in morphological stasis until reaching the current forms of brown hyenas, which should be ascribed to the genus *Pachycrocuta*. However, in southern Africa the lineage also originates *P. bellax*, which are convergent forms with *P. brevirostris*, although not as specialized in scavenging (other contemporary large hyenas from East Africa can be accommodated within *Crocuta eturono*). The emergence of *P. brevirostris* and *P. bellax* from *P. perrieri* occurs relatively rapidly in the first half of the Gelasian, although in the case of *P. brevirostris* there are transitional forms in the late Pliocene, which seems to indicate a gradual evolution. The fate of the two species was different, while in Eurasia *P. brevirostris* replaces *P. perrieri*, in Africa, *P. bellax* was a short-lived taxon and does not displace *P. perrieri*, which evolves into *P. brunnea*. It would be interesting to analyze whether the extinction of large forms of *Pachycrocuta* was linked to interaction with advanced forms of *Crocuta*.

Funding Sources The grupo PAIDI RNM-146 Junta de Andalucía.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New insights into wing evolution in bats: comparative forelimb morphology and yangochiropteran relationships (Mammalia, Chiroptera)

Perini, Fernando A.[2], Salles, Leandro d.[1], Moraes-Neto, Carlos R.[1], Costeur, Loïc[3], Lehmann, Thomas[4], Smith, Krister T.[4], Beck,

Robin M.[5], Orliac, Maëva[6], Hand, Suzanne[7], Simmons, Nancy B.[8]

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The adaptive radiation of the flying placental mammals is among the most remarkable in vertebrate evolution, encompassing a broad spectrum of foraging strategies—from insectivory and herbivory to nectarivory and even sanguivory—each correlated with distinctive flight modes. This study investigates wing evolution in bats through analyses of humeral and radioulnar morpho-patterns of variation within the Yangochiroptera, the most diverse clade within Chiroptera. Trends in forelimb morphology are interpreted as proxies for the evolution of flight behaviors within this suborder and provide a framework for an experimental ecomorphological (functional) study. All yangochiropteran families are represented, with emphasis on early-branching genera, together with two levels of outgroup comparison: Yinpterochiroptera (including Pteropodidae and Rhinolophoidea), and stem chiropterans as recently detailed by Jones et al., such as the Eocene *Hipposideros schlosseri*, *Archaeonycteris trigonodon*, and *Vielasia sigei*—understood by Hand et al. to represent the immediate sister group of crown Chiroptera. Bat humeral and radioulnar anatomy is re-examined in an expanded set of anatomical features, resulting in a significantly enriched morphological dataset. The evolving yangochiropteran data matrix currently incorporates over one hundred primary homology hypotheses for both bone complexes. Possibly one of the most drastic morphological disruptions observed among yangochiropterans involves a molossid rearrangement of the lateral portion of the distal radius, with the ulnar wing aligned anteriorly. The overall understanding is that both humeral and radioulnar morphologies—particularly the articular ends and planes of diaphyseal curvature and torsions—carry substantial phylogenetically informative content, with strong potential to contribute not only to yangochiropteran relationships but also to the phylogenetic reconstruction of the entire order Chiroptera.

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new ichnospecies of *Nihilichnus* from the Paleogene of South America: trace makers and ichnological and paleobiological implications

Perini, Fernando A.[1], Lages, Sergio[2], Carneiro, Leonardo d.[3], Andrade, Luana C.[4], da Silva, Rafael C.[5]

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Dentalites on bones represent important evidence for revealing prey preferences and the feeding ecology of extinct animals. Here, we present a new ichnospecies of *Nihilichnus* based on perforations on mammal jaw-based specimens from the Paleogene of South America. The new ichnotaxon, *Nihilichnus* isp. nov., is identified as a perforation with

associated longitudinal bone fractures. We also present new concepts for ichnological studies in bone substrates: discrete and composite surface patterns and 'antagonistic marks.' A discrete pattern represents a bone specimen with a single or a few organized machichnid traces, resulting in little modification of its surface. A composite pattern represents a bone specimen with many machichnid traces, with organized and non-organized machichnid traces (chaotically dispersed), resulting in visible alteration of bone natural surface. These patterns correlate well with mammalian and mesoeucrocodylian tracemakers, considering Paleogene (Paleocene and Eocene) South American land faunas. The 'antagonistic marks' represent traces produced by occlusally antagonistic teeth (upper and lower teeth), sharing an opposed placement on a substrate. For these traces, the mark made by a jaw teeth-substrate contact is more developed than that of a skull teeth-substrate contact. Two of the studied specimens, medium-sized South American native ungulates (SANUs), display 'antagonistic' perforations assigned to *Nihilichnus* isp. nov. on both lateral sides of the symphyseal part of their jaws, mandatorily identifying their predators as medium-sized mammals, most likely sparassodont metatherians.

Funding Sources CAPES, 88887.712796/2022-00; CNPq, 140891/2020-0 - GD; CNPq, 407158/2022-7; FAPERJ, 966 E-26/210.294/2021; FACEPE, BFP-0203-1.07/23, Brazil.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Characterizing the braincase anatomy of early dinosauriforms: the braincase of *Asilisaurus kongwe* and its implications for dinosauriform evolution

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The arrangement of clades near the base of Dinosauria has been a subject of continued debate. In particular, the placement of Silesauridae has been tumultuous in recent phylogenetic analyses, with some placing them as a monophyletic clade sister to Dinosauria, and others as a paraphyletic grade within ornithischian dinosaurs. The anatomy of the braincase of many early dinosaurs and their close relatives, and hence phylogenetic information thereof, is one aspect that is largely undersampled because of the lack of well-preserved material and the near lack of undocumented variation within a species. Here, we describe the braincase of the silesaurid *Asilisaurus kongwe* from the Middle Triassic Manda Beds of Tanzania, an exemplary taxon known from excellent skeletal material from multiple individuals. Among our sample of *Asilisaurus* material is a complete braincase, a partial braincase from the holotype site, and dozens of disarticulated elements including a parabasisphenoid, three otoccipitals, and at least five basioccipitals from a single locality. We use computed tomography (CT) data and digital segmentation software to reconstruct and describe the braincase of *Asilisaurus*. The braincase contains several similarities to *Silesaurus* which could represent apomorphies characteristic of a potential monophyletic Silesauridae, as these features are not present in ornithischian dinosaurs. These characters include the presence of a shallow recess on the ventral surface of the parabasisphenoid, the cerebral branch of the internal carotid artery entering on the ventral surface of the parabasisphenoid, and the two openings of CN XII being placed directly dorsal to each other on the otoccipitals. Furthermore, the exoccipitals do not meet on the braincase floor in *Asilisaurus* similar to unequivocal members of Dinosauria. The braincase of individuals of *Asilisaurus* does not appear to be as variable as in *Silesaurus*, but variation is certainly present in at least a few characters (e.g., size and shape of basitubera, shape and spacing of the foramen for the entrance of the cerebral branch of the internal carotid artery). Our results further elucidate the braincase character states found in the anatomy of early dinosauriforms, present potential synapomorphies of a monophyletic Silesauridae

clade, and represent just the third time silesaurid braincase material has been described in detail.

Funding Sources National Geographic Research Grant 9606-14, NSF ELT 1337291, Virginia Tech Department of Geosciences

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

The diagenesis of dental enamel proteins in different pH solutions during a thermal degradation experiment

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This study investigates the effect of pH on molecular diagenesis within dental enamel under controlled thermal degradation to improve our understanding of ancient enamel proteome preservation. It also provides a base for future molecular taphonomy experiments on enamel. Due to its highly mineralized and closed-system nature, enamel provides a distinct preservation environment compared to other mineralized tissues. For this reason, paleoproteomic studies have increasingly targeted enamel to address evolutionary questions by conducting phylogenetic analyses based on ancient and modern protein sequences. While many studies have investigated bone collagen degradation under experimental conditions, enamel protein diagenesis is not as well understood. Over time, proteins undergo hydrolysis and chemical changes to the amino acid side chains. Deamidation is a modification that occurs in asparagine and glutamine residues. It accumulates over time and is influenced by environmental conditions, making it a useful marker of degradation. Although acidic conditions can lead to enamel demineralisation in vivo, it is essential to investigate the impact of pH on enamel diagenesis in degradation experiments to assess the potential for recovering peptides and to interpret the levels of fossil degradation in different contexts. In this study, thermal degradation of modern sheep teeth was conducted at 100°C in acidic, neutral and alkaline solutions for 384 hours. Enamel samples were analysed using high-resolution mass spectrometry at 0, 6, 24, 96, and 384 hours. There was no strong evidence of pH-based differences in the overall deamidation rates of the main enamel matrix proteins. Furthermore, the asparagine and glutamine residues in amelogenin underwent complete deamidation after 96 and 384 hours, respectively. These results suggest that the mineral matrix of enamel acts as a buffer, resulting in similar deamidation patterns at different initial pH levels. They also indicate that deamidation saturates much earlier than other degradation markers. The sequence coverage and peptide size of amelogenin, enamelin and ameloblastin remained stable over time, regardless of the initial pH conditions. These results reinforce enamel's potential for long-term molecular preservation and highlight the need for experiments of an extended duration to detect the impact of late-stage hydrolysis. Further analyses are being carried out to investigate the implications for phylogenetic studies.

Funding Sources University of Manchester Research Training Support Grant.

Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

Comparative evidence for independent evolutionary reductions of tail length among stem mammals

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Synapsida is the mammalian total group and originated approximately 305 million years ago during the Carboniferous period. The evolution of crown mammals from stem synapsids

involved a drastic reorganization of the locomotory apparatus, including a reduction in the length of tails. Despite the dramatic variation in tail length in synapsids (3–80 vertebrae), it has been understudied relative to the rest of the skeleton, in part due to historical collection biases focusing on cranial material; even recent work on the postcranial skeleton has also regularly excluded the tail. This has meant that historical assumptions about tail length referring to general 'conditions' for major groups (i.e., 'pelycosaurs' having long tails, therapsids having short tails, and crown mammals having longer tails again) have gone without rigorous or quantitative testing.

Here, we document patterns of tail evolution from the origins of Synapsida to the earliest crown-group mammals using ancestral state reconstruction. Our dataset contains caudal vertebral counts and proportional vertebral lengths in 53 species of non-mammalian synapsids, including 12 'pelycosaurs', 27 therapsids, and 14 cynodonts. A single substantial reduction in tail length occurs at the root of Therapsida, indicating a shift from the long tails (>40 vertebrae) of the 'pelycosaurs' to the mid-size tails (20–40 vertebrae) of the therapsids. However, we also find that within therapsids there are at least three different independent evolutions of derived short tails (1–20 vertebrae), in Titanosuchia, Dicynodontia, and Therocephalia. This suggests that the previously understood 'therapsid condition' of short tails does not reflect the diversity of tail lengths seen in the group. In contrast, intermediate tail lengths were maintained on the direct stem lineage leading to mammals. Our results indicate that the wide ecomorphological diversity of mammalian tails seen in the Mesozoic does not arise from a re-elongation of the tail but rather from an ancestral condition of a mid-size, flexible tail.

Funding Sources NERC Award NE/S007474/1

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Back to the past: the middle and inner ear of selected extinct and extant rodents and its morpho-functional implications

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Rodents are the most diverse group of mammals, inhabiting almost every region of the world with a variety of lifestyles. In particular, extant species of Eusciurida (Sciuridae, Gliridae, *Aplodontia rufa*) are characterized by different body plans, varied locomotor behaviours and habitat use. However, assigning locomotion modes to extinct taxa of rodents is very difficult. Usually, fossil remnants of small mammals are mostly represented by isolated teeth or jaw fragments. In this study, we focus on the ear region, which is responsible for detecting sound (middle ear ossicles and cochlea of the inner ear) and balance (semicircular canals, utricle and saccule of the inner ear). Our aim is to identify the relationships between ear morphology and locomotor behaviour in extant rodents, in order to reconstruct the ecology of fossil taxa. For the extant sample, we used a previously published data set, which comprises 45 extant specimens of Eusciurida (n = 40, including 33 Sciuridae and seven Gliridae) and selected further mammals (n = 5), to elucidate the locomotion mode of nine fossil representatives of rodents. Based on multivariate analyses of the three-dimensional linear and angular measurements of the vestibular system and the cochlea, as well as the volume of the different parts of the inner and middle ear, we reconstructed the palaeobiology of sciurids. The high cross-sectional diameter of the semicircular canals and the more acute angle between the anterior and posterior canals represent the main anatomical features to

distinguish fossorial taxa from arboreal and gliding taxa. In contrast to previous studies focussing on mammals in general, locomotion types in the investigated rodents cannot be distinguished based on semicircular canal height or width. Among our fossil sample, we propose that the most basal taxa were fossorial (†*Ischyromys*), before evolving into arboreal species (†*Palaeosciurus*) with only one occurence of 'leaving' trees as gliding taxa (Pteromyini).

Funding Sources Fazit Foundation (Frankfurt; PhD grant in 2012)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Whose tracks are these? 3D reconstruction of the fossil turtle *Proganochelys quenstedtii* to estimate its locomotion—preliminary results

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3D technologies are revolutionizing paleontology by facilitating precise visualization of fossil material and conducting virtual experiments that were previously unfeasible. They are especially useful for computer simulations of movement in ancient animals, allowing quantitative testing of hypotheses. One such hypothesis is the assignment of the Mesozoic ichnogenus *Chelonipus* to early (stem) turtles. Here, we built the first 3D musculoskeletal model of the stem turtle *Proganochelys* (Late Triassic of Germany and Switzerland), one of the most basal testudinates and the most completely preserved Triassic turtle, to test its locomotor capabilities using a biomechanical model. Due to similarities in the attachment of the pelvis (not sutured to the shell), *Proganochelys*, as the model Triassic turtle, previously was assumed to have a similar mode of locomotion and range of movements as cryptodiran turtles, allowing it to produce trackways of similar characteristics, and thus a viable candidate for the trackmaker of *Chelonipus*. However, numerous differences regarding the pectoral girdle, appendicular bones, and, presumably, the muscular system were thus far ignored and the locomotion of the earliest turtles was never rigorously tested. Moreover, new data show that the distribution of *Proganochelys* was limited compared to *Chelonipus* and that another clade, the Proterochersidae, was much more widespread. The latter turtles had the pelvis co-ossified with the shell, making their locomotion potentially more comparable with pleurodires. Finally, *Chelonipus* is problematic because it appears long before known representatives of the lineage evolved the shell. We digitized bones of *Proganochelys* using surface scanning and photogrammetry. The skeleton was virtually assembled, creating a virtual 'marionette' with an established workflow. Musculature was also reconstructed based on osteological correlates and phylogenetic bracketing. The next step will involve reconstructing the 3D musculature in the model, followed by simulations of potential locomotor patterns. The resulting data will be compared with data from extant turtles and other shelled tetrapods, along with the ichnological record to evaluate their congruence with *Chelonipus* trackways.

Funding Sources National Science Centre, Poland grant no. 2020/39/B/NZ8/01074 to T.S.

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

News from the South: a Brazilian perspective on the Triassic Evolutionary Upheaval

Pinheiro, Felipe[1], Machado, Arielli[1], Paes Neto, Voltaire[2], Farnsworth, Alex[3], Simoes, Tiago R.[4], Pierce, Stephanie E.[5]

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Although the Triassic marked the diversification of key clades that came to dominate modern ecosystems, its continental sedimentary record is very patchy. Consequently, much of our knowledge on Triassic continental faunas—especially for ecosystem-level paleobiological studies—is restricted to a few geological units worldwide, often marked by geographic and/or temporal biases. In this context, there has been a significant increase in the description of new key taxa from the Brazilian Triassic over the last two decades, accompanied by a robust biostratigraphic framework. However, all these new data are not yet integrated into paleobiological research based on fossil occurrences, such as diversification dynamics. To address this gap, our research group assembled a new comprehensive database of fossil tetrapod occurrences from the Brazilian Triassic, including taxonomic, locality, biostratigraphic, and collection data. This effort resulted in 5,084 curated records based on validated specimens from 19 museum collections (13 in Brazil, six abroad)—a 93.72% increase over existing data available on the PBDB. This effort was complemented by literature review and field prospecting, which significantly increased the number of occurrences, especially of early Triassic archosauromorphs and temnospondyls. Our goal is to track terrestrial vertebrate evolutionary trajectories through the Triassic in light of the Permo-Triassic extinction by incorporating the Brazilian fossil data into global frameworks and modeling niche dynamics among major Triassic lineages. Here, we integrated fossil occurrences with BRIDGE paleoclimate simulations to identify predictors of niche suitability for synapsids, reptiles, and temnospondyls. Contrary to traditional views, niche availability in reptiles and temnospondyls was less affected than synapsids by the mass extinction and, in fact, these clades underwent niche expansion and peak diversification early in the Triassic. While temperature change and seasonality emerged as dominant drivers of niche availability, behavioral traits and diet—such as burrowing and piscivory—were also key factors influencing biotic recovery during the Early Triassic. Our new database of Brazilian Triassic tetrapods has the potential to significantly enhance our understanding of the global Triassic record, while also serving as a foundation for future studies beyond the scope initially envisioned by our team.

Funding Sources Lemann Brazil Research Fund, Conselho Nacional de desenvolvimento Científico e Tecnológico (316811/2021-1, 406902/2022-4).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

An update on placeriine dicynodonts: comparative histology, a new taxon, and reorganized phylogeny reveal diversity in body size and life histories

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Placeriine dicynodonts are a clade of large herbivorous stem-mammals that span the Middle to Late Triassic of Pangea, including North America, Africa, and Europe. They uniquely attained the largest body sizes of any non-mammalian synapsid (~12,000 kg), as well as being among the last synapsid megafauna before Cenozoic mammal diversification. Here, we integrate histological and phylogenetic analyses to evaluate life histories of placeriines. In addition, we describe a new unnamed taxon, the smallest known placeriine (<250 kg), from fragmentary cranial and postcranial material of multiple individuals from the "Isalo II" fauna of Madagascar. To test the placement of Placeriinae as a distinct clade of stahleckeriids, and the position of the new taxon, we re-evaluated their interrelationships by rescoring phylogenetic characters for each taxon in a pre-existing matrix of dicynodonts. We then isolated the seven confirmed placeriines, including the Isalo II taxon, from this tree and scored them for additional characters unique to placeriines to resolve their relationships. Phylogenetic results show the geologically older, southern African placeriines, including the Isalo II taxon, among the most basal members, with the newer, North American/north African taxa being closely related, indicating a likely southern Gondwanan origin for the clade.

We further assessed placeriine limb bone histology by characterizing the distribution of primary fibrolamellar and Haversian tissues in *Argodicynodon boreni*, multiple individuals of *Placerias hesternus*, and *Moghreberia nmachouensis.* We compared their percentages of cortical remodeling to construct curves denoting the histological ontogenetic stage of each individual. We found a higher percentage of remodeled Haversian bone in *A. boreni* than in similar and larger-sized *P. hesternus*, supporting that *A. boreni* represents a smaller subadult or adult animal and not a juvenile. The replacement of primary by secondary bone in *A. boreni* is also more abrupt. *P. hesternus* and *M. nmachouensis* have more fibrolamellar bone than *A. boreni*, indicating a possible faster bone growth rate. Ancestral state optimizations of body size indicate that size did not shift in a consistent direction in placeriine phylogeny, with multiple increases and decreases in size. Histological variation between closely related taxa shows that placeriine life history was evolutionarily labile, thus explaining the clade's extreme size disparity over time.

Colbert Prize Session

Utilizing past archives to create long-term biodiversity baselines for declining UK bird populations: enhancing conservation and ecological understanding

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Currently, 40% of birds are in population decline, with 20% of species at risk of extinction. Little availability of long-term avian monitoring means timescales of data are relatively short compared to those needed to establish relevant biodiversity baselines prior to an anthropogenic fingerprint. Using zooarcheological and fossil records can provide the only empirical data on long-term interactions between biodiversity and climate from a natural, pre-human state; necessary for meaningful conservation management and reintroduction assessments. Here, we present two case studies based on the rich past archives of birds in the UK: the grey partridge (*Perdix perdix*) and black grouse (*Lyrurus tetrix*). Both species exhibit contracted, fragmented habitats, have decreasing breeding populations relative to the widespread and abundant distribution that past records suggest, and are on the UK's Red List for Threatened Birds. Species distribution modelling (SDM), using the MaxEnt algorithm, was employed to generate high-performing habitat

suitability models under various climate scenarios in the past, present, and future, enabling assessment of range shifts and drivers of decline. By training the SDMs with presence data from present-day monitoring and from past records separately, we compare how using different time bins can affect resulting habitat suitability maps. Both past and present data predict a poleward shift under future warming climate thresholds, which decreases the overall available suitable land to support these species in the UK. Incorporating past data into these models, however, highlights natural ecologically suitable areas in the future that are otherwise masked by only looking at truncated present presence values, already sculpted in an anthropogenic landscape. Although less severe than today, archeological records can also display a landscape shaped by human activity. Therefore, we include anthropogenic biomes in our models, to account for anthropogenic habitat alteration, allowing a more realistic prediction of habitat suitability by selecting natural versus anthropogenic landscapes, even in the past. This unlocks new potential for areas in which these species have previously persisted but are unrealized as suitable when ignoring past distributions. Incorporating past occurrence data is therefore essential for establishing a temporal framework that links patterns of presence and disappearance to regional landscape changes.

Funding Sources The Royal Society

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Caudal autotomy in tanystropheids (Reptilia, Tanysauria): the first known occurrence of tail shedding in archosauromorphs

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Caudal autotomy (tail shedding) is a defense strategy observed in living salamanders and lepidosaurs. Researchers have hypothesized that fossil tetrapod lineages such as microsaurs, captorhinids, mesosaurs, and tanystropheids were capable of intravertebral caudal autotomy, which involves self-amputation of the tail along transverse fracture planes present in individual vertebrae. This study aims to thoroughly survey Tanystropheidae for further evidence of caudal autotomy, which was first proposed in the 1973 redescription of *Tanystropheus longobardicus*. Since the redescription of *T. longobardicus*, other tanystropheids from around the world have been identified with caudal vertebrae possessing transverse septa associated with fracture planes. For this study, 48 tanystropheid caudal vertebrae from the Upper Triassic strata of western North America were examined and photographed at Petrified Forest National Park and the Museum of Northern Arizona (43 specimens from PFV 456 in Petrified Forest National Park, AZ, and five from the *Placerias* and Downs quarries (MNA 207) near Saint Johns, AZ). Additionally, photographs of tanystropheid caudal vertebrae from Ghost Ranch, NM, the Cow Branch Formation, VA, and the Besano Formation of the Southern Alps were examined for evidence of caudal autotomy. Tanystropheid caudal vertebrae from Petrified Forest National Park and the Argana Formation, Morocco, were scanned using X-ray microcomputed tomography. The scans provided internal visualization of the fracture plane and associated transverse bony septum; the bony septum extends internally through the centrum, comparable to the autotomous vertebrae of extant lepidosaurs. Doubt surrounding tanystropheids having autotomous tails is partially due to the aquatic to semi-aquatic lifestyle and caudal propulsion hypothesized for these reptiles. However, based on their limb proportions and pes anatomy, it is likely that tanystropheids relied on hindlimb-driven propulsion through the water. Therefore, a tanystropheid's ability to navigate its

environment would not be drastically inhibited if it were to shed its tail to evade a predator. Current insights into tanystropheid locomotion, along with the transverse caudal septa identified in this study and past reports, indicate that tanystropheids may have been capable of shedding their tails, making this the first known occurrence of this defense mechanism in archosauromorphs.

Funding Sources Petrified Forest Museum Association.

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Revisiting the pterygoid-palatine complex: ontogenetic and ecological insights into evolution of the crown bird palate

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Crown birds, the only surviving lineage of theropod dinosaurs, represent one of the most species-rich vertebrate clades, displaying exceptional ecological and morphological diversity. The clades Palaeognathae and Neognathae, the deepest split within crown birds, are distinguished by differing arrangements of the pterygoid-palatine complex (PPC), the main component of the avian cranial kinetic system. For over a century, paleognath PPC morphology, with fused and immobile palatal elements, had been considered plesiomorphic for crown group birds due to its resemblance to non-avian theropods and early avialans such as *Gobivenator* and *Archaeopteryx*. However, unexpected fossil evidence from the Late Cretaceous ichthyornithines *Ichthyornis* and *Janavis* suggested that a mobile, neognathous-like palate may have been ancestral for crown birds, challenging the traditional paradigm. Reconciling these two evolutionary scenarios necessitates revisiting the mid-20th century proposal that neoteny (i.e., the retention of ancestral juvenile features in adults) may underpin the distinctive palatal condition of paleognaths, rather than paleognaths retaining ancestral palatal features. However, this evolutionary-developmental hypothesis has yet to be tested with a broad phylogenetic sample, and our understanding of the relative influence of ontogenetic and ecological factors on the evolution of the PPC remains limited. To address these knowledge gaps, we quantitatively explored changes in PPC morphology across post-hatching ontogeny in 70 bird species spanning all major extant avian lineages and investigated links between PPC morphology and feeding ecology. Our results show that paleognaths follow distinct developmental trajectories, but we found no support for heterochrony as a primary driver of these ontogenetic differences, rejecting the hypothesis that paleognaths exhibit neotenic palates. Instead, factors related to developmental mode seem to play a greater role: precocial birds show PPC ontogenetic trajectories that tend to converge in form as skeletal maturity is reached, whereas altricial birds show the opposite pattern: species tend to diverge in PPC form through ontogeny. Combined with morphological data from key stem birds, our findings help establishing a holistic framework for understanding the developmental, functional, and ecological factors underlying the evolution of palatal morphology and cranial kinesis in birds.

Funding Sources Swiss National Science Foundation (SNSF) – Return CH Postdoc.Mobility P5R5PN_230653

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Hungry for more: neuroanatomical insights into the evolution of macrophagy in metriorhynchid crocodylomorphs

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Thalattosuchia were a clade of Mesozoic crocodylomorphs that evolved to have an increasingly pelagic lifestyle, culminating in the aberrant metriorhynchids, the only fully ocean-living group of archosaurs in Earth history. Their evolutionary transition from terrestrial and semiaquatic ancestors, which had a traditional crocodile-like bauplan and ecology, has motivated extensive studies of this clade. Recent osteological studies of Thalattosuchia and other marine reptiles have analysed the evolution of different feeding styles in the Jurassic seas, as these animals filled a variety of ecological roles after they entered the open ocean. Some derived thalattosuchians, the geosaurin metriorhynchids, became high-order predators of the Middle Jurassic seas: macrophagous hunters akin to the killer whale. Little is currently known about the brains and sensory abilities of these predators, despite a wealth of work on endocranial evolution in other thalattosuchians. We use high-resolution computed tomography (CT) scans to describe the endocranial anatomy of seven metriorhynchoid specimens, with a focus on understanding the neurosensory systems of two large macrophagous geosaurins, *Plesiosuchus manselii* and *Torvoneustes coryphaeus*. We show that the neuroanatomy of *Plesiosuchus* and *Torvoneustes* is not drastically different from smaller non-macrophagous metriorhynchids, but they do have some morphologies not observed in other metriorhynchids, most notably, a reduced pituitary fossa chamber (which housed both the pituitary gland and vasculature). It has been suggested that the enlargement of the pituitary fossa chamber in thalattosuchians was linked to thermoregulation and/or osmoregulation. We hypothesize that the reduced size of the pituitary fossa chamber in these large geosaurins is linked to gigantothermy. We ran a principal component analysis (PCA) of linear measurements of the endocranial anatomy of our endocasts and a suite of previously published specimens, and then applied K-means clustering to search for significant groups in the morphospace. We identify four distinct morphotypes, with *Plesiosuchus* and *Torvoneustes* within their own cluster. Thus, although not immediately apparent from gross morphology, the neuroanatomy of macrophagous metriorhynchids is statistically distinctive from that of non-macrophagous metriorhynchids and other crocodylomorphs, suggesting that diet may have had an effect on gross endocranial and brain anatomy in these marine reptiles.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

First occurrences of Trionychidae (Testudines, Cryptodira) from the Miocene of Poland expand the biogeographic range of the family

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Although turtles of the group Trionychidae are quite well-known in the Miocene in Europe, they had never been found in Poland. Here, we describe the first Polish remains from this family, which come from three new Middle Miocene vertebrate localities in the south of the country. The material includes an incomplete skull, together with several shell fragments. The skull is described using both morphological and µCT data, allowing a detailed assessment of the structures. Through detailed comparisons and a

thorough review of the variation of cranial characters in extant and extinct trionychids, and taking into consideration the already existing occurrences of the family in the Miocene of Europe, we propose a tentative assignment for this specimen to *Trionyx* cf. *T. vindobonensis*. These new occurrences are of particular interest as they allow the paleobiogeographic range of Trionychidae to be extended during the Miocene, and hint at an environment still suitable for thermophilic organisms between the Middle Miocene Climatic Optimum and Late Miocene "washhouse" climate in the northern part of Central Europe.

Funding Sources Naurodowe Centrum Nauki OPUS 2022/47/B/ST10/02686, 2023/49/B/ST10/02631, POLONEZ BIS 2022/45/P/NZ8/00600 and University of Warsaw grant 501-D113-01-1130202.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Elucidation of functional morphology in the avian rhamphotheca using finite element analysis

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Archosaur beaks are comprised of a bony core surrounded by a keratinous rhamphotheca. While both the bony and keratinous elements of the beak change dramatically among extant bird species, the functional consequences of relative changes to bone and keratin shape and proportions remain unexplored.

Therefore, we lack an understanding of the functional consequences of the same variation in extinct beaked species, including many non-avian dinosaurs, where the keratin itself may be poorly preserved or even entirely absent from a fossil specimen.

Using CT scans, a 3D model of a Eurasian magpie (*Pica pica*) beak was created, and geometric transformations of the upper rhamphotheca were used to explore variation in rhamphotheca form and function. Transformations included overall thickness, ventral thickness, tip extension and variation in the posterior boundary, thus creating a theoretical morphospace which mimics the morphological variation seen in modern birds.

Finite element analysis was then used to examine stress strain and deformation in the generated models to quantify the functional consequences of the geometric changes. In addition, the relative importance of geometry versus building materials was examined through adjusting the material properties of both bone and keratin.

The analyses show that changes to the overall shape of the rhamphotheca are more important than material properties in determining stress and strain patterns. We therefore note that even when a relatively conservative, comparative approach is used to build finite element models, the change in model shape caused by the presence of a rhamphotheca can dramatically affect the nature of deformations (even though material properties still play an important role in determining the magnitude of these deformations).

We show that relatively long beaks with extended tips are more susceptible to dangerous bending moments, whereas thickened beaks are better at resisting higher bite forces. Conversely, adjusting the posterior margin of the beak has a relatively limited effect on performance.

This exploration of hypothetical geometries with finite element analysis not only provides us with a better understanding of the interplay between function, morphology and material properties in the evolution of bird beaks but also has implications for the best practice reconstruction of the rhamphotheca in extinct beaked organisms.

Funding Sources NERC NE/S007458/1 Studentship 2928956, and BBSRC BB/X014479/1

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

The point of it all: exploring constraints on pointed tooth form in tetrapods

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Life on Earth exhibits a staggering array of forms. A central challenge in paleontology is to understand the processes that both drive and constrain this diversity across deep time. Seilacher's 'morphodynamics' offers a framework for exploring this, proposing that an animal's form is the product of the interplay of functional, developmental, phylogenetic, and ecological factors. However, operationalising this framework in a unified, quantitative design-space has historically proven difficult. Pointed teeth are near ubiquitous among amphibians, reptiles, and mammals, representing the most common dental morphology in tooth-bearing tetrapods. With a deep evolutionary history, broad taxonomic distribution, and well-studied function and ecology, pointed teeth are an ideal system for investigating drivers and constraints on form. Here, we applied a unique approach that integrates 3D morphometrics, a morphogenetic model (the Power Cascade), and biomechanical testing with phylogenetic and ecological analyses to interrogate the full set of factors proposed by Seilacher. First, we used the Power Cascade to generate 75 tooth models representing the range of developmentally possible forms. These were integrated into a combined morphospace with empirical teeth from 205 extant tetrapod species via 3D geometric morphometrics. Next, in a subset of teeth, we assessed functional performance using finite element analysis to estimate breakage resistance and tip sharpness as a proxy for puncture efficiency, which were combined within a Pareto framework to assess optimality. Finally, we included phylogenetic and dietary information to test for relationships with tooth shape. Results show that empirical forms are constrained within the morphogenetic model, occupying less of the morphospace; however, the areas they do occupy are associated with higher optimality. Surprisingly, phylogenetic and dietary analyses show weak or no relationship with tooth shape. Thus, we identify functional optimality as a dominant force shaping pointed tooth morphological diversity. By integrating empirical data within a morphogenetic framework and evaluating all four of Seilacher's factors in a unified design-space, this study presents a rare, quantitative test of morphodynamic theory. More broadly, it sheds new light on the macroevolutionary processes that have shaped tooth form across deep time.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Digital reconstruction of masticatory musculature and jaw mechanics in Soricidae

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Efficient mastication in mammals is governed by the intricate interplay between jaw shape, tooth morphology, and the arrangement of the masticatory muscles. Already in Early Jurassic morganucodontans, a subdivision of the masticatory adductors (temporalis, masseter, and pterygoid) has been suggested, allowing for

more complex jaw motions. The angular process is regarded as crucial in the evolution of mammalian chewing, though its exact function remains debated. The jaw apparatus in Soricidae is characterized by an elongated angular process, as well as a unique double-articulation of the condylar process. While complex jaw motions in Soricidae have been proposed, the details of the double-articulation's role for jaw motions and mastication remain unclear. To investigate the function of these features, we combined scanning electron microscopy of tooth wear with diceCT-based muscle reconstructions for modeling jaw motions using the Occlusal Fingerprint Analyser (OFA) software.

We show that the double-articulation of Soricidae enables complex rotational jaw motions during the power stroke. The highly subdivided masseter and internal pterygoid muscles, both inserting on the angular process, permit controlled yaw and roll (inversion and eversion) of the mandible. Strong eversion of the mandible at the onset of the power stroke facilitates precise molar cutting, followed by an inversion during the shearing phase. This produces rounded and directionally variable striations on the distal flank of the trigonid and talonid. During the crushing and grinding phase, alternating inversion and eversion generate varied directional movements of the protocone through the talonid basin, leaving distinct wear patterns. Precise occlusion is maintained in older individuals with heavily worn teeth by adapting the rotational jaw motions. During the rotational motions of the power stroke, the ventral articular facet of the condylar process performs rotational motions, while the dorsal articular facet moves laterally.

In general, the double articulation, in conjunction with the complex masticatory musculature, enables guided and controlled jaw motions that enhance food fragmentation by increasing the variation of impulses applied to the bolus. This helps to conform to the high metabolic demands of Soricidae. Our study highlights how the interplay of muscle arrangement, jaw morphology, and tooth wear shapes jaw function, offering broader insights into mammalian mastication.

Funding Sources DFG (Deutsche Forschungsgemeinschaft), grant number: MA 1624/24-1

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

Can the evolution and origins of laryngeal echolocation in bats be revealed by examining cranial growth rate?

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Bats (Order Chiroptera) represent nowadays approximately a fifth of mammalian species diversity. The ability of laryngeal echolocation which characterizes these flying mammals has significantly constrained the evolution of their skull. The current bat fossil record does not provide sufficient evidence to determine the origins of laryngeal echolocation. Extinct bat species are morphologically and anatomically comparable to extant bat species and previous

studies have suggested extinct bat species were likely able to use self-powered flight and laryngeal echolocation. The question of whether laryngeal echolocation evolved once in the common ancestor of all bats or twice convergently in rhinolophoids and yangochiropterans remains highly debated. This question could be tackled from a developmental approach by describing mechanisms that drive evolutionary morphological variation and highlighting different strategies in shaping cranial features associated with laryngeal echolocation. Only a few studies on fetal bat specimens were undertaken on the formation and growth of cranial bones, whereas the majority of the differentiation of bony elements between bat species occurs prenatally during the earlier stages of development and could be crucial to better understand the evolutionary history of laryngeal echolocation in bats. In this study, ontogenetic trajectories of cranial elements from foetal to adult stages of the three major bat lineages (i.e., pteropodids, rhinolophoids, and yangochiropterans) were analysed and compared to those from other boreoeutherian mammals to observe whether heterochronic changes occurred across bat phylogeny. An unparalleled sample of 350 crania of fetuses and neonates from 17 bat and 11 non-bat boreoeutherian mammal species were 3D scanned, and all cranial elements were individually segmented. Volumetric data were extracted to quantify cranial growth rate. Principal component analysis and ancestral state of cranial bone growth were used to reconstruct developmental patterns and evolution of bone growth within bat phylogeny. Our results show yangochiropterans experience slower bone growth compared to pteropodids and rhinolophoids. Different developmental patterns to shape the skull are observed in yangochiropterans compared to other bats, resulting in alternative approaches to emit echolocation calls and providing additional evidence of the convergent evolution of laryngeal echolocation between yangochiropterans and rhinolophoids.

Funding Sources Australian Research Council FT200100822, Naito Foundation, JSPS 21H02546, 21K19291, and 22KK0101, JST JPMJFR2148

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A nothosaur-dominated reptile assemblage from the eastern Alpine Triassic (Anisian) of Switzerland

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In the Middle Triassic, sauropterygians were a diverse and disparate clade of marine predators spanning the Eastern and Western Tethys. In the latter, sauropterygians have been historically best documented in the Muschelkalk deposits of the epicontinental Germanic Basin, and in the intraplatform basin facies of the Alpine Triassic located on the margin of the Tethys Ocean. Despite the geographic proximity of these provinces, comparisons have been limited by conspicuous differences in depositional settings. Here, we describe a new sauropterygian assemblage from the upper Anisian S-charl Fm. of the eastern Swiss Alps (Canton Grisons) enabling closer comparisons between these so far disparate faunas. The mainly fragmentary and disarticulated vertebrate remains, interpreted as washed-in carcasses, originate from a tidally influenced lagoonal setting that shows strong environmental and taphonomical similarities to the fossiliferous localities of Winterswijk from the Germanic Muschelkalk, but is roughly contemporaneous and geographically close to the Besano Fm. at Monte San Giorgio in the Southern Alps. The overall taxonomic composition of the assemblage is comparable to that of the Besano Fm. and includes placodonts, pachypleurosaurs, nothosaurs, *Tanystropheus*, and other indeterminate reptiles. However, differing from the Besano Fm., eusauropterygian nothosaurs are numerically dominant, representing half of the total number of specimens recovered. Diagnostic nothosaur remains can be assigned to the eponymous genus *Nothosaurus*, abundant in the Muschelkalk but

classically considered rare in the Alpine Triassic. These remains document not only the large and widespread *N. giganteus*, but also a new small-sized endemic species of *Nothosaurus* represented by associated partial disarticulated cranial and post-cranial material, pointing to different swimming and dispersal abilities across body sizes in nothosaurs. Together, these observations indicate that some of the assumed discrepancies between reptile faunas of the Germanic Basin and Alpine Triassic may reflect biases linked to the exceptional but environmentally restricted fossils of the intraplatform basins of the Alpine Triassic. By combining such rich records with more fragmentary findings from settings with a greater open marine influence, we are able to provide a more complete picture of the marine faunas and relationships at the peak of marine reptile diversity during the Middle Triassic.

Funding Sources The research is supported by the Swiss National Science Foundation (grant No. 10001433).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Paleontology of vertebrate carnivores: study of the late Miocene carnivorous mammals from the Maragheh region, northwestern Iran

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In this research, systematic studies were conducted on fossils of carnivorous mammals found in the Maragheh region of Iran.The data obtained from the morphometric measurements of the skull, teeth, and lower and upper jaws of the fossils were interpreted using multivariate analyzes (PCA, CA) to examine their relationship with fossils found from other regions of the world and to identify the genus and species of fossils studied in this research. Based on systematic studies, one hyena specimen belonging to the family Hyaenidae (*Adcrocuta eximsia*) and two species belonging to the family Felidae (*Pristifelis attica and Paramachaerodus orientalis*) were identified.That is, sample number 3, which was a hyena fossil, was identified as *Adcrocuta eximia*; samples 1, 2, and 4 were related to *Pristifelis attica*; and sample number 5 was related to *Paramachaerodus orientalis*. Morphological measurements of the skull, lower jaw, upper jaw, and teeth of the fossil samples from Maragheh region were carried out and compared with fossil samples from other regions of the world such as Hezheng, China, and Batalons, Spain. The results of the PCA and CA based on the data obtained from skull measurements show that the fossil samples of carnivores from the Maragheh region show a high similarity with the samples from Hezheng, China.The results of the analyses based on the upper jaw data show a good similarity between Chinese and Spanish samples, but only one sample of *Pa. maximiliani* shows a high similarity with Maragheh samples.The results of the analyses based on the lower jaw show a very high overlap between the Chinese and Spanish samples. Qualitatively, there is a high similarity between samples from Maragheh region, Spain, and Greece, and similar genera have been reported in these regions. The similarity of the carnivores of Maragheh region with examples from other countries of the world indicates the existence of a vast environment with the same climatic conditions in the late Miocene. Regarding the paleogeography of the Maragheh region, it can be said that the vertebrates of this region, along with other mammals, are part of a larger Eurasian Pikermian fauna located in a savannah environment at latitudes 30–40 degrees North. Regarding the ancient geography of Maragheh region, it can be said that it was one of the savannah regions in the past.

Funding Sources Convener: Hooman, Pourabbas Vafaei.

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

Post-disaster signs of life: caniform tracks at Ashfall Fossil Beds suggest scavenging and survival

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Ashfall Fossil Beds is a unique lagerstätte in northeastern Nebraska, comprising a waterhole environment with fossils of a *Teleoceras* herd and numerous species of smaller mammals, reptiles, and birds preserved by volcanic ash. Among the few expected taxa not found at the site are large-bodied carnivores. An eruption of the Yellowstone hotspot correlates with zircon U-Pb dates from Ashfall, pinpointing the destructive event at ca. 11.86 Ma, at which time several large-bodied carnivores are known from North America, including both barbourofelid nimravids and borophagine canids.

The discovery of well-preserved tracks and trackways provides the first direct evidence for large carnivores. These delicate tracks are preserved in multiple slightly indurated layers, possibly representing thin subaqueous algal mats. The best preserved caniform tracks are from trackways uncovered in 2014 and 2023. The tracks are 55–80 mm in length and 52–75 mm in width, which approximates the manual/pedal size in the large bone-crushing dogs *Aelurodon taxoides* and *Epicyon saevus*.

Preserved in the possible algal mats but covered by additional ash, we infer the trackways were made within a short recovery interval, at most a few months while the ash was still mobilized on the landscape. The ash covered thousands of square miles of North America and so, coupled with their absence in the skeletal assemblage, this strongly suggests large borophagines survived the changed environmental conditions at least long enough to produce the footprints. Tracks in multiple layers and orientations suggests extended or repeated visits, perhaps drawn by water or a buried foodsource.

The presence of large carnivore traces directly informs interpretation of patterns of scavenging and identification of bone fragment-bearing coprolites discovered at the site. The potential utilization of buried carcasses by surviving large-bodied carnivores as a bridge resource during tough times holds implications for the taphonomy of mass-death assemblages. Though there are unique challenges associated with preserving and collecting data from these tracks, they extend the window for the Ashfall event into its immediate aftermath. In addition to restoring a missing piece to our best portrait of the North America Miocene, these trackways document an important moment in the recovery following a major destructive event and demonstrate the unexpected resilience of large-bodied carnivores to catastrophic ecosystem disruption.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Boa grandfather and Madtsoia sister: new specimen of *Boavus idelmani* shakes up the family tree

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The evolutionary history of Constrictores (boas and pythons) is poorly understood with the first fossil representatives of relative completeness for either Boidae or Pythonidae coming from Eocene deposits from Europe (e.g., *Messelopython*) and North America (e.g., *Boavus*). However, vertebrae referable to these families are known from the Paleogene of South America and Africa. This suggests an earlier divergence of these families from the preexisting snake clades such as Madtsoidae and

Palaeophiidae, both of which had a Gondwanan distribution by the Eocene. Vertebrae of these extinct snake families were once considered to belong to large boids or pythonids due to shared affinities. Further discoveries have found several potential synapomorphies for Madtsoiidae and Palaeophiidae reinforcing their position as stem Serpentes. However, cranial material is markedly rare leaving only few vertebral characteristics to uphold this distinction. Madtsoiid synapomorphies may be more widespread and irregularly expressed than previously thought, and palaeophiid characteristics may be specific to aquatic habits making them convergent with modern aquatic snake species (e.g., Acrochordidae). Description of a new articulated, 3-dimensionally preserved *Boavus idelmani* specimen from the Bridger Formation of Wyoming, USA, reveals a suite of vertebral and cranial features observed in both modern henophidians and extinct madtsoiids such as *Wonambi* and *Najash*. CT data of this new specimen along with those for a broad sampling of modern taxa and other fossil taxa (e.g., *Madtsoia bai*) allowed for systematic review of character distribution across serpentes with focus on the sister relationships of fossil taxa. Unweighted parsimony analysis using a revised morphological data matrix recovers *Boavus* as sister to *Madtsoia bai* and *Messelopython* as a clade in an intermediate position between *Loxocemus* + *Xenopeltis*, and all other alethinophidians, or with implied weightings (K=3.0), in a clade with *Loxocemus* and *Xenopeltis* as the earliest diverging members. *Yurlunggur*, typically considered a madtsoiid, is recovered as a basal-most uropeltoid in all analyses. Vertebral taxa such as *Palaeophis meghebrianus* and *P. colossaeus* are recovered sister to Acrochordidae + Colubroidea. The polyphyletic arrangement of taxa formerly pertaining to Madtsoiidae challenges its validity as a monophyletic family and suggests they may represent a grade of early diverging snakes from several extant clades.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New Maastrichtian microsites update squamate diversity and biogeography of the Lance Creek Formation

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The Lance Creek Formation in Wyoming provides a wide array of vertebrate microfossil assemblages allowing for the assessment of biodiversity dynamics leading up to the Cretaceous–Paleogene (K–Pg) Mass Extinction. While the mammals and dinosaurs of the region have been extensively studied, the squamate fauna remains relatively unexplored and is often described solely in broader studies that combine data from multiple formations. As a result, a herpetofaunal assessment of the Lance Creek Formation is missing.

Here, we present a sample of eleven lizard jaws collected in 2023 and 2024 at new vertebrate microsites in southeastern Wyoming. The groups Teiidae (*Chamops*, *Leptochamops*, *Socognathus*), Anguidae (*Odaxosaurus Piger*), Varanidae (*Palaeosaniwa*), and Necrosauridae (*Parasaniwa*) were found. There is considerable taxonomic overlap in squamates within the Maastrichtian age formations including Lance Creek, Hell Creek, Scollard, and Frenchman as well as in the older Campanian age Oldman Formation. These localities all bordered the Western Interior Seaway with sedimentation indicating a fluvial depositional setting. These shared environmental conditions may provide an explanation for the taxonomic similarities between sites. Of note, the Lance and the Hell Creek Formations contain almost identical occurrences in the current sample with one exception, *Socognathus*. This *Socognathus* occurrence in the Lance Creek not only distinguishes current Lance Creek from Hell

Creek collections but also represents the southernmost distribution of the genus currently reported.

Additionally, this study provides high-resolution micro-computed tomography scans and 3D segmentation to offer additional insight into the internal anatomy of the jaws included in this sample. Structures such as internal canals, and dentition related details like replacement and tooth attachments are revealed. These Lance Creek jaws provide additional anatomical data to these lizard groups that can help to identify more fragmentary jaw pieces. Continued descriptions and collections of Lance Creek lizard faunas will further our understanding of the biogeographic links between Late Cretaceous localities as well as our understanding of the morphologies of these lizard groups.

Funding Sources David B. Jones Foundation

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Using filtered longwave ultraviolet light to detect fossil shark teeth at night in the Upper Cretaceous Cliff House Sandstone Formation of the San Juan Basin in New Mexico, USA

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Collecting fossil shark teeth is an engaging field activity that can be shared by both professional researchers and avocational fossil enthusiasts, but it may sometimes be a challenging task searching for them in sediments or rocks of a similar color. Here, we present an experimental case study that resulted in the detection of many fossil shark teeth, among dental and skeletal remains of some other marine vertebrates (e.g., bony fishes and marine reptiles), from a new locality of the Upper Cretaceous Cliff House Sandstone (middle Campanian) within the San Juan Basin in New Mexico, USA, that fluoresce under ultraviolet (UV) light. The case study was conducted at night during low light conditions, and the fossils found (e.g., carchariid lamniform shark teeth ranging up to a few centimeters in size) were observed fluorescing a bright orange color under specifically filtered 365 nm longwave UV light. Whereas calcium phosphates fluoresce a pale blue or phosphoresce, their orange fluorescence is most likely due to the calcium carbonate permineralized within pore spaces of dental tissues through diagenesis from the surrounding calcareous sandstone. Under unfiltered, 395 nm UV light, the material does not fluoresce nearly as much. During daytime trips to the locality, the presence of strong sun and low clouds increased difficulty in locating fossils compared to thoroughly cloudy conditions. This is primarily due to sun glare from the light-colored sandstone, along with many fossil shark teeth possessing similar coloration to their surrounding matrix. Use of UV light at night can mitigate dependence on uncontrollable weather conditions in the field, all while providing greater contrast between vertebrate fossils and their surrounding sediments or rocks. In summary, this method highlights the promising potential for utilizing longwave UV light as an effective tool to locate large quantities of vertebrate fossils within various size brackets in low light conditions in the field.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Footprints beneath the surface: visualizing foot-substrate interactions using µCT

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In nature, animals commonly traverse compliant, plastically deformable substrates, leaving tracks. Understanding the foot-substrate interaction can

provide valuable insights into trackmaker anatomy, biology and behavior, particularly for extinct animals where these are not directly observable. This information can supplement osteological data and assist in life reconstructions. However, interpreting these interactions can be difficult, as it requires the visualization of both the foot, and internal substrate morphology, below the exposed surface. Previous work has used X-rays to observe foot motions beneath the sediment surface, but sub-surface sediment movement has remained challenging to observe. We used μCT to visualize sub-surface sediment structures. A 10 cm container was filled with thin (1–2 mm) layers of alternating wet sand and clay. This container was μCT scanned with a SkyScan 1273, before, during, and after indentation by a cadaveric pheasant foot. There were challenges both in setting up the sediment (maintaining thin layers of fluid substrate in a confined area) and in visualization (penetrating the wet sediment with X-ray and distinguishing between sediment layers with similar contrast). To address the visualization issues, we explored various segmentation methods including machine learning and semi-automated (watershed transform) techniques. The machine learning algorithms were more effective at segmenting the foot, but for the sediment required so much training (especially in experiments with large numbers of layers) and manual correction as to be unusable. However, the use of the watershed transform combined with manual painting, allowed for relatively rapid discrimination of the layers, despite complications where the foot had penetrated and blended layers together. The workflow promises to provide useful mechanistic information about the foot-sediment interaction and may prove particularly fruitful if expanded into 4D time-series scans.

Funding Sources UKRI Frontier Research Grant TRACKEVOL (selected by the ERC for a consolidator award) (P.L.F.)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Between discovery and destruction: scientific access vs. conservation in a Pierre Shale crocodyliform

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A fragmentary crocodyliform from the Upper Cretaceous Pierre Shale, nicknamed Sheila, shows traits of a new alligatorid taxon and may be a holotype. However, its fragile condition poses a dilemma: traditional preparation could damage key features, while non-invasive methods obscure diagnostic elements. This study assesses Sheila's condition, reviews similar paleontological cases, and weighs the scientific, ethical, and curatorial implications of preparing unstable, potentially type-bearing material. This project aims to guide best practices for handling delicate fossils and balancing taxonomic research with responsible conservation, highlighting the challenges of working with delicate type-quality material and raising important curatorial and methodological questions. The current condition of the specimen, potential preparation strategies, and implications for taxonomic work and long-term conservation are discussed. The goal is to balance scientific discovery with responsible stewardship of fragile fossil resources.

The fossil is heavily encrusted in secondary gypsum deposits, complicating mechanical and chemical preparation. Gypsum crystals have infiltrated key skeletal elements, creating microfractures that compromise structural integrity. Due to its physical and chemical properties, gypsum presents a significant obstacle in fossil preparation. Its crystalline structure often entraps fossil material, and its solubility in water complicates standard mechanical or chemical removal techniques. This study outlines the difficulties encountered while preparing the crocodyliform specimen from gypsum-rich matrices, including damage risk, limitations of mechanical tools, and the ineffectiveness or hazards of chemical solvents. The discussion explores the mineralogical context of the encasement, preparation attempts

and setbacks, and ongoing efforts to balance fossil preservation with the need for scientific access. The case underscores the broader challenges of working with sulfate-rich matrices in vertebrate paleontology and highlights the need for new conservation techniques tailored to evaporite-associated fossil deposits. By presenting this case study and preparation outcomes, we aim to highlight best practices and underscore the need for further research into non-destructive gypsum mitigation strategies in paleontological conservation.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Evolution of the protolabine camels (Artiodactyla, Camelidae)

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The protolabines were a subfamily of North American camelids with characteristically long rostra pinched at the base between the upper canine and P1. They have long been misunderstood, or mistaken for other taxa, and only recognized as a distinct group in the last 50 years. They are distinctive not only in having a constriction of the rostrum, but also a strong buccinator fossa, lateral expansion of the anterior nares, and shortening of the metapodials. Although Honey and Taylor described new genera in 1978, there has been no complete review of the group since then. We recognize just three genera: *Protolabis* Cope, 1876; *Michenia* Frick and Taylor, 1971; and *Tanymykter* Honey and Taylor, 1978. *Tanymykter* was an early, extremely primitive protolabine that was long mistaken for *Oxydactylus*. It contains two species, the late Arikareean (earliest Miocene) *T. brachydontu*s, and the larger early Hemingfordian (late early Miocene) taxon *T. longirostris*. *Protolabis* now contains just three species: the primitive Hemingfordian taxon *P. saxeus*; the type species from the early Barstovian (early middle Miocene), *P. heterodontus* (including *P. barstowensis* and *"P. browni"*); the highly derived Clarendonian–Hemphillian (late Miocene) taxon *P. coartatus*; and the Clarendonian–Hemphillian *P. yavapaiensis*. Finally, the much smaller and more derived genus *Michenia* is known from several species, including the late Arikareean *M. agatensis* and *M. cameloides (= M. deschutesensis)*, early Hemingfordian *M. exilis*, and the late Hemingfordian–Barstovian *M. mudhillsensis*. Thus, the subfamily Protolabinae originated in the late Arikareean, diversified rapidly in the Hemingfordian, and reached its maximum diversity in the Barstovian, but then declined to just two genera and two species in the Clarendonian and early Hemphillian.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Macroevolutionary dynamics of the dinosaur cerebrum

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Although it is widely acknowledged that the phylogenetic distribution of characters can result from various evolutionary models, alternative scenarios are often ignored. This can lead either to over-interpreting every character shift as a selective scenario or under-interpreting

meaningful evolutionary trajectories by assuming universal Brownian Motion (BM). The evolution of relative cerebral size within dinosaurs is a prime example of how best-fitting models can provide insight into the mechanisms behind phylogenetic character shifts. The cerebrum exhibits high variability of size and shape and plays a crucial role in sensory integration and higher-order brain functions. Previous work has shown a complex pattern of change in relative cerebral size among dinosaurs, with multiple apomorphic increases, including within the maniraptoran and ornithopod clades. However, it remains unclear what evolutionary mechanisms might have contributed to these shifts. Here, we tested multiple models of continuous character evolution to decipher whether changes in the cerebral volume follow a pattern consistent with BM, or if these data are better explained by alternative models. We found that BM does not adequately explain the evolution of cerebral volume, but rather that it consistently evolves following an Ornstein-Uhlenbeck (OU) pattern, suggesting the changes may be a result of stabilizing selection. This raises questions regarding what selective mechanisms underly these observed patterns and whether there are correlations with other traits, such as cranial and body sizes, social dynamics, or locomotory strategies. Deciphering cerebral evolution in dinosaurs is not only crucial to understanding the biological, ecological, and cognitive mechanisms that may be at play, but also provides a fundamental framework to better understand the highly diverse and apomorphic morphology of the brain within crown-group Aves. These findings offer a window into how macroevolutionary patterns can help reveal the mechanisms that played a role in sculpting the cerebrum through deep time.

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

We found the rest in the cabinet: reassessing the holotype of the Late Triassic drepanosauromorph *Dolabrosaurus aquatilis* reveals additional elements and unexpected hook-and-pull digging adaptations

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Interpreting the fossils of enigmatic clades is challenging, even when working with articulated and three-dimensionally preserved fossil material. Such is the case with the drepanosauromorph *Dolabrosaurus aquatilis* from the Upper Triassic of northern New Mexico, USA. *Dolabrosaurus* has been in several publications in the over 30 years since its description. In that time, other drepanosauromorph specimens have expanded our understanding of the anatomy of previously described and undescribed portions of the *Dolabrosaurus* holotype. Previously unidentified elements include a hypertrophied second metacarpal, possible forelimb elements, and a partial articulated femur and tibia. The hypertrophied metacarpal is similar to the *Drepanosaurus* sp. metacarpal GR 738 from the similarly-aged Hayden Quarry. The asymmetry of the element suggests it is from the left forelimb. The potential forelimb elements are similar to the intermedium and ulnare of GR 737, though they may be partially disarticulated and are not as well preserved as other parts of the skeleton. These identifications suggest that *Dolabrosaurus* possessed the robust modified forelimb present in other drepanosauromorphs like *Drepanosaurus*. Using this information, we suggest the previously described articulated manus to be a left and reassign the digits to accommodate the enlarged metacarpal. The right hindlimb with much of the foot was originally preserved as a two-sided natural mold that was filled with colored epoxy and set in clear resin. The natural mold has been lost, and the two-part cast has been confused for a right and left hindlimb by some authors. Clarifying the nature of the preparation has allowed us to identify a separate limb impression as a left hindlimb. We also note that much of the caudal series has been

reconstructed with epoxy. Preliminary CT data shows additional elements in some of the blocks, but the specimen scanned poorly which makes it challenging to parse out more anatomy than is visible at the surface. In all, the *Dolabrosaurus* holotype represents portions of every post-cervical skeletal region either as bone or bone impressions. We reconstruct *Dolabrosaurus* as a robust forelimbed drepanosauromorph similar to *Drepanosaurus*, as opposed to the previous more gracile *Megalancosaurus*-like reconstructions. Based on recent analyses of drepanosauromorph anatomy, this suggests previously unsuspected hook-and-pull digging adaptations, possibly burrowing into trees like living silky anteaters.

Funding Sources NSF EAR 1943286; NSF GRFP

Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

The radiation and geographic expansion of primates through diverse climates

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One of the most influential hypotheses in primate evolution posits that their origin, radiation, and major dispersals were driven by exceptionally warm conditions in tropical forests at northern latitudes—the ‘warm tropical forest hypothesis’. However, evaluating this hypothesis has been hindered by persistent uncertainties regarding both the geographic locations and paleoclimates of ancestral species. Here, we overcome these challenges by resolving two key issues. First, we integrate climatic inferences from the fossil record with estimates of ancestral locations, phylogenetic internal nodes, within the most recent and comprehensively sampled Euarchonta phylogeny comprising 902 taxa (419 extant, 483 fossils). To achieve this, we employ a novel implementation of the Geographic (Geo) model in *BayesTraits* v4, which accounts for historical uninhabitable environments (e.g., ancient seas) and incorporates phylogenetic and topological uncertainty. This approach complements fossil and extant species distribution data by revealing previously unknown historical climates in unsampled regions where early primates and their ancestors lived, showing that ancestral species could have potentially dispersed over vast distances. Second, to make the hypothesis formally testable and reproducible, we apply a standardized paleoclimate classification using Köppen-Geiger categories derived from climatic data generated by the Hadley Centre General Circulation Coupled Model. Our results demonstrate that early primates radiated across high-latitude regions through diverse climates, including cold, arid, and temperate zones. Contrary to expectations of the ‘warm tropical forest hypothesis’, warmer global temperatures had no significant effect on dispersal distances or speciation rates. Instead, local environmental variability, particularly changes in temperature and precipitation, strongly predicted both geographic spread and species richness. These findings suggest that dynamic, non-tropical environments exerted strong selective pressures that shaped primate evolutionary trajectories, ultimately enabling their later colonization of tropical forests millions of years after their origin.

Funding Sources This work was funded by a Leverhulme Trust Research Leadership Award to CV (RL-2019-012).

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

The identification of Cretaceous crown placentals is hindered by incomplete fossil records and substantial morphological similarity

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The existence of Cretaceous crown placentals remains controversial despite extensive studies. Recent molecular clock estimates usually place the origin and initial diversification of crown placentals during the Late Cretaceous. In contrast, no unambiguous crown placentals have been confirmed from the Late Cretaceous, although a few candidate taxa have been proposed. To investigate the reasons behind this discrepancy, we reconstructed ancestral nodes across the mammal tree using 3533 skeletal characters from 46 extant taxa, employing both likelihood-based and parsimony-based methods. The likelihood-based estimation was conducted with structured Markov models under a molecular time tree framework. Based on these estimations, we identified fossilizable characters that showed significant distinction between: (1) the estimated ancestors of crown placental and crown therians (10 characters), and (2) the estimated ancestors of crown placental and two placental magnorders, namely Atlantogenata and Boreoeutherian (12 characters). Criteria for identifying early crown placentals were established accordingly and applied to evaluate two putative crown placental taxa (Leptictida and *Protungulatum*) that have fossil records extending from the Late Cretaceous into the Cenozoic. We found that although Paleocene leptictid (*Leptictis dakotensis*) is well supported as crown placental closely related to Boreoeutheria, the incompleteness of Late Cretaceous leptictids (Gypsonictops) and *Protungutalum* fossils poses a major barrier to confidently confirming or rejecting their crown placental status. This is because the skeletal regions containing essential diagnostic characters are not preserved, rather than because these fossils demonstrably lack such characters. This challenge is further compounded by the substantial morphological similarity among ancestors of crown therians, crown placentals, and placental magnorders. Consequently, the apparent discrepancy between molecular estimates of placental diversification and the fossil record may stem from this diagnostic limitation rather than from a real absence of crown placentals during the Late Cretaceous.

Funding Sources Funding Sources This research was financially supported by China Scholarship Council (CSC 202108330088) and University of Bristol postgraduate research support fund.

Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Pneumatic cavities and pneumosteum in Triassic dinosauriform vertebrae reveal deep evolutionary origins of the avian respiratory system

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Crucial to the spectacular evolutionary success of birds is their uniquely efficient respiratory system comprising air sacs that drive unidirectional air flow and pneumatize the postcranial skeleton. Unambiguous osteological features and paleohistological evidence of this system are recognized in derived theropods, sauropods, and pterosaurs, but the lack of evidence in ornithischians and other early branches leaves how and when this highly-specialized system evolved mysterious and controversial. Progress in paleohistological methods revealed bone in contact with air sacs exhibits a distinctive texture called ‘pneumosteum,’ allowing detection of air sacs in fossils. However, due to the destructive nature of sampling, the number of specimens that can be studied—particularly rare early dinosaur fossils—is restricted. Recent innovations in synchrotron X-ray micro- Computed Tomography (SR-μCT) have achieved high-

resolution, non-destructive imaging of osteohistology, with the potential to characterize fine tissues such as pneumosteum in three dimensions. Additionally, this technology enables more accurate three-dimensional reconstruction of internal structures, especially for detailed visualization connectivity. Hence, we performed both laboratory μCT and SR-μCT on a series of Triassic fossils to investigate how avian-like air sac systems evolved within Archosauria. Our research found pneumosteum and other osteological correlates of pneumaticity in two Triassic dinosauriform cervical vertebrae from the Upper Triassic fissure fill deposits of Pant-y-Ffynnon quarry in South Wales. To confirm the presence of pneumosteum, we also imaged the core sampling for histological sections from the *Diplodocus* vertebra in which pneumosteum was first described. This served as a direct similarity of histological characters and three-dimensional structures to the Pant-y-Ffynnon cervical. These two vertebrae provide the first unambiguous evidence that an avian-like respiratory system was already present in the common ancestor of dinosaurs. We also identified, for the first time, that the earliest air sac system had fully invaded the vertebral centrum and neural arch; however, it primarily connected to the exterior through deep external fossae around the neural arch—patterns that differ from living birds. This hyper-pneumatized specimen reveals the early emergence of an efficient avian-like respiratory system that likely underpinned dinosaurian dominance in Mesozoic ecosystems.

Funding Sources Leverhulme Trust Research Project Grant, "A new approach to understanding the origins of the bird respiratory system." Grant No. RPG-2023-051.

Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

Decoupled evolution of melanosome geometry and chemistry in amphibians and reptiles

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Melanosomes are melanin-rich organelles that occur in the integument, eyes, and internal tissues of vertebrates, with tissue-specific geometry and chemistry. Despite growing interest in the application of melanosomes in evolutionary studies, there are limited data on the role of melanin in major evolutionary transitions and whether melanosome geometry and chemistry are linked. We tested this by analysing melanin from 143 tissues from two extant amphibian and four extant reptile taxa. Our data confirm tissue-specific melanosome geometry in both reptiles and amphibians and reveal a broad pattern whereby for a given tissue, melanosomes in reptiles are smaller and more elongate than the same tissue in amphibians, implying conservation of melanin function in the two groups. This does not apply to the heart, ventral skin, and gonads; melanosomes in these tissues are larger and more spherical in reptiles than in amphibians. These differences in melanosomes between amphibians and reptiles suggest divergent melanosome functions in the two groups. Preliminary analysis of synchrotron-X-ray fluorescence data reveals unexpected trends in melanosome chemistry. Melanosomes in the gonads of both amphibians and reptiles have very similar chemistry, with high concentrations of sulfur, chlorine, and zinc, but differ strongly in geometry. In contrast, melanosomes in the dorsal skin of amphibians and reptiles have similar geometries but differ strongly in chemistry, with enrichment in strontium and calcium in amphibians and sulfur and chlorine in reptiles. These data strongly suggest that melanosome geometry is decoupled from chemistry in extant amphibians and reptiles.

Tracing these patterns through the Phanerozoic using data from fossils will reveal whether these trends are early features, or late innovations, within Amphibia and Reptilia, informing on the functional evolution of melanosomes at a pivotal stage of vertebrate evolution.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Neogene–Quaternary biogeographic structuring of the mammalian associations in northern South America

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Mammalian evolution in northern South America—encompassing present-day Colombia and Venezuela—has traditionally been examined within broader continental frameworks due to a scarcity of regionally focused studies. This underrepresentation has hindered the identification of localized evolutionary and biogeographic patterns. Notably, stratigraphic sequences from the Middle Miocene of La Venta (Colombia) and the Miocene–Pleistocene of Urumaco (Venezuela) have yielded mammalian assemblages that are compositionally distinct from the rest of South America. These assemblages suggest an early biogeographic differentiation relative to coeval communities from other parts of the continent. Conversely, younger sites such as El Mene de Inciarte and El Breal de Orocual (Venezuela) have often been dated using southern South American biochronological standards, masking regional signals. In this study, we test the hypothesis that certain Neogene and Quaternary mammalian assemblages from northern South America retain distinctive faunal signatures when compared to other continental regions. We conducted a comparative presence-absence analysis of 79 fossil localities from the Neogene to Quaternary (Venezuela n = 7, Colombia n = 1, Argentina n = 24, Costa Rica = 1, Guatemala = 1, Mexico n = 44, and the United States n = 1) using Detrended Correspondence Analysis (DCA) and similarity indices (Bray–Curtis and Jaccard). Our results show that Middle Miocene faunas from Urumaco and La Venta form a close cluster with those from Argentina's Mesopotamian region, albeit with low similarity (< 8.1%). In contrast, Pliocene–Late Pleistocene sites in northern South America—especially those potentially influenced by the Great American Biotic Interchange (GABI)—cluster more closely with roughly contemporaneous North American localities. In other words, some Venezuelan sites exhibit stronger affinities with Central and North American Late Pleistocene assemblages than with South American ones. These patterns underscore the complexity of faunal exchanges and biogeographic dynamics in northern South America. However, low similarity support values (< 0.15) highlight the preliminary nature of our findings. A more robust framework will require the incorporation of additional fossil datasets, taxonomic standardization, and the use of complementary analytical techniques to refine and validate these emerging biogeographic patterns.

Funding Sources Coordinación de la Investigación Científica, Programa de Intercambio Académico, Universidad Nacional Autónoma de México, Mexico–COIC/STIA/9875/2024; COIC/STIA/10152/2025

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Now there are eight—a new *Palaeochiropteryx* species (Mammalia, Chiroptera) from the Middle Eocene of Messel, Germany

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Bats are typically very rare in the fossil record, but the Messel Pit Fossil Site is an exception. Here, bats are the most abundant mammals and are typically represented by complete or nearly complete skeletons. However, bats that appear 'complete' often consist of a mosaic of broken bones flattened by sediment pressure. Therefore, differentiation of species is not only based on the availability of fossils but also on new research methods.

In 1917 Revilliod used just optical magnification for the description of *Palaeochiropteryx tupaiodon*, *P. spiegeli*, and *Archaeonycteris trigonodon*. He distinguished the genera by dental morphology, the species according to size. Scientific excavations from the 1970s onward yielded new fossils that enabled Smith & Storch in 1981 to publish *Hassianycteris magna* and *H. messelensis*. *Archaeonycteris pollex* Storch and Habersetzer, 1988, and *Tachypteron franzeni* Sigé, Storch, and Habersetzer, 2002, were subsequently identified using 2D X-ray technology.

Thus, the total number of bat species described from Messel was seven from four genera. About 75% of the bats belong to the genus *Palaeochiropteryx*. The members of this genus exhibit great variability in size (body length varies by up to 44% within a species). Therefore, the existence of at least one additional cryptic species has long been suspected. Recently, several exceptionally small specimens of *Palaeochiropteryx* were discovered, and improved access to public and private collections has increased the number of bats accessible for our research (> 800). High-resolution micro-CT technology enabled us to examine and reconstruct the teeth surface without destruction, as the dentition of almost all Messel bats is typically in occlusion. Based on 3D digital models, we were able to fully document morphology and tooth size for the first time.

The new *Palaeochiropteryx* species differs from congeneric species in size and proportions of the teeth as well as length of the radius. Based on reconstructions, we hypothesize that it was more maneuverable and agile than its larger relatives. It most likely foraged for aerial insects close to the ground, vegetation, and perhaps over water at Lake Messel. Discovery of this new species brings the number of bat taxa known in the Messel fauna to eight species making the fauna at Messel the most speciose Eocene bat fauna in this excellent preserved state currently known.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Ain't no 'greater alligator': *Deinosuchus* reconsidered as a giant stem-crocodylian apex predator widespread due to saltwater tolerance

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The transmarine distribution and gigantism observed in the Campanian North American crocodyliform *Deinosuchus* have posed challenges to its consistently inferred phylogenetic placement close to Alligatoridae—a clade typically characterized by smaller body sizes and freshwater ecology. Species of *Deinosuchus* are considered top predators of wetland ecosystems with a diet including dinosaurs but how they achieved widespread distribution both in Laramidia and Appalachia remains controversial. Previous hypotheses inferred vicariant speciation induced by the emergence of the Western Interior Seaway, which considerably predates the oldest

Deinosuchus fossils, however. Here, we present an expanded crocodylian phylogenetic analysis, including previously unsampled key taxa and a molecular scaffold, recovering a topology of improved spatiotemporal congruence that reinterprets species of *Deinosuchus* as stem-group crocodylians, alongside other putative alligatoroids such as *Leidyosuchus canadensis* and the European *Diplocynodon* spp., the latter recovered closely related to North American Paleocene *Borealosuchus griffithi*.

This revised topology supports a plesiomorphic capacity for saltwater tolerance in *Deinosuchus* and the crocodylian crown group, with a secondary loss of this trait occurring early in stem alligatorids. The divergence of freshwater total-group Alligatoridae appears to have coincided with mid-Cretaceous eustatic sea-level maxima, and the widespread distribution of *Deinosuchus* across the Western Interior Seaway is most plausibly explained through marine dispersal routes. This hypothesis remains consistent with an allopatric distribution of species of *Deinosuchus* as transmarine dispersal is incidental in modern saltwater tolerant crocodylians.

A phylogenetic analysis of body length, employing cranial width as a proxy, indicates phyletic dwarfism early in alligatoroid evolution and yields a more modest total length estimate of ~7.7 m for the most complete specimen of *Deinosuchus riograndensis* compared to previous work. Our findings suggest that gigantism in *Deinosuchus* and other crocodyliforms repeatedly evolved under both greenhouse and icehouse global climates and is strongly associated with highly productive, expansive aquatic ecosystems, including examples from recent historical times.

Funding Sources Deutsche Forschungsgemeinschaft grant 417629144 (M.R.); German Research Foundation [417629144].

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Newly described *Chelosphargis advena* specimen from Niobrara, Kansas allows for better understanding of Cretaceous protostegid phylogenetics (Protostegidae, Chelospharginae)

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Although common in the fossil record, marine turtles of the Protostegidae family have been poorly examined in the literature. Little work has been done regarding in-depth descriptions of specimens, comparative analysis and phylogenetic reconstructions. Through the use of CT scanning data and 3-D modeling software, a detailed description of a new juvenile specimen of *Chelosphargis advena* from the late Cretaceous of Kansas furthers the available knowledge of this genus. The cranial material of this Niobrara Formation specimen is extremely well preserved, and allows for identification of nearly all dermatocranial elements. Unfortunately due to the small size of the specimen, the internal braincase structures are difficult to identify and often fragmentary, but this does not apply to the external elements. Although the post-crania is mostly disarticulated, the majority is still present and permits for a quality description. The juvenile state of the animal was determined by examining the development of the costal plates compared to the length of the rib, and the fusion of dermatocranial elements, as these structures tend to become larger and more fused as the animal matures. The overall small size, short costal plates, and weak cranial fusion suggests the specimen was a sub-adult prior to its demise. Once a thorough description of the crania and post-crania was completed, a phylogenetic analysis was run. Using previously compiled data, *Chelosphargis advena* was rescored, allowing 14 new characters to be identified and scored. This phylogeny supports *Protostega gigas* as the sister taxon to *Chelosphargis*, with

Desmatochelys as the sister taxon to the clade. In addition, many characters appear to be reversals to primitive states, suggesting protostegids are a divergent group that has reverted to basal characters. This is also indicative of the shallow-sea environment they are located in, as generalist species tend to occupy more niche space. This may also have implications on their eventual extinction, as their basal form may have put them at a disadvantage at the K–Pg extinction. Other members of the Testudinata such as Chelonidae survived the extinction, so this may provide clues to what differentiated the success of the two groups.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Ecomorphology of notosuchian crocodyliforms from Late Cretaceous (Maastrichtian) Maevarano Formation, northwestern Madagascar

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The Late Cretaceous (Maastrichtian) Maevarano Formation of northwestern Madagascar highlights one of the best-preserved fossil vertebrate faunas from Afro-Madagascar, with ongoing efforts to characterize the paleoecology of this terrestrial ecosystem. Four of the six crocodyliforms known from the Maevarano Fm. represent notosuchians, a primarily terrestrial group of phylogenetically diverse forms known mostly from throughout the Cretaceous Period. Notosuchians of the Maevarano Fm. Include *Simosuchus clarki*, *Araripesuchus tsangatsangana*, *Miadanasuchus oblita*, and *Mahajangasuchus insignis*. This assemblage spans a large range of body sizes and variation in presumed habitat preference and feeding ecologies. To further explore the paleoecology of the Maevarano Fm., we examined several complete and partial skulls of these morphologically diverse crocodyliforms. This study used qualitative and quantitative approaches based on first-hand specimen examination, digital photographs, and high-resolution renderings of CT/μCT scan reconstructions. The size, position, and orientation of the external nares, orbits, and choanae were characterized, with the relative position and size of temporal, suborbital, and external mandibular fenestrae noted for comparisons. The size, shape, number of teeth of the four notosuchians were examined in this study, allowing direct insight into feeding ecology. The four forms can be divided between terrestrial and semi-aquatic lifestyles on the basis of cranial morphology. Among of the three carnivorous taxa (*Mahajangasuchus*, *Miadanasuchus*, *Araripesuchus*), only *Miadanasuchus* and *Araripesuchus* potentially overlapped ecologically as fully terrestrial predators. Estimated maximum adult body size differences between these two forms likely facilitated differences in prey choice, perhaps explaining coexistence in the same terrestrial environment. *Simosuchus* differed significantly from the others based on overall skull and dental morphology and occupied a primarily herbivorous niche. *Mahajangasuchus* is the lone semi-aquatic notosuchian in the assemblage and shared the aquatic environment with representative and smaller-bodied neosuchians. While other factors, including species-specific and ontogenetically-linked habitat and prey preferences, likely contributed to coexistence, the morphologic inferences from the rich crocodyliform fauna of the Maevarano Formation can be used as a case study for comparison with other Cretaceous assemblages.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A quantitative approach to understanding variation in early dinosaur growth patterns

Ramirez, Jean J.[1,2], Botha, Jennifer[3], Moopen, Atashni[3], Twala, Enele[3], Choiniere, Jonah[3], Barta, Daniel E.[4], Curry Rogers, Kristina[5], Chapelle, Kimberley (Kimi)[6], Benson, Roger B.[2], Kulik, Zoe T.[2]

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Researchers have proposed developmental plasticity, the ability of an organism to modify its growth in response to environmental stressors, as one of the key factors in the evolutionary success of early dinosaurs after the end-Triassic extinction. However, most studies of early dinosaur growth have relied on qualitative descriptions of bone histology rather than quantitative comparisons, making it challenging to test this hypothesis in a statistical framework. To quantitatively test developmental plasticity in growth strategies across the archosaur-dinosaur transition, we developed a comparative histological database comprising 600 measurements across 60 taxa from Lower Triassic to Lower Jurassic localities. Sampled taxa include early dinosaurs (e.g., *Massospondylus carinatus*, *Coelophysis bauri*, and *Sefapanosaurus zastronensis*), archosauriforms, and contemporaneous outgroups (e.g., *Hyperodapedon sanjuanensis*). We analyzed 122 fossilized bone thin sections, including 115 digitally shared samples, using standard petrographic histology techniques. We imaged sections at high-resolution and utilized ImageJ to quantify growth mark spacing. We also recorded qualitative data on vascular orientation and cortical remodeling. This data was compiled into growth curves, allowing intra- and interspecific comparisons of growth mark spacing among taxa. Our results suggest that developmental plasticity, defined in our sample by irregular growth mark spacing, is not universal among early dinosaurs. Our quantitative approach finds variation in the irregularities of growth mark spacing among early sauropodomorphs, with some taxa showing more regular growth than others. We also observed intraspecific growth variability in *Coelophysis*, evidenced by differences in bone size between individuals with identical growth mark counts. Outside of dinosaurs we also identified variable growth mark spacing in a hyperodapedontine rhynchosaur. Our data suggest that developmental plasticity was not an innovation unique to dinosaurs but was variably retained and/or altered across lineages. Through our comparative quantitative approach, we find that growth strategies in archosaurs were diverse and unevenly distributed, indicating the need for continued expansion of paleohistological datasets to better understand their role in the evolutionary history of the group.

Funding Sources This work was supported by the NSF REU Biology Program.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

First Quaternary record of *Rhinella* from Bahia, Brazil: osteological description and taxonomic implications

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The anuran fossil record is among the most incomplete of all terrestrial vertebrates. Unsurprisingly, the South American record is particularly scarce and underexplored. Therefore, any fossil discovery is essential for advancing our understanding of the evolution and paleoecology of the order Anura. Here, we

report the first occurrence of *Rhinella* in the Quaternary fossil record of Palmeiras, Bahia State, Brazil. The material was recovered from the Gruta do Ioiô cave, located in the Chapada Diamantina region, and dates from the Late Pleistocene to the Middle Holocene. The specimen consists of a partially preserved skull and incomplete postcranial elements, including an ilium and humeri. The preservation of cranial elements alongside postcranial material enhances the taxonomic value of the specimen, given that most fossil identifications are based exclusively on postcranial components. In this contribution, we provide a detailed osteological description of this material and compare its morphological features with those of other members of the diverse genus *Rhinella*. This work is part of a broader project that aims to use micro-computed tomography (CT scanning) to develop a comprehensive osteological atlas of *Rhinella*, which will facilitate the assessment of intraspecific variation in skeletal traits.

Funding Sources Fundação de Amparo à Pesquisa do Estado de São Paulo

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Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

The apple doesn't fall far from the tree: *Tarbosaurus* has stable discrete characters through ontogeny

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The ontogenies of fossil vertebrates are a rich and debated topic of study, hampered by small sample sizes, uncertain taxonomic referrals, and the ontogenetically-frozen nature of fossil individuals. Tyrannosaurid dinosaurs are a frequent subject of such study and debate; striking ontogenetic changes have been proposed by drawing transformations across a line of increasingly-larger specimens of certain taxa. The species *Tarbosaurus bataar* (Maleev, 1955) is one of the largest tyrannosaurids known, and is known from a relatively substantial sample of individuals found in the Nemegt Formation (Maastrichtian?) of Mongolia.

This sample provides ample opportunity to study the variation in continuous and discrete characters throughout ontogeny in *Tarbosaurus*. Characters likely associated with visual displays, such as cornual processes and nasal rugosities, develop in complexity through ontogeny, and cranial bones tend to become more robust with size. Some discrete characters show almost no change in the entire sample. For example, there remains no evidence for an ontogenetic reduction in tooth count. Finally, other discrete characters vary within both adults and juveniles, appearing to be ontogenetically stable but simply variable within the *Tarbosaurus* hypodigm. For instance, the presence of a complex versus a simple lacrimal-nasal articulation is evenly-distributed among individuals of any size. Were a small sample size of these individuals known, the presence of one character state in a juvenile but the other in an adult may have been interpreted as an ontogenetic transformation, as was suggested for MPC-D 107/7 compared to larger specimens.

Instead, the data permitted by this sample argues against this method of ontogenetic trajectory reconstruction previously used for *Tyrannosaurus rex* and *Daspletosaurus torosus* among tyrannosaurids, as well as broadly in fossil vertebrates. This study corroborates recent similar findings of ontogenetic stability of discrete characters in Albertosaurinae. Paleontological investigations of taxon-specific ontogenetic trends often forget that ontogeny affects individuals, not species; this confusion may have significant ramifications in the reconstruction of taxonomic and phylogenetic relationships.

Funding Sources Danish Student Support+Foreign Nation stipend; DRI student grant+travel grant; UAlberta GPS+GSA travel grant; William Demant-, Nordea- and Louis-Hansen Foundation grants.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Homoplasy and functional innovation characterise the evolution of the mammalian jaw joint in probainognathian cynodonts

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The evolution of the mammalian middle ear from the postdentary bones of non-mammaliaform cynodonts is commonly cited as a textbook example of a morphological transition. This process has been interpreted as a gradual and directional shift in function, with the origin of the dentary-squamosal jaw joint being the final stage in a stepwise reduction of the role of the postdentary bones in load bearing, finally freeing them to specialise for sound detection. However, emerging fossil evidence paints a more complex picture of postdentary bone evolution, with secondary articulations possibly present in several cynodont groups. It is therefore unclear when and how many times functionally important innovations evolved in the jaw joints of cynodonts, and an updated investigation incorporating new fossil data is therefore warranted. Here, I assemble an unprecedented sample of 47 digitised fossil cynodont specimens, from 16 species, to produce a new overview of jaw joint evolution, using novel anatomical data and an updated phylogenetic framework. Micro-CT scans uncover homoplastic evolution in the jaw joint in the approach to mammaliaforms, with ictidosaurs (*Riograndia* plus tritheledontids) independently evolving a dentary-squamosal contact approximately 17 million years before this character first appears in Late Triassic mammaliaforms. Additionally, taking advantage of exceptionally preserved *Brasilodon* and *Riograndia* specimens from the Late Triassic of Brazil, I use finite element analysis to quantify the impact of secondary articulations and modifications to adductor muscle attachment on the function of the postdentary bones across the cynodont-mammaliaform transition. Biomechanical simulations demonstrate that secondary articulations reduce stress in the postdentary bones of derived cynodonts during feeding as has long been assumed, but never tested, whereas the impact of shifting muscle attachments is far less substantial. Collectively, these results demonstrate that key morphological innovations associated with important shifts in function evolved homoplastically across the cynodont-mammaliaform transition, and that the evolution of jaw function in the precursors of mammals was more labile and dynamic than previously appreciated.

Funding Sources This research is funded by the BBSRC-funded South West Biosciences DTP (grant BB/T008741/1) and NERC (Natural Environment Research Council) grant NE/K01496X/1.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Ichnotaxonomic and sedimentological analyses of the fossil record of Thyreophera (Dinosauria: Ornithischia) suggest that some degree of gregarious behavior was common to derived members of the clade

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While varying degrees of gregarious behavior is generally accepted amongst two derived ornithischian clades (hadrosaurids and ceratopsids) of the Late Cretaceous, little consensus exists as to its existence within the clade Thyreophora, consisting of the Ankylosauria, Stegosauria, and more basal members such as *Scutellosaurus lawleri* and *Scelidosaurus harrisonii*. A number of bonebeds of different genera of ankylosaurs, including *Gastonia lorriemcwhinneyae* and *Pinacosaurus grangeri*, exhibit evidence of numerous genera dying together or at a minimum being transported to the same location after death.

To analyze likelihood of gregarious behavior, multiple lines of evidence were used, including

ichnofossils such as the track, *Deltapodus*, as well as a number of mass mortality sites of many different genera of ankylosaurs. Sedimentological settings of these bonebeds are analyzed to determine if the taxa co-occur due to genuine gregariousness or because of fluvial and taphonomic dynamics. Age of taxa within mass-mortality sites are taken into account to test for evidence of age-segregated herding versus more complex multi-generational herds.

With recent publication of groupings of *Deltapodus ibericus* tracks—attributed to stegosaurs—evidence of at least occasional gregarious behavior, it calls into question whether some degree of gregarious behavior is a basal state of Thyreophora as a whole.

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Tetrapod feeding remains: the first bromalites from Bromacker (early Permian, Germany)

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Bromalites—fossilised digested remains—are of high scientific importance as they provide rare insights of feeding behaviours and digestive physiology in extinct organisms, including evidence of predator-prey interactions. These remains can be preserved either internally, within body fossils (e.g., oralites, gastrolites, cololites) or externally, as separate entities (e.g., coprolites, regurgitalites). They are exceptionally rare, especially from Palaeozoic terrestrial deposits. The early Permian Bromacker locality in central Germany (Tambach Formation) yields outstanding fossilised vertebrate traces associated with skeletal remains. Here, we describe the first two bromalites from the Bromacker locality, which were CT-scanned and identified as a coprolite (fossilised faeces) and a regurgitalite (fossilised vomit). The coprolite has an elongated, ovoid shape, with reddish bone remains visible on a broken surface. It contains cranial and post-cranial elements tentatively attributed to the trematopid temnospondyl Rotaryus gothae. In contrast, the regurgitalite consists of a relatively compact cluster of 39 small bones arranged in an unusual taphonomic pattern (i.e., concentrated in a small area and with a preferential orientation), without a fossilised embedding matrix or burrowing structures. Taxonomic analysis of the skeletal inclusions indicates the ingestion of four taxa, interpreted as: a small captorhinomorph—*Thuringothyris mahlendorffae*—a bolosaurid reptile—*Eudibamus cursoris*—along with few elements likely assignable to an unknown diadectid and an indeterminate dissorophoid. Elemental analysis, using X-ray fluorescence spectroscopy (XRF) revealed a numerically clear difference of phosphorous concentration between the two bromalites, allowing us to confidently distinguish coprolitic and regurgitated remains. Based on their size and bone content, we hypothesise that these bromalites were most likely produced by a terrestrial apex predator, such as the sphenacodontid *Dimetrodon teutonis* or the varanopid *Tambacarnifex unguifalcatus*, previously recorded from Bromacker. Moreover, two additional coprolites yielded bone remains, which are currently under study. The size and morphology of the coprolites are consistent with a synapsid cloacal vent impression found at the same locality. These findings provide new insights into the behavioural ecology and trophic structure of the Bromacker ecosystem and of terrestrial tetrapod ecosystems in general.

Funding Sources Elsa-Neumann scholarship (State Berlin, Germany) and Bundesministerium

für Bildung und Forschung (BMBF) for the BROMACKER Project 2020–2025, grant number 01UO2002A.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Body length estimates of the Miocene crocodile shark, *Pseudocarcharias* sp. (Lamniformes: Pseudocarchariidae) based on the extant crocodile shark, *P. kamoharai*

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The crocodile shark, *Pseudocarcharias kamoharai* (Matsubara), is an extant lamniform shark. It is the only living member of the family Pseudocarchariidae and the genus *Pseudocarcharias*, and the smallest extant member of the order Lamniformes that reaches only up to about 1.2 m in total body length (TL). Whereas the genus is represented in the fossil record sporadically by isolated teeth found primarily in Miocene deposits nearly worldwide, many biological aspects, even for the extant *Pseudocarcharias*, are still poorly understood, including the ontogenetic development of teeth. In this study, we used linear regression analyses to examine the relationship between the total body length (TL) and tooth crown height (CH) of each tooth in 14 individuals of extant *P. kamoharai*, ranging from 72–109 cm TL, collected from the Pacific and Indian Oceans. The resulting regression equations suggest that the increase in CH of teeth through tooth replacement is generally proportional to an increase in TL, with high predictability of TL from CH ($p < 0.0001$) found in teeth located mesially (i.e., the so-called "anterior teeth"). This study is significant because it allows TL estimations for *Pseudocarcharias* in the fossil record. For example, previously published *Pseudocarcharias* teeth from the Miocene of Italy, Germany, Japan, Panama, and Peru include anterior teeth with a complete or nearly complete crown. If our regression equations for the anterior teeth are applied to those fossil teeth, their TL estimates range from 47–231 cm. Whereas the smallest estimated individual was likely a neonate, the largest TL estimate is significant because it is about twice the size of the largest known extant *Pseudocarcharias*. This largest TL estimate is still considerably small for Cenozoic lamniforms, but this new finding nevertheless provides new insights into the Neogene marine ecosystem.

Funding Sources The Department of Biological Sciences and the College of Science and Health at DePaul University.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The Winterswijk quarry (Anisian, Middle Triassic, The Netherlands): one of the richest fossil biomes of its time

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The Anisian (early Middle Triassic) fossil locality of Winterswijk (The Netherlands) yields a large number of fossils with exceptional preservation. Since the 1950s, a dedicated group of citizen scientists has been collecting and documenting the fossil assemblage from the quarry. Although many taxa have been studied in detail, less emphasis has so far been given to the ecosystem in its entirety. This study aims to assemble an overview of Winterswijk's taxonomic richness and compare it to other marine fossil localities of a similar age. During the Anisian, Winterswijk was a shallow marine or tidal environment close to the western shore of the Germanic Basin.

Richness, a simple count of taxa, was chosen over diversity metrics due to the straightforwardness of the required data. The taxonomic richness of Winterswijk was compiled through published literature, with the addition of recent own micropaleontological observations. It was then compared to data in the Paleobiology Database (PBDB) over the same stratigraphic interval (Anisian).

The existing PBDB entries on Winterswijk revealed that 51–67% of Winterswijk's actual richness (depending on taxonomic rank) is not recorded in the PBDB. Coverage also varies per group; for example, 86% of arthropods were entered in the PBDB, but molluscs were entirely absent.

Despite this missing data, Winterswijk consistently ranks among the richest Anisian marine fossil localities globally. It ranks first in terms of ichnogenus richness, showing the unique nature of Winterswijk's fossil assemblage even when data are incomplete. It must be noted that other localities also lack data in the PBDB. We are working on a method to assess the completeness of PBDB entries.

Winterswijk's richness assessment, as presented here, is largely due to the work of the citizen scientist community. It provides the most accurate view to date of the site's paleontological importance and contributes to a broader understanding of marine recovery during the Anisian. Our findings help in understanding ecosystem recovery following the Permian-Triassic mass extinction (PTME), as the Anisian taxonomic richness shows the state of ecosystems only a few million years after this devastating mass extinction.

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

Disparity in growth dynamics between early-diverging pseudosuchians and their kin

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Individuals that are small, young, and skeletally immature are critical for assessing and conceptualizing developmental/ontogenetic patterns in species. Such individuals are rare in the fossil record. Thus, early ontogeny is unknown and/or poorly understood for most documented extinct taxa, particularly among pseudosuchians. Because of this, development and growth patterns in Crocodylians, which are the only surviving members of the Pseudosuchia, serve as the main comparative proxies for inferences about the growth dynamics in their extinct pseudosuchian relatives. Although distantly related, extant crocodylians have derived features with an ecology and body plan that is unlike that of most of their extinct relatives, particularly those early-diverging members from the Triassic Period. As a result, this disparity limits paleobiological inferences that can be made about those extinct species.

Aetosaurs are a group of early-diverging pseudosuchians from the Late Triassic Epoch that exhibit an osteoderm-covered body plan that resembles the extant armadillo and some lizards. Recent collections work resulted in the discovery of a cluster of young juvenile individuals that are estimated to be ~1–2 years of age and are referrable to the aetosaur *Coahomasuchus kahleorum*. This cluster provides key data on the development and growth dynamics of an early-diverging pseudosuchian group. First, this cluster exemplifies how our lack of understanding of the growth dynamics in young individuals can influence our taxonomic interpretations that are based on osteohistology—it is evident that various intrinsic and extrinsic factors can shape the growth record independent of ontogenetic trajectory. Second, this cluster indicates the posthatching expression of morphologies that are only observed during the embryonic development of crocodylians. Third, the presence of well-ossified osteoderms in this cluster indicates that they ossify much earlier in

ontogeny in aetosaurs than in crocodylians, which brings to question the inception of their osteogenesis, and, in part, the initial sourcing of the calcium required for their ossification. These data indicate that aetosaurs, and likely other early-diverging pseudosuchians, exhibited a disparity in the ossification and co-ossification patterns from those observed in crocodylians, which highlights their limitations as extant comparative proxies.

Funding Sources Jackson School of Geosciences; The University of Texas at Austin Graduate School; Lundelius Endowment in Vertebrate Paleontology; NSF (Grant No. 2137420; EAR-2223808).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

What goes in must come out: principles for leveraging relational databases to track transactions

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Sending and receiving loans is a routine task for those managing fossil collections, but the procedures and methods of documentation may be less familiar to those making loan requests. Borrowers seeking to study, digitize, destructively sample, or exhibit fossils, may not be aware of the steps involved to initiate, process, and complete loan transactions. Furthermore, institutions with historical collections or those with high staff turnover may have gaps in their paper and digital records, revealing inconsistencies of approach when it comes to tracking specimen movement.

With the advent of relational databases, error is minimized, standardization of record data is possible, supporting documentation and images can be linked, and digital notes can be added to clarify tasks. In order to leverage relational databases for tracking transactions, consider the following principles: 1) assign a unique identifier to each transaction, 2) optimize look up value pick lists for controlled vocabulary, 3) maintain written procedures for data entry and specimen itemization, 4) always catalog material and resolve data discrepancies in advance, 5) export data via reports whenever possible for labels or forms, 6) link voucher specimen photographs to the record in support of the condition assessment, 7) clarify any special permissions in advance and in writing (e.g. destructive sampling, digitization, 3D printing, molding and casting, or other physical preparation or exhibition provisos), and 8) update the physical location of specimens and generate withdrawal labels to serve as a physical pointer for future collection users about the current disposition of the material.

Another practice to consider is including a cover letter with outgoing loans that specifies how the catalog number is to be cited in publications, how receipt of digital data is to be furnished, and what materials and methods should be documented, if destructive sampling or further preparation is permitted. Despite the use of various relational database software around the globe, the foundational principles for tracking the movement of specimens are not so daunting when we collaborate on our policies and procedures and educate both museum staff and borrowers about the utility of creating records that are consistent and detailed. Our approach to recording the historical narrative of each specimen under our care matters—especially as it travels in and out of our respective institutions.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

An *Allosaurus* skull atlas: new insights into the skull anatomy of *Allosaurus jimmadseni* (Dinosauria, Theropoda) based on CT scanning, with an analysis of the use of paranasal sinuses in discriminating *Allosaurus* species

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Biology has long relied on the use of model organisms—that is, organisms with generalized body plans and convenient phylogenetic placements that are well-understood and easily studied (e.g., *Drosophila*, mouse)—to make inferences about the biology of less easily studied organisms. Likewise, the study of extinct animals would benefit from representative model organisms to compensate for an often-incomplete fossil record. The late Jurassic theropod *Allosaurus* is a strong candidate for a model theropod, given its generalized body plan, phylogenetic position, wealth of available fossil material, and nearly 150 years of study. To expand both information about and access to fossil material of this potential model organism for researchers, educators, and other interested parties, the complete skull of the *Allosaurus jimmadseni* specimen MOR 693 (also known as "Big Al") was subjected to computed tomographic (CT) scanning. The skull was then digitally segmented into its constituent parts, including all bones, paranasal pneumatic sinuses, and the brain endocast. This presentation of the *Allosaurus* "skull atlas" presents novel views of a well-studied specimen, such as dorsal views of the palate, medial views of the sagittally sectioned skull, and isolated bones. Beyond the skull atlas, we also present new insights into *Allosaurus* skull anatomy, such as a lack of jugal pneumaticity and the presence of bony septation in the nasal and lacrimal sinuses. In addition, we test the hypothesis that the extent of paranasal pneumaticity can be used to help discriminate species of *Allosaurus*. The nasal and lacrimal sinuses of MOR 693 were compared to those of other *Allosaurus* specimens, including the holotype of *A. jimmadseni* and multiple specimens referred to *A. fragilis*. Preliminary work suggests that the sinuses of *Allosaurus jimmadseni* are more extensive, and the bony septa found within the sinuses of *A. jimmadseni* specimens are not found in the sinuses of *A. fragilis* specimens. Further exploration of variation in sinus anatomy using additional specimens would be beneficial to supplement the small sample size used in this preliminary study and may also provide a partial test of the recently proposed referral of *Allosaurus* specimens from Portugal to *A. fragilis*.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Anatomy and phylogenetic relationships of two new Eocene species of *Argyropelecus* (Sternoptychidae) from the Pabdeh Formation, Iran

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Two new species of deep-sea hatchetfishes have been discovered from the Eocene (Bartonian) deposits of the Pabdeh Formation, Zagros Basin, Iran. A detailed morpho-anatomical analysis revealed diagnostic features that clearly support their alignment with the sternoptychid genus *Argyropelecus* Cocco, 1829. Phylogenetic and geometric morphometric analyses suggest that these new species represent the oldest representatives of two different morphotypes, the deep-bodied "*A. lychnus* species complex" and the slender-bodied "*A. affinis* species complex". The presence of two Eocene species of the genus *Argyropelecus* in the Pabdeh Formation extends the temporal and biogeographical range of these oceanic fishes, providing additional information for our understanding of the evolutionary history of the deep-sea hatchetfishes.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

An atlas of cranial anatomy for extant worm lizards (Squamata: Amphisbaenia) using diceCT to re-evaluate the fossil record of Rhineuridae

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Rhineuridae is one of the six families of Amphisbaenians, more commonly referred to as worm-lizards due to their mostly limbless and fossorial lifestyle. Results from recent phylogenetic analyses of Amphisbaenians support Rhineuridae as the earliest diverging family, sometime in the mid- to late Mesozoic. While the only extant rhineurid (*Rhineura floridana*) is restricted to Florida, the fossil record of this group has been suggested to extend back into the Eocene of North America and is more broadly distributed, found as far west as Wyoming. The very small body size and limits to studying crania based on external surfaces and dissections has historically led to inconsistent and, in some cases, incorrect interpretations of anatomy, resulting in problematic systematic and ecological inferences. To address this, I generated standard and diceCT scans of crania for five of the six extant amphisbaenian families, including *R. floridana*, to evaluate osteological characteristics, their relationship to soft tissues, and potential correlations with ecology. I found that *R. floridana* was unique in having: 1) external perforations through the frontal bone marking the termini of the ophthalmic frontal branch of the trigeminal nerve that merges posteriorly into a single branch and runs through a canal within the frontal, exiting into the orbit for increased facial sensitivity related to its fossorial ecology, 2) symmetrical scars on the parietal that mark the attachment of the nuchal tendon which is embedded in muscle and extends posteriorly, attaching to 3) symmetrical striations on the neural spine of anterior trunk vertebrae, facilitating the spade-style digging unique to this taxon. Using these observations, together with new microCT scans of fossil crania from the 1) Oligocene of Nebraska (*R. hatcherii*), Colorado (*Dyticonastis*), and South Dakota (*Hyporhina*), 2) late Eocene of Texas (*Solastella*), and 3) the early Eocene of Wyoming (*Spathorhynchus*), I evaluate previous taxonomic and ecological hypotheses. Results suggest that the unique fossorial characteristics of extant *R. floridana* are present at least as far back as the earliest Eocene, and possibly into the Paleocene based on isolated fossil vertebrae. An exclusively North American distribution in the fossil record of Rhineuridae and its basal phylogenetic position supports a North American origination for Amphisbaenia.

Funding Sources National Science Foundation Grants: EAR-0640076, EAR-0719941, DBI-1701714, EAR-2422839; FLMNH (Gapenski Endowment); UF Geology (LUECI).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A partially fused juvenile hesperornithiform (Avialae, Ornithuromorpha) metatarsus from the Albian–Cenomanian (Cretaceous) of northern Alberta, Canada

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Hesperornithiformes is a well-known group of aquatic Cretaceous birds, but their geographic origin is unclear and there is little reported material older than Late Cretaceous. A metatarsus (UALVP 61432) of a juvenile hesperornithiform from a bonebed just south of Peace River, Alberta, represents the geologically oldest known hesperornithiform in North America. The bonebed is located on the Peace River near the mid-Cretaceous transition between the Albian Peace River Formation and the overlying Cenomanian Shaftesbury

Formation. The specimen comprises metatarsals II–IV with unfused proximal and distal ends and no evidence of distal tarsals, implying that tarsometatarsal fusion began at the midshaft as in neornithines. The medial surface of the metatarsus has been eroded, especially distally. In combination with *Enaliornis* spp. from the Cambridge Greensand of England, the only known Albian hesperornithiforms, UALVP 61432 indicates that members of this clade were becoming widespread in the northern hemisphere by the earliest Late Cretaceous. The shaft of UALVP 61432 is twisted, an adaptation to foot-propelled diving present in all hesperornithiforms. However, the specimen lacks the tightly spaced and highly shingled trochleae seen in derived hesperornithiforms such as *Hesperornis*, suggesting basal placement within the group and only limited aquatic adaptation. UALVP 61432 bears a close overall resemblance to a similarly sized juvenile metatarsus of *Enaliornis barretti*, although the proximal end of metatarsal II is both craniocaudally deeper and more cranially positioned, relative to that of metatarsal III, in the former metatarsus than in the latter. By contrast, UALVP 61432 differs from *Pasquiaornis* spp., the earliest named hesperornithiforms from North America, in bearing a cranial ridge on metatarsal III that begins at the midshaft and becomes more prominent distally, and in that the ridge arising proximally on metatarsal IV stops well short of the midshaft region. The resemblances in metatarsal anatomy between UALVP 61432 and *Enaliornis* may indicate that the earliest North American hesperornithiforms exhibited a body plan similar to that of *Enaliornis*, consistent with their shared Albian-Cenomanian age. Parsimony-based phylogenetic analysis of a previously published matrix with UALVP 61432 added in supports such a conclusion by positing this specimen and *Enaliornis* as the most basal hesperornithiforms.

Funding Sources Natural Sciences and Engineering Research Council of Canada, Discovery Grant RGPIN-2023-04916.

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Bringing paleontology into the classroom: a digital teaching unit on evolution using ongoing research

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We developed an interactive online teaching unit (viten.no/evolusjon) for pupils aged 13–16, integrating ongoing paleontological research to strengthen understanding of evolution. The website viten.no is a well-established digital platform used by over 40,000 pupils annually, supporting science education in the classroom for young people aged 13–19 in Norway. Our new unit on evolution follows researchers from the Natural History Museum in Oslo during fieldwork in Svalbard, investigating fossils that illuminate life's recovery after the end-Permian mass extinction 252 million years ago. Using drone footage, animations, interactive and written tasks, students conduct virtual data collection and identification. They analyze findings, and form explanations, mirroring authentic scientific practices. The curriculum consists of three modules. The first addresses geological and biological upheavals after the extinction event. The second immerses students in biostratigraphy, field observations and in the interpretation of fossil findings. The third focuses on interpreting fossil data to understand evolutionary theory. This approach fosters active learning and critical thinking, aiming to deepen students' comprehension of paleontological methods and evolutionary concepts in line with Norway's national curriculum. Student responses to embedded written exercises are collected anonymously to evaluate learning outcomes and guide iterative improvements to the unit. Early feedback indicates increased student engagement and improved grasp of complex scientific ideas. This program exemplifies how integrating real-world research

into education can inspire the next generation of scientists.

Funding Sources Growth House, at the University of Oslo, Norway.

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

From dachshunds to dire wolves: Landmark free morphometrics reveals extreme shape variation in the appendicular skeleton of canids

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Natural and artificial selection across Canidae has produced remarkable morphological diversity, offering a unique framework to investigate the evolutionary, developmental, and functional drivers of shape variation. Skull morphology is well understood across Canidae and through time, as are the implications for phylogenetics, biomechanics, and development. The postcranial skeleton is comparatively understudied, partly due to the relative paucity of homologous landmark positions in limb bones. Here we present the first landmark-free Deterministic Atlas Analysis of limb bone shape across Canini, sampling the humerus, radius, ulna, scapula, femur, tibia, fibula and pelvis of 14 species, including 13 breeds of domestic dog (*Canis familiaris*), resulting in a total sample of 1182 individual elements. Our dataset spans recent, historical and fossil specimens, enabling us to investigate morphological diversity through deep and shallow time.

Our findings reveal that each limb bone in domestic dogs occupies a morphospace approximately an order of magnitude larger than that of all other sampled species. Remarkably, much of this expanded morphospace is attributable solely to dachshunds, while wolfhounds, deerhounds, and greyhounds cluster closely with wild canids. Excluding domestic dogs from the analysis, we observe distinct separation between dire wolves (*Aenocyon dirus*) and all other taxa across each morphospace. We use these results to reassess the taxonomic identity of specimens previously attributed to *Canis lupus* from the La Brea Tar Pits. This research holds a broad set of implications for vertebrate palaeontology and veterinary science. It informs breed-specific musculoskeletal health in domestic dogs, refines interpretations of the canid fossil record, and advances our understanding of the interplay between postcranial morphology, development, and biomechanics across canid phylogeny.

Funding Sources BBSRC grant BB/X014819/1.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

'Immediate' phosphatization: understanding exceptional fossilization in the Quercy mummies (Eocene–Oligocene of France; MEDUSE-P)

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The Quercy phosphorites (Eocene–Oligocene of France) have yielded rare examples of tetrapods fossilised in alive body dimensions and with soft tissues (referred as 'natural mummies'). Preserved in calcium phosphate, replicating tissues to their finest resolution, these mummies have proven great interests to document the paleobiology of these lineages, but also their taphonomy. Recently, new Quercy mummies were reported, providing an unprecedented occasion to (1) finely characterize the morphology of both their hard and soft tissues,

including to the ultrastructural level, and to (2) document the process by which a range of fossil remains, organisms, and organs have experienced a rapid phosphatization. In this latter goal, the MEDUSE-P project aims at comparing the textures, compositions and interaction between phosphate crystals and microorganisms in (a) phosphorites crusts, (b) fossilized tissues, (c) some experimentally-phosphatized tissues. The latter part is led both in lab and in karst external conditions, on fruits of Vitacea and Anacardiacea. Fossilized soft tissues consist of a selection of tetrapod and arthropod tissues, fruits of the above-mentioned plant families, and fossil droppings. Both fossilized and experimentally-obtained phosphates are spatially characterized using PPC-Synchrotron-RµCT (ESRF) and SEM for textures and microbial interaction. Compositions and crystallizations are assessed using EDS, Raman spectroscopy, and FTIR. Preservation to the cellular level was identified in many fossil tissues using PPC-Synchrotron-RµCT. Raman spectroscopy and FTIR signals do not reflect a varying crystallization along the centrifugal axis of fossil tissues in section. SEM and EDS signals tend to distinguish between zoned and layering mineralisation type (richer in C) and a more amorphic phosphate which resulting of completely intertwined fine apatite nanoscopic needles (poorer in C). Different types of microorganisms are observed in association with these two crystal growing phases, as well as different densities (evidenced by PPC-Synchrotron-RµCT data). SEM imaging and spectral analyses will ultimately be applied onto phosphates experimentally-produced in lab and, in karst, where the mummies naturally formed.

Funding Sources This research is funded by the French CNRS-Mission for Cross-Cutting and Interdisciplinary Initiatives 2024-2026 (MEDUSE-P).

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

Quantifying morphological disparity in the petrosal bone and the bony labyrinth: a case study using extinct and extant camelids

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The internal otic region of mammals consists of several structures including the petrosal bone and the bony labyrinth. The petrosal surrounds the bony labyrinth, the latter of which contains the organs of hearing and balance in life. The petrosal is also associated with several other soft tissues. Advances in µCT scanning have allowed the petrosal and bony labyrinth to be studied more intensively with a growing emphasis on comparative morphology. Because widespread access to these data are relatively recent, variation within species and among closely related species remains understudied, leading to inferences made from limited material assumed to represent an average morphology.

To quantify petrosal and bony labyrinth variation in camelids, we developed 3D geometric morphometric landmark schemes for the structures, with a total of 136 and 93 landmarks, respectively. Based on a sample of 14 extant camelids representing six of the seven living species, two specimens of the early camelid *Poebrotherium*, and a specimen of the extinct cameline *Camelops*, the petrosal is more morphologically variable than previously thought. After standardizing landmark configurations, we visualized this morphology with a principal component analysis. *Camelops* grouped with the extant aucheniinins, an unsurprising result given that *Camelops* is thought to be an extinct aucheniinin. Camelinins, aucheniinins, and *Poebrotherium* occupied distinct areas of the morphospace. Camelinins were separated from both the

aucheniinins and *Poebrotherium* along PC1, likely because of differences in subarcuate fossa and rostral petrosal morphology. Bactrian and dromedary camels were separated in morphospace, suggesting that there may be undescribed differences between their petrosals. Aucheniinins exhibit a great deal of within-species variation that may be equivalent to their among-species variation. Based on a reduced sample of twelve individuals, a similar pattern was present in the bony labyrinth, although camelinins and aucheniinins had less separation and *Poebrotherium* greatly differed from both tribes. Comparing the Procrustes distances of the petrosals and BLs of these twelve individuals, we found that the petrosals had significantly more variation ($p < 0.001$) than the bony labyrinths. This suggests that, despite the two structures being closely associated, their morphological variability is quite different and more intensive sampling of petrosals from both extinct and extant taxa is needed.

Funding Sources NSERC Discovery Grant to JM Theodor.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New insights into the geology and paleontology of the Upper Cretaceous (Turonian/Coniacian?) Ankazomihaboka sandstones, Mahajanga Basin, northwestern Madagascar

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The fossil record of Late Cretaceous terrestrial and freshwater vertebrates from the island of Madagascar is derived almost exclusively from the Maastrichtian Maevarano Formation exposed within the Mahajanga Basin, northwestern Madagascar. The only documented records of earlier Cretaceous Madagascan vertebrates include isolated specimens of fishes (dipnoans, coelacanths, and pycnodonts), turtles, crocodyliforms, and dinosaurs first recovered in the early 1900s by French naturalist Perrier de la Bathie. These older fossils come from the Ankazomihaboka sandstones, which comprise an informal but distinctive sedimentary unit of terrestrial origin (predominantly fluvial and floodplain facies) that overlies basalts dated to the Turonian. Radiometric dates are unavailable for the coarse-grained sandstones (litharenites) that dominate the unit but inferences based on the stratigraphy and sedimentology of the unit indicate that it is likely also of Turonian, or perhaps Coniacian, age and thus significantly older (by potentially over 20 million years) than the overlying Maevarano Formation, which has yielded a relatively well-sampled, well-documented, diverse, and pristinely preserved vertebrate fauna. Here, as part of the long-term Mahajanga Basin Project, we report the discovery of a new, large sample (approximately 1,500 specimens) of vertebrate fossils (and rare fossil plants) from the Ankazomihaboka sandstones, collected over the course of roughly three decades. The sample is dominated by dipnoan fishes but also includes an array of bony fishes, pleurodiran turtles, notosuchian crocodyliforms, and both abelisauroid theropod and titanosaurian sauropod dinosaurs. Interestingly, the vast majority of dipnoan specimens come from one particularly rich locality discovered in 1996 (MAD 96-18). All of the vertebrate specimens from the Ankazomihaboka sandstones were recovered as isolated elements (most of them weathered from outcrop and no longer in situ), which stands in strong contrast to the abundance of associated and articulated specimens found in situ in the Maevarano Formation. The vertebrate assemblage recovered from the Ankazomihaboka sandstones, deposited at roughly the same time that Madagascar became fully isolated from the Indian subcontinent and the Seychelles as an island in the Indian Ocean, includes several new taxa and will provide profound insights into the biogeographic origins of the much better-known Maevarano Formation fauna.

Funding Sources Multiple grants from the National Science Foundation, the National Geographic Society, and the David B. Jones Foundation. Additional support by the DMNS and the USNM.

Colbert Prize Session

Fossoriality and forelimb function in early tetrapods: a comparative 3D range of motion analysis of the Permian recumbirostran 'microsaur' *Batropetes palatinus*

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Throughout vertebrate evolution, the acquisition of fossorial adaptations has enabled animals to excavate burrows for diverse purposes, including shelter, breeding, and foraging. Some of the earliest evidence for fossoriality has been proposed to be linked with recumbirostran 'microsaurs'—a diverse clade of terrestrial Permo-Carboniferous tetrapods. These taxa display a wide range of morphological adaptations associated with a fossorial lifestyle, including specializations for head-first burrowing and forelimb-based scratch-digging. However, their morpho-functional abilities, in particular of their forelimbs, currently lack robust biomechanical testing. Among them, *Batropetes palatinus* stands out as one of the best-preserved representatives, making it an ideal candidate to assess its potential fossorial capabilities. Here, we employ comparative range of motion (ROM) analyses on the complete and articulated forelimb of *Batropetes*. To validate our analysis and account for the disputed phylogenetic position of the group, we selected both fossorial and non-fossorial taxa from amphibians and reptiles as phylogenetic bracketing analogues, namely the amphibians *Ambystoma tigrinum* (fossorial) and *Salamandra salamandra* (non-fossorial), and the reptilians *Heloderma suspectum* (fossorial) and *Xantusia riversiana* (non-fossorial). Preliminary ROM results in *Batropetes* show a greater overall similarity in forelimb joint mobility to *Heloderma, Xantusia*, and *Ambystoma* than to *Salamandra*. Notably, ROM patterns in the elbow and wrist joint of *Batropetes* closely resemble those of the fossorial taxa. In these species, elbow movement is markedly restricted to the frontal plane, particularly to adduction, compared to their respective non-fossorial relatives. Likewise, wrist mobility is primarily restricted to the sagittal plane, whereas non-fossorial taxa exhibit larger mobility across all planes. We hypothesize that restricted elbow and wrist motion may help stabilize the forelimb and reinforce joints to withstand the mechanical loads during digging. This study highlights the need to expand our understanding of fossoriality in extant amphibians and reptiles in order to provide more suitable comparative material for early tetrapods. Our findings provide new biomechanical perspectives on evolutionary adaptations associated with a fossorial lifestyle and contribute to a clearer understanding of forelimb function in recumbirostran 'microsaurs' and early tetrapods in general.

Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

The first known dentally associated postcrania of a microsyopid plesiadapiform (Mammalia, Euarchonta) from the Eocene of Wyoming reveals specialized traits of the wrist and ankle

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Anthropology, Duke University, Durham, North Carolina, United States, [5]Department of Anthropology, City University of New York, New York, New York, United States, [6]New York Consortium in Evolutionary Primatology, New York, New York, United States, [7]Centre for Functional Anatomy and Evolution, John Hopkins University School of Medicine, Baltimore, Maryland, United States, [8]Department of Anthropology, Yale University, New Haven, Connecticut, United States, [9]Division of Vertebrate Paleontology and Vertebrate Zoology, Yale Peabody Museum, New Haven, Connecticut, United States

Plesiadapiforms are early Paleogene (Paleocene–Eocene), mammals that are often considered stem primates or primitive members of the Euarchonta. Currently, few of the families in this group are represented by dentally associated postcrania leaving large gaps in our understanding of their morphology and behavior. Here we provide a detailed morphological description of postcranial elements associated with craniodental materials of *Microsyops latidens* (USNM 527684) from the lower Eocene part of the Willwood Formation, Bighorn Basin, Wyoming, the first for the family Microsyopidae.

USNM 527684 includes dentition indicative of two *M. latidens* individuals, partial left and right fore- and hind limbs, an astragalar body, calcaneus, cuboids, ecto- and mesocuneiforms, a trapezium, and a distal phalanx. The forelimbs of *M. latidens* indicate a mobile shoulder and a habitually flexed, mobile elbow. The trapezium's first metacarpal facet is different from that known for plesiadapoids and more similar to many living euarchontans in exhibiting a dorsopalmarly oriented ridge (adding stability in abduction, while retaining stability in flexion). The hind limbs reveal a mobile hip suited to habitually flexed and abducted postures and a knee that rotated laterally during extension to aid in pedal inversion, necessary when clinging to large supports. Further evidence of a large range of stable inversion and eversion comes from the deeply concave, helical calcaneocuboid facet that permitted an extreme degree of midfoot rotation, stabilized by a thick, proximodistally extensive pedal ridge on the cuboid. Overall, *M. latidens* shared many features common in other plesiadapiforms indicative of arboreal behaviors with frequent orthograde clinging on large diameter supports. However, unique features in the wrist and ankle may indicate specialized mobility at these joints aiding in manual grasping, and under branch postures.

Clarifying the behavioral profiles and morphological affinities of plesiadapiforms is key to understanding broader relationships among early primates and testing hypotheses surrounding primate origins. This association offers evidence that more morphological diversity existed in plesiadapiforms than previously understood making it a key sample for future morphological, phylogenetic, and taxonomic comparisons.

Funding Sources Funded by an NSERC Discovery grant to MTS; FLMNH Research Funds to JIB; NSF grant (BCS 1552848) to DMB; NSF grant to KDR.

Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Melanin chemistry as a tool to investigate the phylogenetic affinity of enigmatic fossils: Mazon Creek Lagerstätte as a case study

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Melanins are black to orange pigments that are widespread across extant organisms and play important roles in coloration and physiology. Fossil evidence of melanin and melanosomes (melanin-bearing organelles) has been reported from fossils dating back to the Carboniferous. Recent advancements in our understanding of melanosome attributes, including distribution, abundance, morphology, and chemistry, highlighted strong tissue- and taxon-specific signals in extant and fossil vertebrates,

prompting the use of those melanosome attributes to investigate phylogenetic affinities in enigmatic fossil taxa. Raman spectroscopy is an emerging tool in palaeontology to investigate the chemistry of organically preserved fossils. We have recently demonstrated that quantitative analysis of Raman signatures can discriminate between melanin-rich tissues and other biological materials following thermal maturation. Here, we test the capacity of this approach to discriminate different taxa, using Palaeozoic fossils. We analysed 21 specimens from the Mazon Creek Lagerstätte, including vertebrates, invertebrates, and the enigmatic *Tullimonstrum gregarium*. We analysed the chemistry of the melanosome film preserved in the eyespots using a Renishaw inVia Qontor Raman Microscope System using a 532 nm 50 mW laser. All samples are dominated by melanin characteristic Raman peaks. Multivariate statistical analysis of the Raman data reveals differences in the Raman signal between invertebrates and vertebrates. Critically, our analysis suggests that *Tullimonstrum* has a vertebrate affinity. Our findings on the affinity of *Tullimonstrum* align with phylogenetic interpretations based on the morphologies of ocular melanosomes but differ from interpretations based on melanosome metal chemistry, which instead suggested an invertebrate affinity. This highlights the challenges of the application of taphonomic information to phylogenetic interpretations when our understanding of the taphonomic history of fossils, especially at the molecular level, is incomplete.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Not at all living fossils: recent advances in paleobiology of tragulids

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Modern Tragulidae are a group of ten small-sized artiodactyl species, including the smallest living hoofed mammal (*Tragulus javanicus*). Their lifestyle is reclusive in thick undergrowth of disjunct areas of tropical Africa and Asia. Because they clearly share apomorphies with pecoran (deer, buffaloes, giraffes, pronghorns, musk deer) ruminants, but otherwise are equipped with strikingly differing traits, they were interpreted survivors of the dawn of ruminants, in other words: living fossils.

Yet, increased research in the last 20 years on the widely distributed Afro-Eurasian Miocene record not only surprised with a much larger phenotypic diversity of tragulids than in the modern world, but also points to a complex, not straight, evolutionary history, adjusting with ecological challenges arisen from tectonical and climatic activities. Though a Pliocene and Pleistocene record is largely missing, Recent tragulids demonstrate that there was a serious cut to the Miocene tragulid success, when tragulids were dominant over pecorans for some time. Eventually, ecological shifts forced them to retreat to forested relic areas, where they feed on frugivorous diet year-round.

Research on dentition, appendicular skeleton, and skull morphology, and metrics of a number of old and new Miocene materials from Africa, Europe, and Asia allowed for long overdue taxonomical revision, body mass estimation, phylogenetic analysis, and updated paleobiogeography reflecting aquaphilous adaptation. Analyses of isotope geochemistry, mesowear, and microwear contributed to the reconstruction of dietary and habitat preferences of mosaic wooded to forested environments. Results always were compared with and used to assess extant tragulid phenotyps within the clade. Overall, phenotypic disparity among Miocene and extant tragulids as well as the derived condition of the latter is supported. This presentation aims at summarizing the recent achievements in understanding tragulid evolutionary history, pointing out remaining major gaps, highlighting current studies on the

largest sample ever known of †*Dorcatherium guntianum* from Hambach (Germany), cranial discrepancies in †*Dorcabune crissum* and *Hyemoschus aquaticus*, quantifying tooth crown height differences among tragulids, and demonstrating that living tragulids are no living fossils.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Splash proof! Nesting sieve bins: a novel preparation method that prioritizes safety and efficiency in chemical preparation of fossiliferous concretions

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Chemical preparation is a widely popular technique for the removal of matrix from concreted fossil specimens. However, despite widespread use, current methodology leaves plenty of room for accidents, damage to specimens and errors when using acids. Utilizing a novel system of nesting bins for placing and removing fossiliferous concretions into acids, preparators are able to reduce the risk of accidents, increase efficiency and speed of concretion processing, and retention of specimen information when processing multiple specimens simultaneously. These bins work like nesting dolls, with sieve-like bins resting in larger retention containers of acid. This allows acid to flow from the retention container into the internal nested sieve-bin when submerging fossils, without risk of splashing, and allows sieve-bins to drain quickly and carefully, minimizing drips and splashes, and completely eliminating the need for a preparator to ever dip a (gloved) hand into the acid themselves. Specimen information, especially when written directly on a fossil, can be lost and hard to keep track of when the specimen is dipped into acid; however, the nesting bins themselves can be labeled and assigned to specific specimens. Finally, this method allows for multiple specimens to be placed into the same vat of acid by using several small nesting bins. This allows for increased efficiency in the use of resources, as well as in the use of preparators' time. This poster intends to outline the schematics of such a system as well as the many benefits of the design so that the model may be adapted and utilized.

Funding Sources This method was created at the Burke Museum of Natural History and Culture utilizing materials purchased by the Burke and the University of Washington.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The fruits of collaboration across specialties: the earliest documentation of cartilage-related cancer, a chondrosarcoma, in the fossil record

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Denizens of the Mesozoic were afflicted with many disorders indistinguishable in their osseous manifestations from those that afflict humankind today, including tumors of the musculoskeletal system. Benign tumors of bone seem relatively common, at least in certain phylogenetic groups; neoplastic disease, less so, although amenable to specific diagnosis. The most common among them are the osteosarcomas, where specific varieties (e.g., parosteal, periosteal) have been documented in the fossil record. The second most common category of malignant musculoskeletal tumors in humans are those affecting cartilage. They have a highly recognizable "signature" with

pathognomonic specificity. Cartilage-derived (cartilaginous tumors) have characteristic popcorn-like rings, arcs and annular calcification incorporated into their lobular matrix. Such malignancies may be primary or may derive from otherwise benign osteochondromas (bone spicules covered by cartilage caps). Notation of benign cartilaginous tumors (i.e., osteochondromas), present in 50% of some species in the Cenozoic, stimulated survey of older fossil collections for bones wherein the characteristic arc and curls mimicking popcorn were visualizable to assess the antiquity of such benign and malignant varieties, in the form of chondrosarcomas.

Periosteal reaction and surface disruption were noted in the proximal aspect of the femur of a lepidosaurid rhynchocephalian *Clevosaurus hudsoni.* Close examination of the exposed internal character of the disrupted region revealed internal calcifications in the form of arcs and annular densities creating a popcorn-like appearance. Histological examination additionally revealed cortical breakthrough, irregular internal calcifications that had a popcorn-like appearance and endosteal cortical scalloping. The presence of characteristic internal calcifications confirmed the pathology as derived from a cartilage cell line. While surface disruption may not always have specificity and may be difficult to distinguish from taphonomy, the endosteal cortical scalloping is a definitive marker for malignancy. Thus, this specimen represents the earliest recognition of a cartilage-derived tumor, a chondrosarcoma.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A new species of *Struthiomimus* from the Horseshoe Canyon Formation reveals a species complex within the genus

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Struthiomimus altus is one of the best-known Ornithomimids. However, the taxonomy of Struthiomimus remains uncertain. Previously, all associated material was referred to the type species *Struthiomimus altus* based on a lack of obvious morphological gaps. This combined with the extensive temporal range of all referred material, has created a species complex within *Struthiomimus*. Additionally, the possibility of type 2 errors from undersampling of species diversity in theropods may underestimate Ornithomimid diversity. Recently published data and unpublished materials warrant a review of all *Struthiomimus* material as part of a revision of *Struthiomimus* taxonomy. In this study we recognize a morphologically distinct *Struthiomimus* from the Horseshoe Canyon Formation of Alberta, Canada.

The new morphotype of *Struthiomimus* comes from the Drumheller member of the Horseshoe Canyon Formation and consists of a complete skeleton that is stratigraphically separate from *Struthiomimus altus*, which occurs in the Dinosaur Park Formation. Through surface scans and firsthand observations of the anatomy, we infer that the Horseshoe Canyon species can be differentiated from *Struthiomimus altus* by a suite of cranial and postcranial differences with discrete character states. Cranial differences in the maxilla, dentary, surangular, lacrimal, prefrontal-frontal contact, and cranial pneumatization are observed. Differences in the postcranium can also be observed, most notably in the forelimb anatomy. The Horseshoe Canyon species has a more gracile forelimb anatomy, and proportional differences within the forelimb differ from *Struthiomimus altus*. Furthermore, there are morphological differences in the manus and metacarpals. Our results add to the broader framework of understanding North American ornithomimid diversity and taxonomy. Further work on Maastrichtian age *Struthiomimus* material as well as other Upper Cretaceous ornithomimids has the potential to produce previously unrecognized species.

Funding Sources Canada graduate scholarship-Master's NSERC.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Examination and reconstruction of locomotory patterns for *Captorhinus* sp. And *Mesenosaurus efremovi* using digital modeling methodology

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Excluding information gathered from trackway ichnofossils, the reconstruction of locomotion for early and stem amniotes is limited to the diadectid *Orobates pabsti* and the captorhinid *Captorhinus*. While the former has been described in several successive papers involving both digital and physical reconstruction, it is a considerably specialized taxon that is not necessarily as informative regarding the transition to Amniota. In contrast, *Captorhinus* has been studied previously as a composite physical model. Accordingly, we have chosen to reconstruct the locomotory patterns of this stem reptile, as well as the varanopid *Mesenosaurus efremovi*. This latter taxon was chosen due to recently discovered postcrania, revealing a suite of unusual characters including a mostly immobile crurotarsus, a highly robust astragalus, and an enlarged calcaneal tuberosity not seen in other varanopids. Here, we utilized the computer graphics software Blender to construct and rearticulate three-dimensional models of *Captorhinus* and *M. efremovi*. Posing was also accomplished using Blender's rigging tools, and the resulting rig was animated according to the limitations presented by articular surfaces, as well as hypothesized cartilage. We have found that the anatomy of *Captorhinus* results in a similar morphology to the ichnotaxon *Dromopus*, but the various anatomical constraints present in *M. efremovi* result in a form of foot-dragging locomotion inconsistent with other ichnotaxa such as *Varanopus*. Our findings highlight the diversity of hindlimb anatomy within early amniotes as a result of both phylogenetic and ecological divergence, with *Captorhinus* potentially representing a condition close to that of the ancestral amniote.

Funding Sources This work was funded by a Natural Sciences and Engineering Research Council Discovery Grant (RGPIN-2020-04959).

Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Experimental maturation of carotenoids and psittacofulvins indicates their lower preservation potential compared to melanin, in carbonaceous compression fossils

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Vivid plumage colours in extant birds—such as yellow, orange, red, and green—are typically produced by polyene-based pigments, notably carotenoids and psittacofulvins. Carotenoids likely evolved multiple times within passerines and may have been present in stem archosaurs, whereas psittacofulvins are unique to parrots and possibly represent a single evolutionary origin. Despite the central role of these pigments in avian ecology and signalling, their fossilization potential remains poorly understood, especially in contrast to melanin, which is more chemically stable and better represented in the fossil record. To assess the diagenetic stability of polyene

pigments, we subjected modern, polyene pigmented feathers to a series of controlled thermal maturation experiments. Feathers were embedded in compacted sediment and exposed to pressures of 250 bars and temperatures ranging from 40°C to 200°C for 24 hours to simulate burial conditions. Post-experiment chemical analyses were carried out using a multi-technique approach that included optical stereomicroscopy, UV-Vis-NIR spectroscopy, μ-FTIR/ATR, and μ-Raman spectroscopy, to characterise both the visual appearance and chemical changes in pigments and corneous β-proteins (CBPs). Our results show a progressive loss of polyene pigment signatures with increasing temperature. Above 150°C, visible pigmentation is lost and characteristic spectral bands disappear, indicating degradation and volatilization of conjugated double bonds. No evidence was found for intra/inter-molecular crosslinking similar to melanin and CBP degradation products were not detected beyond 100°C. More importantly, some saturated remnants of polyene pigments persist up to 150°C, suggesting limited preservation potential under low-grade diagenetic conditions. This study provides the first experimental framework for understanding the diagenetic pathways of polyene-based feather pigments. Our findings suggest that although these pigments are less stable than melanin, remnants may still be detectable in fossil feathers from minimal to moderate thermally altered deposits. Hence our results have direct implications for reconstructing the original coloration of fossils and deepen our understanding of the chemical constraints on pigment preservation in deep time.

Funding Sources A.R.: HK PhD Fellowship(PF16-09281), PalAss CDG(PA-CD202103). E.T.S.: Bob Savage Mem. Fund(Univ. of Bristol, UK). M.P.: Faculty of Science(The Univ. of Hong Kong, China)

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Walking before giants: Triassic fossil trackways from the Newark Basin and their evolutionary and behavioral implications for neotheropod dinosaurs

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The evolution of theropod locomotion is a topic of considerable interest within the field of paleontology due to the direct relationship between extinct theropods and extant avians. Despite this interest, most work done on theropod locomotion has been focused around skeletal specimens, and the work that has been done with ichnological fossils has largely ignored the abundant collection of Triassic footprints from the Newark Basin. This study aims to remedy this gap in knowledge by conducting a taxonomic and biomechanical analysis of Triassic theropod footprints from the Lockatong formation in the Newark Basin. An 80 x 110cm slab from a Lockatong outcrop in Limerick Pennsylvania, which consisted of 15 individual footprints and three separate trackways, was digitally scanned with an Arctec scanner to create a 3D composite digital model in the modelling software Meshlab. Through this model, the morphological characteristics of 11 footprints and 2 trackways were measured; these measurements were used to calculate projection ratios, digit ratios, average speeds, hip heights, body length, and body size for each footprint, and stride length, gait, and actual speed for each trackway. When these variables were compared against pre-existing data, three separate ichnospecies were identified: *Grallator parallelus*, *Anchisauripus sillimani*, and *Anchisauripus tuberosus*; the latter two species have not been found in Lockatong sediments and may constitute a new earliest appearance for their ichnogenus. A comparison of digit ratios against other early dinosaurs revealed a tight cluster between the Limerick footprints and *Procompsognathus* instead of *Coelophysis*, implying the trackmakers were more basal than previously thought. A comparison of stride length and footprint length for the Limerick trackways, when compared with other theropods across the lineage, revealed that the Limerick

trackways fell well within the general trend, indicating their presence in the most basal of theropods. A comparison between body mass and stride length revealed a general positive trend within theropods which the Limerick trackways fall well short of. The reason for this lack of conformability is unknown, but may be due to natural variation, the behavioral mechanisms of the organism, or the lack this particular trait in basal theropods.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A preliminary study of the small ornithopod bones from the Barremian-Aptian site of Viajete (Burgos, northern Spain)

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The Viajete site is located in the vicinity of Salas de los Infantes (Burgos province) and is one of the many significant Lower Cretaceous sites of the region, along with others such as Vegagete, Torrelara, Tenadas de los Vallejos II, El OterilloII, Tenadas de Viajete, La Solana, Río Gente, El Peñascal, La Tejera, etc. Over the years, numerous bone remains of various groups of Mesozoic reptiles, such as dinosaurs, pterosaurs, crocodiles and turtles have been provided by these sites. The Viajete site is specially relevant for providing the first bone remains of the Squamata order in the region, which were found in the Castrillo de la Reina formation, dated to the late Barremian and early Aptian. This culminated in the description of the species *Arcanosaurus ibericus*, which was tentatively assigned to the Varanoidea superfamily.

Near the place the *Arcanosaurus* remains were found, two other sets of bones of dinosaurian morphology were discovered, including several fragments attributable to different parts of the premaxillary and dentary, fragments of scapulae and illium, numerous vertebral centers and neural arches from different zones of the vertebral series, and fragments corresponding to most of the bones of the forelimbs and hind limbs. Several individuals have been identified and assigned to the same taxon. These remains were found in the year 1995 and after a preliminary study were attributed to hypsilophodontid ornithopod dinosaurs, but it has not been described until now.

In this work, the first detailed study and description of these remains is carried out, and their possible affinities with the genus *Hypsilophodon* and other genera and families of basal ornithopods are analyzed, in order to establish the kinship relationships of these skeletal remains.

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

The origin of toothed filter feeding in seals

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The crabeater seal (*Lobodon carcinophaga*) is the most abundant seal globally. It owes its name to blunt multi-cusped postcanine teeth that set it apart from other carnivorans and allow it to filter-feed on small prey underwater. The origins of this adaptation remain unknown. Here, we re-describe a small fossil mandible (GNS CD 34) from the Early Pleistocene of New Zealand originally referred to *Ommatophoca rossii*. Dental and mandibular characters identify the fossil as a distinct taxon of the Antarctic true seal tribe Lobodontini, while parsimony and fossilised birth-death Bayesian phylogenetic analyses resolve it as sister to crabeater seals.

To assess toothed filter-feeding evolution, we compiled ten multicusped sharpness measurements, a 3D volume based cusp-index, and four mandibular log-shape ratios from 75 3D laser scanned premolars representing 30 pinniped and outgroup carnivorans. We then summarised these metrics using a principal component analysis. A phylogenetic ANOVA found that morphological variation accounted for feeding strategy, with blunt, multi-cusped postcanines indicating toothed filter-feeding. A discriminant function analysis of all measurements estimated that GNS CD 34 was a suction feeder based on mandibular morphology, and a toothed filter-feeder based on dental morphology.

Our results identify GNS CD 34 as the earliest fossil evidence of specialised tooth filter feeding in seals. Its small size is unexpected in this context, as the effectiveness of dental filtration is dependent on prey size relative to predator body size. It is likely that possessing a lower prey-to-predator body-size ratio is a key stage in the evolution of toothed filter feeding.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Coprofauna from the Cenozoic of China: insights from Longgupo Cave on ecosystem complexity and coprolite taphonomic processes

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Cenozoic coprolite assemblages from China represent an underexplored archive for reconstructing ancient ecosystems and trophic dynamics. This study will employ a multidisciplinary methodology—including morphometric analysis, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), and computed tomography (CT) imaging—to investigate the taxonomic composition, dietary inclusions, and diagenetic features of coprolites recovered from multiple stratigraphic units at the Longgupo site in Chongqing Municipality. The inclusions—anticipated to comprise osteological fragments, pollens or phytoliths, possible biomarkers, and helminth eggs—are expected to provide direct evidence of predator-prey interactions and digestive processes. The resulting data will offer novel insights into the ecological coexistence of canids, hyaenids, hominoids, and sympatric taxa, potentially revealing a trophically complex and spatially heterogeneous paleoecosystem. Taphonomic assessment will aim to determine how preservation pathways were influenced by early mineralization, microbial mediation, and sedimentary context, thus contributing to our understanding of coprolite fidelity. This study is expected to enhance knowledge of the ecological structure and functional diversity of Cenozoic faunal communities in East Asia, and underscore the utility of coprofaunal analysis in resolving fine-scale paleoecological and behavioral reconstructions.

Funding Sources Research Fund for International Scientists of National Natural Science Foundation of China (Grant No. 42350410443)

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

The Tournaisian tetrapod *Diploradus austiumensis* (Ballagan Formation, Scotland) and the shape of the tetrapod stem

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The two known specimens of the Tournaisian tetrapod *Diploradus austiumensis*—a disarticulated skull with a right mandibular ramus and the anterior portion of a left mandibular ramus—were recovered from two sandy siltstone horizons within the upper Ballagan Formation at Burnmouth, Scotland, interpreted as floodplain deposits. Re-examination of the material, aided by micro-computed tomography, has yielded new anatomical insights, allowing us to revise the original description and produce a partial cranial reconstruction. *Diploradus* is diagnosed by a distinctive combination of features: a double row of small coronoid teeth parallel to the dentary series; a small antorbital vacuity bordered by the prefrontal and lacrimal; a sickle-shaped postfrontal; frontals tapering rapidly posteriorly and contributing to the orbital margin; abbreviated, subpentagonal parietals with an anteriorly positioned pineal foramen; separately ossified parasphenoid and basisphenoid; a chevron-shaped parasphenoid; a subrhomboidal palatal ramus of the pterygoid closely appressed to or contacting the cultriform process; and lateral line canals expressed as shallow grooves on the snout, cheek, and lower jaw. As reconstructed, the skull bears a superficial resemblance to those of baphetids and spathicephalids, with a broad snout and abbreviated postorbital region, but differs in having proportionally larger orbits, more elongate frontals, and reduced nasals. A new cladistic analysis places *Diploradus* either within baphetids—as a plesiomorphic member of that clade—or along the tetrapod stem, branching crownward of *Sigournea* but below *Crassigyrinus*, *Mesanerpeton*, and other Carboniferous stem tetrapods. Despite these differing placements, *Diploradus* contributes to the growing consensus that many early tetrapod lineages likely originated near, or even prior to, the Devonian–Carboniferous boundary.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Ontogeny of Late Cretaceous polycotylid plesiosaurs from the Western Interior Seaway in Saskatchewan, Canada: a histological approach to long bone microanatomy

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The short-necked polycotylid plesiosaurs were a diverse group of marine reptiles with a global distribution during the Cretaceous and are particularly well represented in the Upper Cretaceous deposits of the Western Interior Seaway. A multi-taxic marine bonebed near Herschel, Saskatchewan, Canada, dating to the Campanian (~76–70 Ma) preserves an unusually high number of isolated polycotylid limb bones. The size and morphological variation observed among these elements suggests an ontogenetic series, offering the opportunity to investigate growth and development within a single plesiosaur lineage. This study explores the morphological and histological variation among these specimens to determine osteological maturity. Histological thin sectioning techniques were applied to characterize the internal microstructure of these limb bones, focusing on vascularization patterns, tissue organization, and the degree of secondary remodeling to assess relative growth stages. Results indicate that

juvenile specimens exhibit a dense network of radial vascular canals and woven bone in the periosteal tissue, features consistent with immature bone and rapid early-stage growth. Larger specimens have more mature periosteal tissue, including remodeled lamellar bone and secondary osteons, though still retaining primary periosteal bone with radial vasculature. This data is interpreted within the framework of established histological ontogenetic stages proposed for other plesiosaur taxa, allowing for comparative evaluation to enhance our understanding of polycotylid growth trajectories. By reconstructing a detailed growth profile for the plesiosaurs at this locality, this study refines our understanding of polycotylid bone development and offers broader insight into plesiosaur paleoecology and the evolution of osteological adaptations to a secondarily aquatic lifestyle.

Funding Sources Natural Sciences and Engineering Research Council of Canada (NSERC) Canada Graduate Scholarship (Master's).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Re-discovery of well-preserved sauropterygian skeletons from the Gogolin Formation in Poland—insights into the early evolution and spread of aquatic reptiles in the Early/Middle Triassic

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The end-Permian mass extinction marked an extensive faunal turnover, which has drastically changed most of the Earth's ecosystems. In the aftermath of this event, in the Triassic, several evolutionarily important reptile groups appeared and diversified. Simultaneously, the early phase of the Mesozoic Marine Revolution began, resulting in a major transformation of the aquatic ecosystems. The history of these changes is obscured by the scarcity of fossil finds from the Early Triassic, particularly in contrast to the abundant Middle Triassic record of marine faunas. This pattern is evident in Central Europe, with the late Olenekian transgressions marking the beginning of the Muschelkalk sea. The Muschelkalk localities have yielded thousands of vertebrate fossils and have been particularly important for the studies of aquatic reptiles, especially the sauropterygians, which achieved a remarkable evolutionary success in the Mesozoic. Historically, one of the most important sources of the Muschelkalk specimens has been the Gogolin Formation in Silesia, Poland. These deposits date to the late Olenekian/early Anisian and preserve the oldest known Triassic marine vertebrate assemblage in the region. Unfortunately, vertebrate fossils from the Muschelkalk are predominantly found as isolated elements. Several articulated sauropterygian skeletons have, however, originated from the Gogolin Formation. Herein, we report on the status of such currently accessible remains, including, among others, the holotypes of both *Dactylosaurus* species and the holotypes of both *Proneusticosaurus* species. These important specimens have long been forgotten, lost, or thought to have been lost, with their detailed descriptions being largely non-existent, outdated, or based solely on casts. Importantly, the mentioned skeletons are a perfect source of three-dimensional information on the cranial and postcranial skeletal morphology of early sauropterygians. Our preliminary studies confirm the high potential of obtaining such data through computed tomography scanning of this material. Studies on the well-preserved articulated specimens from the Gogolin Formation provide us insights into one of the earliest well-developed marine communities of the Mesozoic and are a key to understanding the diversification of Sauropterygia—a reptile group that would later dominate the marine environments.

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Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Reevaluation of a destructive sampling program

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Ten years ago, the Texas Vertebrate Paleontology Collection curatorial group implemented a formal system of requests for sampling vertebrate fossils in the collection. Being entirely composed of research-minded faculty and staff, the curatorial group leans heavily toward favoring sampling requests. Our logic supporting these approvals being that increasing peer-reviewed publications from the collection, and augmenting fossil collections with isotopic and histological data, enhances the value of those collections and the institution.

Sampling requests are initiated through the collections manager's office, a questionnaire is completed, then distributed and discussed among the curatorial group. Approval or denial of a request for sampling is based upon evaluations of scientific merit, methodology, researcher competence, and specimen selection. Researchers are expected to return to the collections their resulting data and publications in a timely manner.

Cursory reviews of destructive sampling projects that were approved and conducted via this request system, indicate that few of the completed projects met all requirements on which approval was based. It is especially troubling that researchers rarely supply their raw data to our collections management office as we require. A comprehensive review of destructive sampling projects that used our collections provides a better understanding of our system's shortcomings and how we might improve our administration of these sampling projects. For example, data reported from sampling projects are not always presented to the repository in a format that curators can use to assess sampling protocols or extend to other projects.

Reexamining our policies also raises broader questions for the museum community, such as whether we are able to properly assess the value that destructive sampling adds to our collection. Similarly, does the publication of sampling-based research reflect positively on the collections and the perceptions of the institution? Finally, what ethical responsibility do scientific journals bear to the collections that underpin the research that they publish? The reevaluation of our destructive sampling program remains an open discussion, with options ranging from further educating collections users to returning to a general prohibition of destructive sampling.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

DinoSAW: experimental biomechanics of whole-toothrow cutting function in theropod dinosaurs

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Long rows of medio-laterally compressed, recurved and serrated (ziphodont) teeth were common and widespread across extinct amniotes, both in synapsids (e.g., pelycosaurs) and in diapsids, the most famous of the latter being the extinct non-avian theropod dinosaurs. This widespread observation of ziphodont tooth rows in the fossil record—despite its limited occurrence in extant species—indicates a predatory palaeoecology that was possibly very different from what we see today.

Despite widespread occurrence in the fossil record, little is known about the functional performances of ziphodont toothrows. Much of the limited existing literature is focussed on fossil bite marks, dental wear patterns and observations in modern ziphodont species (the Komodo dragon, Varanus komodoensis), but

none have investigated the functional performances of whole-toothrow cutting, either through biomechanical modelling or through physical experiments. Understanding how extinct predators fed on prey will enable us to build a better picture of the palaeoecology of long-vanished terrestrial ecosystems which have no modern analogues.

To this end, I present an experimental biomechanical approach to document and measure the physical interactions between ziphodont tooth rows and prey tissues under different cutting motions. I developed a biomechanical biting/cutting rig, the DinoSAW, specifically designed and built to record forces generated during simulated cutting motions. Comparisons of forces across different cutting motions (e.g., vertical, horizontal, arc motion) can reveal how ziphodont toothrows perform under different scenarios of biting and cutting.

For an initial trial, I recorded and compared forces generated under two scenarios: 1) a two-phase vertical, then horizontal (puncture-then-pull) motion; and 2) a single-phase simultaneous vertical-horizontal (pull-cutting) motion.

Preliminary results indicate that the single-phase simultaneous pull-cut motion generates, on average, two to three times less forces compared to the two-phase puncture-then-pull motion. This indicates that a single-phase biting is more efficient and could be a potential feeding mode for theropod dinosaurs.

I also present ongoing work on the effects of whole toothrow engagement and the presence of serrations on cutting performances. Taken together, my DinoSAW experimental approach is a novel and powerful tool to gain insights into the feeding function and ecology of extinct predators.

Funding Sources Royal Society

University of Reading

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

A systematic reassessment of giant *Gryposuchus* and *Hesperogavialis* species (Crocodylia, Gavialidae) from the late Miocene of Venezuela

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The adaptive radiation of the Gavialidae in freshwater basins of South America resulted in the evolution of *Gryposuchus* species with notably similar skull features to those of the extant Indian gharial *Gavialis gangeticus* from Southeast Asia. In 1982, the anatomical hallmark of *Gavialis* not previously documented in *Gryposuchus*—the lack of premaxillary-nasal (pmx-na) contact—was recognized in a giant rostrum (UNEFM-CIAAP 320) from the late Miocene of Urumaco, Venezuela, and described as *Hesperogavialis cruxenti*. Later, another species from Urumaco, *Gryposuchus croizati*, was erected based on two giant crania (holotype MCN-URU-2002-77 [now MCNC 77-72V], 1120 mm length; paratype AMU CURS 58; 1400 mm length), among which the snout of the holotype was partially collapsed. While the authors identified pmx-na contact in both specimens, the lack of pmx-na contact of *H. cruxenti* and its phylogenetic status were overlooked in most contributions. Examination of types and new fossils from Urumaco revealed prominent differences between holotype and paratype skulls of *G. croizati* that overwhelm knowledge of intraspecific variation in crocodylians. Notably, we recognized lack of pmx-na contact in MCNC 77-72V where maxillary cracks were misinterpreted as nasals contacting the premaxillae. Conversely, MCNC 77-72V and the type of *H. cruxenti* are

congruent in anatomy. Our Bayesian total-evidence phylogenetic analysis of Eusuchia included 90 taxa and the holotype (MCNC 77-72V) and paratype (AMU CURS 58) of *G. croizati* as different OTUs. We recovered AMU CURS 58 as the earliest branching of the *Gryposuchus* clade. MCNC 77-72V is redundant with *H. cruxenti* and well nested within this clade as sister to *G. neogaeus*, confirming independent loss of pmx-na contact within *Gryposuchus* and *Gavialis*. MCNC 77-72V furthers differ from AMU CURS 58 in bearing a more quadrangular skull table with oblique supratemporal fenestrae and sharper expansion of the skull in front of the orbits. Thus, we assigned MCNC 77-72V to *H. cruxenti* and propose the allocation of this species to *Gryposuchus* (*G. cruxenti*). Whereas *G. croizati* is regarded as a junior synonym of *G. cruxenti*, results indicate that AMU CURS 58 represents a new *Gryposuchus* species characterized by a relatively short mandibular symphysis and posterior enlarged alveoli, the latter a novelty for advanced gavialids. The late Miocene Urumaco ecosystems supported a rich crocodylian community, featuring two giant species of *Gryposuchus*.

Funding Sources Swiss National Science Foundation grant SNF 320030-231714 (R.S-G.)

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Pelvic and hind limb biomechanics of a limping basal styracosternan from the Lower Cretaceous of the Eastern Iberian Peninsula

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Non-hadrosauroid styracosternans were a clade of large-bodied ornithopod dinosaurs with a long research history, broad geographic distribution and high taxonomic diversity, especially from the Lower Cretaceous of Europe and North America. The most derived representatives of this group show a remarkable record of articulated specimens that facilitate comprehensive musculoskeletal studies. The Arcillas de Morella Formation (Castellón Province, northeastern Spain) has one of the best fossil records of styracosternans in Europe. Among the recovered material, a specimen discovered at Mas de la Parreta Quarry exhibiting multiple pathologies in the axial skeleton is noteworthy for implications for normal gait development. The morphology and proportions of the left ilium of this individual are significantly different, but they are not attributable to taphonomic deformation, as the surrounding pelvic elements exhibit normal morphologies.

To analyze these abnormalities, we created 3D models of the pelvis, right fibula and the first caudal vertebra of this individual using photogrammetry. For the reconstruction of the rest of the hind limb bones, the last dorsal vertebrae and the first caudal were used, along with elements from other individuals found in other sites of the Mas de la Parreta Quarry. We scaled them according to the proportions of the studied individual. The virtual skeleton was assembled in the software Blender and the biomechanic analysis was performed using MuSkeMo, a new open-source Blender add-on. It provides a highly interactive interface to define different aspects of the musculoskeletal reconstruction, calculate inertial properties and apply convex hull-based mass-estimations from the literature. The final dynamic musculoskeletal model was created using previous work on hadrosaurid muscle reconstructions. In addition, published values for *Mantellisaurus*, *Iguanodon* and *Edmontosaurus* and other extant large-sized tetrapods were used to estimate some parameters. The results of this study provide an opportunity to explore the implications of specific pathologies on the locomotion of ornithopod dinosaurs.

Funding Sources JSH is funded by a FPI UNED fellowship.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A middle Campanian dyrosaurid skull from Egypt illuminates the origin and early biogeography of the clade

Salem, Belal S.[1,2], Saber, Sara[1,3], Ouda, Khaled[3], Gohar, Abdullah S.[1,4], El-Sayed, Sanaa[1,5], O'Connor, Patrick M.[6,7], Sallam, Hesham[1,8]

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The early diversification of Dyrosauridae, a clade of crocodyliforms, remains poorly understood due to the limited Campanian fossil record. Here, we describe a nearly complete skull (MUVP 636) from the middle Campanian Quseir Formation of Egypt, which provides critical insights into the early evolutionary history of the group. MUVP 636 displays a combination of cranial features, including an elongated snout (~70% of total skull length), dorsally oriented and mediolaterally broad external nares, and long, slender maxillary teeth. Additional diagnostic traits include a rounded squamosal prong, non-projecting squamosals, and an occipital condyle with a height measuring 77–84% of its width.

Phylogenetic analyses using both discrete and combined discrete–continuous datasets consistently recover MUVP 636 as the sister taxon to *Chenanisuchus lateroculi*, forming the earliest-diverging branch of Dyrosauridae. This result aligns with the stratigraphic position of MUVP 636 as the oldest definitive dyrosaurid known. Its cranial morphology bridges the gap between *Elosuchus* and more derived dyrosaurids, offering new perspectives on skull roof and rostral evolution. Furthermore, revised scoring of *Brachiosuchus kababishensis* from the younger Kababish Formation in Sudan places it within Phosphatosaurinae rather than Hyposaurinae, refining our understanding of subclade relationships and biogeographic patterns within Dyrosauridae.

Building on its placement as the sister taxon to *Chenanisuchus*, MUVP 636 offers new insights into premaxillary evolution at the base of Dyrosauridae. The specimen exhibits four premaxillary alveoli, with pm1 closely spaced and pm2 positioned nearer to pm3 than to pm1—a derived configuration compared to *Elosuchus*. This arrangement, along with a reduced first premaxillary tooth and a deep, open occlusal notch, suggests a transitional stage between the enclosed occlusal pit seen in *Elosuchus* and the more derived dyrosaurid condition. These features reflect a key reorganization of the rostral margin and dental alignment, marking an early evolutionary shift toward longirostry within the clade.

Collectively, these findings reinforce a North African origin for Dyrosauridae and suggest that transatlantic dispersal to South America may have occurred earlier than previously recognized. MUVP 636 thus represents a critical phylogenetic and morphological anchor for reconstructing the early evolutionary trajectory of the clade.

Funding Sources Mansoura University, American University in Cairo, Science and Technology Development Fund (STDF).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Postcranial material of a spinosaurid (Dinosauria: Theropoda) from the Early Cretaceous of Khon Kaen, Thailand: implications for evolution and paleobiogeography of Asian spinosaurids

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The Spinosauridae is a clade of large theropod dinosaurs characterized by an elongated snout and crocodile-like teeth, primarily found in the Cretaceous period of Gondwana and Laurasia. They were presumably, at least partially, piscivorous. The Spinosauridae is traditionally recognized as a member of the Megalosauroidea and can be divided into two subclades: the Spinosaurinae and the Baryonychinae.

New postcranial material of a spinosaurid, found in the Early Cretaceous Khok Kruat Formation at the Sam Ran locality, Khon Kaen, Thailand, is reported here. It consists of cervical, dorsal, and sacral vertebrae, pelvic elements, and a chevron. The preliminary analysis suggests that the specimen represents a member of the subclade Spinosaurinae, more closely related to *Spinosaurus* from North Africa than to *Ichthyovenator* from Laos (15 taxa, 120 characters). The new taxon is identified as a spinosaurid by the following characters: (1) the presence of webbing at the base of the neural spine in posterior dorsal vertebrae; (2) an L-shaped distal end of the pubic boot; and (3) absence of an anterior process ventral to the articular facet of the chevron. The new taxon is also identified as a spinosaurine by the following characters: (1) cervical neural spine is taller than long; (2) middle and posterior dorsal vertebrae with deeply excavated prezygoparadiapophyseal fossa (prpadf); (3) middle and posterior dorsal vertebrae with reduced, knob-like parapophyses; (4) posterior dorsal neural spines is taller than 12 times their width; and (5) pubis has posterior extension of distal foot, among others.

The reports on Asian spinosaurids suggest that the distribution of this clade in Asia is complex and uncertain due to the incompleteness of materials and the uncertainty surrounding the age of several fossil-bearing strata. The spinosaurid ancestors dispersed along the coastal shoreline from Europe by crossing an ephemeral landbridge during the pre-Barremian. Then, they spread out to Thailand, Malaysia, southern China, and Japan. The presence of Late Cretaceous spinosaurids in China suggests that Asian spinosaurids persisted until the extinction event of this clade, as happened in western Laurasia and Gondwana during the Cenomanian. The new study from Thailand provides insights into spinosaurine anatomy and contributes to updated paleobiogeographic reconstructions for the clade in Asia.

Funding Sources This project is funded by the National Research Council of Thailand (NRCT). Grant number: N42A660838.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Head to toe: the latest in Aepyornithidae research using exceptional cranial remains

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The island of Madagascar hosts some of the world's most diverse and threatened ecosystems. Many recently extinct endemic species are represented in Madagascar's rich Late

Pleistocene-Holocene subfossil record, including extinct lemurs, hippopotami, tortoises, and the largest megaherbivores—the enigmatic elephant birds (Aepyornithidae). Recent phylogenetic research using ancient DNA from eggshells and postcranial remains has led to a controversial tentative synonymization of the largest morphotypes, and a conflict in the number of proposed species, with the largest skeletal genotype remaining unsampled. Publications incorporating specimens from this collection indicate at least five elephant bird skull morphotypes described in the late 19th and early 20th centuries, suggesting there is at least one species of elephant bird that is currently unrecognized by both post-cranial morphometrics and genetic sampling.

In 2019, 35 morphologically and allometrically diverse elephant bird crania were rediscovered in the collections of the University of Antananarivo; before this discovery, only three elephant bird skulls were known to have survived the destruction of the collection during a fire at the Queen's Palace in Antananarivo in 1995. This rediscovery is leading to multi-faceted research including cranial morphometrics, endocast reconstructions, ancient DNA extractions and forthcoming biomechanical analyses.

Here we introduce the broader ongoing research and present the first of these results, a morphometric assessment of the external cranial morphological diversity. 3D surface landmarks were analyzed using Procrustes transformed Principal Component Analysis with Bayesian clustering to determine distinct morphological groups/taxa, and results suggest four morphotypes based on cranial morphology. This research represents the most comprehensive study of elephant bird diversity to date. As ratites are known to be important ecosystem engineers, and the extinction of the elephant birds has left important unanswered questions about whether these species played key trophic roles in shaping Madagascar's terrestrial ecosystems through dietary behavior, fruit/seed dispersal, and nutrient cycling, this work will help place elephant birds within the context of wider avian evolutionary diversity, help evaluate how much these systems have altered following extinction of the island's megafauna, and better inform how to manage and regulate these systems sustainably today.

Funding Sources National Geographic grant funding NGS-161R-18

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Ontogenetic data for the early Permian basal captorhinid eureptile *Labidosaurus*: comparative anatomy and possible behavioral implications

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Ontogenetic information for Paleozoic vertebrates is rare, and in most cases restricted to fish and amphibians. An exceptional locality known as the '*Labidosaurus* pocket' in early Permian sediments of the Clear Fork Formation, Leonardian in age (formally interpreted as the "Arroyo Formation") in Baylor County of north-central Texas include both mature and juvenile postcranial elements that may be confidently ascribed to *Labidosaurus*. Additionally, newly prepared cranial material from the same location is tentatively assigned to *Labidosaurus* as well. The name of the locality derives from the monotaxic preservation of multiple individuals of both adult and juvenile individuals of the single-tooth rowed captorhinid reptile *Labidosaurus*. The adult morphology of *Labidosaurus* has been thoroughly described, but multiple preserved Labidosaurus specimens provide rare ontogenetic information for a basal amniote and comparison with homologous elements of other mature captorhinids. The juvenile materials, while clearly in an immature incomplete state, are still larger than any other coeval adult captorhinid forms and were thus confidently interpreted as juveniles. Material interpreted as juvenile tooth-bearing dentaries and humeral elements of *Labidosaurus* are all

more poorly ossified, but still larger than mature examples the captorhinid reptiles *Captorhinus, Rhodotheratus*, and *Sumidadectes* humeri from nearby localities in Texas and Oklahoma. Specimens were 3D surface scanned, and data were loaded into the modeling and sculpting package of the three-dimensional digital asset building software Blender to facilitate digital surface reconstruction of both adult and incomplete juvenile elements. Reconstructions indicate at least two different size classes of juveniles were preserved at the locality. A minimum count analysis of elements recovered from the *Labidosaurus* pocket potentially preserves at least five individuals representing different ontogenetic life stages. The undistorted and completely articulated adult skeletons from the *Labidosaurus* pocket suggest that there was little or no transport of animals after death. If this is the case, then adults and juveniles may have been living in close proximity to one another. These conditions of preservation might be the earliest evidence of social interactions between differing ontogenetic stages in the reptilian fossil record.

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Synchrotron X-ray based virtual paleo-microanatomy and histology: a new dimension to reveal fossil bone inner structure

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The first thin sections of fossil hard tissue for microscopic observation were published by Richard Owen in 1840. Since then, many technological advances have been made in the field of microscopy. In recent decades, synchrotron-based virtual paleohistology has brought it to a whole new scale. As well as being non-destructive, this technique is one of the most powerful for revealing fossilized hard tissues in three dimensions. Based on case studies of stem tetrapods, I propose to demonstrate the potential of this technique for studying fossil life history traits, biomechanics, and soft tissue traces.

I will present examples of skeletochronological studies that have revealed an evolutionary trend towards accelerated ontogeny in stem tetrapods from the Devonian to the Permian. I will show how the combination of microtomography and synchrotron X-ray diffraction can reveal the crystal structure of mineralized matrix in three dimensions, including the presence of muscle fiber bundles. This promising combination of techniques is key for opening up new avenues in the field of paleohistology.

Finally, I will present how biomechanical methods could be applied to fossil bones to show in detail the distribution of von Mises stresses in the trabecular mesh of a limb bone. This mapping method could reveal how the stresses were absorbed by the trabeculae, providing clues to a better understanding of tetrapod terrestrialization.

All these case studies illustrate the great potential of synchrotron X-ray imaging for obtaining a complete picture of mineralized tissues down to the finest details.

Funding Sources Swedish Research Council (VR 2015-04335, VR 2019-04595), European Research Council (LimbEvolution - 101126181), European Synchrotron Radiation Facility (EC203, EC519, LS2832)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Marine ray-finned fishes from the Cenomanian–Turonian of the La Luna Formation in Venezuela illuminate the Late Cretaceous biodiversity of the Proto-Caribbean

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The onset of the Late Cretaceous is characterized by a warming climatic trend that culminated in a severe anoxic event at the Cenomanian–Turonian Boundary (~93.9 Ma). The latter is viewed as a major biodiversity crisis of the Phanerozoic. In contrast to the negative effects on many marine groups, ray-finned fishes diversified during this time interval, producing taxa that dominated Late Cretaceous marine ichthyofaunas, with some surviving the K–Pg Extinction. Our understanding of these biodiversity-shaping events is heavily influenced by fossils from Europe, North America, North Africa, and the Levant, while comparably little information is available from South America. The Cenomanian–Turonian pelagic deposits of the La Luna Formation in Venezuela have been known for decades to yield fossils that could expand our understanding of the marine vertebrates of the Cretaceous beyond the areas of historical scientific focus. Yet, ray-finned fishes from those deposits have only been cursorily studied. Drawing on a previously undescribed fossil sample from Zulia and Trujillo States, hosted in Venezuelan institutions, we present novel information on the ichthyofaunal composition La Luna Formation. Our material ranges from three-dimensionally preserved skulls to flattened and disarticulated elements, corresponding to a minimum of three genera and four species. A †pachirhizodontid skull confirms the anecdotally hinted presence of the Genus *Pachyrhizodus* in the lower La Luna Fm. Two distinct †*Enchodus* (†Enchodontidae) morphotypes are represented by isolated mandibles and teeth. One of them strongly resembles †enchodontids known the Late Cretaceous of the Western Interior Seaway in the absence of marginal teeth, a slender mandible and teeth, and a similar number of ventral prongs, but may belong to a new species. A mandible assigned to †*Gillicus* (†Saurodontidae) is amongst the earliest occurrences known for the genus, and likely also belongs to an undescribed species. These specimens mark the earliest records of their respective genera in South America and shed new light on ray-finned fish diversity in the Proto-Caribbean. Critically, they offer clues for tracing the dispersal patterns of Late Cretaceous marine vertebrates between North America and the Tethys.

Funding Sources Swiss National Science Foundation Grant No. 320030-231714.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

***Litosoolithus poyosi*, a new fusioolithid ootaxon from the Upper Cretaceous of Spain, and its implications for titanosaur reproductive diversity**

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The Poyos fossil site (Villalba de la Sierra Fm., late Campanian–early Maastrichtian, Central Spain) has yielded an exceptional association of fusioolithid dinosaur eggs, possibly the oldest in Europe. This site has yielded numerous partial clutches of complete or near-complete eggs, associated eggshell fragments, and stratigraphically consistent horizons across more than 10 meters of section. Most eggs are preserved in three dimensions, laterally deformed post-burial but not compressed or collapsed, allowing detailed analysis of their morphology and taphonomy.

Two fusioolithid ootaxa have been identified at this locality: the widespread *Fusioolithus baghensis* and the newly erected *Litosoolithus poyosi.* The latter is based on very large, subspherical eggs (up to 250 mm in diameter) with extremely thin eggshells (0.8–1.1 mm), very low porosity (0,57 pores/mm^2), and a dispersituberculated ornamentation, which contrasts with the compactituberculated pattern typical of other fusioolithids. The partial clutches (of up to seven eggs so far) show an arrangement consistent with nesting patterns observed in other titanosaur oosites, such as those from Auca Mahuevo (Argentina) or Pinyes (Spain). Additionally, the eggshell microstructure reveals two sharply distinct spherolith morphologies: flat, heavily fused shell units that form internodal areas, and convex shell units that end in low, bell-shaped nodes. Statistical comparisons of spherolith height and width on over 400 thin-sectioned eggshell simples across 17 ootaxa, including multiple fusioolithid and megaloolithid species from Europe, South America, and India, demonstrate significant inter- and intraootaxonomic differences. These results support the parataxonomic validity of *Litosoolithus poyosi* and reinforce its distinction from *Fusioolithus baghensis*, with which it co-occurs on the same stratigraphic levels. Such fusioolithid co-occurrence is rare outside the Indian subcontinent and may reflect ecological differentiation among titanosaur species or reproductive partitioning within shared nesting areas.

Litosoolithus poyosi represents the largest known titanosaur egg with the thinnest eggshell ever described, suggesting possible adaptations to incubation in hot and dry, semi-arid conditions. This discovery significantly expands the known diversity of fusioolithid eggs in Europe and provides new insights into the reproductive strategies, environmental plasticity, and paleobiogeography of Late Cretaceous sauropods.

Funding Sources Fellowships FPI PRE2020-093594 (FS) and Juan de la Cierva JDC2023-050836-I (AdC); related to project PID2023-148083NB-I00 of the MICIU (Spain).

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Deciphering the teleostean fishes from the paleowetland of Las Hoyas: implications on the early diversification of teleosts during the Cretaceous

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Teleostean fishes are a fundamental component of Las Hoyas paleowetland (Early Cretaceous, 129–126 Ma). Their exceptional fossil record is relevant both ecosystemically—as one of the most abundant and well-preserved biotic elements—and at a macroevolutionary scale, with the middle Cretaceous marking a key stage in teleostean diversification that shaped modern aquatic ecosystems. However, these fish are taxonomically challenging to identify, especially during this dynamic diversification period characterized by mosaic evolutionary patterns. A multidisciplinary approach was developed to address the biodiversity and ecology of Las Hoyas teleosts, leveraging fossil preservation and integrating qualitative descriptions of articulated and disarticulated specimens, soft tissue identification (including digestive organs), osseochronological data, and both traditional and geometric morphometrics. From a total sample of over 4,000 specimens, more than half a dozen morphotypes were identified as morphometrically and/or anatomically distinct, but limited specimens of some morphotypes prevent formal species-level assignment. As a result, four new species have been diagnosed, and two previously described gonorynchiform taxa, emblematic of the site, have also been reassessed, highlighting the strength of this multidisciplinary approach. Differences in digestive system morphology also support the presence of distinct species and suggest ecological niche segregation. Moreover, the quantitative analysis of isolated large scales reveals the existence of much larger fish than

any articulated specimens found so far in the locality, indicating ecological bias and supporting niche partitioning hypotheses within this wetland's ecological dynamics. Findings include ultrastructural preservation, drivers of morphological variation (e.g., allometry, maturity, plasticity), and paleoecological reinterpretation at local and regional scales. This multiapproach research advances our understanding of the early fossil record of basal modern teleostean lineages and establishes an integrative methodological framework for other paleontological contexts.

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Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

A phylogeny for Heterostraci (stem gnathostomes)

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The armored jawless fishes ("ostracoderms") are major and widespread components of middle Paleozoic ecosystems. As successive branches on the gnathostome stem lineage, they reveal the early sequences of vertebrate evolution, including the assembly of the vertebrate skeleton. This is predicated, however, on understanding of their diversity and interrelationships. The largest ostracoderm clade, the Pteraspidomorphi, is often reconstructed as sister taxon to other boney vertebrates yet they lack a cladistic phylogenetic framework, in particular the heterostracans. Problematic heterostracans with a tessellate headshield ('tessellate-basal' model) are often regarded as the plesiomorphic condition for the clade but no phylogenetic analysis has included these taxa. Here we review the Heterostraci and present their first comprehensive phylogenetic analysis (131 heterostracan taxa and 55 outgroup taxa). Heterostraci are recovered as monophyletic, and forming a clade together with the Ordovician Pteraspidomorphi near the root of the gnathostome crown group in parsimony analyses. The heavily armored Amphiaspida are recovered as sister taxon to all other Heterostraci. Within the Heterostraci, the Psammosteida are nested within the Pteraspidiformes, which are sister group to the Traquairaspidida, whist Cyathaspidida form a monophyletic group. The results presented here are the first phylogenetic hypotheses of heterostracan relationships and it is hoped a first step into an accurate interpretation of character evolution in this crucial episode of vertebrate evolution

Funding Sources NERC

BBSRC

Synthesys

Technical Session IV: Lepidosauria (Wednesday, November 12, 2025, 1:45 PM)

Convergence of sensory anatomy in fossorial, limbless lizards: olfactory bulb size correlates to ecology in squamates

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The evolution of the limbless body form in squamates is one of the most remarkable examples of convergent evolution in vertebrates. Lineages that evolve this bauplan change almost every part of their body as they adapt to a burrowing lifestyle. In addition to an elongate body and reduced limbs, these animals show a narrowing of the skull, a modified rostrum for digging, and reduced or absent eyes. With a reduced ability to see, and limited visual information available underground, finding prey and mates must be accomplished with other sensory information. However, it has been unclear what strategies burrowing squamates have evolved to use and whether or not the different limbless lineages have adapted in the same way. In this study, computed tomography was used to obtain 3-D models of brains, endocasts, and skulls. The species included were burrowers and non-burrowers, with varying degrees of limblessness from almost all major squamate lineages exhibiting limb reduction. Burrowing lizards were found to have relatively larger olfactory bulbs than even limbless surface-dwellers. This suggests that smell is a more important sense in burrowing squamates than it is in surface-dwellers. These results indicate that fossorial squamates exhibit convergence in their sensory strategies as well as ecological mode. Osteological correlates in the skull, as suggested by this study, have the potential to be used to estimate general olfactory function in fossil squamates.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A basal felid clade in North America at the end of the 'cat gap'

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We provide new evidence that a separate lineage of basal felids (Felidae, Carnivora, Mammalia) was present in North America in the mid Miocene at the end of the 'cat gap.' A small carnivoran was reported in the 1950s from the Early Miocene (Hemingfordian) of Florida and referred to the mustelid *Miomustela* and carnivorans of similar age and morphology from Nebraska were referred to the mustelid genus *Plesictis*. Much later, the Florida animal, which has a large sectoral blade and reduced metaconid, was determined not to be a mustelid, but more like the basal felid *Stenogale*. Independently, the Nebraska material was assigned to a new taxon, *Cryptailurus tedfordi*, based on a complete skull and mandible, and referred to a new basal feliform clade Palaeogalidae.

A new tarsal specimen shows that the Thomas Farm carnivoran is a member of the basal Felidae, and perhaps lies at the base of Felinae. Morphometric and phylogenetic analysis of the isolated calcaneum shows it is derived in having an elongated distal process, a rounded, posteriorly positioned sustentacular facet, and a feline-shaped astragalocalcaneal facet that are more derived than *Pseudaelurus*, the basal felid that is considered the earliest immigrant to North America, and is similar in morphology to crown felids *Prionailurus* and *Felis.* The size and allometric scaling of the Thomas Farm specimen indicate that the specimen belongs to the same taxon as the "*Stenogale*" dentition, which itself shares derived features that link it to *Cryptailurus tedfordi*. The dental morphology of these taxa is considerably different from the *Paleogale* material from John Day. Based on scaling of the m1, the Thomas Farm taxon was around 1 kg in body mass, and about one-third the mass of *Cryptailurus tedfordi* suggesting either substantial within taxon size variation or that the two are different taxa.

This evidence suggests that the two are likely to be members of crown Felidae or very closely related to it and thus represent a lineage of small at the end of the 'cat gap' that must have

immigrated to North America independently of *Pseudaelurus*. Interestingly, an even smaller carnivoran with molar morphology nearly identical to the Thomas Farm and Running Water taxa is known from the Arikarean of Florida, predating the normally recognized end of the 'cat gap.' If it is also referrable to the same derived felid clade, then it may have entered North America independently.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A new Turonian polycotylid plesiosaur from Hokkaido, Japan

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The Polycotylidae are a group of short-necked plesiosaurs (Reptilia; Sauropterygia) known from the middle to the uppermost Cretaceous. We describe a new taxon of the Polycotylidae based on a partially articulated postcranial skeleton from the middle Turonian (*Inoceramus hobetsensis* Zone), Upper Cretaceous, of the Yezo Group in Hokkaido, northern Japan. The specimen was collected and donated to the Hobetsu Museum in 1993, and much of the preparation was undertaken in the following several years. Based on the meticulously taken historical photographic records of the preparation kept at the museum, combined with our 3D scanning and photogrammetry of the prepared elements, we created a digital reconstruction to demonstrate the original 3D distribution of bones in the stratum thirty years after the collection and preparation.

The polycotylid specimen represents a fully ossified adult. Although most of the elements anterior to the shoulder (i.e., skull, cervical vertebrae, clavicular arch, forelimbs) are missing, the specimen preserves isolated teeth, mostly articulated vertebrae (anterior dorsals to posterior caudals), haemapophyses (= chevron bones), ribs and partial gastralia, a scapula, coracoids, mostly complete pelvic girdle elements, and partial hindlimbs. Postmortem deformation of individual elements is minimal, allowing us to describe the characteristic morphology of the sacral ribs as well as the morphological variability of the serially homologous elements, such as vertebrae and haemapophyses, not previously detailed for polycotylids.

Phylogenetic analysis to determine the relationship of the newly described taxon to other plesiosaurs suffers from the large number of MPTs and loss of resolution in consensus trees, most likely due to the lack of the skull, which results in abundant missing data. Another possibility is the effect of contemporaneous taxa represented by juvenile individuals only. Our preliminary analysis places this taxon within the Polycotylinae which consists of derived members of the Polycotylidae, but confidence is very low.

Funding Sources Inamori Foundation Research Grant, JSPS KAKENHI, Tokyo Gakugei University, Kanagawa University.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A practical process for repairing and reinforcing damaged field jackets

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In paleontology, field jackets are commonly used to protect fossils during transport from excavation sites to laboratories and, in some cases, may remain in storage for decades. However, as these jackets age and are exposed to various environmental factors and physical stress, they become susceptible to damage from causes such as weather, rough handling, or even vandalism. In 2024, the American Museum of

Natural History undertook the repair of several large field jackets that had sustained extensive damage in the field and required stabilization before further movement. To safeguard the fossils inside and prevent additional deterioration, a standardized repair process was implemented. This procedure involves seven key steps: 1) Observing and documenting the damage; 2) Cleaning of the damaged area; 3) Removing non-functioning plaster; 4) Further cleaning and consolidating exposed fossils and matrix; 5) Applying separators, plaster, and reinforcement to cover exposed areas; 6) Adding a reinforcing layer of plaster and burlap to both the original jacket and the treated areas; and 7) Labeling the jacket directly on its surface for clear identification. As reshaping jackets can alter their weight distribution and compromise stability, careful planning based on detailed observations is crucial. Following this procedure ensures the preservation of both the jackets and the fossils within, allowing safe transport and long-term storage.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Analyses of the early sauropodomorph dinosaur *Plateosaurus trossingensis* using 3D geometric morphometrics

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Plateosaurus trossingensis is among the earliest described and best-known dinosaurs and is represented by over 200 specimens exhibiting significant morphological variation. Previous efforts to resolve the taxonomy of these specimens have employed various methodologies, yet have not succeeded in reaching a consensus. The main question is whether the observed morphological differences reflect developmental plasticity, sexual dimorphism, population variance, or taxonomic distinctions. Using geometric morphometrics, we aim to gain deeper insight into these different possibilities and provide a robust basis to refine the taxonomy and paleobiology of these animals. In this study, we applied 3D geometric morphometric landmarks to analyze 268 bones from 16 distinct appendicular elements of 45 individuals across six localities in Germany and Switzerland, all attributed to *Plateosaurus trossingensis*. The analyses resulted in a spread out clustering pattern of specimens from the various localities away from the specimens of the type locality in Trossingen Germany. Especially the specimens from Bebenhausen, Wüstenrot, and Stuttgart-Erlenberg exhibit a substantial separation across several skeletal elements, implying potential taxonomic divergence. Specimens from Halberstadt, Frick, and Stuttgart-Degerloch also show notable, though less pronounced, variation, which may reflect biologically plausible differences or taphonomic influence.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Early diversification and coexistence of macropods in the late Oligocene, Etadunna Formation, South Australia

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The Etadunna Formation, located in the Lake Eyre Basin, South Australia, has significantly contributed to our understanding of macropod evolution in Australia. This is largely due to its extensive fossil record, which includes some of the oldest known members of the three living macropodoid families (kangaroos, rat-kangaroos, and musky rat-kangaroos). Deposits of the Etadunna Fm. reveal the presence of all four macropodiform families: the extant Hypsiprymnodontidae, Potoroidae, and Macropodidae, as well as the extinct Balbaridae. In the lower faunal zones (Zones A and B) of the

formation, only a single taxon, a potoroid (Genus *K. nov. gen. et sp*.), is present, and terrestrial herbivores with selenodont dentition dominate the local faunas. In contrast, higher faunal zones (Zones C through E) show a shift in the terrestrial, herbivorous taxa present, with taxa exhibiting lophodont or semi-lophodont dentition becoming prominent. Additionally, a greater diversity and number of macropodiform species are observed in these higher zones. This faunal and dental turnover suggests not only a dietary shift among these species but also remarkable diversification, with numerous new species represented within a single local fauna. With four macropodiform families comprised of multiple species in the Etadunna Fm., how did the different species coexist over a span of a million years?

Measurements of the lower premolar (p3) and first lower molar (m1) from the four macropodiform families, represented by eight genera and nine species, were analyzed by regression and family-based morphospace analysis with t-test comparisons between ratios of specific measurements to determine dental parameters that indicate dietary niche differentiation between species occurring in the same faunal level.

Preliminary results indicate no correlation between p3 length and m1 length ($p = 0.596$). However, a morphospace plot of p3 length versus m1 length showed potoroids occupied a morphospace significantly different from those of hypsiprymnodontids and macropodids, while macropodids and balbarids completely overlapped. This same morphospace pattern occurred for m1 width versus m1 length: potoroids differed significantly from the other families; hypsiprymnodontid morphospace differed significantly from macropodid morphospace; and macropodids and balbarids again overlapped entirely. These differences in dental parameters suggest distinctions between families and potential dietary niche differentiation.

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

A reappraisal of *Metriacanthosaurus parkeri* from the Middle-Upper Jurassic Oxford Clay Formation of England and the evolutionary relationships of allosauroid theropod dinosaurs

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Allosauroidea represents a cosmopolitan lineage of tetanuran theropods, which lived from at least the Early Jurassic until their extinction in the Turonian. Three allosauroid lineages are hypothesised: Allosauridae, Metriacanthosauridae and Carcharodontosauria. *Metriacanthosaurus parkeri* is an understudied metriacanthosaurid from England, receiving little attention since its description. As such, the anatomy and relationships of *M. parkeri* remain elusive. Here, we reexamine the holotype of this species with the aim of establishing diagnostic features of M. Parkeri and evaluate the relationships of *M. parkeri* in light of numerous recently described taxa. We present a new phylogenetic supermatrix that facilitates the largest total-group analysis of Allosauroidea to date. The new matrix consists of 419 characters for 42 allosauroid OTUs and was analyzed under equal and extended implied weights parsimony and Fossilised Birth-Death models.

We find *Metriacanthosaurus* to be diagnosed on the basis of unique character combinations, many of which are shared between *Sinraptor* and *Alpkarakush*, as well as two autapomorphies. Phylogenetic analysis recovers *M. parkeri* as the sister taxon to *Alpkarakush* in a new clade. Our analyses provide support for a clade uniting Metriacanthosauridae and Carcharodontosauria—Carcharodontosauriformes—as opposed to the traditional hypothesis where Allosauridae is closer to Carcharodontosauria. We find further

support for two distinct lineages within Carcharodontosaurinae. We recognise '*Carcharodontosaurus*' *iguidensis* as a distinct genus based on anatomical, phylogenetic and biogeographic grounds and establish a new genus for this Nigerien taxon. Preliminary analysis suggests widespread ancestral populations, dispersal, sympatry and vicariance governed Allosauroid biogeography. Dispersal of *Metriacanthosaurus* into European biotas likely occurred prior to the late Middle Jurassic. Carcharodontosaurians were globally distributed by the Early Cretaceous. Carcharodontosaurines likely diverged as a result of vicariance during the Albian–Cenomanian, with dispersal occurring until the Cenomanian. Throughout allosaur evolution, multiple dispersals between Laurasia, Gondwana and their constituent landmasses resulted in their global distribution. Large spatiotemporal sampling gaps in the allosauroid fossil record should be targeted for future investigations. Filling these gaps will no doubt improve understanding of the evolution of these theropods.

Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Recent excavations in the Upper Triassic '*Plateosaurus*' graveyard of Frick, Canton Aargau, northern Switzerland, revealed unexpected taxonomic diversity by abundant novel small vertebrate remains (Reptilia, Diapsida)

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For more than half a century, the Gruhalde claypit in Frick was famous for its *Plateosaurus* skeletons (Plateosauridae, Sauropodomorpha) that completely dominated excavation finds, yielding more than a hundred specimens including several well-articulated and largely complete specimens. Other faunal components were extremely rare and restricted to isolated bones and teeth (i.e., teeth of chondrichthyan, actinopterygian and sarcopterygian fishes, rhynchocephalian lepidosaurs, theropod dinosaurs and a cynodont therapsid, and a pseudosuchian neural arch and an imprint of an aetosaur osteoderm). These finds allowed for only very small glimpses of the ecosystem that was present within the marls of the Late Triassic Klettgau Formation (c. 220–205 Ma) in what is now known as Frick. Exceptions were the 2006 and 2009 finds of the semi-articulated skeleton *Notatesseraeraptor frickensis*, one of the best-preserved theropods of Europe from the Upper Triassic, and a skeleton of the stem-turtle *Proganochelys quenstedtii*, found at the Frickberg opposite of the Gruhalde claypit. The low abundance of non-*Plateosaurus* material was previously attributed to these smaller reptiles (and juvenile *Plateosaurus*) largely evading the muddy environments of fluvial overbank deposits that trapped many of the heavier and larger dinosaurs. More recent excavation efforts over the past five years have not only yielded more isolated theropod bones and teeth from several bone-bearing horizons, but also abundant smaller vertebrate remains from high in the lowest bone-bearing layer at Frick that are associated or (semi-)articulated and often preserved in 3D. These finds include a disarticulated, small and potentially juvenile skeleton of the aetosaur *Aetosaurus ferratus*, several skeletons of at least two early-branching and one acrosphenodont Rhynchocephalia including a hitherto unreported species, a semi-articulated shell of a stem-turtle distinctly smaller than the Frickberg *P. quenstedtii* and six pterosaur specimens. The latter include postcranial remains such as wings with the characteristic elongate fourth digit, and skull remains that indicate the presence of at least two species of non-eudimorphodontoid Eopterosauria. These novel finds challenge the simple taphonomic mud-trap scenario hypothesised for this environment and begin to reveal a more diverse reptile fauna for Frick

more similar in ecosystem complexity to ‘plateosaur graveyards’ in the Trossingen Formation in Germany.

Funding Sources Excavations at Frick are funded by Swisslos and research is supported by the SNSF (grant Nos. 222388 & 10001433).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

New insights into the anatomy of the early Permian trematopid *Rotaryus gothae* (Temnospondyli, Dissorophoidea) using CT data and re-evaluation of its phylogenetic position

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Trematopids are a monophyletic group of Permo-Carboniferous dissorophoid temnospondyls from North America and Europe. These anamniotes were well adapted for a terrestrial lifestyle, yet most species are only known from a single specimen. The scarcity of well-preserved fossils, combined with anatomical variation among taxa, poses significant challenges for resolving trematopid taxonomy and interrelationships. This study re-evaluates *Rotaryus gothae*, a trematopid from the early Permian Bromacker locality in central Germany, using computed tomography (CT) and 3D digital segmentation. This detailed examination of its cranial anatomy has enabled the identification of previously unrecognized features and the re-examination of formerly obscured structures. Notable findings include the presence of an internarial fenestra and insights on the mandibular and palatal anatomy, including new information on the dentition of the dentary and palate, such as the now-discernible palatal tusks of the ectopterygoid. Furthermore, a comprehensive set of postcranial elements was uncovered, including a previously unknown, nearly complete and articulated right hindlimb. These discoveries provide valuable new insights into the locomotor morphology and functional anatomy of *Rotaryus gothae*. Bayesian and parsimony analyses were respectively conducted using two recently published character-taxon matrices. The results of these analyses confirm the classification of *Rotaryus* as a trematopid, but its phylogenetic position varies by dataset and method used. This inconsistency suggests that *Rotaryus* acts as a wildcard taxon. Furthermore, the broader relationships within Olsoniformes remain unresolved. This combination of 3D imaging techniques and traditional anatomical investigations has led to a better understanding of *Rotaryus* and its phylogenetic relationships. Our findings highlight both the challenges posed by limited specimen availability and morphological variability. Ultimately, this research underscores the necessity of re-evaluating early tetrapods with modern tools to address unresolved research questions and provide a foundation for future investigations.

Funding Sources Museum für Naturkunde Berlin.

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

Affected by nearing extinction: congenital pathologies in dwindling populations of the saber-toothed cat *Smilodon fatalis* and the dire wolf *Aenocyon dirus*

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Tracing the health of dwindling populations facing extinction is of much current relevance. Documenting health in deep time is challenging, but skeletal markers of inbreeding exist. Notably, high incidence of spine malformations has been recorded in interbred extinct mammalian populations, possibly as consequence of low genetic diversity leading to disturbances in developmental processes. The exceptional preservation of hundreds of specimens of the saber-toothed cat *Smilodon fatalis* and the large canid *Aenocyon dirus* at the La Brea Tar Pits in Los Angeles allows us to examine pathologies across populations, with our collected data on domestic dogs and extant felids and canids as base comparisons.

Joint diseases may hamper the behavior of large predators. We investigated the prevalence of osteochondrosis dissecans (OCD), a developmental bone disease affecting joints in juvenile and adult *S. fatalis* and *A. dirus*. Subchondral defects in the distal femur had an occurrence of 6% in *S. fatalis* and 2.6% in *A. dirus*; in the shoulder of *A. dirus* occurrence was 4.5%. The La Brean predators were far more often affected by OCD than any extant carnivores, with domestic cats and large felids showing very rarely OCD, and even domestic dogs being generally markedly inbred and some breeds affected by OCD.

Vertebral malformations can also have a negative effect on large hunting animals. They include transitional vertebrae, those with features of two contiguous spinal segments or other congenital spinal malformation like block (fused) vertebrae. We identified 228 transitional vertebrae in *S. fatalis*, with high frequencies of intrasegmental cervical and lumbosacral transitions. Most transitions were found in the youngest tar pits, approaching the species extinction, indicating an effect of inbreeding. With an occurrence of 5.6% were block vertebrae tenfold more common in *S. fatalis* relative to extant felids, and were also common in the *A. dirus*, with a peaking both species at ~28 ka, probably related to environmental pollution.

As in reported cases of dwindling woolly mammoths, rhinoceros, gray wolves, and Neanderthals, the studied carnivorans show how accelerating inbreeding prior to extinction leads to more frequent inherited diseases. The Rancho La Brea fossils are unique in presenting a chronological study of well-dated large populations towards the end of the Pleistocene.

Funding Sources Swiss SNF IZSTZ0_208545 project (MRS-V) about megafaunal diversification and extinction; IVC Evidensia research grant 9077_Apr23_HS

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Functional morphology of the prepubis in Pterosauria

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Pterosaurs had a unique pelvic morphology, in which a mobile prepubic skeletal element articulated with an anteroventral facet on the pubis. The prepubis is present in the earliest representatives of the clade Pterosauria, from the Triassic onward, but the homology and function of the pterosaur prepubis remain poorly understood. An analogous pelvic structure evolved in the Jurassic in Crocodyliformes, in which the pubis articulates with a single facet on the anterior process of the ischium. This pelvic anatomy is still present in extant crocodylians and functions in lung ventilation and aquatic locomotion. To examine the function of the prepubis in pterosaurs, we studied the effects of prepubic movement on body volume and center of mass (CoM) during prepubic rotation and visceral shifting using three-dimensional digital models. We digitally simulated pubic and prepubic movements, respectively, in the extant crocodylian *Alligator mississippiensis*, in the basal rhamphorhynchoid *Rhamphorhynchus muensteri*, and in the derived pterodactyloid, *Pterodactylus antiquus*, using pubic rotation

metrics derived from in vivo cineradiographic studies of *A. mississippiensis*. In both pterosaur taxa, prepubic depression resulted in CoM displacements of less than 0.2% of total body length, while expanding the abdominal cavity and reducing trunk density by approximately 10%. Digitally simulated pubic and hepatic piston movement in *A. mississippiensis* yielded CoM shifts of approximately 1% of the total body length. Given the difference in CoM shifts between the pterosaur taxa and *A. mississippiensis* yielded by our analyses, it appears unlikely that prepubic movement in pterosaurs had a comparable impact on aerial manoeuvring as pubic movement does on aquatic locomotion in crocodylians. The effect of patagium and cranium movement on overall mass distribution would have had a much greater impact on CoM shifts. In fact, the minimal impact of prepubic motion on CoM movement suggests an inherently stable body plan adapted for pulmonary ventilation without impairing flight. We propose that the pterosaur prepubis served as an accessory breathing mechanism, similar to the respiratory function of the pubis in extant crocodylians. As a novel system, the prepubic system helped support the metabolically demanding flight of pterosaurs and may have been a key innovation for the successful radiation into the aerial realm of the first vertebrate group to evolve wing-powered flight.

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Synchrotron scanning of *Doryaspis arctica* reveals an exceptionally preserved heterostracan feeding apparatus

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Re-engineering of the head to accommodate jaws in support of feeding and ventilation is a key innovation in early vertebrate history, contributing to the dominance of jawed vertebrates in past and present ecosystems. Today, jawless vertebrates, the lampreys and hagfish (cyclostomes), only comprise a minuscule proportion of modern vertebrate diversity. However, jawless vertebrates dominated aquatic ecosystems prior to the end-Devonian and were represented by a broad array of taxa generally referred to as ostracoderms. The reasons for their initial success are poorly understood, and the phylogenetic distance between ostracoderms and extant cyclostomes makes comparisons of feeding mechanisms problematic. Little is known about the feeding structures of these early stem-gnathostomes beyond a handful of 'model' taxa, which in turn leaves gaps in our knowledge of vertebrate head evolution. Here, we present the oral anatomy of the Devonian pteraspid heterostracan *Doryaspis arctica* from the Wood Bay Formation of Spitsbergen, Norway. *Doryaspis* is known for its unique body plan, with wing-like lateral projections and an extensive ventral process underlying a dorsally located mouth. While it has been the subject of numerous publications focusing on its taxonomy and functional morphology, little is known about its oral morphology. Using synchrotron X-ray micro-computed tomography and 3D digital renderings, we reveal hitherto undescribed features of the heterostracan oral region. The oral apparatus of *Doryaspis* contains a series of pteraspid-like elongated oral plates, arranged transversely across the oral opening, which connect posteriorly to struts, combining to produce a comb-like sieve. Dorsally, the oral

region is constrained by a semicircular ‘funnel—shaped rostral plate creating a restricted convex opening. The rostral plate exhibits a rugose ornamentation on its internal surface which presumably facilitated redirection of water flow into the oral cavity to pass through the sieve structure. Our results indicate that at least some pteraspid heterostracans, including *Doryaspis*, were microphagous suspension feeders, refuting alternative hypotheses suggesting a deposit or predatory feeding style. The discovery of an extensive oral apparatus structure in *Doryaspis* fills a major gap in our understanding of the evolution of early gnathostome feeding and lends further support to previous interpretations that heterostracans were predominantly suspension feeders.

Funding Sources This study was funded by the Leverhulme Trust grant RPG-2021-271 “Feeding without Jaws” and the European Synchrotron Radiation Facility award ES-1458.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Some like it hot: examining thermal tolerance at extreme body size

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As the planet continues to heat, the resulting biodiversity crisis has the potential to drastically reshape communities. As body mass is highly correlated with numerous diversity trends, examination of the extremes of terrestrial size has the potential to more clearly define the ecologically destabilizing effects of climate change. Dinosaurs represent the extreme-end of body masses in terrestrial vertebrates, the largest of which thrived during one of the hottest periods of Earth’s history, the Cretaceous Thermal Maximum (CTM). It remains unclear whether these extremely warm climates were approaching dinosaurs’ physiological thermal maximum, and how these hot climate states may have affected primary productivity and food web structure. Here we explore the trophic implications of extreme heat through examination of trophic transfer efficiency and diversity metrics in two dinosaur communities. We analyzed the ratio of biomasses contained within each trophic level, the ratio of endotherms to ectotherms and median body size in the Maastrichtian Hell Creek and Turonian Bissekty Formations. Initial results indicate a decrease in trophic transfer efficiency and median body mass of terrestrial vertebrates during the hottest interval. Intriguingly, the number of endotherms increased at the same time. These results provide insight into the adaptations and adaptability of terrestrial communities to extreme heat.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Between sauropod toes: a microvertebrate survey of fine-grained deposits from the Upper Jurassic Morrison Formation (northern Wyoming, USA)

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First discovered during dinosaur excavations in the late 19th century, the mammal fossils of the Morrison Formation have since contributed to our understanding of Mesozoic ecosystems. Once thought to be merely nocturnal insectivores in the shadow of dinosaurs, early mammals are now recognized as ecologically diverse and much more abundant than previously assumed.

One particularly promising site is the Jurassic Mile in far northern Wyoming, a locality that has proven a true treasure trove of Mesozoic fossils. The site preserves material from both the terrestrial Morrison Formation and the underlying marine Sundance Formation, including dinosaur remains, fossilized plants,

ichnofossils, fish, marine reptiles, and insects. The deposits are considered to be Late Jurassic in age, which is particularly valuable given the limited global record from the poorly understood Jurassic–Cretaceous boundary.

In 2024, a pilot study was initiated to investigate the site's smallest vertebrate fossils, with a focus on capturing microvertebrate diversity often overlooked in large-scale excavations. Roughly 1,000 kg of fine-grained clay, interpreted as low-energy depositional sediment, was screen-washed from three stratigraphic layers using stacked sieves. The resulting fractions (~5–2.5 mm and ~2.5–0.5 mm) were dried in the field and subsequently screened under a stereomicroscope at Naturalis Biodiversity Center, Leiden.

Preliminary results highlight one particularly fossiliferous layer, informally dubbed 'The River Channel', which produced a rich assemblage of microvertebrates. These include numerous premolars and other molariform teeth tentatively attributed to multituberculates and/or haramiyids. Additional finds include small theropod teeth, fish remains, and various indeterminate tetrapod bone fragments. The high number of mammalian elements recovered from a relatively small amount of sediment, along with dental variation suggesting diverse feeding strategies, indicates that mammals were already an established part of a rich and complex ecosystem.

Future efforts will expand the volume of processed sediment from The River Channel and conduct detailed taxonomic analysis of the recovered material. Through these efforts, we aim to better characterize the small-bodied vertebrate fauna of the Morrison Formation and enhance our understanding of Mesozoic mammalian diversity and ecological dynamics near the Jurassic–Cretaceous transition.

Funding Sources NWO Mozaïek 2.0.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

An evolutionary conundrum: the mammalian medial pterygoid muscle

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The medial pterygoid (i.e., musculus pterygoideus internus, internal pterygoid muscle) is part of the mammalian jaw adductor muscle complex, and because it attaches to the posteromedial portions of the jaw, it underwent significant anatomical reorganization concomitant with the detachment of the middle ear bones during the therapsid–mammal transition. In therians (placentals and marsupials), the medial pterygoid develops medial to Meckel's cartilage and inserts on the angular process. Similarly, in non-mammalian cynodonts, the medial pterygoid is generally reconstructed as passing medial to Meckel's cartilage, inserting on the dentary 'angular' (i.e., pseudangular) process. Thus, the traditional interpretation is that the medial pterygoid remained in the same anatomical region through the evolutionary transitions from non-mammalian cynodonts to therians. Here, we highlight issues with that interpretation: the medial pterygoid muscle of monotremes inserts lateral (not medial) to Meckel's cartilage, and that is likely the case in early mammal groups (e.g., spalacotherioids, eutriconodonts) that lack an angular process. This suggests two possible explanatory hypotheses: 1) the medial pterygoid is evolutionarily labile, shifting in position relative to Meckel's cartilage multiple times throughout evolutionary history or 2) the medial pterygoid did not insert on the pseudangular process of non-mammalian cynodonts and instead inserted on the mandibular medial ridge. We favor the latter hypothesis, which implies the medial ridge and overlying fossa of mammaliaforms, the pterygoid 'shelf' and fossa

of early mammals, and the medial surface of the angular process of therians are homologous. Further, we advocate for Patterson's 1956 suggestion that the cynodont pterygoideus did not split into the medial and lateral pterygoids (and possibly tensors veli palatini and tympani) until the cladotherian node (therians and close relatives), thus coinciding with the evolution of the angular process and the separation of the middle ear bones from the dentary. Lastly, we demonstrate support for the hypothesis that the pseudangular process of non-mammalian cynodonts was the attachment site for jaw-depressor muscles. Patterson's hypothesis is in line with a growing body of evidence that indicate concomitant evolutionary changes of muscles, ears, and jaws at the cladotherian node were important catalysts for the evolution of hearing and feeding specializations in extant mammals.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Canine replacement and cortex size of an Oligocene juvenile nimravid, *Dinictis* sp., with sabertooth adaptation

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The Nimravidae were top predators of the Paleogene and early Neogene of North America, Eurasia, and Africa. As observed in machairodontine sabertooth cats, juvenile nimravids experienced a phase with persistent deciduous upper canines, which possibly helped to stabilize the erupting successors. Here, we describe a *Dinictis* sp. skull from the Brule Formation of South Dakota (NA) with persisting deciduous upper canines and almost fully erupted permanent upper canines. Our study is based on the comparison of tooth surfaces and brain endocasts generated from µCT scans. Comparison with extant pantherine felids shows that the canine replacement pattern of *Neofelis nebulosa* with elongated (sabertooth-like) canines differs from that of *Dinictis*. In *Dinictis* the permanent canines erupt lingual to the deciduous canines whereas in *Neofelis* they erupt anteromesial of the deciduous canines, which is also seen in *Panthera pardus* and *Panthera tigris*.

The virtually reconstructed relative area of exposed cortex (RAEC) of the subadult *Dinictis* is higher than that of other Oligocene carnivores such as *Eusmilus bidentatus* (Nimravidae), *Cephalogale minor* (Arctoidea), *Hesperocyon gregarious* (Canidae), *Otarocyon cooki* (Canidae), and *Mesocyon* sp. (Canidae) described in previous studies. A comparison of *Dinictis* with other felids indicates an enlargement of the relative surface area of the outer cortex in extant felids and the Pleistocene *Panthera spelaea*. Although the RAEC of the *Dinictis* specimen is lower than that of all extant felids we examined, it is relatively high for an Oligocene carnivoran. Among the felid taxa we included in our study, the RAEC of *Dinictis* and the related nimravid *Hoplophoneus primaevus* are closest to *Puma concolor*. The extant feliform *Nandinia binotata* has a much lower RAEC, representing a more plesiomophic condition, while the highest RAEC was found in *Acinonyx jubatus*.

In conclusion, we found a delayed replacement process of the upper canines in *Dinictis*, with a spatial position of the erupting permanent canines that is not observed among living felids, but characteristic for sabertooth ecomorphs. Overall, our data is in congruence with previous studies, which found an increase in brain volume and complexity of cortex gyrification during carnivoran evolution. Unexpected is the expanded relative area of exposed cortex of *Dinictis* exceeding that of other Oligocene carnivorans, which might indicate complex behavioural adaptations.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Mosaic evolution of the neck and inner ear in aquatic carnivorans

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The transition back to an aquatic lifestyle represents one of the most remarkable repeated ecological transitions in the evolution of tetrapods. A secondarily aquatic lifestyle requires drastic changes in body plan. However, the degree to which different body systems are constrained by developmental, functional, or evolutionary history can vary greatly. Here we focus on the secondarily aquatic transition of carnivorans (pinnipeds, mustelids, and ursids), as a model system to understand the coordinated evolution of different anatomical systems during major ecological transitions. For instance, the inner ear labyrinth, key to maintaining balance and spatial orientation, has a distinct morphology in various secondarily aquatic vertebrates and has been associated with the stabilization of the neck. Therefore, we ask: Have the neck and inner ear evolved in a coordinated or mosaic fashion across terrestrial-to-aquatic transitions in carnivores?

We use a multi-element approach to quantitatively assess the craniocervical region (inner ear labyrinth and cervical vertebrae), using computed tomography (CT) imaging of carnivoran skulls to reconstruct their inner ear labyrinths, alongside 3D models of the seven cervical vertebrae (25 extant taxa and 4 fossils). To better capture the terrestrial-aquatic transition, we include four extinct species: the mustelid *Siamogale melilutra*, the stem-pinniped *Potamotherium vallentoni*, the already flippered pinnipedimorph *Enaliarctos mitchelli*, and the phocid *Callophoca* sp. We combine high-dimensional landmark-based morphometrics with landmark-free shape analysis (using Auto3dgm) to trace morphological transformations associated with aquatic adaptations over evolutionary time and across the carnivoran phylogeny. We analyzed each component separately and created a consensus shape analysis of all elements using Morphoblocks. Results reveal distinct morphologies based on habitat preferences in carnivorans (aquatic, semiaquatic, and terrestrial), with the aquatic otariids and phocids forming clusters indicating a phylogenetic influence. The aquatic inner ear morphology of carnivorans shows similarities with other secondarily aquatic tetrapods, suggesting an overall trend. The fossil species each displayed their own distinct morphology. This study allows us to get a better understanding of patterns of mosaic evolution during the secondarily aquatic transitions.

Funding Sources Leverhulme Trust Early Career Fellowship (ECF-2023-365) and the John Fell Oxford University Press Research Fund

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Feeding the dead: I. *Mastodonsaurus giganteus*

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Understanding the feeding behavior and diet of early tetrapods is essential to understand their ecological roles, particularly during their transition from aquatic to terrestrial environments. The study of early tetrapod feeding is also crucial in unravelling the evolution of vertebrate feeding behaviors from primary aquatic suction feeders that gulp and often lack oropharyngeal food processing

behaviors to terrestrial biters and chewers featuring diverse ingestion strategies. A multidisciplinary project focused on the reconstruction of life history strategies of early tetrapods, among other analyses, aims to illuminate the feeding strategies and dietary habits of temnospondyls by integrating ontogenetic, phylogenetic, and functional analyses. The Middle Triassic capitosaur *Mastodonsaurus giganteus*, one of the key study species in this multidisciplinary project, was the largest temnospondyl and the dominant aquatic predator in freshwater to brackish ecosystems from Central Europe. The overall cranial proportions were relatively conservative throughout the development of *Mastodonsaurus*, potentially indicating a conservative aquatic feeding strategy throughout ontogeny. We investigate this trait by applying computational fluid dynamics (CFD) to better understand if aquatic feeding, particularly ingestion, changed during development. Adult *Mastodonsaurus* were not restricted to a particular prey type, but preferred relatively large prey, including the temnospondyls *Plagiosuchus*, *Gerrothorax*, *Tatrasuchus*, and likely smaller conspecifics, while smaller individuals preferred actinistians and lungfishes. The consumption of relatively large and potentially dangerous prey indicates the presence of mechanical prey processing strategies that helped to incapacitate prey. Finite element analysis (FEA) is employed to simulate a range of inferred food processing strategies, drawing on comparative functional morphology with extant vertebrates. Integrating CFD, FEA, and evidence from living analogues, we reconstruct the feeding ontogeny of *Mastodonsaurus giganteus*. Our results reveal a range of strategies for prey ingestion and mechanical processing, which may reflect an adaptive capacity for exploiting both aquatic and terrestrial feeding environments.

Funding Sources Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – 468618938; 508778113

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Sauropod diversity in the Middle and Upper Dinosaur Member of the Late Jurassic Tendaguru Formation in Tanzania

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The fossil material from the colonial German Tendaguru Expedition (GTE, 1909–1913) to today's Tanzania includes an exceptionally diverse Late Jurassic dinosaur fauna, including ornithischians, theropods, and, to a great extent, sauropods. Within the Tendaguru Formation, mainly the Middle (MDM, Kimmeridgian), and Upper (UDM, Tithonian) Dinosaur Members yielded dinosaur bones. However, our survey of the taxonomic and phylogenetic record of described dinosaur material from both strata revealed a notable change in the dinosaur diversity from the MDM to the UDM. Whereas ornithischians are known mostly from the MDM, theropods seem to be equally represented in both MDM and UDM. The faunistic changes become most evident in the altering sauropod diversity: whereas the MDM comprises only the neosauropods *Giraffatitan brancai*, *Dicraeosaurus hansemanni*, *Tornieria Africana* and *Janenschia robusta*, a broad spectrum of eu- and neosauropods is described from the UDM, including *Giraffatitan brancai*, *Dicraeosaurus sattleri*, *Tornieria africana*, *Australodocus bohetii*, *Janenschia robusta*, *Tendaguria tanzaniensis*, and *Wamweracaudia keranjei*.

For a more precise characterization of the faunal shift between MDM and UDM, we started analyzing the old GTE field catalogues, which allows determination of the amount of sauropod material originally found in the more than 60 quarries around the Tendaguru area. Discrepancies between the material listed in these field catalogues and the actually catalogued specimens in the collection of the

Museum für Naturkunde Berlin reveal a notable loss of material between excavation and collection accession. This affects the documented taxonomic diversity of sauropods from both the MDM and the UDM as demonstrated here on the examples of quarry dd from the MDM and quarry K from the UDM, both containing still undetermined diplodocoid material. Concluding, in future studies the Tendaguru sauropod fossils from the MDM and UDM should be compared against each other to refine our knowledge about their taxonomic and phylogenetic diversity. The observed diversity changes in the Tendaguru Formation are particularly evident within herbivorous dinosaurs, and likely reflects environmental fluctuations, such as changes in the availability of fodder plants. These changes may also indicate shifts in dinosaur migration patterns, facilitating the introduction of new faunal elements into the Tendaguru region during the Tithonian.

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Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

Revised Triassic chronology of the Rewan Group and its implications for vertebrate recovery in the Northern Bowen Basin

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The Lower Triassic Rewan Group of the northern Bowen Basin has long been regarded as an Early Triassic archive of vertebrate recovery following the End-Permian Mass Extinction (EPME). We applied U/Pb detrital zircon geochronology to fluvial sandstones of the Sagittarius Sandstone and Arcadia Formation (Rewan Group) to constrain maximum depositional ages (MDAs) and refine their biostratigraphic framework. Samples from three main vertebrate localities (The Crater, Oakey Creek, Duckworth Creek) and six drill cores were analyzed (≈300 grains/sample; total >4,000 grains) by LA–ICP–MS, filtered for <15% discordance. MDAs were calculated using youngest grain cluster (YGC; 2σ), maximum-likelihood age (MLA), and youngest statistical population (YSP) methods.

In tectonic foredeep settings, sedimentation across the Permian–Triassic boundary appears continuous, but back-bulge localities record an abrupt unconformity and delayed Rewan Group deposition. At main vertebrate fossil sites, MDAs range from 235.1±2.6 Ma (Arcadia Formation; Ladinian–Carnian) to 231.1±1.3 Ma (Arcadia Formation; Carnian), with drill-core data corroborating a mid-Carnian onset (~232 Ma). The absence of Induan–Olenekian ages defines a ~10–15 Myr hiatus between the underlying Bandanna Formation (~252 Ma) and the Rewan Group in the backbulge, likely driven by Hunter–Bowen orogenic uplift and erosion. Lateral MDA variation across structural highs further demonstrates diachronous sedimentation, with isolated depocenters persisting into the Late Triassic.

Reassigning Arcadia Formation vertebrate assemblages, dominated by temnospondyls and minor amniotes to the Middle–Late Triassic repositions these faunas as elements of a progressively diversifying mid-Triassic ecosystem rather than immediate post-extinction survivors, affecting this contribution to the understanding of post-extinction dynamics in high-latitude Gondwana. It also demands updated stratigraphic correlations across the Bowen and Galilee basins and prompts reevaluation of other purported Early Triassic vertebrate faunas in eastern Australia.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Postcranial anatomy of the late Miocene hippopotamoids from Toros-Ménalla, Chad

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Hippopotamoidea is a superfamily of cetartiodactyls that are nowadays limited to two extant species: *Hippopotamus amphibius*, the common hippopotamus, and *Choeropsis liberiensis*, the Liberian hippopotamus. Restricted to Africa, these two mammals inhabit ecosystems closely linked to water and are the only extant members of a specialized ecological guild called the large semi-aquatic herbivores. The bulk of the diversity of this superfamily was composed by the paraphyletic anthracotheres, a geographically, temporally, and ecologically more diverse group from which hippopotamids originated.

Historically, the phylogenetical relationships of these taxa were debated, especially since the establishment of the clade Cetancodonta composed by cetaceans and hippopotamids. Studies have tried to help resolve these issues with the help of cranial, intracranial, and dental anatomy. Their postcranial anatomy has until now been mostly unexploited data, sometimes due to poor preservation. At Toros-Ménalla (TM), a Late Miocene fossiliferous area in Chad, the last African anthracothere *Libycosaurus bahri* has been found coexisting with the large hippopotamid *Hexaprotodon garyam*. Their coexistence in humid environments suggests some form of niche-partitioning. As a major way for an animal to interact with its environment, the locomotor apparatus is a great candidate to help clarify the phylogenetical issues cited previously but also to discuss functional and ecological considerations mentioned in the past literature.

This study proposes an anatomical comparison between these two coexisting hippopotamoids and their closest extant ecomorph, the common hippopotamus. With the observation of characters on a sample of ca. 650 specimens, we setup a framework for the identification and differentiation of the postcranial skeleton of hippopotamoids, but we also demonstrate the relevancy of the inclusion of postcranial skeleton in future phylogenetical analyses. Additionally, we discuss the postcranial anatomy of those taxa in the context of the environments of the African Miocene, allowing new functional and ecological interpretations for the interaction between hippopotamoids and changes in their wet environments, which remains a major driver in the evolutionary history of these large artiodactyls.

Funding Sources This work was funded by the Agence Nationale pour La Recherche, SPLASH programme.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Preliminary evidence of osteosclerosis as indication of diving behavior in a fragmentary K/Pg fossil ornithurine from New Jersey

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A rare incomplete avian tarsometatarsus was recovered from the Cretaceous/Paleogene Hornerstown Formation at Edelman Fossil Park in Mantua, New Jersey, USA. Superficially, it

resembles those of foot-propelled diving birds (e.g., *Baptornis*, extant grebes). However, the upper mass estimate for this specimen is 70–75 grams based on an approximately 1 mm tarsometatarsal midshaft width, considerably smaller than most foot-propelled divers. This study examines the compactness of the bones for indication of osteosclerosis, an adaptation by diving birds to counteract buoyancy. To do this, the bone was μCT scanned and cross-sections were chosen as close to the midshaft as possible while avoiding major erosion for measuring Relative Bone Thickness and Observed Compactness values of the shaft. Then, these were compared to those of femora of previously published diving birds. With a Relative Bone Thickness of 25.5 and an Observed Compactness of 0.729, which are on the high end for diving birds, our results preliminarily support the gross morphological evidence that this fragmentary leg bone belonged to a small diving bird. Further interpretation requires focus on phylogenetic placement and further research on foot-propelled diver osteology.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Disparity analyses are robust to ancestral state estimation uncertainty

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Ancestral state estimation is a key method for inferring evolutionary history across a phylogeny beyond observed trait data. This is particularly useful in morphological disparity analyses by accounting for ghost lineages left by an incomplete fossil record. Despite its widespread use, it is unclear how uncertainties inherent to ancestral state estimations are handled and how well this affects our ability to recover accurate disparity patterns. Here, we investigate how different approaches for treating uncertainties in discrete ancestral state methods affect estimates of morphological disparity under varying levels of fossil sampling. Using a simulation approach along with empirical data, we compare two threshold-based methods (where states are collapsed according to a set cutoff) with an approach that samples ancestral states proportional to their marginal likelihoods. From our known simulated data, we assess both the raw accuracy of ancestral state estimation but also how these uncertainties can have a cascading effect on disparity analyses. We then expanded this simulation framework to incorporate mass extinction events with varying intensity and selectivity, further assessing the impact of fossil sampling on the accuracy of ancestral estimations. Our results show that, although raw estimation accuracy decreases rapidly with poorer fossil sampling, disparity estimates remain remarkably accurate across different disparity metrics. This suggests that morphological disparity analyses are generally robust to uncertainties in ancestral state estimation, even under high levels of missing data. Both raw ancestral state and disparity estimates were also robust across random extinctions but declined significantly under selective extinctions when fossil sampling was low. This highlights the importance of fossil data for reliable ancestral state estimation, especially in scenarios where extinctions bias trait distributions. Finally, we demonstrate that explicitly propagating uncertainty—rather than collapsing states into point estimates—more effectively captures variation and returns more accurate disparity estimates, reinforcing the need to move beyond point estimates when working with the incomplete fossil record.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

An analysis of *Lystrosaurus* Calcium apatite: insights into the survival strategies across the Permo–Triassic boundary

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Lystrosaurus is one of the survivors of the end-Permian Mass Extinction event. It was able to occupy a wide geographical range and increase its abundance post-extinction. In the upper Katberg formation, it coexisted with no other herbivores. It has been proposed in the literature that the observed increase in abundance and wide geographic range can be attributed to the species' classification as an r-strategist, its opportunistic nature, and its adaptation to consuming tough vegetation. *Lystrosaurus* had a relatively short stratigraphic range, with its abundance predominantly observed at the Permo–Triassic Boundary. Trace elements compositions found in fossil apatite holds record of the type of diet, diagenetic history, water composition, position in the food chain and temperature, hence, stable isotope analysis is of great use in archaeology and palaeontology. Trophic structuring of extinct and extant biota is often done using geochemical archives, namely bones and teeth. However, diagenesis becomes a limiting factor in trophic structuring of extinct biota due to the fossilization process of skeletal tissue changing both the chemical and isotope composition of the geochemical archives. Interestingly, major inorganic component like calcium shows no change in both chemical and isotopic composition over time unlike major organic and trace elements. The reason for this is that calcium fractionation doesn't take place through the blood, urine, or mineralised tissue degradation processes. To test whether calcium isotope analysis could expose recovery patterns that promote survival strategies following terrestrial extinction events, we investigated the isotope composition of *Lystrosaurus* species to determine any species strategies or trophic level traits that promoted survivorship in the end-Permian Mass Extinction Event. We collected calcium isotope ratios ($\delta^{44}Ca/\,^{42}\delta Ca$ and $\delta^{43}Ca/\delta^{42}Ca$) of the four *Lystrosaurus* species and compared them based on their biostratigraphic ranges and estimated body size. Isotope compositions were measured using three techniques: 1) preparation of samples, 2) ion-exchange chromatography, and 3) Isotope ratio mass spectrometry. We can confidently say that calcium isotope analysis is expected to provide crucial insights into the survival strategies of Triassic communities, and ongoing work will refine these interpretations.

Funding Sources PAV: NSF DEB-2325380

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

An opportune moment: investigating inertial properties of the distal limb of horses through an iconic evolutionary transition

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Horse side-digit reduction is used as a textbook example of adaptive evolution. A principal hypothesis for the reduction (and eventual loss) of side-digits in horses (family Equidae) is that it minimizes energetic cost during locomotion, linked to reduced inertial load of the limbs (inertial load hypothesis). The inertial load, or moment of inertia (MOI), of the equid distal limb would intuitively have decreased with side-digit loss, as side-digits account for mass at the furthest point from the rotation center of, e.g., the forelimb (at the scapula). Our study tested that hypothesis by estimating and comparing inertial loads of tridactyl (three-toed) equid limbs, both with and without side-digits. Additionally, it compared the inertial load of tridactyl and monodactyl (one-toed) equids to

investigate the effect of side-digit loss across the equid lineage. To represent the variability in equid distal limbs over time, 24 equid species were analyzed (Eocene to present). The dataset included basal anchitheres with long side-digits, hipparionins with reduced side digits, and extinct and extant monodactyl equids. To address our biomechanical question, limb soft tissue was reconstructed using a convex hulling method based on muscle attachments on the full forelimb skeleton. This method estimates the smallest convex shape enclosing a set of points (e.g., the individual limb segments in this study). A validation analysis using 3D renders of cadaver specimens confirmed the accuracy of the convex hull reconstructions, which were then applied to extinct species. Our results demonstrate that the entire limb MOI relative to the scapular rotation center is significantly smaller without side-digits. However, the difference is minimal, calling into question its functional significance. Size-corrected MOI between monodactyl and tridactyl taxa suggest significant differences (monodactyl equids with lower MOI); however, distal limb mass comparisons showed no signs of the effect of side-digits. Based on the negative relationship of MOI with the proportion of limb mass relative to limb length, we posit that allometric differences in segment proportions led to the reduction in MOI, rather than the absence of side-digits. Our study refutes the theory that side-digit reduction in derived tridactyl equids was linked to inertial load minimization, potentially explaining the retention of side-digits in even the most derived hipparionin ('advanced' tridactyl) equids.

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Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Assessing the diverse avemetatarsalian (Diapsida, Archosauria) record from the Upper Triassic of India

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The Upper Triassic horizons of India are rich in archosaurian fossils including various avemetarsalians with dinosaurian affinities. These are mostly known from the Maleri and lower Dharmaram Formations of Pranhita-Godavari Basin and the Tiki Formation of the Rewa Gondwana Basin. Detailed osteological studies and thorough comparison with other similar forms revealed that the femora and astragalus, previously assigned to *Alwalkeria*, exhibited morphological traits congruent with lagerpetids and herrerasaurids, respectively. A probable theropod is present in the same horizon. The coexistence of a dinosaur precursor/pterosauromorph, a herrerasaurid, and a possible theropod in the Maleri Formation align with similar findings in other coeval horizons such as the Santa Maria Formation of Brazil, Chinle Formation of New Mexico and Dockum Group of Texas. The current study also reports a probable silesaurid from the overlying Lower Dharmaram Formation.

In addition, recent recovery of numerous small, isolated and articulated postcranial remains from the Tiki Formation of another Gondwana basin showed co-occurrence of diverse early dinosaurs that included a silesaurid, a herrerasaurid, and a sauropodomorph. If the silesaurid is considered an ornithischian based on recent phylogenetic analyses, then the sympatric association of Tiki saurischian and ornithischian dinosaurs demonstrates a faunal composition that parallels the *Hyperodapedon-Exaeretodon-Herrerasaurus* Assemblage Zone of the Ischigualasto Formation of Argentina. This study highlights the highly diverse Upper Triassic, mainly Carnian-Norian, avemetatarsalians from the Indian subcontinent. However, in a global scenario, this diversity is comparable to that of Africa but much lower than that of the South American counterpart.

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Technical Session V: Vertebrate Assemblages (Wednesday, November 12, 2025, 1:45 PM)

Life and death in the Mesozoic deep-sea: paleobiology and taphonomy of pelagic vertebrate megafauna from the abyssal Upper Cretaceous of Northern Italy

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The Ligurian Complex of the Northern Apennines (Northern Italy) comprises outcrops of deep-sea sediments from the Lower-Upper Cretaceous. These units were deposited in an abyssal plain paleoenvironment, a largely unexplored setting during the Mesozoic. Though extremely rare and fragmentary, the complex has yielded a diverse record of marine vertebrate megafauna that is currently the subject of extensive paleobiological and taphonomic revision. We conducted a detailed survey of the taxa, often with the support of CT scanning. When possible, histological samples were extracted for microstructural and compositional analysis. The record has a long stratigraphic range, spanning from at least the Albian to the Maastrichtian. Pelagic amniotes are represented by platyperygiine ichthyosaurs, mosasaurine mosasaurs, and leptocleid plesiosaurs. Bony fishes are exceedingly rare, with isolated instances of the hypsocormine pachycormid *Protosphyraena* alongside plethodid tselfatiiforms; among plethodids, a large taxon exhibiting remarkable convergences with extant billfishes is described for the first time. The chondrichthyan record is represented by lamniform sharks, with vertebral and dental remains of Anacoracidae and Cretoxyrhinidae. The vertebrate record is cumulatively represented by large predatory morphotypes: this aspect may represent a genuine paleoecological signal, as pelagic megafauna is often segregated in open-ocean settings. While specimens are largely incomplete, their anatomical units are pristinely preserved, with fully three-dimensional, undistorted, and histologically coherent skeletal elements. This aspect has major paleobiological implications, allowing for the reconstruction of fine anatomical features, such as the osteological correlates for neurovascular structures and glandular sinuses. Odontoskeletal tissues are typically encrusted by polymetallic compounds and often present traces of microbial activity in the form of sulphur-reduction byproducts and bioerosion. Finally, these specimens are characterized by a mild but significant radioactivity caused by uranium embedded in the bone lattice, possibly linked to a biogenic origin. The record offers a unique window into the diversity, paleobiology, and taphonomy of pelagic vertebrates from the deep-sea of the late Mesozoic, suggesting how some taxonomic assemblages, ecological signals, and fossilization processes might be unique to these unexplored abyssal settings.

Funding Sources The Lauer Foundation for Paleontology Science and Education (PSE) is profoundly thanked for providing UV equipment to GS.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

New bohaiornithid-like bird from the Lower Cretaceous of China with well-preserved gastric pellet

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The Enantiornithes constitutes the most diverse group of Mesozoic birds, representing the first major radiation of avian dinosaurs. This group

comprises several families with a global distribution, among which Bohaiornithidae is the most taxonomically rich. Bohaiornithidae are distinguished by broad teeth with recurved tips, a straight pygostyle, metacarpal III longer than metacarpal II, and a robust first pedal digit. Despite the abundance of enantiornithines specimens, no Chinese enantiornithine, let alone bohaiornithid, has been found preserving direct evidence of diet.

A newly discovered bohaiornithid specimen from the Jiufotang Formation, Lower Cretaceous of China, is here described for the first time. The nearly complete specimen preserves several elongate bones caudal to the skull, identified as parts of the hyoid apparatus, the ceratobranchials. These bones are quite elongate, measuring half the length of the skull. This proportion closely matches other Mesozoic enantiornithines with preserved hyoids, indicating that this feature may be more widely distributed than previously thought. There are also several delicate and elongate bones present in the skull identified as pterygoids, contributing valuable data to the poorly known palatal anatomy for Mesozoic birds, an area for which well preserved specimens remains scarce. Notably, located near the cervical region is a dense concentration of bones. Based on the morphology, makeup, and placement, this mass is identified as a bromalite, specifically a regurgitalite (gastric pellet), composed of teleost fish remains. This identification makes this specimen tfhe first direct evidence of piscivory among enantiornithines. This new bohaiornithid specimen provides new information about the palatal and hyoid evolution of early birds, and expands our understanding of dietary preferences and feeding adaptations among enantiornithines.

Funding Sources National Key Research and Development Project of China (2024YFF0807603), National Natural Science Foundation of China grant 42288201, ANSO Scholarship for Young Talents.

Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

First sauropod dinosaur from the Lower Cretaceous Khok Kruat Formation of Thailand: expanding the diversity of somphospondylan titanosauriforms in Southeast Asia

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Thailand has observed a substantial increase in paleontological discoveries over the past two decades, particularly involving sauropod dinosaur remains. Nevertheless, to date, only two sauropod species have been identified: *Isanosaurus attavipachi*, an early-branching sauropod from the Early Jurassic Nam Phong Formation, and *Phuwiangosaurus sirindhornae*, a euhelopodid somphospondylan titanosauriform from the upper Valanginian–lower Hauterivian (Lower Cretaceous) Sao Khua Formation. Here, we describe the first sauropod found in the youngest fossil-bearing Mesozoic formation of Thailand. This new taxon, a large somphospondylan titanosauriform, comes from the Aptian–Albian (Lower Cretaceous) Khok Kruat Formation in Chaiyaphum Province, northeastern Thailand. Preserved elements include four dorsal vertebrae, four sacral vertebrae, five dorsal ribs, a right humerus, right ilium, left and right pubes, and a nearly complete right femur. This taxon is distinguished from other Southeast Asian forms by its size (estimated mass of 29 tonnes) and a unique suite of anatomical features, such as serial variation in hyposphene-hypantrum morphology, pronounced aliform processes, spinopostzygapophyseal laminae that are divided throughout their entire length, bifurcated

middle dorsal neural spines, gracile humerus with posterolaterally deflected lateral margin and anteromedially directed deltopectoral crest, and a gracile pubic peduncle on the ilium. Phylogenetic analysis using a data matrix of 153 taxa and 570 characters, places the new taxon as the sister taxon of *Tangvayosaurus*, a euhelopodid somphospondylan from the Aptian–Albian Grés Supérieur Formation of Laos. *Phuwiangosaurus* is in turn the sister taxon to this clade. These findings enhance our understanding of sauropod evolution in Southeast Asia, shedding light on the diversity of euhelopodid somphospondylans in the region, and the potential case for an endemic clade of Early Cretaceous sauropods.

Funding Sources Fieldwork and laboratory analysis were supported by a National Geographic Society grant no. EC-106536R-24.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The dermal skeleton of stem-actinopterygian *Moythomasia* and its implications for the evolution of cosmine

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The dermal skeleton is the most primitive component of the vertebrate mineralized skeleton and features of its structure and development are key to resolving the evolutionary relationships of early vertebrates and bony fishes. In particular, the nature and phylogenetic distribution of cosmine, a dermal complex of hard tissue and vascular systems, has been the focus of debate over the nature of the ancestral osteichthyan and the timing of actinopterygian-sarcopterygian divergence. In large part, this controversy occurs because of a paucity of knowledge of the nature of the dermal skeleton in stem-actinopterygians. Here we describe a three-dimensional virtual dissection of the dermal skeletal histology of the 376-million-year-old stem-actinopterygian *Moythomasia duringia*, using synchrotron radiation X-ray tomographic microscopy (SRXTM), with a reconstruction of its topological variation and development. Our results reveal that the dermal skeleton of *Moythomasia* generally consists of a superficial layer of stacked odontodes and a basal layer of lamellar bone. Odontogenic resorption is extensively present, displaying as thinned and scalloped layers. However, substantial histological variation is observed across different dermal skeletal elements, particularly between the cranial and postcranial regions. The number of generations of odontodes varies in different elements, ranging from two to nine generations. A middle layer of vascular bone is present in cranial bones but absent in the scale. Notably, the cranial dermal skeleton of *Moythomasia* displays a structure resembling the pore-canal system of cosmine, consisting of pore openings and cavities interconnected through horizontal canals. These results provide new insights into the evolution of cosmine in early osteichthyans. They suggest that fossil taxa currently classified as stem-sarcopterygians, may instead be stem-actinopterygians, or even stem-osteichthyans, with implications for the nature of the ancestral bony fish and timing of osteichthyan diversification.

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

Multidisciplinary approaches to the study of evolution and function of unique cranial morphology in Lagomorpha

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Rabbits and hares (Leporidae) exhibit unique cranial traits that distinguish them from other mammals, including extensive fenestrations of the rostrum and posterior cranial bones, ventral flexion of the anterior cranium, and a potential

intracranial joint that may provide intracranial movement. If verified, this instance is the only known example of cranial kinesis in mammals. These morphological features are thought to enhance locomotor efficiency by reducing weight, improving visual field, mitigating shock, and protecting the sensory organs during high-speed running. However, despite their unique morphology, research on their evolutionary history, comparative anatomy, and biomechanical function is lacking. Across several studies, we investigate leporid skull morphology utilizing phylogenetic comparative methods, complexity analysis, geometric morphometrics, and finite element analysis (FEA). We include both living and extinct species, including a new, undescribed specimen of the stem lagomorph *Palaeolagus haydeni*, which features a mosaic of cranial morphological traits that share similarities with both modern Leporidae and Ochotonidae. Through ancestral state reconstruction, we found that the last common ancestor of living leporids likely had facial tilting, rostral fenestrations, and an intracranial joint but that the last common ancestor of all lagomorphs (including pikas) did not. We also found significant correlations between the intracranial joint complexity, locomotor mode, and facial tilt angle indicating that cursorial species have a less complex joint and greater facial tilting. Finally, FEA simulating locomotor forces showed that the fastest species (*Lepus*) have lower strain energy and relatively fewer compressive strain-dominated elements in the intracranial joint compared to generalists. Results suggest that these unique morphological traits likely developed alongside the onset of specialized saltatorial and cursorial locomotion within leporids supporting previous studies suggesting that locomotion is likely a strong evolutionary driver of cranial morphology in leporid lagomorphs.

Funding Sources Natural Environment Research Council (NERC) DTP studentship grant 2441957

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Revision of *Mosasaurus lemonnieri* reveals unique anatomy, significant variation, taxonomic issues, and a new species

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In the late 19th century, Louis Dollo assembled one of the first museum paleontology fieldwork crews to collect a wealth of mosasaur (Squamata: Mosasauridae) fossils discovered by miners working below Mons, Belgium. Dollo named several taxa from this assemblage, but grouped most specimens into the new species *Mosasaurus lemonnieri*. Despite its exceptional sample size by mosasaur paleontological standards, only two publications have focused on this assemblage in the century since Dollo's initial works, and this taxon is excluded from most studies of mosasaur anatomy and systematics. We performed an extensive survey of this material, with the goal of establishing the re-diagnosis, validity, monophyly, and anatomical variation of this taxon. Counter to some previous assertions, *M. lemonnieri* is a valid species that can be differentiated from other *Mosasaurus* primarily by its elongate premaxilla-maxilla suture. Several specimens preserve the axial column in detail, revealing a sharper tail bend than in other mosasaurines (where preserved). Osteological variation within this sample is mostly randomly-distributed, interpreted here to represent expected variation within a metapopulation of large vertebrates. Notable examples include the inconsistent co-fusion of the frontals, the variable shape of the suprastapedial process, and pathology of the intramandibular joint. *M. hoffmannii*-like craniodental morphology is observed in larger (~10 meter) but not smaller *M. lemonnieri*; the worldwide referral of robust Maastrichtian

mosasaurine material to *M. hoffmannii* is thus problematic, as this robusticity appears to develop allometrically in *Mosasaurus*. There is high variation among *M. lemonnieri* in dental characters (dimensions, curvature, facet presence and count) that are often used to delineate tooth taxa, and new comparisons with *M. hoffmannii* reveal similar unreported variability. The range of variation in these taxa encompass the morphology of *M. beaugei*, a tooth taxon known predominantly from Morocco; we regard *M. beaugei* as invalid. Our revised diagnosis allows the removal of one well-preserved specimen from *M. lemonnieri*. This individual, here identified as a new species of mosasaurine, shares features of the quadrate and autopodium with "prognathodontins", but possesses gracile craniodental morphology. The exceptional thorax and abdomen of this specimen contain visceral contents, which yield surprising data hidden in plain sight for over 130 years.

Funding Sources NSERC CGS-M Award

NSERC Discovery Grant

Alberta Graduate Excellence Scholarship

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New high-latitude multituberculates reveal mammalian dispersals and endemism in Late Cretaceous Alaska

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The Late Cretaceous Prince Creek Formation of Alaska (~80–85°N paleolatitude) preserves the northernmost Mesozoic multituberculate mammals known to date, offering a glimpse into high-latitude vertebrate ecosystems during a time of profound climatic and faunal transitions. We recognize three new taxa from late Campanian-aged localities, each exhibiting striking dental specializations, including distinct morphologies in the upper and lower ultimate premolars. These differences suggest niche partitioning and ecological adaptation to strongly seasonal polar conditions marked by prolonged winter darkness and low primary productivity. To evaluate their evolutionary and biogeographic significance, we employed a multifaceted analytical framework combining detailed morphological assessment, biogeographic modelling, and both maximum parsimony and Bayesian phylogenetic inference, the latter marking the first application of Bayesian methods in multituberculate systematics. Our results provide support for the placement of one of the new species within Djadochtatherioidea, a clade previously restricted to the Late Cretaceous of Mongolia, representing the earliest direct evidence of an Asia-to-Laramidia dispersal of multituberculates. In contrast, another new species emerges as the geologically oldest member of Microcosmodontidae, suggesting a high-latitude origin for the clade, perhaps conveying survivorship through the Cretaceous-Paleogene mass extinction. The third new species represents the northernmost occurrence of the North American Cimolomyidae. Biogeographic range reconstructions incorporating phylogenetic data point to intercontinental faunal exchange between Asia and Laramidia through the Late Cretaceous. Together, these discoveries document both long-distance dispersal and localized diversification in the ancient Arctic, challenging the perception of high-latitude environments as evolutionary impasses. Instead, our findings position the paleo-Arctic as a dynamic cradle of mammalian innovation, where high-latitude ecosystems act as engines of diversification, resilience, and evolutionary significance deep in Earth's past.

Funding Sources National Science Foundation EAR 1226730 and EAR 1736515

Colbert Prize Session

A new, articulated, early tetrapod from the end-Devonian of Greenland

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Our knowledge of early tetrapods from the Devonian is rather incomplete. Besides *Ichthyostega* and *Acanthostega*, most taxa are only known from isolated bones and incomplete, disarticulated individuals. Here we present a first look at a new, largely complete, stem tetrapod from a newly discovered locality of latest Famennian age from the Stensiö Bjerg Formation of Celsius Bjerg, East Greenland. This individual represents one of at least five new tetrapod taxa that form the youngest known multi-species assemblage of Devonian tetrapod fossils, allowing us to better understand the tetrapod biota that faced the end-Devonian mass extinction.

The specimen was imaged using propagation phase-contrast synchrotron microtomography (PPC-SRμCT) at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France. This individual has the first example of a fully articulated pelvic girdle and posterior vertebral column down to the tail, in life position, of any Devonian tetrapod. The pelvis resembles that of *Ichthyostega* but has a wider, flatter iliac neck. The lumbar and post-sacral vertebrae consist of intercentra with smaller paired pleurocentra positioned posterior to them. Dorsally, the lumbar and sacral neural arches carry jagged outgrowths, presumably muscle attachments, similar to those observed in *Ichthyostega.* Some of these growths project laterally and align to form an antero-posterior ridgeline. The anterior portion of the animal is disarticulated, and elements have been displaced posteriorly, including various pectoral girdle, limb, and anterior trunk bones. The humerus of this specimen closely resembles ANSP21350, an isolated humerus from the Catskill Formation, USA, which is regarded as having a root-ward morphology among stem tetrapods. A complete femur is preserved, which is similar in length to the humerus and has a relatively long intertrochanteric fossa compared to other early tetrapod femora. Despite being disarticulated from the rest of the body, the skull has excellent 3D preservation and is complete except for the lower jaws, maxilla, and premaxilla. Remarkably, the belly skin of this individual is also preserved. Whilst it shares some similarities with other early tetrapods, the new tetrapod does not belong to any previously described taxon.

Funding Sources Funding provided by the Knut and Alice Wallenberg Foundation. Fieldwork funded by ERC Advanced Grant 101019613 “Tetrapod Origin”.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new application of OpenSim to study fossil bird biomechanics

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The Enantiornithes are the major group of Mesozoic birds with a relatively complete fossil record in comparison to that of the Euornithes, the ancestors to modern birds. Enantiornithean skeletal morphology falls short of fully expressing the triosseal canal that modern birds rely on. Researchers have been debating the strength of enantiornithean flight without the triosseal canal for many years, including controversial suggestions of alternative flight systems. We propose that the Enantiornithean birds were equal flyers to their modern counterparts, as their basal flight muscle systems could produce equally strong flying abilities.

However, there is currently no available software to assess the biomechanics of bird

flight from a perspective of mechanical load. By extension, this also means there is no available system for similar assessments of extinct species either. Here we present a new application of OpenSim, an open-source biomechanics program, to fill this analytical gap.

OpenSim performs calculations of joint movements and muscle activation with the purpose of assessing mechanical efficiency of a musculoskeletal system. OpenSim has been expanded into research of terrestrial animal locomotion many times, which we are expanding into flight. OpenSim bases its calculations on both tracked movement and attributes of 3D models, so tracked motion from modern birds integrated with fossil bird muscles and skeletons will produce different results. With these tools, we can compare and assess the muscle arrangements from Enantiornithean and modern birds for their ability to maintain flight.

Funding Sources Self-funded

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New finds of fossil bovids from the Linxia Basin, northwest China, and their implications for biostratigraphy

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Fossil bovids are essential elements of the Neogene mammal faunas in Eurasia, characterised by high diversity and a high evolutionary rate, thus having substantial implications for biostratigraphy and climate change. The Linxia Basin reports the most abundant fossil bovids in China, from the Early Miocene to the Early Pleistocene, except for a deposit loss in the Late Pliocene, providing an excellent framework to discuss the evolution of Chinese fossil bovids. In recent years, many bovids have been described from the Linxia Basin, including various Late Miocene ‘ovibovins’, and the widespread tragoportacins in Eurasia. We discussed their phylogenetic relationships and importance in bovid evolution. Besides, I reviewed all the fossil bovids from the Linxia Basin in the nine fossiliferous layers and 43 fossil localities, including more than 20 genera in at least seven tribes, and compared the fossil bovid compositions in the Linxia Basin with other Chinese fossil localities. The diversity of fossil bovids in the Linxia Basin increased prominently from the Early to Late Miocene, and the fossil bovids in the Early Pleistocene of the Linxia Basin are also abundant. With plenty of species and materials of fossil bovids, the Linxia Basin is an important region for further studies on the evolution and adaptation of Chinese fossil bovids.

Funding Sources Chinese Academy of Sciences (QYZDY-SSW-DQC022), and National Natural Science Foundation of China (42472042).

Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

A new species of *Dinanomodon* (Dicynodontia) from China and the paleobiogeographic implications of Pangaea during the late Permian

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The dispersal pattern of tetrapods across southern and northern Pangaea is a crucial problem for understanding the Permian terrestrial ecosystem. Although Pangaea had already assembled during the Lopingian, the shared low-rank taxonomic records between the Laurasian and Gondwanan faunas remained rare. This study describes a rare cross-equatorial dicynodont from China, which can be referred to *Dinanomodon*, a genus formerly only known from South Africa, as a new species. It can be diagnosed by the following features: caniniform buttress absent; small postparietal contribution

to intertemporal bar; and lacrimal boss confluent with prefrontal boss. This specimen was discovered in a new locality of Gansu Province. Although only a large therocephalian (*Moschowhaitsia lidaqingi*) was reported previously from this locality, the coexistence of these taxa and the other unreported specimens indicates that a highly diverse fauna existed in this region during the Lopingian. This finding also roughly correlates this new fossil bed with the upper *Cistecephalus* Assemblage Zone and the *Daptocephalus* Assemblage Zone of Karoo Basin, South Africa.

We revised the current dicynodont dataset, recoding several characters and discretized those continuous characters. The parsimony analysis and Bayesian inference were performed under this new dataset. The results show unstable topologies within Bidentalia. We suggest the lack of informative characters for bidentalians is the major issue; further systematic revision needs to be conducted in this clade.

To investigate the divergence patterns of dicynodonts, we performed the first Bayesian tip-dating analysis within the anomodonts. Tip-dating analysis suggests that cryptodonts and dicynodontoids diverged after the end-Guadalupian extinction, but their origin occurred prior to the Emeishan Large Igneous Province (ELIP).

Considering other tetrapod occurrences, we suggest that frequent cross-equatorial dispersal of tetrapods occurred during the Lopingian. The ecological corridor for equatorial-dispersal had the capacity to carry large animals (e.g., *Dinanomodon*, *Inostrancevia*). We emphasize the importance of precipitation, rather than temperature, as the major controlling factor of the cross-equatorial dispersal of tetrapods during the Permian.

Symposium: Synchrotron radiation micro-CT scanning in paleontology (Wednesday, November 12, 2025, 8:00 AM)

Bone histology of therian mammals from the Upper Cretaceous Bissekty Formation of Uzbekistan, with implications for the marsupial-placental dichotomy

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Extant therian mammals exhibit dichotomous reproductive strategies: marsupials have short gestation and long lactation periods, whereas placentals have long gestation and short lactation periods. The origins and evolutionary consequences of this marsupial–placental dichotomy are hotly debated, in part because the fossil record has so far provided little insight into the life histories of the earliest metatherians or eutherians. Here, we describe the paleohistology of mammalian humeri from the Upper Cretaceous (ca. 90 Ma) Bissekty Formation of Uzbekistan, which represent one of the oldest and most taxonomically diverse records of therian mammal postcrania. Histological data were generated via synchrotron X-ray micro-computed tomography on nine specimens of eight morphotypes representing mostly eutherians and a potential metatherian. We generated mid-shaft cross-sectional radiographs that were stacked and Z-projected to create virtual thin sections. Preliminary observations reveal three growth trajectories, reflected by histological features, that have been

shown previously to correspond to reproductive strategies in extant small-bodied marsupials and placentals: (1) a homogenous cortex comprised entirely of lamellar tissue with little/no vascularity, interpreted as a 'marsupial-like' strategy with primarily appositional postnatal bone growth to increase the diameter of the mid-shaft; (2) a bipartite cortex with the outermost tissue comprised of woven-to-fibrolamellar bone grading deeply to avascular lamellar bone, interpreted as similar to juvenile placentals, representing perinatal bone in the outermost cortex buttressed endosteally by lamellar bone; (3) a tripartite 'sandwich' pattern, with a mid-cortex comprised of woven, fibrolamellar, and/or compact coarse cancellous bone, bracketed superficially (separated by a tide line) and deeply (gradational contact) by mostly avascular lamellar bone—this is a continuation of Pattern 2 incorporating later deposition of periosteal lamellar bone, as observed in adult placentals. Counter to our expectations, two of seven eutherian morphotypes exhibit the 'marsupial-like' Pattern 1, and the potential metatherian morphotype exhibits the 'placental-like' Pattern 3. This suggests that the Bissekty therians may not have strictly conformed to the marsupial–placental dichotomy seen today, complicating our view of the origin and evolution of therian reproductive strategies.

Funding Sources The Turner Award and The Department of Earth and Environmental Sciences, University of Michigan; Vertebrate Paleontology Collection Study Grant, The Burke Museum

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The rediscovery of 'Bendix-Almgreen's' gigantic vertebral specimen of the extinct megatooth shark, *Otodus megalodon* (Lamniformes: Otodontidae), from the Upper Miocene Gram Formation in Denmark

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The megatooth shark, *Otodus megalodon* (Lamniformes: Otodontidae), is an iconic prehistoric shark whose fossil remains are commonly found in the mid-Miocene–early Pliocene marine deposits nearly worldwide. Because no complete skeleton of the species is known to date, deciphering its biology, including as simple as its total length (TL), has been challenging. Whereas the use of the extant white shark, *Carcharodon carcharias*, is now known to provide underestimated TL, a recent study applied data of body part proportions in many extant and extinct shark taxa to two vertebral specimens of *O. megalodon* to reassess the TL of the prehistoric shark. One of the two vertebra specimens was an associated set of gigantic, disarticulated vertebrae that was found from the Upper Miocene Gram Formation in Gram, Denmark, which was critical to suggest that *O. megalodon* could have measured as much as 24.3 m TL. This specimen, which is broadly known informally as 'Bendix-Almgreen's vertebral specimen', was known only from photographic records published in the 1980s by Svend Erik Bendix-Almgreen. Here, we report the preservation of a small portion of the vertebral specimen in the Natural History Museum of Denmark under the catalog number NHMD 157890. This 'rediscovery' of the specimen is important as it confirms the vertebral diameter of 23 cm. The recent study also suggested that 'Bendix-Almgreen's' *O. megalodon* could have been about 80 years old at death based on a prediction made by an ontogenetic analysis conducted on the incremental growth bands observed in another vertebral specimen from Belgium. Although even the best-preserved vertebra in NHMD 157890 is poorly preserved, the combination of our microCT-based observation and extrapolations made for the missing portion of the centrum suggests that the vertebra minimally had 65 growth bands. More significantly, the

confirmation of 23 cm in vertebral diameter in NHMD 157890 is important because the previously estimated length of 24.3 m, as the currently largest possible reasonable estimate for *O. megalodon*, no longer relies on mere photographic evidence.

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Stabilizing a large fossil specimen from the Green River Formation for long-term conservation and display

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The Fossil Butte Member of the Green River Formation is renowned for its exceptionally well-preserved fossils. Among its most productive sites, the Fossil Lake locality is notable for yielding diverse and abundant specimens, particularly fish, but also birds, reptiles, mammals, and plants. However, the large limestone slabs frequently collected from this site can pose significant challenges for transport, preparation, and conservation.

This case study details the stabilization and backing of a large specimen with a woody angiosperm plant with attached capsular fruits (FMNH PP61708) collected in 2022. The specimen slab broke into two pieces during excavation, an advantageous break that facilitated transport and preparation. However, matrix removal during preparation to reveal morphological details substantially reduced the slab's thickness and compromised its structural integrity, making it fragile and difficult to handle. To ensure long-term stability and prepare the specimen for exhibition, both pieces were mounted to a custom backboard made of medium density fiberboard (MDF) and reinforced with a steel frame. A slow curing epoxy was used as an adhesive because of its longer working time. The straight edges of the specimen were used for the alignment with the backboard. To apply epoxy to the specimen's underside without damage, the specimen was securely sandwiched between two sets of ethafoam and plywood using ratchet straps, brought to a vertical position, and unstrapped to remove the lower layers. A base coat of low viscosity epoxy was applied to increase adhesion, followed by a fumed silica thickened epoxy on both the slab's underside and the backboard. The components were assembled in a vertical position and strapped together before being laid down to cure horizontally. Once the epoxy cured, the edges of the specimen were protected with masking tape and ethafoam, then the gap between the slab and backboard was filled with fast curing epoxy using syringes. The process was repeated for the second half of the slab, and missing areas were filled for visual consistency. This method resulted in an archival solution for stabilizing a large and fragile fossil specimen for long term conservation and exhibition purposes.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Tracking changes in tetrapod diversity throughout the upper Permian Usili Formation (Lopingian) of Tanzania

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The Karoo Basin of South Africa hosts a succession of well-preserved terrestrial fossil assemblages that provide the backbone for our understanding of the Permian-Triassic Mass

Extinction (PTME). However, the Karoo is not the only Permo-Triassic basin of southern Africa with exceptional fossil preservation, and its dominance in the literature could lead regional patterns to have an outsize impact on studies of the PTME. Data collected from the Lopingian Usili Formation of Tanzania's Ruhuhu Basin indicate broad similarities between the tetrapod assemblages of the Usili Formation and those of the Karoo Basin. Following similar efforts to map changes in faunal assemblages throughout Zambia's Madumabisa Mudstone Formation (Lopingian), we present a new faunal range chart for the Usili Formation.

Using both historical data and the results of recent fieldwork, we divided the nearly one hundred fossil localities in the Usili into four U-levels (U1–U4). Our results indicate a clear delineation in faunal composition between the lowest level (U1) and the upper levels (U2–U4). U1 produces multiple taxa not seen elsewhere in the formation, including the large emydopoid dicynodont *Dicynodontoides kubwa*, the temnospondyl *Peltobatrachus*, the burnetiamorph *Pembecephalus*, and the gorgonopsian *Inostrancevia*. The well-sampled U3 level, by contrast, contains the smaller *Dicynodontoides nowacki*, no temnospondyls, and the early cynodont *Procynosuchus*. Though the U2 and U4 levels are relatively poorly sampled, only U4 preserves the lystrosaurid *Euptychognathus*, and only U2 preserves *Geikia*.

We find both similarities and differences with faunal assemblages in other Permian–Triassic Basins. For example, *Dicynodontoides kubwa* is endemic to the Usili, and *Inostrancevia* occurring alongside other large African gorgonopsians is unusual for the taxon. However, the presence of *Euptychognathus* in the upper U4 level is similar to the presence of *Euptychognathus* in the upper horizon of the Madumabisa Mudstone Formation, which has been correlated to the *Daptocephalus* zone of South Africa. If *Daptocephalus* Assemblage Zone strata exist in the Ruhuhu Basin, the Usili could provide novel information about ecological communities prior to the PTME. Though further sampling is needed to improve resolution, this study serves to summarize current data and correlate it with other formations of a similar age.

Funding Sources NGS 7787-05, NSF EAR1337291, EAR1337569, Grainger Foundation, NRF of South Africa, African Origins Platform grant no.13650, French Ministry of High Education and Research

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A description of *Pararyctes pattersoni* and *Palaeoryctes* sp. nov. (Mammalia: Palaeoryctidae) from the late Paleocene Fort Union Formation of Wyoming, USA

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Palaeoryctids (Mammalia: Palaeoryctidae) are a group of small, insectivorous mammals known primarily from the early Paleocene to the early Eocene of North America and Asia. Most palaeoryctids are known from dental material alone, and with minimal material available, the placement of palaeoryctids with respect to other eutherian mammals is uncertain. Additionally, species-level relationships within Palaeoryctidae remain unsettled.

Here, we describe several new specimens of the poorly-known North American palaeoryctid *Pararyctes pattersoni* collected from its type locality (Saddle Locality, Bison Basin, Fort Union Formation, WY, USA; Tiffanian-2). These specimens include important and diagnostic tooth loci not previously known for this taxon, including M3, c1, p1–4, and m3. Based on this material, we present an emended diagnosis for *P. pattersoni*.

Additionally, we describe dental material for another palaeoryctid from the same locality, tentatively referred to *Palaeoryctes* sp. nov. Material known for this taxon includes P4, M1–2, c1, p4, m1–3, and alveoli for p2–3. The presence of this taxon at Saddle Locality during the early Tiffanian fills a stratigraphic gap in the occurrence of the genus *Palaeoryctes* in North America.

New material of both taxa was incorporated into a morphological character matrix consisting of twelve palaeoryctid taxa and 107 craniodental characters. With the addition of the newly recognized tooth loci, we evaluate the positions of *Pararyctes pattersoni* and *Palaeoryctes* sp. nov. with respect to other North American palaeoryctids. This research provides new insight into the taxonomic placement of *Pararyctes*, helps resolve the evolutionary relationship between members of Palaeoryctidae, and provides insight into the evolution and biogeography of the group.

Funding Sources Duke University Shared Materials Instrumentation Facility (SMIF) and the Arizona State University Graduate Student Government (GSG).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Finite element analysis and puncture testing reveal diverse dental mechanics among early dinosaurs

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The evolutionary success of dinosaurs through the Mesozoic was partly due to their diverse feeding adaptations, which allowed them to exploit a wide range of dietary niches. Some of these adaptations emerged during their initial radiation in the Late Triassic, particularly involving changes to their skulls and dentition. Previous studies on dental function in these early dinosaurs have been primarily restricted to morphological studies with no biomechanical testing. Here, we use a combination of finite element analysis and physical puncture testing to investigate the tooth mechanics that underlie these early tooth morphologies. To do this we utilized idealized models representative of the tooth shapes found in early dinosaur groups: a lanceolate form for post-Carnian sauropodomorphs, triangular for ornithischians, and bladed for theropods, herrerasaurids and the earliest sauropodomorphs. Results show that the lanceolate tooth model exhibited poor stress resistance and puncture, which we interpret as better suited to processing soft plants. The triangular tooth model showed high structural strength, particularly along the cingula, suggesting processing of tough brittle foods. The bladed tooth model demonstrated the lowest structural resistance but high angled puncture performance typical of carnivorous predators. Our combined biomechanical approach provides novel insights into the relationship between dental morphologies and function within early dinosaur evolution underpinning their remarkable dietary diversification.

Funding Sources John Templeton Foundation Grant (JTF 62574) (to E.J.R.; views expressed are the authors' and do not reflect the views of the John Templeton Foundation).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Direct inference of ontogenetic pathway networks in PhyG: a viable alternative to 'cladistic' Relative Maturity Assessment and 'reticulistic' Ontogenetic Sequence Analysis?

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'Cladistic ontogeny' was first proposed as 'diagnosis of morphological ontogenetic stages', then revised as 'relative maturity assessment' (RMA) and 'quantitative ontogenetic analysis', partly incorporating advice from previous authors. The procedure codes 'postnatal' specimens from the same population as terminal OTUs, resulting in an 'ontogenetic' matrix of ordered morphological characters. The matrix is then analyzed via equal-weighted parsimony in either PAUP* or TNT, producing a dichotomously branching hierarchy of ontogenetic staging or 'ontogram'.

Critics of RMA have correctly noted issues arising from inconsistent correction for character allometry and isometry, as well as uneven sampling of growth stages, but largely glossed over difficulties in accounting for multiple equally parsimonious sequence pathways. Earlier, Ontogenetic Sequence Analysis (OSA) attempted reticulate sequence maps by incorporating branch lengths from alternate MPTs with 'normal' and 'reversed' rooting, but then-available methods using MacClade and PAUP* indefensibly relied on manual rather than algorithmic calculation of the final networks.

PhyG allows for network inference under parsimony or phylogenetic minimum description length (PMDL). Here, I explore its utility in inferring ontogenetic networks using published discrete and continuous data from *Alligator*, *Asilisaurus*, *Branta*, *Centrosaurus*, *Coelophysis*, *Dicrocerus*, *Proterosuchus*, *Tyrannosaurus*, and *Tylosaurus*; and GM coordinate data from *Alligator*, Interatheriidae, *Mesodma*, *Mus*, *Protoceratops*, "Protungulatidae", and Triceratopsini.

Incredibly, PhyG fails to recover robust network patterns for most datasets, regardless of optimality criterion, matrix size, character state space, and specimen completeness. Instead, most ontograms are similarly pectinate to those produced in TNT 1.6 under parsimony with extended implied weighting, which are indistinguishable in Kishino–Hasegawa and Templeton tests. While it is possible PhyG is currently unsuitable for most network analyses, my findings imply OSA overestimates well-supported reticulation for datasets with high character variability, uneven ontogenetic sampling, and high OTU incompleteness, biasing results toward 'half-hourglass'-shaped sequence networks as opposed to 'funnel'-shaped ones.

Funding Sources Geological Society of America, Graduate Student Research Grant; UW ESS, Stephen G. Warren Endowed Fund; Willi Hennig Society, James S. Farris Founders Award.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

New *Hesperotestudo* specimen from Western Oklahoma and the functional morphology of the humerus regarding testudine locomotion

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Testudines exhibit diverse locomotion strategies, each imposing different stresses on forelimb structure, largely due to its vital role in both swimming and burrowing behaviors. Morphological characteristics can thus offer insight into locomotion. Here we describe and interpret a new *Hesperotestudo* specimen (OMNH98918) collected from the Middle Miocene of Western Oklahoma. *Hesperotestudo* is the only genus of large extinct tortoise found in North America, known from finds across the United States. OMNH 98918 contains a nearly complete right and left forelimb, including carpals, metacarpals, phalanges, along with a mostly complete plastron, a partial carapace with intact vertebrae, and a femur. Remarkably preserved limb armor and osteoderms also shed light on body ornamentation in *Hesperotestudo*. The wedge-shaped carpals led us to hypothesize a fully terrestrial lifestyle, similar to the

Galapagos tortoise, and less adapted to burrowing than species like sulcata tortoises.

To quantify how OMNH 98918 compares to the ecological diversity of extant testudines, we compared humeral shape across 29 extant and four extinct genera. Data sources include Morphosource, published literature, and original photographs. Landmark-based geometric morphometrics were conducted in lateral and dorsal views, emphasizing the curvature and proportional size of the humeral head. Ecological categories were assigned at two hierarchical levels: broadly as terrestrial, aquatic, or semi-aquatic, and further refined by locomotor strategy (e.g., burrowing, bottom-walking, paddling, and rowing).

Our results reveal a strong separation in humeral shape between terrestrial and aquatic taxa. Terrestrial species formed a distinct cluster, while aquatic forms showed overlap between locomotor modes, suggesting that phylogenetic history may obscure ecological signal. OMNH 98918 grouped with extant terrestrial taxa, supporting our hypothesis regarding its ecomorphology. Continued work will refine our terrestrial ecomorphologies through broader sampling and more precise ecological categorization to better understand the balance of functional and phylogenetic influences.

Technical Session XI: Crocs & Turts (Friday, November 14, 2025, 8:00 AM)

Ecological and environmental controls on crocodyliform diversity and macroevolution in South America across the Cenozoic

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South America hosts the greatest diversity of living crocodylians and a rich Cenozoic fossil record that captures the remarkable ecological breadth and evolutionary success of crocodyliforms on the continent over the past 66 million years. This record reveals an array of terrestrial and semi-aquatic predators, spanning a broad range of sizes and morphologies, including highly specialized ‘duck-billed’ and ‘stubby-snouted’ forms. Much of this diversity stems from the crocodylian clades Alligatoridae and Longirostres, but it also includes Mesozoic holdovers such as the Dyrosauridae, Peirosauridae, and Sebecosuchia. Such taxonomic and morphological richness contrasts with crocodyliform diversity on other continents, and has been linked to major environmental transformations, notably the Andean orogeny and the evolution of the Amazon River system. Yet the eco-evolutionary mechanisms by which these events shaped crocodyliform macroevolution remain poorly resolved.

Here, we integrate morphometric and palaeooccurrence data with new palaeoclimate and palaeotopographic reconstructions to assess the ecological and environmental drivers of crocodyliform macroevolution in South America from 66 Ma to the present. Using phylogenetic comparative methods alongside biogeographic and Bayesian modelling, we track shifts in ecomorphology and diversification dynamics through time. Our results reveal divergent cranial ecomorphological trends between Palaeogene basal crocodyliforms and Neogene crocodylians, reflecting their contrasting functional adaptations to terrestrial and aquatic predation, respectively. We affirm strong links between climatic trends and crocodyliform diversity and disparity, and highlight the critical role of habitat availability and heterogeneity in shaping patterns of speciation and extinction. The rise of the Pebas Megawetland in the Miocene was a major driver of speciation; the expansion of this wetland habitat mosaic fostered a caiman adaptive radiation and richer crocodylian assemblages through enhanced

trophic and spatial niche partitioning. Its collapse, driven by the ongoing Andean uplift and ensuing climate change, was the principal driver of crocodyliform extinctions in the Neogene. These results offer new insight into how long-term environmental perturbations shaped crocodyliform macroevolution in South America and the structuring of clade dynamics through deep time.

Funding Sources The Leverhulme Trust Grant RPG-2024-076.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A synoptic view of life and death in the Newark Basin—new perspectives from the ETE and beyond

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The end-Triassic mass extinction (ETE, 202 Ma) was pivotal in shaping the tropical communities of the earliest Jurassic, establishing a macrofaunal regime dominated by large dinosaurs that would last for over 130 million years. The emplacement of the Central Atlantic Magmatic Province (CAMP) triggered the extinction, creating hostile environmental conditions on a global scale. Although significant attention has been paid to the effects of rising CO_2 at the extinction event, the fossil record of terrestrial tropical communities exhibits a cold-forced extinction record. Allometric analysis of the theropod footprint record from a key site after the terrestrial extinction but before the emplacement of extrusive flows in the Newark Basin reveals that three previously distinct ichnotaxa are most parsimoniously interpreted as an ontogenetic series from one species exhibiting near perfect isometry, suggesting that the apparent allometry of other early Mesozoic brontozoiid tracks is a consequence of evolutionary allometry in different taxa as opposed to more traditional ontogenetic allometry. This is discernable because of the exceptionally low diversity at this site, as opposed to the younger, more diverse, Connecticut Valley type assemblages. Further study in the basin has also revealed that the smaller members of the faunal community had begun to take on a decidedly modern aspect, with traces that resemble those of modern saurians, as well as suggesting the Late Triassic origin of the crown group mammals. Additionally, a concurrent paleo-floral turnover demonstrates that the equatorward spread of previously temperate and subarctic plants adapted to colder conditions followed the observed extinction of prominent tropical forms. The effects of CAMP scale volcanic emissions on global climate are difficult to model because they are orders of magnitude larger than anything directly observed. But, they had the potential to dump enormous amounts of sulfur aerosols into the upper atmosphere, leading to protracted millennial-scale episodes of pulsed volcanic winters that could overwhelm the volcanic CO_2 global warming, perhaps causing transient polar glaciation with a concomitant dramatic sea-level decrease. Put simply, the environmental stresses induced by the albedo-increasing effects of sulfur aerosols from the CAMP caused the extinction of non-cold-adapted fauna, allowing the dinosaurs, mammals, and small burrowing groups to survive.

Funding Sources Graduate Research Fellowship from the National Science Foundation

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Conservation of the Mongolian dinosaur collection of the Polish Academy of Sciences

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The Polish-Mongolian Paleontological Expeditions (1963–1971) were not only among

the most significant collaborations between the Polish and Mongolian Academies of Sciences, but also among the most fruitful paleontological endeavors worldwide. The agreements establishing the partnership involved division of discovered fossils: half of the specimens of each genera were supposed to stay in Mongolia, and the rest could become a part of the paleontological collection of the Institute of Paleobiology, Polish Academy of Sciences in Warsaw, Poland (ZPAL). However, some of the recovered specimens (e.g., *Deinocheirus mirificus*, *Homalocephale calathocercos*) were prepared in Warsaw and only after the publication of their scientific descriptions sent back to the Mongolian Academy of Sciences. Thus, the preparation lab in Warsaw was an important facility where Polish and Mongolian scientists and technicians shared their experience. The Polish crew was not experienced in excavations involving recovery of large Mesozoic vertebrates, although before going to Mongolia, they visited the Paleontological Institute of the Russian Academy of Sciences for advice. Most articulated skeletons were fully prepared to free individual bones, a common practice at the time. In 1968 it was possible to open a small exhibition on dinosaurs from Mongolia in Warsaw. However, the collection still houses many specimens virtually untouched since their arrival to Poland or preliminary preparation, revealing some unusual historical solutions of specimen preservation and preparation. The idea of this poster is to show a few individuals interesting from the preparators' point of view, explain modern methods applied to safely prepare those historical specimens, and to fix problems that arose due to improper, outdated procedures. The most striking examples are a partial skull of *Tarbosaurus bataar* plastered in gypsum and a young *Tarbosaurus bataar* skeleton covered with a thick layer of glue used to stabilize it, but that over the years resulted in detachment of bone surfaces. Methods employed to conserve specimens found and prepared mainly in the 1960s and 1970s can be useful for preparation labs dealing with still unprepared fossils found in the past.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Locomotory changes within the therizinosaurian lineage from *Falcarius* to *Nothronychus*

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Therizinosaurs were a rapidly evolving clade of maniraptoran theropods from the Upper Cretaceous of Asia and North America. *Falcarius* is a basal, potentially cursorial therizinosaur with a propubic pelvis and typical gait. *Nothronychus* was a much larger, waddling organism with an opisthopubic pelvis. Therizinosaurs were characterized by extensive hind limb muscle reorganization. This project describes biomechanical changes in the hind limbs of *Falcarius* and *Nothronychus*.

An increasingly flexed resting pose is modeled throughout the lineage. *Falcarius* is regarded as a hip-propelled animal, whereas *Nothronychus* was knee-propelled. *Falcarius* possessed plesiomorphic hips with closely spaced acetabulae. M. caudofemoralis longus was still well-developed, resulting in a substantial tail. *Nothronychus* reduced the tail and M. caudofemoralis longus, and possessed broadly spaced acetabulae. To remain stable, the femur would rotate anteriorly with some abduction to accommodate the abdomen. Therefore, the tail was decoupled from the hind limbs during a walking cycle. During locomotion, the ground reaction force would shift laterally during each stride. The body followed suit to maintain stability. This increased torsional stress on the femur and resulted in a waddling gait, convergent with some extant birds.

Analyses were performed separately for both taxa. Moment arms were estimated for major

muscles spanning the hip, knee, and ankle. Abduction/adduction, protraction/retraction, and long axis rotation were permitted at the hip. Protraction/retraction were permitted at the knee and ankle. Observed changes in moment arms were related to changes of orientation of the pubis and femur, and for allometry, as *Nothronychus* was a larger animal than *Falcarius*. Moment arm magnitudes tended to be larger in *Nothronychus*. Variation at the hip was increased compared to the knee and ankle. Protraction/retraction at the hip was reduced in *Nothronychus* relative to *Falcarius*. Long axis rotation of the femur was increased in *Nothronychus*. There was an increase in knee flexion relative to extension. Ankles performed as expected. *Falcarius* possessed a plesiomorphic locomotory apparatus, but it was altered in *Nothronychus* to approach the flexed condition seen in at least some modern birds. Therefore, such locomotion had to evolve at least twice within maniraptoran theropods.

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

The differing response of mammalian carnivores to the terminal Pleistocene extinction

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The significant extinctions in Earth history have largely been unpredictable in terms of who perished and what traits made them susceptible. This changed at the terminal Pleistocene, however, when human activities led to a strikingly size-biased extinction of large-bodied mammals; this continued into the Holocene and has accelerated over the modern era. Such trophic and body size downgrading is leading to changes in the structure and function of modern ecological communities. Predicting the full effects of biodiversity loss is of obvious importance for effective conservation and management, but many of the indirect interactions can take decades, centuries or longer to play out. Here, we use the fossil record of the terminal Pleistocene megafauna extinction in the Americas as a proxy for characterizing the consequences of modern biodiversity loss. Using a mammal community in the Edward's Plateau of Texas, we quantify both the isotopic ($\delta^{13}C$ and $\delta^{15}N$) and body-size niche of a mammal community in Texas before and after the terminal Pleistocene biodiversity loss to assess shifts in the ecology and ecological interactions of surviving species. This was a rich and diverse mammal community before the extinction, with a variety of C_4-grazers, C_3-browsers, and mixed-feeders, quite similar to African savannas today. There was a strikingly regular partitioning of dietary isotopic niche with body size within each carnivore family with the various carnivore guilds (Ursidae, Felidae, and Canidae) largely non-overlapping. Moreover, the largest carnivores were highly specialized. Post-extinction, considerable body size and isotopic niche space were lost, carnivores became more generalized, and some shifted their dietary isotopic niche. We find that the ecological roles megafauna play in the earth system are not replicated by smaller-bodied animals. Our work highlights the importance of integrating a paleontological perspective into modern conservation efforts to develop a more synoptic understanding of ecosystems.

Funding Sources National Science Foundation Division of Environmental Biology (DEB 2344776; F.A. Smith PI, S.K. Lyons co-PI).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

New Campanian plastomenid turtle material from the San Juan Basin, New Mexico, and a reassessment of the genus *Helopanoplia*

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Previous fieldwork in the Menefee, Fruitland, and Kirtland Formations (Fms.) of the San Juan Basin, New Mexico has revealed diverse dinosaurian and crocodyliform fauna. Initial reports of turtles from the middle Campanian Menefee Fm. comprised predominantly baenid and trionychid taxa. However, recent work demonstrates a diverse assemblage of adocid, baenid, helochelydrid, nanhsiungchelyid, and trionychid species, increasing the affinity with the upper Campanian Fruitland and Kirtland Fms., albeit slightly less diverse.

Here, we report on two Menefee Fm. plastomenid taxa: *Helopanoplia* sp. is represented by a costal edge and several isolated shell fragments, while a second indeterminate plastomenid is represented by a few small shell fragments. Both forms are less abundant than co-occurring Menefee trionychids. In *Helopanoplia*, recessed areas are less pit-like with flatter floors than other Menefee pan-trionychid taxa. Ridges between them are thin and form polygonal rather than rounded shapes. A distinctly upturned lip along the free edge lacks pits, and flares into a shoulder at the margin of costal 2 in the carapace of *Helopanoplia.* The indeterminate plastomenid specimens are distinguished by tiny (~1 mm) pits and very thin shells. A faint ridge crosses the shell surface in one specimen, as in *Gilmoremys gettyspherensis*, but more material is required for further taxonomic referral.

The recognition of *Helopanoplia* in the Menefee Fm. represents an early occurrence of the genus, which is otherwise reported from the middle to late Campanian Kaiparowits and Aguja Fms. and is best known from numerous later northern Maastrichtian deposits, suggesting a southern Laramidian origin for the genus. Surprisingly, *Helopanoplia* has not been documented from the younger Fruitland and Kirtland Fms. in the San Juan Basin. However, a re-evaluation of the pan-trionychid assemblage from these formations calls into question whether previous reports of *Aspideretoides austerus* from the late Campanian De-na-zin Member may represent *Helopanoplia*. Both taxa share a coarse punctate surface marked by thin polygonal ridges.

Helopanoplia has been reconstructed as being primarily omnivorous, suggesting potential niche partitioning with co-occurring piscivorous pan-trionychians. The diversity of pan-trionychid fauna in the Menefee Fm. suggests that local nonmarine hydrological regimes manifested in a variety of habitat types representing both fluvial and ponded paleoenvironments.

Funding Sources Western Interior Paleontological Society.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Antler morphology of an exceptional specimen of *Cervalces scotti* from northwestern New Jersey, USA

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Diagnostic fossils of *Cervalces scotti*, among the largest cervids to have lived in Pleistocene North America, have remained relatively rare since its initial recognition in 1805. We describe a complete skull preserving both antlers (EMK Q-0002) recovered near Columbia, New Jersey, between 1969 and 1973 representing one of the most complete individuals currently documented. It was collected from boggy lacustrine deposits in a woodland setting, C14 dated to ~12,300 yr B.P. The specimen consists of the complete cranium with all teeth and the mandible with six of eight incisors. Axial

elements include the atlas, five cervical, eight thoracic, four lumbar, and all sacral vertebrae, with associated ribs. Anterior appendicular material includes both right and left scapulae and portions of both forelimbs including: humeri, radii, ulnae, carpals, metacarpals, and manus. Posterior appendicular elements include both innominates and portions of hind limbs, including: the right femur; both patellae; and the right calcaneum, astragalus, metatarsal, toes and distal phalanges (hooves). Missing elements, including both tibiae and much of the left hind limb were originally present but were lost during excavation. The antlers were fragmented but complete enough for reconstruction.

The antlers consist of parallel, perfectly horizontal proximal beams connecting to a complex array of palmate beams. These include a lateral, elongated, palmate main beam, anterodorsal anterior brow palm and posterodorsal posterior brow palms. The palmate main beam includes smaller undulations along the palm; a distinct triangular anterior tine; and elongated posterior and ventral tines. The elongated anterior brow palms are differentiated into four distinct tines on both sides. The elongated posterior brow palm is also differentiated into four distinct tines on both sides. Comparisons with other known specimens of *Cervalces scotti* reveal degrees of variation in antler morphology in this species, though linking this variation to temporally or geographically defined subpopulations is not yet possible.

Among Pleistocene cervids, the antler morphology of *Cervalces scotti* is unique compared to *Rangifer* and *Alces* and likely reflects the necessity for elaborate display structures in dense, eastern North American deciduous woodlands in contrast to *Cervalces latifrons* in Eurasia during the Pleistocene.

Funding Sources Natural History Museum of Utah, Salt Lake City, Utah, USA

Department of Geosciences, University of Utah, Salt Lake City, Utah, USA

Museum of Evolution Knuthenborg, Denmark

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

Skeletal accumulations of the parareptile *Procolophon trigoniceps* reflect fossorial response to Early Triassic climatic instability across southern Gondwana

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The Lower Triassic parareptile *Procolophon trigoniceps* is known from hundreds of specimens, mostly from upper Katberg Formation of the South African Karoo, where it co-occurs with the dicynodont *Lystrosaurus declivis* and the diminutive temnospondyl *Micropholis.* The same taxon also occurs in the lower-mid Triassic Fremouw Formation of Transantarctic Basin and the coeval Sanga do Cabral Formation of Paraná Basin in Brazil. The Gondwana-wide distribution of *P. trigoniceps* raises questions as to how they so successfully colonized southern Gondwana and why their fossils occur in hyper-abundant skeletal concentrations.

We collected field data of the stratigraphy, sedimentology and taphonomy of *P. trigoniceps* accumulations in South Africa, Brazil and Antarctica to determine the biostratinomic factors that resulted in such hyper-abundant preservation. South African localities are all from upper Katberg Formation comprising predominantly red mudrock with horizons of intraformational conglomerate and micrite nodules. Some nodules contain up to five fully- and partially articulated *Procolophon* skeletons, commonly of adult and juveniles in bone-on-

bone contact lying side-by-side, criss-crossing, or in curled-up poses. In situ cylindrical scratch-marked decline burrow casts occur in the same outcrops. Neutron tomography of a scratch-marked burrow cast revealed a curled-up adult and disarticulated juvenile. Rare, but notable, tooth puncture marks occur on some articulated specimens which we interpret as bite marks from intraspecific sparring. The Antarctic specimens occur in only slightly rubified mudrock and have similar adult-juvenile associations although not within nodules. Cylindrical *Reniformichnus* burrow casts are also present. The Brazilian specimens are mostly disarticulated elements within lenses of intraformational conglomerate, however, some articulated specimens have recently been found in calcareous nodules.

General palaeoenvironment of all the *P. trigoniceps* bearing intervals is of warm drought-and-deluge prone floodplains between low sinuosity anastomosing channels close to ephemeral ponds and is further evidence for continued Gondwana-wide climatic instability following the end-Permian mass extinction. The taphonomic evidence supports previous suggestions that *P. trigoniceps* was a group-living, possibly communal, fossorial reptile analogous in its life habits to *Gopherus agassizii*, an extant North American desert tortoise.

Funding Sources National Research Foundation AOP (RMS GU-136503; JB GU-136505), GENUS (JB), ANSTO ACNS 16182 (JB)

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Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

A new diminutive tetrapod from the Tournaisian of Burnmouth, Scotland, revealed by microcomputed tomography

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At Burnmouth on the Scottish Berwickshire coast, the entire Tournaisian sequence is exposed, spanning approximately 520 metres from the Devonian/Carboniferous boundary to the base of the Viséan. Fossil vertebrates have been found in multiple beds, including tetrapod remains. The oldest tetrapod bed is ~ 35 metres above the boundary, while the others are 300-400 metres above. We describe the skull of a small new tetrapod (~28 mm long) from 341 metres above the boundary, revealed through microcomputed tomography. Most cranial bones are represented at least once, but the mandibles are not preserved. Though disarticulated, the skull roof is well-ossified, with a prominent pit and ridge ornament and a lateral line system featuring pits and grooves. Salient features of the new taxon include: lack of an intertemporal; broad postorbital-parietal contact; supratemporal bordering temporal notch; vomer with tusk pair and four accessory teeth enclosing anterior palatal fontanelle; incomplete palatal element with tusk pair and two accessory teeth; incomplete denticulated pterygoid with slightly curved medial edge, possibly delimiting lateral margin of narrow interpterygoid vacuity; braincase represented by well-preserved denticulated basiparasphenoid, with a short cultriform process, well-developed basipterygoid processes, and broad posterior plate; dorsum sellae excavated ventrally on either side of midline prong by retractor pockets for the eye muscles; circular hypophyseal fossa below prong; premaxilla with 10 curved, dagger-like teeth; maxilla with spaces for approximately 40 teeth and no obvious replacement pits. Phylogenetic analysis places the new animal on the tetrapod stem, crownward of colosteids and, tentatively, in proximity to a clade of ‘non-microsaur lepospondyls’. Its size suggests that the initial diversification of some early tetrapod groups was rooted in an array of diminutive microcarnivorous forms, exploiting a variety of

prey during the rapid colonization of the increasingly fragmented Carboniferous habitats.

Technical Session XVIII: Early Tetrapoda & Lissamphibia (Saturday, November 15, 2025, 1:45 PM)

Taxonomic diversity and development of Late Carboniferous amphibamiforms from the Mazon Creek Lagerstätte

So, Calvin[1,4], Montgomery, Miranda E.[1], Cookson, Naiomi I.[1], Pardo, Jason[1], Maddin, Hillary C.[2], Sues, Hans-Dieter[3], Mann, Arjan[1,4]

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Living lissamphibians are diverse in their ecology and life history. The earliest anatomically modern representatives of frogs, salamanders, and caecilians all occur in the Triassic; however, there is a significant gap in our understanding of how and when these lineages diversified. Historical narratives suggest a stepwise acquisition of lissamphibian features and a protracted evolution of modern ecology from plesiomorphic Permo-Carboniferous amphibamiform relatives (i.e., temnospondyl hypothesis). Recent research instead suggests that the radiation of lissamphibian morphology and ecology occurred more rapidly and earlier than previously proposed.

Amphibamus grandiceps from the Mazon Creek Lagerstätte is both the oldest occurring and one of the most morphologically derived amphibamiforms. New amphibamiform specimens (at least 10), including adults and juveniles with soft tissue preservation have been assigned to *Amphibamus*, but lack of comprehensive systematic and anatomical revision of this taxon has hindered our assessment of this material. Here, we revise the anatomy of all known Mazon Creek amphibamiform specimens using comparative anatomical and phylogenetic methods, μCT, 3D segmentation, and SEM. We re-diagnose *Amphibamus grandiceps* by the following combination of characters including bicuspid and pedicellate teeth, 18 presacral vertebrae, and a blunt snout, among other characters. Furthermore, we recognize a diverse assemblage of at least four additional taxa. Notably, this includes a new long-bodied taxon (FMNH PR 5055) with a unique count of 30 presacrals, a worm-like body, and proportionately longer limbs than *Amphibamus*; a *Platyrhinops*-like taxon (YPM 795) with 26 presacrals; and the first definitive branchiosaur from North America, *Micrerpeton caudatum* (FMNH UR 38). The numerous larval specimens allow us to identify discrete ossification patterns in *Amphibamus* life history that establishes a staging table for *Amphibamus*. Phylogenetic analysis under maximum parsimony and Bayesian inference recovered specimens in derived positions, including FMNH PR 5055 as the immediate sister taxon to Lissamphibia. This study highlights the need to revisit other Permo-Carboniferous amphibamiform assemblages as they may record further evolutionary and ecological context significant to lissamphibian origins.

Funding Sources Lauer Foundation for Paleontology, Wheaton, Illinois, USA

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

The paleobiology of *Prolacerta broomi*: inferences from paleoneurology

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Archosauromorpha is a clade of diapsid reptiles comprising living crocodylians and birds, and all

fossil groups more closely related to them than to lepidosaurs. The group originated in the middle-late Permian, and radiated to a broad array of environments before the origin of the crown, including aquatic and possibly gliding forms. Among terrestrial taxa, most were specialized for carnivory, but earlier members like *Prolacerta* were probably faunivorous. Because no diel activity pattern has been formally proposed for *Prolacerta*, here we analyze the scleral ossicle ring anatomy for the first time based on a new specimen. The ring is composed of 20 ossicles, a number greater than that documented for extant reptiles and also higher than the 13–14 ossicles reconstructed earlier for this taxon based on an incomplete ring. Each ossicle is formed proximally by an anteroposteriorly long plate and a projection extending distally. Dorsally on the ring, these projections are tall and narrow, but not ventrally, where they are short and broad—a pattern similar to *Sphenodon*. The scleral ring is slightly elliptical, with the anteroposterior axis measuring 9.16 mm and the dorsoventral one 6.22 mm internally, a relatively small aperture compared to the orbit, which is 19.11 mm long and 15.5 mm high. A phylogenetic flexible discriminant analysis with 96% accuracy confirmed *Prolacerta* was a photopic (diurnal) taxon, with a posterior probability of 0.87 (range: 0.86–0.90). Based on the segmentation of SAM-PK-6047A, the same analysis confirmed scotopic (nocturnal) habits for *Euparkeria*, with a probability of 0.96 (range: 0.95–0.97). It is interesting to notice that with an external anteroposterior length of 19.22 mm and height of 15.14 mm, the scleral ring of *Prolacerta* is very large, occupying most of the external orbital area. In fact, the plate projections extend beyond the orbital rim and underneath the orbital bones in some places, resulting in a large attachment surface for the eye muscles responsible for corneal accommodation. This is found in taxa with demonstrably good vision, such as birds, indicating that *Prolacerta* also had a very accurate vision. This is the first time diel activity patterns have been estimated for stem-archosaurs based on the direct measurement of complete scleral ossicle rings and our results agree with the diverse paleobiological roles inferred for the group based on other lines of evidence.

Funding Sources Funding provided by DFG (Award 491131419).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Ecomorphological divergence of semicircular canals in cetaceans: implications for locomotor adaptation in diverse aquatic habitats

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The semicircular canals (SCCs) are crucial for sensing head rotation and maintaining postural stability, vital for cetaceans navigating complex 3D underwater environments. While cetacean SCCs are relatively small for their body size compared to terrestrial mammals, how their morphology varies with distinct sensory landscapes of riverine versus marine habitats is largely unexplored. Riverine cetaceans often inhabit turbid, structurally complex waters with severely limited visual information, contrasting with marine environments where light penetration is greater. This visual disparity likely imposes differing selective pressures on the vestibular system, increasing reliance on non-visual cues for orientation in visually restricted riverine settings. We predict adaptive divergence in SCC morphology reflecting these varied sensory and navigational challenges, potentially manifesting as enhanced vestibular sensitivity or operational range.

This study quantitatively examines ecomorphological trends in the SCCs of 40 extant cetacean species (36 marine, four riverine). 3D SCC models were generated from high-resolution CT scans. Morphometric measurements (canal radii of curvature, lengths, inter-canal angles) were extracted using 3D

Slicer. These variables, accounting for body size and primary habitat, were subjected to Principal Component Analysis (PCA) and statistical comparisons to elucidate ecomorphological patterns.

Our PCA, utilizing 38 variables, revealed distinct morphological groupings. The first two principal components explained a significant portion of total variance, primarily representing overall SCC size and shape, respectively. Specific canal morphologies appear to have adaptively evolved in species with high-speed, agile locomotion and in those in turbid, low-visibility riverine environments, reflecting adaptations to their ecological niches. *Mesoplodon* spp. showed large SCCs with a common shape profile, possibly linked to deep-diving. Other riverine species had SCC sizes comparable to smaller marine taxa but varied in shape.

Overall, cetacean SCC morphology has diversified not only phylogenetically but also in association with species-specific locomotor styles, agility, and habitat characteristics. Species adapted to extreme locomotion or specialized environments showed marked SCC specializations. This study highlights SCC morphology's potential as a crucial indicator for reconstructing cetacean paleoecology, including extinct taxa.

Technical Session IX: Synapsida (Thursday, November 13, 2025, 1:45 PM)

Exceptionally preserved skeleton from a lower Permian interdune deposit in southeastern Utah sheds light on early synapsid phylogeny and ecomorphological diversity

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The earliest stem mammals diversified during the late Carboniferous and early Permian, with Caseasauria, Ophiacodontidae, Sphenacomorpha, and Varanopidae present in the fossil record by the Carboniferous/Permian boundary ~298.9 Ma. The phylogenetic placement of varanopids within Synapsida has recently come under scrutiny, but few fossils of early representatives and few functional studies limit our knowledge of their biology and ecology. We report on an articulated synapsid skeleton preserved in an interdune deposit in the lower Permian Cedar Mesa Sandstone of Indian Creek in San Juan County, Utah, U.S.A. The site preserves several permineralized conifer logs associated with a pond deposit that accumulated abundant vertebrate remains. The skull consists of a partial right maxilla with recurved caniniform teeth, and a partial pterygoid and squamosal. The vertebral column shows dorsal centra bearing a ridged ventral surface and tall, anteriorly inclined neural spines. The appendicular skeleton preserves pectoral and pelvic girdles, parts of both humeri, ulnae, and radii, and a mostly articulated right hindlimb with slender long bones, metapodials, and phalanges, and curved unguals. Although these unguals display less curvature than *Eoscansor cobrensis*, several specializations, such as elongation of the penultimate phalanges and the long, gracile limbs, are consistent with an arboreal or scansorial lifestyle in both taxa. Our phylogenetic analyses indicate that this specimen occupies a relatively early-diverging position within Synapsida, with parsimony analyses recovering it as a varanopid and sister taxon to *E. cobrensis*, and Bayesian analyses placing these two taxa and eothyridids in a basal polytomy within Caseasauria. The parsimony analysis appears to optimize postcranial synapomorphies such as the ventral ridge and neural spines of the dorsal vertebrae, the Bayesian analysis is supported by an eothyridid-like tooth morphology, though this is likely plesiomorphic. Though the Indian Creek specimen and *E. cobrensis* lack important

diagnostic skull characters, the postcrania suggest greater affinity with varanopids than caseasaurs. This incongruence is likely in part due to the plesiomorphic nature of the skeleton at this early stage of synapsid evolution, despite considerable diversity by Permian times. Correctly polarizing these tooth and postcranial characters will help clarify the evolutionary history of varanopids and the diversification of Synapsida.

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Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Hemiplasy helps explain high rates of apparent morphological convergence in neoavian birds

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The fossil record and phylogenomic studies suggest that the clade Neoaves—which comprises more than 95% of extant bird diversity—underwent a rapid episode of diversification associated with the end-Cretaceous mass extinction event. Relatedly, the pattern of interrelationships among the major neoavian subclades remains challenging to disentangle, with contradictory topologies arising from analyses of phylogenomic datasets. Regardless of the true pattern of neoavian relationships, patterns of morphological variation across Neoaves reveal rampant homoplasy, traditionally interpreted as the result of evolutionary convergence. Here, we suggest an alternative interpretation for extensive homoplasy across the neoavian radiation. We show extremely high hemiplasy risk factors mapping to branches near the origin of Neoaves. Our results therefore suggest that many instances of apparent morphological convergence among major neoavian lineages may be better interpreted as the result of high levels of morphological incomplete lineage sorting due to the rapid neoavian radiation in the aftermath of the K–Pg mass extinction event. This explanation is congruent with the ongoing difficulty of inferring a stable bifurcating phylogenetic topology at the base of Neoaves. Our results have implications for phylogenetic inference, the placement of fossils near the origin of Neoaves, and morphological character state evolution, and highlight conserved polymorphism combined with rapid cladogenesis as an underappreciated explanation for extensive homoplasy in comparative morphological datasets.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Pterosaur phylogeny revisited with novel characters and comprehensive analyses

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Pterosaurs are flying reptiles that display considerable morphological diversity. Recent years have witnessed substantial advances in the study of pterosaur phylogeny, marked by the incorporation of an expanding array of characters and operational taxonomic units (OTUs) into different datasets. However, few studies focused solely on the phylogeny or aim to re-evaluate character definitions and taxon scorings, frequently without explicit criteria for

applying different character states. Here we assemble a new data matrix covering full taxonomic breadth of Pterosauria, featuring over 550 characters and 170 ingroup taxa. Among these, over 200 new characters were incorporated to the matrix, notably with a substantial improvement on character resolution of the palatal region and postcranial skeleton.

Multiple analytical approaches, including maximum parsimony under diverse weighting schemes and Bayesian inference, were applied to our data matrix. Preliminary analyses employing implied weighting parsimony across a recommended range of K values yield generally congruent topologies, represented by the global reduced consensus tree of K = 12, 15 and 18. Triassic pterosaurs with tricuspid teeth were not found in a monophyletic clade. Anurognathidae was consistently resolved as a basally branching novialoid, forming the sister taxon to a group comprising remaining members of this clade except for *Campylognathoides*. A monophyletic clade of early monofenestratan pterosaurs, primarily comprising wukongopterids from the Tiaojishan Formation of China, was supported. “Archaeopterodactyloidea”, which was considered as the earliest diverging clade of Pterodactyloidea by many previous studies, is not monophyletic. Regarding traditional members of this lineage, *Pterodactylus* and *Diopecephalus* are more basally branching than a monophyletic Ctenochasmatoidea, whereas *Altmuehlopterus* and *Germanodactylus* form successive outgroups of Ornithocheiroidea. Dsungaripteridae is recoverd as the earliest-branching ornithocheiroid, forming the sister group of a clade comprising Pteranodontoidea and Azhdarchoidea. Within Pteranodontoidea, *Hamipterus* was found as a non-lanceodontian ornithocheiromorph. Notwithstanding these novel results, resampling and bremer supports remain low for some clades. Moreover, topological discordance was also detected with analyses employing equal weighting parsimony or Bayesian inference, warranting caution in the interpretation of phylogenetic relationships.

Funding Sources This work is funded by the National Natural Science Foundation of China (42072028 and 41688103).

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Adaptability through time: biochronology and ecomorphology of *Bison* in the Western Palearctic during the Quaternary

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The genus *Bison*, one of the few large Quaternary mammals to survive the Pleistocene extinction in the Northern Hemisphere, owes its success to remarkable ecomorphological plasticity shaped by 2.5 million years of climatic oscillations. This study, based on the analysis of 20 *Bison* records from the European Pleistocene, presents a reappraised biochronological framework for the genus and infers the ecomorphological patterns that shaped its evolutionary history throughout the Quaternary.

The earliest *Bison* forms, often grouped within the subgenus *Eobison*, likely originated in inland Asia or the Pontocaspian region at the Plio-Pleistocene boundary and reached Europe around 1.8 Ma. These early representatives, characterized by moderate size and slender limb bones, inhabited mixed forested environments but already displayed adaptations to increasing aridity—particularly when compared to earlier taxa such as *Leptobos*. From ~1.2 Ma onward, coinciding with the Early–Middle Pleistocene Transition, the fossil record documents the emergence of larger, more robust, and derived *Bison* (subgenus *Bison*), better suited to open, seasonal landscapes and showing a high degree of ecological plasticity, allowing widespread dispersal across Eurasia and into North America.

Morphometric and anatomical analyses reveal a general trend toward stouter distal limb proportions and increased body mass, shaped by both phylogenetic inheritance and environmental pressures. These changes, however, are not uniform across the Western Palearctic, reflecting

asynchronous responses to glacial–interglacial dynamics and regional habitat fragmentation. Interestingly, relatively small, often short-limbed, morphotypes are typically associated with open, steppe-like environments, whereas larger forms with elongated limbs are more frequent in wooded, temperate settings. This contrasts with general expectations in many bovids where cursorial adaptations (e.g., elongated distal limbs) correlate with open habitats and with Bergmann's rule, which predicts larger body sizes in colder climates.

By integrating comparative morphology, body mass estimates, and stratigraphic data across multiple populations, this work refines the evolutionary trajectory of *Bison* in Europe. It underscores the need to interpret phenotypic variation as the outcome of multiple interacting factors—such as allometry, ecogeography, resource availability, competition, and predation—rather than as the result of phylogenetic history alone.

Funding Sources Humboldt Research Fellowship, Alexander von Humboldt Foundation

CERCA Programme, Generalitat de Catalunya

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The size-temperature relationship in *Ctenothrissa* (Ctenothrissiformes) and *Macropoma* (Coelacanthiformes) in the Late Cretaceous UK Chalk Sea

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The size-temperature relationship, where adult body size decreases with increased temperature, is observed in some extant marine fish and is a concern when considering the response of marine ecosystems to current climate change. However, testing whether this is a general relationship in extant fish is challenging. To provide an alternative source of data, this study aimed to test the size-temperature relationship in fossil fish. The UK Chalk Group was deposited during the Cenomanian–Maastrichtian stages of the Late Cretaceous (100 to ~70 Ma), and records numerous rapid climate change events. We used the extensive Chalk fossil fish collections held at the Natural History Museum, London (NHMUK) to test the size-temperature relationship in two Cretaceous fish genera; *Ctenothrissa* (Actinopterygii: Ctenothrissiformes) and *Macropoma* (Sarcopterygii: Coelacanthiformes). Thirteen morphometric parameters of the head, body, and fins were measured for *Ctenothrissa* specimens (n=86) and seven for *Macropoma* specimens (n=69). Measurements were plotted against standard length for *Ctenothrissa* and total length for *Macropoma* in individual linear regressions. The parameters that most closely correlated with length in these regressions were used to estimate the lengths of incomplete specimens. Biological age of *Ctenothrissa* specimens was estimated by counting circuli, and where possible annuli, on sufficiently preserved scales. Oxygen isotope analysis of bulk chalk matrix was conducted on the largest possible size range of adult specimens. Sea surface temperatures (SST) were estimated from these results and plotted against length for each genus. Although there was no significant linear or non-linear relationship between SST and length for either genus, absolute temperatures were notably different between the taxa: the SST range for *Ctenothrissa* specimens (22.0-29.8°C) was more than twice that of *Macropoma* specimens (24.4–27.8°C). This may suggest that *Ctenothrissa* had a broader thermal tolerance and was more resilient to climate change in the Cretaceous Chalk Sea than *Macropoma* or may indicate that *Macropoma* only migrated onto the Chalk Sea shelf during limited intervals of time. These data highlight the importance of the fossil record for better understanding organismal response to environmental change and indicate that the response of fish to climate warming may be more variable than previously thought.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Revision of the turtles from the Upper Jurassic Canjuers lagerstätte (SE France)

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The Tithonian lithographic limestones of Canjuers in southeastern France represent a remarkable, yet historically underexplored, Mesozoic lagerstätte formed in a lagoonal environment. Known since the 1970s for its exceptional fossil preservation and high vertebrate diversity, the site has yielded over 1,000 specimens, including fishes, pleurosaurs, sphenodontids, a pterosaur, a crocodilian, and the iconic dinosaur *Compsognathus longipes*. The exceptional preservation of the latter specimen, one of the best-preserved dinosaurs from France, sparked renewed scientific interest in the locality and led first to the reopening of the quarries and then to the resumption of systematic fieldwork in the past few years.

A few turtle specimens are known in Canjuers. They belong to the Thalassochelydia, the earliest known clade of marine-adapted turtles. This group, which flourished in the epicontinental seas of the Late Jurassic of Europe and South America, includes over 30 named species. However, the taxonomy, diversity, and evolutionary relationships of thalassochelydians, particularly within the informal group "Eurysternidae," remain poorly resolved, as many taxa were originally described from incomplete or poorly preserved material in the 19th century. This study presents the first in-depth reassessment of the eurysternid turtles from Canjuers, combining traditional morphological analysis with advanced imaging techniques (UV photography and multispectral imaging). Our results include the description of a new eurysternid species and provide novel insights into the morphological variability of the large-headed eurysternid *Solnhofia parsonsi*. These findings not only shed new light on the turtle assemblage from Canjuers and reaffirm the site's importance as a Upper Jurassic vertebrate lagerstätte but also represent a crucial first step in the broader systematic revision of eurysternid turtles.

Funding Sources Swiss National Science Foundation to Jérémy Anquetin (SNSF IC00I0-227983).

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

A drepanosauromorph from the Grès à Voltzia fossil Lagerstätte (early Anisian) of northeastern France reveals early diversification of integumentary appendages among Diapsida

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The Grès à Voltzia of northeastern France (Upper Buntsandstein) is a world-renowned Konservat-Lagerstätte famous for its exquisite preservation of diverse flora and fauna, particularly arthropods. Deposited in a deltaic environment coincident with the Muschelkalk transgression into the Central European Basin during the early Anisian (~247 mya), these clastic sediments provide a critical window into the biotic recovery following the Permo–Triassic mass extinction, yet tetrapod remains have been notably scarce. Here, we report a small arboreal diapsid preserving remarkable integumentary appendages extending serially along its back, forming a distinctive crest resembling that of the long controversial *Longisquama insignis*. This new form was discovered after the recent transfer of the historic Grauvogel fossil collection to the State Museum of Natural History in Stuttgart (SMNS). Detailed anatomical study, aided by Synchrotron radiation micro-computed tomography (SRμCT) and UV fluorescence, identifies the new taxon as a drepanosauromorph—the stratigraphically oldest record of this clade by circa 20 million years. The cranial reconstruction shows a tiny (~2 cm long), superficially bird-like skull with a narrow, anteriorly edentulous snout, large forward-facing orbits, and a dome-like skull roof. The postcranial skeleton displays many clearly drepanosauromorph synapomorphies, including a long, barrel-shaped torso, a ventrally curved tail, absence of cervical ribs, and a very narrow scapular blade. The integumentary appendages exhibit a distally expanded bilateral morphology and their melanosomes, analysed using scanning electron microscopy (SEM) and Synchrotron rapid scanning-X-ray fluorescence (SRS-XRF), are geometrically similar to feather melanosomes. Nevertheless, the absence of internal branching indicates that these bilateral structures formed independently to avemetatarsalian feathers and other known amniote integumentary appendages like hairs and scales. The vertical orientation and large size of the crest suggest that it likely served for visual display. Our findings show that complex integumentary appendages are not restricted to avemetatarsalians and mammaliaforms among amniotes and evolved in a lineage likely basal to all extant reptiles. These results challenge our understanding of the evolution of the reptilian integument and highlight the Triassic Period as a time of evolutionary innovation amongst reptiles.

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Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Combining perspectives on archosaur ontogeny reveals the first multitaxic assemblage of "sphenosuchians" from the same Upper Triassic vertebrate community

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The earliest-diverging crocodylomorphs comprise the paraphyletic "Sphenosuchia" (i.e., non-crocodyliform crocodylomorphs). "Sphenosuchians" represent the first pulse of crocodylomorph evolution in the Late Triassic, but the "sphenosuchian" record is sporadic, with most taxa diagnosed from one specimen, singletons within their respective localities or even entire rock units. This lack of spatiotemporal overlap prevents a close comparison of variation in both morphology and size; when the two sources of variation are studied in isolation, it can preclude needed insight on taxonomic diversity and ontogenetic variation. Here we use an integrated approach on three "sphenosuchian" specimens of different sizes from a single locality, assessing both

morphological variation and gross size in relation to each other to evaluate whether the size array indicates a growth series. We describe cranial and cervical elements of two newly indentified "sphenosuchians" (CM 87670 and CMNH 50955) from the Rhaetian-aged *Coelophysis* Quarry from Ghost Ranch, New Mexico, USA, which is a rare example of an assemblage capturing a 'snapshot' of a single coeval vertebrate community. We compare them to the only crocodylomorph skull formally described from the *Coelophysis* Quarry (CM 29894, referred to *Hesperosuchus agilis*). All three specimens clearly show apomorphies of the maxilla and premaxilla associated with non-crocodyliform crocodylomorphs. CM 87670 is only slightly smaller than the referred '*Hesperosuchus*,' but the ~25° angle between the ascending and posterior rami of the maxilla for CM 87670 is too unlike the nearly parallel rami of the '*Hesperosuchus*' specimen to be attributed solely to an ontogenetic difference. The maxilla of CMNH 50955 is under a quarter of the length of that of CM 87670, but neurocentral suture closure in the cervical vertebrae and parietal fusion suggest that CMNH 50955 was approaching skeletal maturity at its diminutive size and represents a third distinct species. Despite a history of isolated "sphenosuchian" occurrences, the *Coelophysis* Quarry provides our first glimpse of an ecosystem in Triassic equatorial Pangea wherein at least three taxa achieving distinct body sizes coexisted. Combining different aging methods indicates persistence and coexistence, rather than replacement and turnover, among non-crocodyliform crocodylomorph lineages in the low latitudes up to the latest days of the Triassic Period.

Funding Sources NSF EAR 1943286.

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Environmental drivers of neoselachian diversity and turnover across the Mesozoic and Cenozoic

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Sharks, rays, and skates (Neoselachii) are ecologically pivotal marine vertebrates in today's oceans with an evolutionary history spanning over 250 million years. Despite their resilience, more than one-third of extant species are currently threatened with extinction, underscoring the need to understand the macroevolutionary forces that have shaped their diversity. However, the mechanisms that underpin their diversification and survival across major environmental perturbations remain incompletely resolved. This study examines the long-term diversity dynamics of Mesozoic and Cenozoic neoselachians by integrating 50,000 fossil occurrences with environmental and palaeogeographic data. Using sampling-standardized diversity estimates, detrended correspondence analysis, and stepwise multivariate regression modelling, we quantify the impact of environmental changes on neoselachian genus-level diversity and faunal turnover. We show that neoselachians underwent a major radiation during the Cretaceous, experienced a comparatively mild extinction across the K/Pg boundary, and reached a peak in diversity during the early Eocene—documented here for the first time using sampling—standardized data. Two major faunal turnovers occurred in the Miocene, representing the most significant compositional shifts since the Early Jurassic. The results indicate that the availability of shallow, heterogeneous marine habitats emerged as the primary diversification driver

along with a number of secondary factors across the Mesozoic and Cenozoic. However, responses varied across ecological and taxonomic groups. Our findings contrast with previous assumptions regarding the extinction event at the Cretaceous–Paleogene boundary, suggesting a less pronounced extinction than previously thought. Furthermore, the results of this study underscore the pivotal function of habitat heterogeneity in fostering long-term resilience. Our study presents a new macroevolutionary framework to understand neoselachian responses to environmental perturbations, evaluate their vulnerability to anthropogenic pressures, and contribute insights relevant to conservation. Further exploration of geographic origins, latitudinal diversity gradients, and the relationship between range loss and extinction risk will contribute to a more comprehensive evolutionary baseline to support the conservation of one of the ocean's most threatened vertebrate groups.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Relative homoplasy index: revealing patterns of homoplasy in discrete phylogenetic datasets with a new cross-comparable index

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Investigating patterns of homoplasy can improve our understanding of macroevolutionary processes by revealing evolutionary constraints on morphology and highlighting convergent form-function relationships. Here, we test the performance of several widely-used methods of measuring homoplasy, including the consistency (CI) and retention indices (RI), as well as the homoplasy excess (HER) and homoplasy slope ratios (HSR) using simulated and empirical discrete morphological datasets. In addition, we describe and test a new method with a novel randomisation protocol in the context of homoplasy estimation, the relative homoplasy index (RHI). Our results suggest that RI consistently underestimates the extent of homoplasy. By contrast, RHI outperforms other methods in a range of situations and allows comparisons between different datasets, whereas the HER method may perform poorly when non-parsimony inferred trees or highly homoplastic datasets are analysed. We corroborate the fact that relative levels of homoplasy remain constant with the addition of characters and decrease with the addition of taxa. We calculate relative homoplasy levels across several published, empirical bird datasets, showing how RHI can be used as a comparative tool with phylogenetic data. Finally, we show that levels of homoplasy can strongly influence the distribution of taxa in morphospace. Low homoplasy results in highly partitioned morphospace, while high homoplasy leads to clades overlapping in morphospace. Our results help illuminate the properties of homoplasy in morphological matrices, opening new potential avenues of research for homoplasy quantification in macroevolutionary studies.

Funding Sources Sarah Woodhead Research Fellowship in Earth Sciences, Girton College, NE/S007164/1, MR/X015130/1, ÄR-NT 2020-03515

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Mapping *Triceratops* Gulch: a GIS and drone photogrammetry approach to the Lance Formation beds of Glenrock, Wyoming

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Accurate stratigraphic contextualization is essential for interpreting fossil localities,

particularly in structurally and topographically complex exposures where traditional mapping is limited. The Glenrock Exposure (Lance Formation, eastern Wyoming) preserves a diverse assemblage of Upper Cretaceous flora and fauna, but steep bedding planes, topographic complexity, and limited resources have previously hindered detailed stratigraphic correlation. This study employed drone-based photogrammetry and Geographic Information Systems (GIS) to produce a high-resolution spatial and stratigraphic framework for the site. Aerial surveys conducted via a DJI Mavic 3 Pro drone generated orthomosaics and digital surface models, while 379 strike and dip measurements were collected using mobile digital compasses. These datasets were integrated in ArcGIS Pro and analyzed using custom python scripting to reconstruct bedding planes and contour bedding layer contacts. Results indicate a consistent monocline structure across the exposure, enabling the construction of a quantitative stratigraphic column spanning ~750 meters of section.

The Glenrock Exposure is unusual in having multiple fossil preservation forms (including large bonebeds, macro-vertebrate assemblages, leaf beds, and trackways) concentrated in close proximity. Fossil quarry positions, including multiple *Triceratops* skeletons (representing both *T. prorsus* and *T. horridus*), were georeferenced within the stratigraphic framework. This revealed clustering of fossil quarries within specific depositional intervals. The stratigraphic locations support previous evidence for the temporal separation of *Triceratops* species in the Hell Creek Formation. The workflow created for this study demonstrates the utility of GIS and photogrammetry as cost-effective, scalable tools for paleontological mapping in complex field settings.

Funding Sources College of Charleston GSO, College of Charleston GSA, College of Charleston MESSA, College of Charleston SURF Grant.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Molar evolution in Canidae surmounts a developmental rule

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Today, the biases and boundaries that developmental realities impose upon evolution are recognized as vital for understanding what forms life has taken and may yet take. Though the evolutionary-developmental interface remains as vast as it is complex, specific interactions within it can be characterized as developmental rules. One such is outlined by the Inhibitory Cascade (IC) model that interprets common size patterns in mammal molars as a result of a shared system of sequential tooth development: first-developing anterior molars inhibit the growth of the later-developing molars behind them, which produces a trend of linear tooth size change along the molar row. Molar proportions in most mammalian taxa are known to adhere to the predictions of the IC model. Yet some mammals, such as many canid taxa, exhibit molar proportions outside the confines of the IC model.

We examined lower dentitions across Canidae to shed light on how these rule-breaking molar size proportions evolve and develop—how an evolutionary process may surmount a developmental boundary. Our specimens included a variety of extant and extinct canid species either from the Finnish Museum of Natural History (FMNH Luomus) or as previously published in literature. We compared lower molar size proportions as measured in occlusal area and examined overall carnassial morphology in relation to the degree of adherence to the predictions of the IC model.

Using this approach, we identified two types of canid dentitions: in taxa that follow the predictions of the IC model, such as *Vulpes zerda* and *Urocyon cinereoargenteus*, the trigonid and talonid of the carnassial are closer in size. However, in taxa that strongly deviate from the expectations of the IC model, such as *Aenocyon* and *Canis lupus*, the carnassial trigonid is proportionally larger. The area ratio of the trigonid to the talonid in the canid lower carnassial appears to be linked to how closely the molar row follows IC size patterns.

These results suggest that divergence from the expectations of the IC model seen in many canids stems from a size increase of the trigonid producing an increasingly elongated carnassial. This change in dental morphology is likely to mirror a shift towards more prominent carnivory. Identifying further cases, in which robust developmental systems change in deep time, could let us pinpoint similar evolutionary key moments during which adaptive forces have reigned strong enough to surpass developmental bias.

Funding Sources This research was funded by the FINDOS Doctoral Programme in Oral Sciences at the University of Helsinki and the Research Council of Finland.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

The southernmost and first occurrence of a leatherback turtle in the Southern Hemisphere in the Neogene

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The extant leatherback turtle, *Dermochelys coriacea*, is distinctive from all remaining turtles in the extreme reduction of its primary (thecal) carapace and the poor ossification of its plastron. Above the extremely reduced thecal carapace of *D. coriacea*, thousands of irregular ossicles form an epithecal (secondary) carapace. In the Paleocene, the reduction of the primary carapace started, accompanied by the appearance of the secondary carapace. The shape and arrangement of the ossicles, as well as the presence of ornamentations and keels in the carapace, are used to classify this peculiar group of marine turtles. Unfortunately, the fossil record of dermochelyid turtles is fragmentary and isolated, and it has not been studied in detail, leading to poorly resolved alpha taxonomy. In this presentation, we show one of the most complete dermochelyid turtles in the world represented by an almost complete carapace with associated postcranial remains (e.g., cervical, thoracic, and caudal vertebrae, pelvic girdle, scapulae, femur). This specimen is housed in the Museo Paleontológico Egidio Feruglio (Trelew, Argentina) with the catalog number MPEF-PV 10918. It was recovered from the Gaiman Formation (lower Miocene) on the coast of Chubut Province, Argentina. Based on the distinctive anatomical features, we recognize it as a new genus and species. The cladistic analysis suggests that this new species is located in a clade characterized by the presence of longitudinal ridges in the carapace and ossicles arranged in a ‘sunflower’ pattern. The histological analysis of the femur revealed a highly remodeled cortex in which secondary osteons exhibit an irregular shape and arrangement, an uncommon feature among turtles. Different from other marine turtles, the femoral cortex exhibits a strong degree of compactness. As in other secondary adapted marine tetrapods (e.g., penguins, cetaceans), we recognize two diversity peaks and three extinction events in the evolution of dermochelyid turtles during the Cenozoic.

Funding Sources Fundación Egidio Feruglio and the Agencia Nacional de Promoción Científica y Tecnológica PICT 2015-0792 (M.B., J.C.) and PICT 2019-00327 (M.B., J.S.).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A well-preserved specimen of fossil sea turtle sheds light on the evolution of pelagic specializations

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Modern hard-shelled sea turtles (crown group Cheloniidae, seven extant species) originated in the Miocene. However, fossils from the late Miocene, a key transitional period between the stem and crown lineages, are rare. Here we report the first well-preserved stem cheloniid from the late Miocene (LACM 21850), a subadult specimen of *Pacifichelys* from the upper part of the "Monterey" Formation of Orange County, California (USA). LACM 21850 preserves most of the postcranial material, including parts of three of the four limbs, allowing for direct comparison of limb anatomy and pelagic adaptations among *Pacifichelys*, Cretaceous stem cheloniids, and crown cheloniids for the first time. In doing so, we enhance our understanding of the evolution of pelagic specializations within sea turtles.

The forelimb of LACM 21850 has a mosaic of traits that more closely match Cretaceous stem cheloniids or the crown, or are intermediate: the humerus and first digit are short and robust, most closely resembling Cretaceous stem cheloniids, whereas the radius and ulna proportions are more similar to those of other Cenozoic pan-cheloniids. The metapodial elements also have a blend of plesiomorphic and derived characteristics. The proportions of the forelimb and hind limb, proximal placement of the lateral process of the humerus, saddle-shaped distal end of the tibia, and presence of retroarticular processes on the metapodial elements all suggest that LACM 21850 utilized an anteroposterior quadrupedal rowing swimming style. This differs from the dorsoventral flapping "underwater flight" used by extant sea turtles. If correct, *Pacifichelys* would be the stratigraphically youngest known chelonioid to use the ancestral rowing style of aquatic locomotion. LACM 21850 thus provides a unique snapshot of the evolutionary transitions between the stem and crown cheloniids, bridging a critical gap in our understanding of pan-cheloniid evolution.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A new nimravid from the Eocene Pipestone Springs Locality, Montana

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The Pipestone Springs locality in Jefferson County, Montana, preserves a diverse array of Chadronian vertebrates including the nimravids (Carnivora; Feliformia) *Hoplophoneus* and *Dinictis*. In 1994, the partial left dentary of a carnivoran (Museum of the Rockies [MOR] specimen 1304) was discovered at Pipestone Springs. This specimen preserves molars m1 and m2. The preserved molars exhibit elevated, linearly aligned cusps, which is consistent with referral to Nimravidae. Of the known nimravids, the monospecific *Dinictis* is the only genus that retains an m2. Further, the m1 of MOR 1304 retains a metaconid and the trigonid makes up 72% of the total length, features which are consistent with referral to *Dinictis*. Whereas the m1 is consistent with Dinictis, the m2 in MOR 1304 is unique in shape and size, differing from that of the only recognized species of *Dinictis*: *D. felina*. The m2 is 8 mm long with a high elevated paraconid, protoconid, and metaconid arranged in a linear alignment, creating a tooth derived for slicing. The m2 of *D. felina* is typically closer to 4 mm in length, with flat cusps that are arranged to create a typical trigonal basin. These features suggest that MOR

1304 is a unique nimravid and may represent a new species of *Dinictis*. Further morphological study of MOR 1304, including phylogenetic and morphometric analyses, will provide new insights into the diversity of nimravids and the paleoecology of the Pipestone Springs locality.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Adapiform (Primates) tarsal assemblage from the Prémontré Eocene fossil locality in France represents multiple species previously only known from dental material

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The fossil record of primate taxa from the early Eocene of Europe, especially postcranial elements, is poorly sampled relative to the North American record. A lack of fossil material from early European sites limits the phylogenetic and functional interpretations of these groups. Here we analyze fifteen undescribed adapiform primate tarsals (eight astragali and seven calcanei) from the Prémontré locality in France from the Upper Ypresian (~53–49 MYA). Size as well as qualitative features show inter-assemblage variation indicating that multiple species of adapiform primates are present. The Prémontré postcranial assemblage described here represents the only postcrania of adapiform primates from this site and helps create a clearer picture of euprimate diversity from this region. Though the postcranial fossils are not dentally associated, many can be attributed to primate dental taxa from the site. The smallest specimens are confidently attributed to cf. *Anchomomys sp.*, based on size. At least one astragalus can be allocated to *Agerinia recticuspidens*, based on both size and a presence of a qualitative feature lacking in other specimens. Quantitative assessments comparing the assemblage to both fossil and extant taxa show similarity between the tarsals and North American adapiforms, as well as between some specimens and *Margodinotius indicus,* an adapiform species from India. The addition of these tarsals into the paleontological record furthers our understanding of the euprimates of the Prémontré fossil site and increases our knowledge of the potential locomotor adaptations of early Eocene adapiforms. Through comparisons with tarsals of coeval and Eocene adapiforms, the tarsals will be situated in the larger context of crown primate origins and early evolution.

Funding Sources NSF BCS-1317525, NSF BCS-1440742, NSF BCS-1552848, NSF BCS-2020434

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Postcranial anatomy of *Torosaurus* (Ceratopsidae: Chasmosaurine) from the Upper Cretaceous (Maastrichtian) Ojo Alamo Formation of the southeastern San Juan Basin, New Mexico, USA

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Despite the abundance of ceratopsid fossils known from the Maastrichtian of western North America, postcranial elements associated with diagnostic cranial remains of *Torosaurus* remain exceptionally rare. We document the first, relatively complete postcranial skeleton of a large individual referred confidently to *Torosaurus* (EMK 0001) from the Maastrichtian Ojo Alamo Formation of the southeastern San

Juan Basin of New Mexico. Cranial material of EMK 0001 includes a nearly complete skull and mandible with a broad, thin, fenestrate parietal; a total of 12 epiparietals; and an elongate squamosal with a prominent dorsal ridge and fossa. Axial elements are represented by all cervical vertebrae (Ce4 through Ce9) except the syncervical (Ce1 through Ce3); all free dorsal vertebrae (D1–D12); a synsacrum that includes sacrodorsals Sd1 and Sd2, sacral vertebrae S1–4, and caudosacrals Sc1–Sc6; and corresponding cervical and dorsal ribs. Appendicular elements include both scapulae, coracoids, and humeri; both ilia, ischia, and pubes; and the left tibia and fibula.

Postcrania confidently associated with cranial remains of *Torosaurus* was previously limited to ribs, pectoral girdle, and forelimbs in MPM VP6841, limiting postcranial comparisons with sympatric *Triceratops*. Based on insights provided by EMK 0001, notable morphology distinct from *Triceratops* includes: a distinct 'hump' produced by tall neural spines on dorsal vertebrae D3–D10; elongated coracoid foramina with axes parallel to the scapula suture; a dorsally positioned scapular spine oriented subparallel to the overall blade; the absence of a distal expansion on the scapular blade; a more proximally positioned deltopectoral crest on the humerus; entire shaft of the ischium flattened and strongly 'sickle-shaped' with a ventrally concave curve; and ischium straight in dorsal view. While it is possible that the exceptionally large size, preservation, and/or advanced ontogenetic stage of EMK 0001 account for some of these differences, the wealth of morphologically consistent *Triceratops* postcranial material indicates that these features represent distinct morphology. These insights could permit more confident referral of elements and partial skeletons lacking diagnostic cranial remains, permitting more accurate evaluations of relative abundance and paleoecology, and potentially adding important phylogenetic information from the postcranial anatomy of Chasmosaurinae.

Funding Sources University of Utah, Salt Lake City, Utah, USA.

Museum of Evolution, Knuthenborg, Denmark

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Unearthing the future: exploring implications of geographic range dynamics in the fossil record

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The fossil record offers a unique temporal perspective on the interplay between biodiversity and environmental change, revealing patterns of resilience and vulnerability across geological time. As modern ecosystems face accelerating biodiversity loss, this archive therefore challenges us to reflect on its potential to deepen our understanding of the changes ahead.

Here we investigate macroevolutionary trends in geographic range across key marine classes—Anthozoa, Bivalvia, Chondrichthyes, Echinoidea, Gastropoda, and Mammalia—to identify patterns associated with genus-level extinction and survival. Using statistical modelling of Cenozoic fossil data, the analyses explore how geographic range dynamics relate to extinction risk and climatic variability, with particular focus on the roles of taxonomic identity, organismal traits, and climate history.

By uncovering patterns of extinction and persistence, this research contributes to a deeper understanding of the mechanisms underlying ecological change; knowledge that is increasingly vital for understanding, anticipating, and addressing future challenges.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

Can suction feeding be determined for fossil cetaceans? Morphological criteria for identifying suction specialists

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Over the past two decades, numerous studies have inferred suction feeding in extinct aquatic tetrapods, including fossil whales. Suction feeding involves capturing and transporting prey using intraorally generated subambient pressures. Most secondarily aquatic mammals employ suction to some extent in the feeding process (e.g., transporting grasped prey to the back of the oral cavity), with many converging on feeding strategies that use suction for prey capture. Suction feeding has repeatedly evolved in odontocetes, with notable examples in extant sperm whales and beaked whales. However, a specialized suction feeding morphology has never been clearly distinguished from specialized raptorial and multimodal (generalist) morphotypes. This has implications for determining how well-suited early whales—including different lineages of archaeocetes, stem odontocetes, and stem mysticetes—were to generating and using suction for prey capture and transport. Here, we aim to develop a scoring system that (1) quantifies specialized suction feeding morphologies from a suite of morphological characters and (2) predicts suction feeding in fossil whales. We evaluated the degree of suction specialization in 68 extant odontocete taxa using 10 morphological characters (skull and hyoid osteology, dentition, and soft tissue structures) historically associated with suction feeding in cetaceans. We found that scorings solely based on osteology and dentition predict scores that include soft tissue. Our results suggest that weak jaw adductors, a robust tongue (or hyoid), and dental wear are the strongest predictors of suction feeding. We also found that basic models can distinguish specialized suction feeding morphologies from generalists and raptorial specialists. Application of this method to extinct taxa identifies possible suction specialists and generalists among a strict dataset of 9 fossil odontocetes preserving all of the osteological characters. Ultimately, our analysis provides a robust foundation and rigorous method for inferring suction feeding in extinct cetaceans.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Pain in the neck: first report of vertebral osteomyelitis in *Deinosuchus*

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The giant crocodyliform *Deinosuchus* is widely known from Campanian Upper Cretaceous deposits across North America. Despite abundant material, specimens with evidence of pathology remain rare. Here, we report a previously undescribed cervical vertebra (VMNH 129952) from the Tar Heel Formation that exhibits two regions of bilateral, irregular bony lesions consistent with a potentially chronic infection. The vertebra is referred to *Deinosuchus* based on its relatively large size and the abundance of remains within the Tar Heel Formation as well as in stratigraphically equivalent Appalachian localities. This specimen thereby constitutes the first documented case of disease-associated bone proliferation in this genus.

Gross morphological examination revealed asymmetrical, porous bony proliferations positioned bilaterally along the ventrolateral surfaces of the cervical centrum, lateral to the ventral keel and near the neurocentral junction. The affected surface texture has a pock-marked appearance, which indicates periosteal proliferation and cortical remodeling. There is also localized degradation of the ventrolateral

margin of the anterior surface of the centrum, suggesting progressive remodeling associated with the pathological process. These features are most consistent with chronic osteomyelitis, though differential diagnoses may include neoplasia or metabolic bone disease. The external morphology of the lesion lacks the typical presentation of metabolic conditions. Furthermore, neoplasia in extant crocodilians is infrequently observed and usually benign. Likely etiology involved either localized trauma with secondary infection or systemic infection with vertebral involvement. This hypothesis is supported by partially healed punctures in other vertebrae from the same collection. Computed tomographic (CT) imaging and anatomical investigation provided a framework for refining the differential diagnosis and yielded insight into the origin and development of these lesions.

Vertebral osteomyelitis is infrequently reported in extant crocodilian taxa and almost unknown in fossil crocodyliforms. The bilateral distribution and presence of the lesions in this specimen offer rare insight into the pathophysiological response of large crocodylomorphs and pathology within *Deinosuchus*. This case expands the sparse record of pathologies in the vertebral skeleton of a fossil crocodyliform and highlights the utility of paleopathology in reconstructing ancient disease processes.

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Evaluating trends in mandibular form and function across vertebrate water–land transitions

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As one of the most pivotal events in vertebrate evolution, the origin of tetrapods ~390 Ma involved major changes throughout the body plan as these animals first became adapted to life on land. One of the most prominent modifications involved the feeding apparatus: whereas aquatic vertebrates often employ suction-based mechanisms to capture and ingest food, the different fluid properties of water versus air preclude this technique on land. As a result, the evolution of early tetrapod feeding mechanisms has typically been portrayed as a broad transformation from aquatic suction-feeding to terrestrial biting-based feeding. Much prior work studying feeding across this transition has focused on the mandible, using morphofunctional changes in the lower jaw as an indication of broader shifts in overall feeding mode. However, the assumption that the mandible constitutes a reliable proxy for overall feeding mechanisms has yet to be rigorously tested. Such validation is critical, as feeding behaviors in living tetrapods are more diverse than simply suction-feeding *versus* biting and food capture is often driven by structures other than the mandible (e.g., hyoid, tongue). Here, we test the long-standing notion of a core trade-off between suction-feeding versus biting, assessing both morphology (via geometric morphometrics) and function (via commonly-used performance metrics) across a broad dataset of extant (n≈100) and extinct (n≈65) vertebrate mandibles. First, using a modern sample of ecologically diverse vertebrates (fishes, salamanders, and turtles), we test whether the mandible is indeed capable of reliably distinguishing among known feeding ecologies. Applying these findings to an extinct sample spanning the origin of tetrapods, we then discuss implications for inferring feeding modes—and transformations thereto—throughout the fossil record. Our results show that extant clades exhibit phylogenetically-structured morphofunctional solutions to the challenge of feeding in different environments and that these are distinct from the trends exhibited by extinct taxa, highlighting the need for caution when relying on mandibles for deep-time reconstructions of feeding mode. By providing the first large-scale validation of functional trait differences across vertebrate feeding mechanisms, our research offers the necessary quantitative context to better inform

the origin of tetrapods and how they came to dominate the terrestrial realm.

Funding Sources NSERC Postgraduate Scholarship-Doctoral to CRCS; American Association for Anatomy Predoctoral Fellowship to CRCS; NSF EAR #2219069 to SEP.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

New eutheriodont (Synapsida: Therapsida) specimens from the Permo–Triassic boundary locality Nooitgedacht 68 in South Africa

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The Permo–Triassic Mass Extinction had unprecedented effects on terrestrial ecosystem structure and vertebrate diversity. During the earliest Triassic, this transition is marked by the disappearance of charismatic middle-to-late Permian therapsid groups (e.g., dinocephalians and gorgonopsians), diversity reductions and bottlenecks in others (e.g., dicynodonts, cynodonts, and therocephalians), and radiations of new tetrapod groups (e.g., archosauriforms). The rocks of the Beaufort Group (Karoo Supergroup) in South Africa preserve the most complete and extensive fossil record of this transition in terrestrial ecosystems. The earliest Triassic extinction acme phase is recorded in the upper Palingkloof Member of the Balfour Formation, and the subsequent post-extinction recovery phase in the lower Katberg Formation. Multiple well-known sites (e.g., Nooitgedacht 68, Bethel 763, Donald 207, Lootsberg Pass) across the Free State and Eastern Cape provinces of South Africa contain exposures of these sequences, which preserve eutheriodont (therocephalians and cynodonts) and dicynodont therapsids. The baurioid therocephalians are among the most abundant eutheriodonts in these earliest Triassic ecosystems and have long been considered as important components of the post-extinction recovery fauna. We describe a new early-diverging bauriamorph therocephalian based on NMQR 4130, which was recovered from the *Lystrosaurus declivis* Assemblage Zone of the Katberg Formation on Nooitgedacht 68. NMQR 4130 preserves a complete skull and anterior skeleton and increases the generic diversity of the baurioid therocephalian lineage during the Early Triassic. We also evaluate the phylogenetic position of NMQR 4130 using an updated phylogenetic matrix of 64 therapsid taxa and 137 morphological characters, which includes 58 therocephalian operational taxonomic units, representing the most inclusive therocephalian sample to date. Additionally, we describe BP/1/9330 from the same locality and identify it as representing the second known specimen of the epicynodont *Progalesaurus lootsbergensis* and the first identifiable cynodont from Nooitgedacht 68. Lastly, we discuss the distribution and proportion shifts of therocephalians and cynodonts across various Permo-Triassic boundary sites in South Africa. We show that therocephalians are more abundant in the Upper Palingkloof Member, but tend to be more equally represented with respect to cynodonts in the lower Katberg Formation.

Funding Sources GENUS: DSI-NRF Centre of Excellence in Palaeosciences, National Research Foundation, funded this research.

Technical Session XII: Mesozoic & Cenozoic Fishes (Friday, November 14, 2025, 1:45 PM)

Decoding the demise of hybodontiforms: phylogenetic clues to a Mesozoic mystery

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The enigmatic decline of hybodontiforms, dominant Mesozoic chondrichthyans regarded as the sister group to neoselachians (sharks and rays), represents a critical but still unaddressed question in vertebrate evolution. Despite their widespread distribution throughout much of the early Mesozoic, these shark-like upper trophic level predators, equipped with teeth of variable shapes and distinguished by characteristic dorsal fin and cephalic spines, disappeared by the end of the Cretaceous. The prevailing hypothesis suggests competitive exclusion from major marine niches by rapidly diversifying neoselachians. However, understanding hybodontiform evolution is complicated by two key limitations: the reliance on dental remains, whose utility for accurately tracing hybodontiform diversity dynamics is limited due to their tendency to underestimate genuine diversity patterns, and the lack of quantitative phylogenetic analyses to robustly infer evolutionary interrelationships of better-known taxa. To address these fundamental limitations, we present the first quantitative phylogenetic assessment of better-known Mesozoic hybodontiforms, focusing on taxa for which well-preserved skeletal material is available, including new, yet undescribed forms from the Jurassic of Europe and Southeast Asia. Initial results, while not yet fully resolved, provide novel insights into hybodontiform macroevolution. Critically, these data suggest a prolonged period of evolutionary stasis among euryhaline generalists prior to their demise during the Early Cretaceous. These findings offer a preliminary framework for elucidating the transition from hybodontiform- to neoselachian-dominated marine ecosystems during the Cretaceous, but improved phylogenetic resolution is needed to robustly test emerging evolutionary hypotheses.

Funding Sources Austrian Science Fund (FWF) [10.55776/PAT2291524] to S.S.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Retrodeformation and jaw muscle reconstruction of a *Chaohusaurus brevifemoralis* (Ichthyosauriformes, Reptilia) skull from the Lower Triassic of South China

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Due to the deformation and loss of skeletal parts during fossilization, it is often necessary to use digital techniques to create an accurate model of the specimen before morphofunctional analyses can be performed. This process, referred to as retrodeformation and reconstruction, could largely influence the result of subsequent studies such as finite element analyses. Therefore, continuous effort has been made to reduce the subjectivity and interpretation introduced in its methods.

Ichthyosaurs are mostly preserved in a laterally compressed state, and quantified measures have been proposed for retrodeforming these two-dimensional fossils. In rarer cases where the research requires three-dimensional anatomical structures of ichthyosaur specimens, the retrodeformation and reconstruction processes are still mainly based on qualitative measures, relying on the reference to related species and the interpretation of the researcher. In this study, we propose anatomical landmarks for the ichthyosaur skull, then apply the retrodeformation method based on landmarks

and semi-landmarks to restore the 3D structure of a deformed skull of *Chaohusaurus brevifemoralis*. We also explore the influence of the exceptionally large eyeball on the position of specific bones, which is an important characteristic of ichthyosaurs. Based on our skeletal model, we reconstruct the jaw muscles and perform finite element analyses on the skull to calculate the maximum and optimal bite force and stress distribution.

This study offers quantitative evidence of the feeding behavior and prey preference of the basal ichthyosauriform *Chaohusaurus brevifemoralis*, providing insight into the ecological niche of this species as well as the early evolution of ichthyosaurs. It can also serve as a reference for a more subjective measure to retrodeform and reconstruct three-dimensionally preserved ichthyosaur skulls, enhancing the accuracy of the skeletal model especially regarding the unique skull features of this clade.

Funding Sources Funding for this work was provided by the National Natural Science Foundation of China (NSFC).

Colbert Prize Session

A novel approach to estimate body mass of non-avian dinosaur embryos

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Various methods have been established for body mass (BM) estimation in non-avian dinosaurs, but these methods have predominantly utilized specimens of mature individuals. Because embryos/perinates generally exhibit different body proportions relative to adults, it is necessary to develop a method to more accurately estimate their BM. Thus, a new method applicable to estimating BM of embryos/perinates for bipedal dinosaurs is established here, based on scaling of BM and bone dimensions (e.g., skull length, femur volume, femur cross-sectional area) in extant bird embryos of seven genera. Our results reveal that vertebra length and femur volume, both have high correlations with BM, and were the best-fit independent variables for estimation:

$\log_{10}BM(g) = -11.529 + 2.658 * \log_{10}$Vertebra Length (μm)

$\log_{10}BM(g) = -7.417 + 0.842 * \log_{10}$Femur Volume ($\mu m^3$)

Other dimensions, such as femur length and mandible length, were also proven to have strong correlations with BM and, therefore, could also be useful. Application of this method to the fossil embryos of an enantiornithine (IGM100/2010), oviraptorid (YLSNH01266), and lambeosaurine (TMP1987.79.219), resulted in the estimated BM of 270g, 9.2–10.3g, and 3316g, respectively. Scaling with the femur volume yielded a BM estimate for these embryos that is consistent with their estimated egg masses (based on egg dimensions) whereas the previous methods based on femur length, mainly of mature individuals, produce substantially inconsistent results. A more accurate BM estimate for embryos/perinates will lead to a better understanding of factors related to growth, physiology, and other life history parameters in extinct dinosaurs and birds.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A diminutive hesperornithiform bird from the Upper Cretaceous Wapiti Formation of northern Alberta, Canada, and the form of the hesperornithiform carpometacarpus

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The DC (Dinosaur-Chelonian) Bonebed, in the Campanian part of the Wapiti Formation of northern Alberta, Canada, has yielded bones and teeth of diverse vertebrates including the eponymous turtles and dinosaurs. Reported specimens from the Bonebed include a tarsometatarsus (TMT) referable to Hesperornithiformes, flightless Cretaceous foot-propelled diving birds closely related to Neornithes. Two more bird bones, namely a tibiotarsus (TT) and a carpometacarpus (CMC), have been recovered from the Bonebed more recently. Here we examine the morphology and possible affinities of all three specimens, the only bird bones so far known from the Wapiti Formation.

The TMT resembles those of *Baptornis* and *Fumicollis* but is much smaller (56.9 mm long) and also distinctive in that the proximal end of metatarsal IV is flared plantarly, trochleae III and IV are connected by a discrete bony bridge to create a distal vascular foramen, and the outer condyle of metatarsal IV protrudes sharply in the lateroplantar direction. The TT shows hesperornithiform features, most notably a fibular crest that extends about halfway to the distal end of the bone and has a fainter distal continuation, but lacks many of the specializations seen in the hesperornithids *Parahesperornis* and *Hesperornis*. The TT has a preserved length of only 85.7 mm, tiny by hesperornithiform standards even allowing for minor damage. The CMC is distally incomplete, but the alular metacarpal is 5.7 mm long, far less than in CMCs attributed to the Cenomanian hesperornithiform *Pasquiaornis tankei*. The DC CMC also differs notably from the *P. tankei* specimens, the only CMCs so far referred to Hesperornithiformes, in that the cranial edge of the alular metacarpal is sinuous rather than convex.

Parsimony-based analysis of a hesperornithiform-focused matrix with the DC avian bones added one at a time posits the TMT in a trichotomy with *Fumicollis* and hesperornithids, the TT as sister to Hesperornithidae, and the CMC as sister to Ornithuromorpha. Given the similar phylogenetic signals from the two hindlimb elements, and the distinctiveness of the TMT, they appear to represent a small novel hesperornithiform close to Hesperornithidae. The CMC may be evidence of a second, non-hesperornithiform bird in the Wapiti Formation, but an alternative is that the putative CMCs of *Pasquiaornis* have been misattributed and the DC specimen reveals the form of the CMC in hesperornithiforms that retained this bone.

Funding Sources National Sciences and Engineering Research Council of Canada (DG RGPIN-2023-04916); Currie Professorship endowment at the University of Alberta

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Biogeography and community structure of Eurasian and African large mammals from the Late Miocene to the present: continental-scale turnover, functional stability, and no wave of dispersal associated with *Homo* out of Africa

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The origin of early hominins in Africa is widely accepted based on fossil and archeological evidence. There are different ideas on the context or possible drivers of the dispersal, including environmental change, faunal change, evolutionary change, or technological advances. Additionally, there are questions about the impact of hominins on Eurasian faunas after

their dispersal there. For example, several large carnivores are believed to have accompanied hominins from Africa into Eurasia, and possibly these new arrivals could have precipitated major changes in the Eurasian mammal community structure. But this has not been synthetically examined before. The spatial and temporal distribution of large mammal faunas contemporary with early *Homo* could help us understand the context and impact of hominin dispersal out of Africa.

In this study, we focused on the Eurasian and African large mammal faunas of the last 10 Ma. We conducted both taxonomic (genus-level) and functional clustering based on pair-wise similarity in order to better understand the faunal context and potential impact of hominin dispersals on Eurasian community structure. Body mass, diet, and locomotion were used as functional traits. We tested two hypotheses: 1) the dispersal of hominins across Eurasia around or shortly after ~2 Ma was part of a wave of faunal dispersal out of Africa and 2) the arrival of hominins at Eurasian sites coincided with major changes in the functional structure of large mammal communities in Eurasia.

Our results indicate that hominin dispersal from Africa to Eurasia during the early Pleistocene was not part of a significant faunal dispersal and that African faunas and Eurasian faunas were mostly well separated since at least early Pliocene. Our results also indicate a relative stability in community functional structure across Eurasia and Africa since at least 10 Ma.

Funding Sources Funding for this work was received from ERC Advanced Grant BICAEHFID (to I.d.l.T.).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A new late middle Pleistocene fauna yielding *Pongo* from Krabi, peninsular Thailand

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Orangutans are present today in Borneo (*Pongo pygmaeus*) and Sumatra (*Pongo abelii* and *Pongo tapanuliensis*). However, their distribution range was considerably broader during the Pleistocene. Fossils of *Pongo* were often found from cave sites throughout South China and Southeast Asia, but extremely rare for the northern part of the Sundaic subregion (Thai-Malay Peninsula), only some teeth having been recorded from Peninsular Malaysia. As peninsular or southern Thailand is regarded as an obligatory pathway for Pleistocene hominins and large mammals during their dispersal across the Indochinese and Sundaic biogeographic subregions, the region has held potential for documenting the evolutionary history and distribution of *Pongo* during the Quaternary, particularly in terms of first and last appearance records. Paleoecological and paleoenvironmental investigations linked to the cause of local extinction of *Pongo* in this region are thus highly relevant.

In 2021, isolated teeth of mammals were collected from the layer of cave breccia within the cave of Khao Phak Kut (or Tham Khao Phak Kut), Krabi Province in Peninsular Thailand based on several field excavations. The fauna not only contained several living taxa (e.g., macaques, colobines, ursids, elephants, rhinocerotids, suids, and large cervids and bovids) but also yielded some locally extinct taxa: *Hystrix indica*, *Pongo* sp. And *Naemorhedus goral*. Preliminary chronological results based on combined ESR/U-series analyses of faunal teeth as well as luminescence dating of sediments with U-series applied to

overlying flowstones suggest a late Middle Pleistocene age for the fauna. The stable carbon isotope ratios of mammalian tooth enamel indicate that the area was covered by a wide range of ecosystems ranging from closed forests to open grasslands dominated by C_4 vegetation.

Our findings represent the first record of fossil *Pongo* in peninsular Thailand, indicating a prevailing forest habitat in the area. Although the forest-grassland mosaic was dominant in the region during the late middle Pleistocene, this study suggests that patches of forests might have been a key role contributing to the survival of orangutans. The expansion of diverse tropical forest environments or forest mosaics across Sundaland might have facilitated the transequatorial dispersal of orangutans into the islands of Indonesia (Sumatra, Java, and Borneo) during the late middle Pleistocene, prior to the subsequent isolation of their populations.

Funding Sources Fossil Management Fund 2022 (Department of Mineral Resources) & Research Grant for Talented Young Researchers 2022 (National Research Council of Thailand, No. N42A650202)

Colbert Prize Session

Mammals from the Hewett's Foresight local fauna (Lance Formation, Bighorn Basin, Wyoming) suggest Laramide uplifts influenced terrestrial diversity patterns near the end of the Cretaceous

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Patterns of Late Cretaceous terrestrial biodiversity and biogeography have emerged via continent-scale studies focused on latitudinal gradients; however, high-spatial-resolution, basin-scale studies reduce sampling bias and permit more direct tests of how other environmental gradients, such as topography, influence those patterns. In modern continental basins, biodiversity is highest within and proximal to mountain uplifts and decreases in more distal lowlands. In the fossil record, species richness increases as tectonic activity increases; for example, the Cretaceous diversification of mammals coincided with the acceleration of tectonic processes that formed the North American Cordillera. Thus, in deep time, topographic diversity gradients should be revealed by comparing contemporaneous mountain-proximal vs. mountain-distal faunal assemblages. This study describes mammal teeth from the Hewett's Foresight local fauna, a site ~15 km southwest of the Beartooth Uplift, from the latest Cretaceous (ca. 68–66 Ma) Lance Formation of the Bighorn Basin, northwestern Wyoming. Preliminary observations indicate that multituberculate and eutherian species richness at Hewett's Foresight may be higher than previously noted and may exceed that of the roughly coeval, mountain-distal Type Lance local fauna nearly 400 km to the east, near the South Dakota border. Specifically, we find high species richness and relative abundance of small multituberculates from the Hewett's Foresight local fauna, which shows a striking similarity with coeval assemblages proximal to Laramide uplifts: Black Butte Station in southwestern Wyoming and Pawnee National Grassland in northeastern Colorado. The species richness and composition of leptictids and cimolestids indicate affinities between Hewett's Foresight eutherians and the coeval Scollard Formation assemblage, proximal to the Sevier front in Alberta. The higher species richness and strong faunal similarities among mountain-proximal sites suggests there may have been a topographic diversity gradient in the latest Cretaceous of western North America. If this pattern holds, it suggests tectonic processes, specifically the emergence of Laramide uplifts, were important drivers of mammalian community assembly and spatial heterogeneity in the North American Western Interior just prior to the Cretaceous–Paleogene mass extinction, emphasizing the role of mountain building in shaping biodiversity in the past and present.

Funding Sources Funding provided by the Turner Fund, University of Michigan Department of Earth and Environmental Sciences, and the Rackham Graduate School.

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Mammalian faunal turnover in Europe triggered by a latest Paleocene Pre-PETM global warming event

Tabuce, Rodolphe[1], Marandat, Bernard[1], Adnet, Sylvain[2], Gernelle, Killian[2], Girard, Flavia[2], Marivaux, Laurent[1], Schnyder, Johann[3], Steurbaut, Etienne[4], Storme, Jean-Yves[5], Yans, Johan[5]

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A short-lived global warming episode, known as the Pre-Onset Excursion (POE), occurred just before the Paleocene-Eocene Thermal Maximum (PETM, ~56 Ma). Disentangling the evolutionary impacts of these two closely spaced hyperthermal events is challenging, largely due to their temporal proximity and the scarcity of well-dated, comprehensive paleontological records—particularly from terrestrial settings. As a result, the influence of the POE on mammalian evolution and its potential role in shaping PETM faunas remained unknown. Here, we present a newly discovered mammalian fauna from Albas (Corbières Basin, Southern France), which, on the basis of $\delta^{13}C_{org}$ chemostratigraphy, is interpreted to postdate the POE and predate the PETM. The absence of artiodactyls, perissodactyls, and euprimates at Albas supports the debated hypothesis that these 'modern' mammalian groups first appeared in Europe during the PETM. In contrast, Albas provides the first definitive European Paleocene records of metatherians, paromomyid primates, "creodonts," and rodents, challenging the prevailing view that most of these groups arrived in Europe during the PETM. Given that many of these taxa trace their origins to Clarkforkian North American species predating the POE, we tentatively propose that these 'precursor' mammals dispersed into Europe during the POE. Similar to the 'modern' orders during the PETM, the 'precursor' dispersers likely entered Europe through land corridors in the continuous evergreen forest belt at high latitudes. Our findings highlight how a brief warming event during the latest Paleocene, such as the POE (which could result in a release of carbon into the atmosphere similar to cumulative ongoing anthropogenic emissions), significantly influenced the evolutionary dynamics of European mammals.

Funding Sources ANR-20-CE02-0007

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Cranial morphology of *Mesodermochelys undulatus* (Testudines: Chelonioidea) and its systematic revision

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Mesodermochelys undulatus is a chelonioid turtle abundantly found in the Late Cretaceous of Japan, and it was originally described as a rare Mesozoic dermochelyid based on the postcranial materials. However, the cranium of

the species has not been described or used for systematic assessment despite its phylogenetic informativeness, and the systematic affinity of the species remains uncertain.

Here we describe newly discovered chelonioid specimens that are referable to *Mesodermochelys undulatus*. They were collected from the marine Maastrichtian Kitaama Formation, which crops out in Awaji Island in Hyogo Prefecture, Japan. Multiple complete and partial crania were included, and those were found with peripherals having an undulating medial border that is autapomorphic to the species. Cranial morphology was observed with their CT-scan data, and its phylogenetic position was analyzed using a recent data matrix that emphasizes cranial characters.

As a result, *Mesodermochelys undulatus* was found to possess several autapomorphic features in its cranium, including 1) conspicuously robust lingual ridges on the palatal surface, and 2) a unique process on the caudal edge of the opisthotic. In particular, the robust lingual ridge, together with the well-developed supraoccipital crest and processus trochlearis osticum, indicates its strong bite force and durophagous diet.

In addition, the cranium of *Mesodermochelys undulatus* exhibits several phylogenetically informative characters. Although it has large parietals similar to those in dermochelyids, it has 1) prefrontals lacking medial contact, 2) interpalatine contact, and 3) pterygoid extending onto the mandibular articular surface of the quadrate, all of which are the cranial synapomorphies of protostegids. Indeed, in the phylogenetic analysis in which both cranial and postcranial scorings of *M. undulatus* were included, it was recovered as a basal member of protostegids, contrary to the previous hypotheses. The revised affinity of *M. undulatus* is consistent with the trend of Mesozoic chelonioid biogeography that protostegids were likely the most dominant clade in the Late Cretaceous, and *M. undulatus* was one of the last protostegid species that lived until the Maastrichtian.

Funding Sources JSPS KAKENHI grant no. 24KJ1879

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Testing the preservation of $\delta^{15}N$ in intracrystalline amino acids

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The nitrogen isotopic composition ($\delta^{15}N$) of amino acids provides powerful insights into trophic positions and ecosystem structures. While routinely applied to proteins such as collagen and keratin, the poor preservation of these biomolecules beyond 100,000 years has limited such analyses to relatively recent ecosystems and fossils.

More recently, the development of compound-specific $\delta^{15}N$ analysis has offered a major improvement over traditional bulk $\delta^{15}N$ measurements. Some amino acids, like glutamic acid, are heavily involved in metabolic processes, resulting in progressive ^{15}N enrichment at higher trophic levels. Others, such as phenylalanine, undergo minimal modification and largely retain the $\delta^{15}N$ signature of the baseline environment. By separately measuring the $\delta^{15}N$ of individual amino acids, it becomes possible to resolve diets and trophic dynamics with greater precision by disentangling trophic and baseline signals.

Recent studies have identified the presence of amino acids within the crystalline matrix of Mesozoic eggshells. Because this intracrystalline fraction is effectively isolated from the external environment, it may provide a pathway to recover $\delta^{15}N$-based trophic information that has so far been inaccessible.

However, whether these isotopic signals remain stable under diagenetic conditions remains untested. In this study, we empirically evaluate the preservation potential of both bulk and compound-specific $\delta^{15}N$ values in the intracrystalline amino acids of modern ostrich

eggshells, subjected to a range of thermal and temporal conditions.

This research represents the first targeted assessment of $\delta^{15}N$ preservation in intra-crystalline amino acids and aims to establish the methodological foundation for applying compound-specific isotope analysis to fossil eggshells. Validating this approach could unlock new opportunities to investigate trophic dynamics in Mesozoic and Cenozoic ecosystems.

Funding Sources Palaeontological Association Research Grant (PA-RG202402).

Symposium: Evolution of Triassic non-marine tetrapod communities through time II (Friday, November 14, 2025, 1:45 PM)

Early development of aetosaurs (Archosauria, Pseudosuchia)—a key to their success in the Late Triassic ecosystems?

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Late Triassic witnessed the rise of pseudosuchians and dinosaurs in the terrestrial ecosystems. The former radiated into many ecologically distinct groups including armored, mainly omnivorous aetosaurs. Here we calculated the prevalence of various omnivore/herbivore vertebrates in the late Carnian and the entire Norian in all geological units that yield any of them. We found that aetosaurs (Pseudosuchia) were present in a significant majority (79%) of them, outnumbering other groups like prosauropods (29%) by two- to three-fold. This suggests that the expansion of aetosaurs in the terrestrial ecosystems was much faster than that of dinosaurs. The causes of a more rapid expansion of aetosaurs are unclear, since we know very little about their biology (e.g., development) compared to that of dinosaurs. Here we present a nearly complete skeleton of a very young aetosaur from Wozniki (Poland). We visualize its 3D anatomy using high-resolution propagation phase contrast synchrotron X-ray microcomputed tomography. The bone structure and dental increments point towards this individual being an early juvenile. Gross morphology of the skeleton additionally supports this statement as it presents a lot of features characteristic for young individuals, such as proximal head of the humerus slightly expanded medially, supratemporal fenestra roughly half the size of the orbit, ventral portion of antorbital fossa in lateral view of the maxilla dorsoventrally shallow, etc. The specimen retained even some features considered to be embryonic in other archosaurs (e.g., dinosaurs) like notochord canal in the cervical centra. We interpret that as a very slow skeletal development, as we excluded embryonic stage due to histological evidence. Perhaps this developmental strategy could be linked to the success of aetosaurs in the Triassic continental ecosystems, which often experienced environmental instability.

Funding Sources Polish National Science Centre No. 2019/33/B/Nz8/01453, (2019–2025, study grant of T.S.), and No. 2024/52/C/ST10/00111 (study grant of E.M.T).

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Bird-like orbits originated in maniraptoriform dinosaurs

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Modern birds have markedly different skulls compared to their theropod dinosaur ancestors. The relatively large and circular eyes of extant birds are of note, as they are a key sensory organ implicated in adaptations for flight and changes to brain anatomy. However, given much of the avian body plan was acquired piecemeal over the theropod-bird transition, we expect to see classically 'avian' orbit features appearing in bird-like maniraptoriform dinosaurs. To test this, we measured orbit and skull length in 25 Mesozoic and 37 extant avian taxa, from the literature and museum collections, and compared them with measurements from other theropods. We also traced the orbit shape of the studied species and analyzed them with 2D geometric morphometric methods and in a phylogenetic context. We find that most Mesozoic avians have similar orbit sizes, both absolutely and relatively, to closely related maniraptoriforms. Likewise, most Mesozoic birds have circular orbit shapes analogous to other maniraptoriforms. However, Mesozoic avians with elongate skulls that lack a temporal fenestra substantially diverge in orbit size and shape from typical maniraptoriforms. Modern birds exhibit greater diversity in orbit size than Mesozoic birds but have similar orbit shapes. These findings highlight phylogenetic biases in skull evolution through the dinosaur-bird transition and imply a role for sensory exaptations in the evolution of flight.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Veggiesaurus rex: environmental and biotic drivers of herbivorous theropod biogeography and evolution

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Theropod dinosaurs are renowned for their predatory nature, yet the group exhibited a wide range of dietary strategies. Several theropod clades, such as therizinosaurs, ornithomimosaurs, and oviraptorosaurs, independently shifted from ancestral carnivory to omnivory or herbivory. However, the drivers of this innovation in theropod diet remain poorly understood. Previous work has suggested that the origin and diversification of herbivorous theropods were linked to climate conditions and the floralistic composition of global ecosystems. Furthermore, competition between herbivorous theropods and other herbivorous dinosaur groups may have influenced these patterns, but this has not yet been quantified. Here, we investigate the relationship between climate conditions and theropod diversity and distributions during the Middle Jurassic to Late Cretaceous (~175–66 Ma). We utilize dinosaur occurrence data from the Paleobiology Database (PBDB), updated with comprehensive stratigraphic data from the recent literature and integrated with paleoclimatic reconstructions from a spatially-explicit general circulation model (HadCM3L). We quantified the 'paleoclimate niche space' occupied by each major dinosaur group, and used multivariate statistical approaches to compare this niche space between dinosaurs of different dietary guilds. An informal species supertree was constructed and time-calibrated using a Bayesian tip-dating approach, and phylogenetic comparative methods were applied to examine the mode and tempo of paleoclimate niche evolution across all theropods. Our results

indicate that across the study interval, herbivorous theropods were more restricted in their paleoclimatic niche compared to other dinosaur groups, preferring lower mean annual temperatures and greater seasonal variability. We detect a shift in paleoclimatic niche at the base of Coelurosauria, suggesting that common coelurosaurian traits allowed the major herbivorous theropod groups to adapt to cooler habitats, thus leading to their observed global distributions. Our analyses also provide evidence of niche partitioning between herbivorous theropods and thyreophoran dinosaurs during the Early Cretaceous, implying that resource availability and biotic competition controlled herbivorous theropod distributions. Together, our results demonstrate that climate played a key role in constraining herbivorous theropod biogeographic patterns.

Funding Sources This work was partially funded by a Palaeontological Association Undergraduate Research Bursary (grant number: PA-UB202303)

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Morphometrics and ancient DNA reveal a new species of extinct insular shelduck (Anatidae, *Tadorna*) from Rekohu Chatham Islands

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The Rekohu Chatham Islands, 785 km east of mainland Aotearoa New Zealand, exhibit high levels of species endemism. The islands supported a rich waterfowl fauna comprising at least eight anatid species at the time of Polynesian settlement in the 13th century. Here we describe a new extinct duck from Holocene fossil bone deposits on the islands. Geometric morphometric analyses and phylogenetic analysis of complete mitogenomes confirm that it was the sister taxon to the putangitangi paradise shelduck (*Tadorna variegata*) from mainland New Zealand. Comparatively short, robust wing bones and long leg bones indicate the species was flight-reduced relative to its mainland congener. The ancestors of the Rekohu shelduck colonized the islands around 390,000 years ago during the Late Pleistocene. The presence of Rekohu shelduck bones in early Moriori midden deposits suggests its extinction was due to overhunting prior to the European and Maori settlement of the islands in the 19th century.

Funding Sources The Royal Society Te Aparangi Marsden Fund (16-UOO-096; 20-UOO-130).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Variation in humeral disparity across avian evolution

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The evolution of powered flight in birds involved major changes to the forelimb skeleton. The humerus, which connects to the pectoral girdle, plays a central role by transmitting the forces generated during flapping. Although these transformations have been well documented, the disparity of the humeral shape from non-avian

pennaraptorans to crown birds, remains largely unexplored.

We use geometric morphometrics to quantify the humeral outline shape in extinct and extant taxa within Pennaraptora, spanning over 150 million years. We examine the distribution of taxa in phylomorphospace alongside an allometric assessment to identify large-scale patterns of shape disparity. Preliminary analyses restricted to Enantiornithes support the existence of two main humeral morphotypes among volant forms and a marked shape deviation in flightless taxa—indicating functional signals even within low overall disparity.

Our results reveal that modern birds (Neornithes) tend to converge on a general humeral shape associated with flapping efficiency, setting them apart from more stemward taxa. We also show that some avian groups exhibit convergent trends, and others found alternative shapes to deal with different functional advantages. By analyzing shape in relation to size and phylogeny, we aim to determine whether lineages followed shared or divergent evolutionary trajectories. This study contributes to clarifying how function, constraint, and evolutionary history have shaped avialan humeral form.

Funding Sources Spanish Ministry of Science and Innovation, project CNS2023-145050.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Triassic time of transitions: does the high growth pattern variability within Archosauriformes have a palaeclimatic origin?

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Triassic archosauromorphs and their descendants show a high variability of growth patterns in the form of the deposition of fibrolamellar bone (FLB), lamellar-zonal bone (LZB) or a mix of both bone complexes. Furthermore, the variability of bone tissue type is not only visible between clades, but also within a group, e.g., in Aetosauria or Phytosauria. *Smok wawelski* is a taxon known from two Upper Triassic localities in southern Poland. Morphologically, *Smok* shares characters of a basal archosaur, a 'rauisuchian' and a theropod dinosaur, making its taxonomic position very difficult to assess. A sectioned long bone of *Smok* revealed an unexpected histological growth pattern. It grew with a laminar FLB architecture typical of many dinosaurs, however, the framework contains no deposition of woven bone, which makes it remarkable. Based on the histological growth pattern alone, the assignment to a dinosaur can most likely be ruled out and thus *Smok* instead represents a pseudosuchian archosaur. This raises the question of whether other pseudosuchians or even archosauriforms sectioned to date grew with true FLB or exhibited a more intermediate complex with the absence of woven bone as observed in *Smok*. Further comparative analyses will investigate the factors influencing the deposition of FLB or LZB in archosaurs: whether the deposited tissue is a response to environmental and/or climatic conditions, if it has a phylogenetic precursor, or if archosaurs simply show a high developmental plasticity.

Funding Sources Polish National Centre Sonatina grant no. UMO-2024/52/C/ST10/00111.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A remarkable new 3D cranium of the ctenochasmatid *Gnathosaurus* reveals new anatomical details of the genus

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The Late Jurassic (and potentially Early Cretaceous) ctenochasmatid pterosaur *Gnathosaurus* is a relatively rare faunal component of the lithographic limestones (Plattenkalke) of southern Germany, with only one good cranium from a large individual previously known. Here, we present a new, well-preserved *Gnathosaurus* cranium from the Painten quarry. It is positioned upright on a limestone slab with its palatal side buried in matrix. As opposed to most Plattenkalk pterosaurs that are compressed into 2D, it is three-dimensionally preserved, showing almost no signs of crushing or distortion, and the only missing part is the rostrum tip. We performed a CT scan to be able to fully assess this exceptional specimen.

Despite being smaller than the previously known good skull, the presence of a premaxillary crest here indicates it had reached, or was close to, sexual maturity. The new cranium reveals novel anatomical details of *Gnathosaurus*, such as an ascending ramus of the maxilla, giving the anterior end of the nasoantorbital fenestra a slit-like appearance. Both, the already known and the new cranium, possess a similar lacrimal, consisting of a posteriorly curving jugal process and a marked, horizontal supraorbital crest. Although present in some other pterosaurs, this structure is large here and has not specifically been discussed before. It is very prominent in dorsal view, overhanging the anterodorsal margin of the orbit. Conceivably, it could have served as a display structure, in addition to the premaxillary crest, or an anti-glare shield protecting the eyes from sunlight. The latter is the function of the soft tissue superciliary ridge in extant birds of prey and some seabirds, which is, in fact, supported by a bony protrusion over the orbit. Since *Gnathosaurus* likely foraged for aquatic food items at the coast, or at least at the water in general, protection against intense direct and indirect sunlight (surface reflections) in such environments might have been advantageous to this taxon.

Notably, the CT data shows that number of alveoli per upper jaw of the new skull (around 40 even without the missing rostrum tip) is significantly higher than in the type species *G. subulatus* (32–34). The shape of the supraorbital crests differs between them as well, suggesting that the new specimen may represent a novel species.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Life-and-death situation in the Late Cretaceous: comparison of dinosaur cursorial adaptations in the ecosystems of the Dinosaur Park, Hell Creek, and Nemegt formations

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In their struggle for survival, prey species need to evolve adaptations to successfully avoid/escape predation. Some of the most straightforward adaptations involve increasing limb length in order to outrun predators. Because limbs function as levers, the longer the distal elements (tibia, metatarsus) are relative to proximal elements (femur), the longer the stride an animal can make. As such, limb segment proportions (i.e., length ratios of tibia/femur and [metatarsus + tibia]/femur) are often used as proxies to infer the relative cursorial abilities of dinosaur species or clades. These ratios, however, have rarely been used to compare species within ecosystems in order to evaluate potential predator-prey relationships.

Hindlimb segment proportions were calculated for bipedal (i.e., theropods, thescelosaurids, pachycephalosaurids) and facultatively bipedal (i.e., hadrosaurids) dinosaur species from the well-represented ecosystems of the upper Campanian Dinosaur Park Formation of Alberta,

Canada, of the upper Maastrichtian Hell Creek Formation of the U.S.A., and of the Nemegt Formation of Mongolia. Measurements were taken directly from specimens or from the literature. In the Dinosaur Park ecosystem, tibia/femur ratios suggest that the dromaeosaurid *Saurornitholestes* and the caenagnathid *Citipes* possessed similar highly cursorial adaptations (131–142%), the caenagnathid *Chirostenotes*, *Troodon*, ornithomimids, thescelosaurids, and immature tyrannosaurids were cursorial (107–124%), whereas adult tyrannosaurids, hadrosaurids, and the pachycephalosaurid *Stegoceras* had the lowest cursorial abilities (85–99%). When the length of the metatarsus is taken into consideration, however, interpretation of cursorial abilities changes significantly: *Citipes* and the ornithomimid *Dromiceiomimus* clearly had the most cursorial adaptations (210–219%), the cursorial abilities of *Saurornitholestes* were lower and fell within the range of *Chirostenotes*, *Troodon*, ornithomimids, thescelosaurids, and immature tyrannosaurids (170–195%), whereas the cursorial abilities of adult tyrannosaurids and *Stegoceras* were lower still (146–165%) but better than those of hadrosaurids (117–128%). Similar cursorial "categories" are also observed in the ecosystems of the Hell Creek and Nemegt formations. These results support the hypothesis that juvenile tyrannosaurids and dromaeosaurids chased after small, swift prey species whereas adult tyrannosaurids fed upon slower-moving megaherbivores.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The posture of the hind limb in ceratopsid dinosaurs

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Dinosaurs are generally reconstructed with an upright limb posture, but a semi-sprawling pose with the humerus slightly abducted has been controversially proposed for the forelimbs of ceratopsid dinosaurs. Here we draw attention to morphologic features of the ceratopsid femur which suggest that the hind limb may have operated in a semi-sprawling manner as well. The lateral condyle of the femur extends farther distally than the medial condyle, and the femoral head is typically angled proximomedially.

To assess the posture of the ceratopsid hind limb, we created models of the pelvic and hind limb bones of *Centrosaurus* from the Royal Tyrrell Museum and the United States Museum of Natural History using photogrammetry and scaled them based on an articulated specimen. We digitally articulated these models in Maya based on our observations of various articulated ceratopsid specimens and the apparent goodness of fit of the bones.

The model was used to visualize two possible standing poses for *Centrosaurus*. In one, the femur was kept vertical, which resulted in a large gap between the medial condyle and the proximal surface of the tibia. In the other pose, the femur was inclined medially to bring the medial condyle into closer juxtaposition with the tibia, resulting in a semi-sprawling posture in which the femur was set at an angle with the tibia of ~150° and an angle with a horizontal plane between the two ilia of ~105°.

An important consideration in deciding between the two postures is whether the medial side of the knee joint could plausibly have contained enough cartilage and/or meniscal soft tissue to fill the gap between the medial condyle and the tibia in the upright pose. Some articulated specimens, such as TMP 1989.097.0001 (*Styracosaurus*), preserve the femur and tibia in such close contact that little intervening soft tissue could have been present, suggesting little separation in life between the tibia and the

ossified medial condyle and supporting a close articulation of the tibia and femur. Others, such as AMNH FARB 5351 (*Centrosaurus*) do show a gap between the medial condyle of the femur and the proximal end of the tibia, which could be consistent with the presence of extensive soft tissue between these elements during life. Exploration of moment arms of the musculature of the hip joint, and visualization of a stride cycle as opposed to a simple standing pose, should provide greater insight into which posture was more likely for the ceratopsid hind limb.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Giant size convergently evolved multiple times in Azhdarchidae (Pterosauria, Azhdarchoidea)

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Azhdarchoidea is a clade of pterosaurs which includes the largest-ever flying animals. The evolutionary history and interrelationships of this clade remains incompletely understood and debated. We combine multiple preexisting phylogenetic datasets with 23 new OTUs and 51 new characters, resulting in the most comprehensive phylogenetic analysis of pterosaurs to date, with a focus on Azhdarchoidea. A reduced-consensus tree, omitting taxa lacking reliable size estimates, is used for maximum likelihood ancestral state reconstruction, tracking the evolution of large size in pterosaurs.

Outside of Azhdarchoidea, Rhamphorhynchinae and Wukongopteridae are resolved as monophyletic, rather than as grades on the lineage leading to Pterodactyloidea. *Inabtanin* and *Microtuban* are recovered as basal azhdarchomorphs. Robust azhdarchids from Eastern Europe form a seemingly endemic clade, which includes *Bakonydraco* and all large pterosaur material from Maastrichtian Romania, including the type material of *Hatzegopteryx*. The genus *Quetzalcoatlus* is non-monophyletic: *Q. northropi* is the sister taxon to *Thanatosdrakon*, while *'Q.' lawsone* belongs to a clade containing various medium-sized quetzalcoatlines. The placement of various putative Late Jurassic and Early Cretaceous azhdarchids is phylogenetically tested, and all are recovered as either non-azhdarchid azhdarchoids or ctenochasmatoids, while the Campanian *Volgadraco* is a pteranodontid. The oldest unambiguous azhdarchid material is early Cenomanian, but this material is deeply nested within the clade, suggesting a cryptic radiation of azhdarchids in the late Early Cretaceous.

Azhdarchoidea and Azhdarchidae are reconstructed as having ancestral wingspans of 3.0 and 4.4 meters, respectively. Smaller size evolved independently in Tapejaridae, Chaoyangopteridae, and *Microtuban*, while gigantism evolved independently four times in Azhdarchidae: *Cryodrakon*, *Hatzegopteryx* sensu lato, *Arambourgiania philadelphiae*, and the *Q. northropi-Thanatosdrakon* clade. Although fragmentary, morphological differences are evident between these lineages, suggesting variable ecomorphologies and separate acquisitions of giant size in response to different environmental pressures. The unique azhdarchid bauplan likely facilitated the diversity of body sizes present across the clade.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

PerissOrigin: re-examining the phylogeny of early perissodactyls reveals unnoticed dispersals of the first North American, European, and Asian 'horses'

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Perissodactyls are a major group of large herbivorous mammals that comprise very few

extant species (five rhinocerotids, five tapirids, and seven equids), representing a tiny portion of their very high extinct diversity. They first appeared 56 Ma, at the same time as most modern mammal orders, but contrary to these other mammals, are represented by many different genera that are endemic to the three Holarctic continents: North America, Europe, and Asia. The origin of these genera, and their early evolution is thus very unclear. Among those early genera, *Hyracotherium*, one of the earliest 'horses', was considered as the most emblematic, and the most diverse in terms of species. The evolution of horses was also considered as a remarkable evolutionary sequence. However, the systematics of *Hyracotherium* is actually particularly confusing, and it has been split into many different genera that have been considered dubious by some paleontologists.

Here, we aimed to solve the systematics of this genus, as well as other early perissodactyls, by analyzing a new morphological characters' matrix with a comprehensive species sample. This new matrix includes 101 cranio-dental characters and 71 terminals, comprising early representatives of all major perissodactyls groups. We used a variety of outgroups, including Arctocyonidae, Phenacodontidae, *Radinskya*, and Cambaytheriidae. We analyzed this matrix in TNT with a parsimony algorithm.

We obtained a large-scale phylogeny that supports the hypothesis that the number of early perissodactyls genera was overestimated but also that *Hyracotherium* and many other early perissodactyls are not actually closely related to equids. In addition, these results also show that at least two genera of early perissodactyls, *Pliolophus* and *Cardiolophus*, experienced vast and fast dispersals between North America, Europe, and Asia, during the Paleocene–Eocene Thermal Maximum (PETM; 56 Ma).

Funding Sources The project PerissOrigin is funded by the Belgian Research Action through Interdisciplinary Networks BRAIN-be 2.0 program of the Belgian Science Policy Office (BELSPO).

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

New insights into the Early Triassic archosauromorph radiation from a South African Lagerstätte site

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The end-Permian mass extinction event (EPME) constituted the largest biotic crisis in the history of life on Earth. In the wake of this cataclysm, it is hypothesized that ecological stability and faunal diversity in terrestrial ecosystems did not recover until the Middle Triassic. Fossiliferous continental strata capturing this timeframe are scarce globally, and seldom preserve small tetrapods (or "microvertebrates"), confounding effective assessment of the terrestrial diversity rebound in the Triassic. This is especially problematic for vertebrate paleontology because the ancestors of living birds, crocodiles and turtles (the Archosauromorpha) are hypothesized to undergo a rapid radiation during this time. Over the remainder of the Triassic Period, archosauromorph taxa diversified into many of the ecological niches left vacant by taxa that disappeared during the EPME. However, the initial phases of the archosauromorph evolutionary radiation during the Early Triassic remain poorly understood.

The Burgersdorp Formation of the Karoo Basin in South Africa contains one of the most extensive Lower Triassic vertebrate fossil records in the world, making it an ideal study area to understand faunal recovery from the

EPME. Its *Langbergia-Garjania* Subzone (LGSz) represents the latest stage of the Lower Triassic (Olenekian). The Driefontein 11 locality in the Free State province presents a Konzentrat-Lagerstätte of vertebrate fossils in the LGSz, including several hundred archosauromorph specimens. We used multiple lines of investigation to assess the taxonomic and palaeobiological diversity in archosauromorph taxa in this sample including evaluating gross external morphology, and imaging bone tissue microstructures with Synchrotron X-ray micro-Computed Tomography.

Our findings from both comparative anatomy and paleohistological data indicate the presence of multiple distinct taxa, including tanystropheid, and allokotosaur archosauromorphs, and later-branching archosauriformes. Furthermore, the paleohistological data have shown an unexpected wide variation in growth strategies, lifestyle history and body mass among early archosauromorphs. Together, these results reveal a striking diversity among stem archosaurs during their initial radiation, occurring much more rapidly after the EPME than was previously anticipated. Furthermore, our findings highlight an incredible diversity of archosauromorph fauna within a localized geographic assemblage.

Funding Sources DSI-NRF Centre of Excellence in Palaeosciences (UID 86073).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Giant mustelids (Mammalia, Carnivora) from the lower member of the Irrawaddy Formation (upper Neogene) of Myanmar

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The lower member of the Irrawaddy Formation of central Myanmar has produced rich assemblages of Neogene vertebrate fossils that are key to reconstructing the faunal dynamics of Southeast Asia in relation to the region's tectonic, climatic, and biotic histories. Here we report occurrences of two giant mustelid taxa in the uppermost Miocene–lower Pliocene portion of the lower member of the Irrawaddy Formation in the Chaingzauk area and discuss their biogeographic implications. We refer dentognathic specimens to *Plesiogulo* cf. *P. monspessulanus*, the holotype of which is known from the Pliocene of France. Based on molar measurements, we estimate the body masses of the individuals represented by these specimens to have been approximately 50 kg (95% CI = 36–69 kg). Although the species-level identities of the Myanmar specimens are difficult to ascertain, owing to unresolved taxonomic issues, they expand the paleogeographic range of *Plesiogulo* to Southeast Asia. The presence of very large and morphologically very similar forms of *Plesiogulo* (representing either a single species or a species complex) across Africa, Eurasia, and North America near the Miocene–Pliocene boundary is biogeographically noteworthy in that no extant carnivoran clade of comparable morphological uniformity attains such a vast geographic range that crosses the equator and stretches over three continents. The other giant mustelid from the Chaingzauk area is represented by a single calcaneum, which is characterized by an extremely well developed peroneal tubercle positioned at its distolateral extremity. We refer this calcaneum to Lutrinae, and illustrate its similarities with the calcaneum of *Sivaonyx beyi* from the late Miocene of Chad, as well as those of extant lutrines. For this generically-indeterminate lutrine, we obtained an estimated body mass of 85 kg (95% CI = 51–140 kg), which makes it one of the largest

mustelids known, and approaching some of the modern bears in body mass. Beyond these giant mustelids, the large-carnivoran guild of the Chaingzauk fossil assemblage, which has yet to be fully described, exhibits notable compositional similarities with some of the late Miocene to early Pliocene fossil assemblages from not only elsewhere in Asia but also Europe and Africa, hinting at a relatively high degree of environmental continuity among these regions.

Funding Sources JSPS (Grant No. JP22KK0048, JP23K03562, JP22H02708, JP18H01327, JP15K05330, JP23370044), Mitsubishi Foundation (No. 201910022), Yamada Science Foundation (No. 1071).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Campanian-Maastrichtian vertebrate fauna from Laurasia: a comparative analysis between southern North American and Iberian Peninsula fauna

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It has been suggested that “bridges” were sporadically established between North America and Europe during the Late Cretaceous, allowing faunal interchanges. To test this hypothesis, we first carried out a comparison of the Campanian-Maastrichtian faunal associations between three main Iberian Peninsula basins (Laño, Lo Hueco, Western Tremp Synclines from Spain) and the southern localities of Laramida (Cerro del Pueblo, Aguja and El Gallo formations from Mexico). As a result of the analysis: within the osteichthyes, Lepisosteidae predominates in both regions, followed by Phyllodontidae and Amiidae. Among lissamphibians, albenerpentontid is shared, and the diversity of salamanders and anurans is similar. It is worth noting the absence of Palaeobatrachidae frogs in Mexico, a family present in the Iberian Peninsula and in northern North American localities. Lepidosaur diversity appears to be greater in the Iberian Peninsula, but much of this material is not identified below the family level, so its diversity could be overestimated. Bothremydid turtles are present in both regions, ten turtle families are reported in Mexico, and four in the Iberian Peninsula. The diversity of crocodylomorphs is greater in the Peninsula Iberica. Within theropods, six families are reported in Mexico while three (possibly four) in Spain. Each region has its main predator, tyrannosaurids in southern North America and abelisaurs in the Iberian Peninsula. Within the small theropods, dromeosaurs are present in both regions, but velociraptorines predominate in the Iberian Peninsula, and sauronitholestines in Mexico. What most distinguishes both regions is their sauropod and ornithischian component. In the Iberian Peninsula the titanosaurs are the main component followed by nodosaurids and the ornithopod *Rhabdodon*, but in Mexico, it is dominated by hadrosaurs, followed by ceratopsids and ankylosaurids. The mammals of the Iberian Peninsula are represented by the eutherian zhelestid of the genus *Lainodon*, while in southern North America multituberculates, marsupials and the eutherian *Gallolestes* are present.

The Iberian Peninsula has a lower diversity than the Mexican localities, but this only applies in turtles, theropods, ornithopods and mammals. In addition to the lack of absolute dating of some of the Spanish localities, one of the difficulties is the fragmentary condition of the fossil remains in both areas, which leads to a general taxonomic identification.

Funding Sources Programa de Apoyo para la Superación del Personal, DGAPA, UNAM to MMB, and Proyecto Consolidación Investigadora 2023 CNS2023-144950 to AT.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Genetic polymorphism, morphological evolution, and the origin of turtles

Torres, Fernando J., Huang, EJ, Bever, Gabriel S.

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Comparative genomics is a powerful heuristic tool that is rapidly expanding our understanding of evolutionary mechanisms and the time scales on which they operate. A prominent example is the concept of incomplete lineage sorting (ILS), which promotes the extended conservation of genetic polymorphism. While detecting ILS in genomic data presents methodological challenges, it bears the potential for informing variational dynamics of phenotypic systems, thus providing a new analytical framework to long-disputed phylogenetic and evolutionary problems. We apply this framework to the classical problem of turtle origins by examining patterns of genetic polymorphism in whole-genome data across 24 amniote species. We first calculated the relative frequency of topology support across gene trees. Additionally, we explored deep coalescent patterns by estimating divergence time across gene trees. We found exceptionally high levels of genetic polymorphism affecting the crown divergences of mammals, reptiles, and of the turtle-archosaur clade, along with their respective stem lineages, clades known to present pronounced morphological homoplasy. Notably, divergence time estimations show similar average values for ILS and non-ILS genes at the node that defines Reptilia and Mammalia. This pattern suggests that along the stem of these clades there are more deep-coalescent non-ILS genes, and consequently more polymorphism, than expected under the neutrality predictions of coalescence theory. The phenotypic implications of these ILS patterns require further investigation, but suggest that the historic lack of consilience between molecular and morphological/paleontological hypotheses for the phylogenetic position of turtles may stem from the effects of retained ancestral polymorphism on phenotypic traits. By establishing the relationship of ILS to tree parameters such as branch length, and ultimately to the genotype-phenotype map, conflicting patterns of morphological expression in early amniote fossils might be reinterpreted as congruence within an increasingly sophisticated evolutionary theory.

Funding Sources NSF award to GSB: 1947001

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Reinvestigation of the auditory bulla and postcranium of the *Plesiadapis* genus and its implications for the phylogenetic affinities of plesiadapiforms

Toussaint, Severine L.[1], Godinot, Marc[2], LADEVEZE, Sandrine[1]

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Plesiadapiforms were a successful group of eutherian mammals that thrived during the Paleocene and early Eocene across North America, Europe, and Asia. Although their paleoecology and functional adaptations are increasingly well understood, their phylogenetic relationships within Euarchonta, particularly with Euprimates, remain debated. Recent cladistic analyses have supported the Euprimateformes hypothesis, placing Plesiadapiformes as stem primates based on cranial, dental, and postcranial traits. Specifically, it proposes that the superfamily Plesiadapoidea shares a common ancestor with Euprimates, characterized by grasping-related pedal adaptations, such as a nail-bearing hallux, and an auditory bulla formed by the petrosal bone. Within Plesiadapoidea, *Plesiadapis* is one of the best-known genera, especially *P. tricuspidens* from the late Paleocene localities of Berru and Cernay in France, known from numerous postcranial elements and well-preserved skulls. Another species, *P. insignis*, is also represented by exceptionally complete

imprints of postcrania from the late Paleocene Menat Basin (central France). However, these remains have not been used in previous phylogenetic analyses, and key synapomorphies supporting the Euprimateformes hypothesis, such as foot and auditory features, have so far only been identified in another genus, *Carpolestes*. This study re-evaluates the *Plesiadapis* genus by focusing on anatomical regions central to the debate on primate origins: the auditory region (petrosal bulla and arterial pathways) and limb morphology (hand and foot features). We applied high-resolution X-ray computed tomography to the complete Pellouin skull of *P. tricuspidens*, and reflectance transformation imaging (RTI) to the four imprints of articulated postcranial elements of *P. insignis*. Our analyses reveal that the auditory bulla of *Plesiadapis* is not petrosal-derived and that its first pedal digit bears a claw, not a nail. Incorporating these new data into the most recent character matrix for early euarchontan relationships does not support the Euprimateformes hypothesis, but instead a sister group relationship of Plesiadapiformes and Euprimates.

Funding Sources UMR 7207

Technical Session X: Paleontological Practices (Friday, November 14, 2025, 8:00 AM)

Race to adapt: engaging diverse public audiences with vertebrate responses to climate change via interactive media and field-based learning

Townsend, K.E. B.[1,2], Thompson, Lisa[2], Clifford, Casey[2], Friscia, Anthony[3], Murphey, Paul C.[4], Stroik, Laura[5], Higgins, Pennilyn[6], Kumpf, Amber[7]

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We developed a multifaceted outreach initiative to engage public audiences with vertebrate paleontology and climate change, anchored in fossils from the Uinta Formation, Uinta Basin, Utah. Central to the effort is a video interactive (Race to Adapt) that allows users to guide two types of mammals through warming events to assess how different species adapt to either slow- or fast-paced rates of climate change. The 'game' draws on real paleontological and paleoenvironmental data to make evolutionary principles and extinction risk both tangible and urgent.

The interactive component of our outreach initiative went through extensive prototyping with museum visitors and is a useful model to gather back-end analytics, as it provides specific real-time data that can be utilized to assess the educational impact of our project's main research goal: evaluating vertebrate response to a rapid warming event. In the 10+ months that the interactive has been installed at the Natural History Museum of Utah (NHMU), this multi-level, multi-character 'game' has had 21,908 sessions, with 44.3% percent of players finishing all three levels of the interactive. This is a high play-through rate for a three-minute experience in a busy museum environment and is an excellent indicator that visitors find it engaging.

To expand our impact, we also created a field course targeting non-STEM majors at the University of California, Los Angeles (UCLA), and an exhibit at a local Michigan community college science museum. UCLA students went to fossil localities, where they explored how vertebrates in Utah's past responded to climate change. A Utah mammals 'past and present' exhibit will be unveiled at the John Bartley Science Museum, Muskegon Community College, in September 2025. Complementing these efforts, NHMU developed a teaching box on Utah's past and present mammals, which has been distributed to regional educators as a

hands-on classroom resource. NHMU teaching boxes reach approximately 850 students each year. Importantly, since 2021, we have mentored 60 students in field and laboratory settings.

Our project is novel within the paleontology community for its combination of museum gaming, informal and formal learning, and integration of paleontological data into systems-thinking frameworks. By blending digital tools, field-based education, and teaching kits, we provide a scalable model for increasing public understanding of vertebrate paleontology in the context of global climate change.

Funding Sources National Science Foundation-EAR Awards: 2011695 (Townsend), 2011741 (Thompson), 2011677 (Friscia), 2011685(Stroik), 2011698(Murphey). Interactive designed by Thought Den.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Methodological approaches to microfossil data collection: sorting vs. CT-scanning

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Vertebrate microfossil assemblages are key study systems that reveal ecosystem heterogeneity in time and space and more accurately depict faunal diversity than macrofossil collections alone. As a result, these assemblages provide a robust panorama of the past. Ensuring that these studies follow accurate and consistent sampling parameters (i.e., fossil composition, locality, depositional setting) is crucial to account for said species diversity and interactions, and for potential changes in ecological measures such as ecosystem evenness. Historically, these collections have heavily relied on material that is obtained through surface collection, identification and excavation of productive layers, and subsequent screenwashing. After collections are made in the field, this material is then sorted under a microscope to recover microfossil elements. These sorting methods, however, are subject to human error and alteration in the process of screenwashing, which can break apart fragile material. Here, we test the effectiveness of microfossil data collection using micro-computed tomography (micro-CT) scanning of compact rocks and comparing these results to data that has been collected using the well-established sorting method through loose sediment.

The material used for this comparative study (both loose sediments and consolidated sedimentary rocks) was recovered in situ from the Maastrichtian deposits of the Lance Creek Formation in southeastern Wyoming. Specifically, this study examines rock and sediment from an established vertebrate microsite that is preliminarily interpreted as a high-energy fluvial deposit. Using equal weights of compact rock vs. loose sediment, we quantified a few key variables: 1) identifiable elements (i.e., element richness and diversity), 2) preservation status (i.e., partial or complete), and 3) taxonomic diversity across both sets of sampling. Our comparisons reveal 1) identifiable elements were more abundant in sorted sediment–including more fragile material such as cranial elements; 2) preservation was similar between sampling methods; and 3) taxonomic richness was higher in sorted sediment. These results suggest that, at least for vertebrate microsites preserved from higher energy systems, like the one reported here, traditional sorting and picking remains a preferable option.

Future work will investigate if similar trends apply to lower energy systems, where preservation of material may be more intact prior to fossilization.

Funding Sources David B Jones Foundation; National Science Foundation GRFP 2024377938.

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

Emergent network properties link phenotypic modules to ecomorphological divergence in the skulls of carnivoran mammals

Tseng, Z. Jack[1,2], Grohé, Camille[3,2], DesRocher, Bailee[4], Waldman, Emily[5], Flynn, John J.[2,6]

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The skull is the skeletal core of a multicomponent, multifunctional system that controls organismal activities. In particular, a common set of skeletal modules is known in mammal skulls and is correlated to developmental and functional compartmentalization. However, it is unclear to what extent these modules further organize into, and evolve as, higher-level networks. Using extant carnivorans as a study model, we show that mammalian skull modules represent a topological network, where inter-module connectivity correlates with spatial proximity. Deviations from this general pattern are linked to evolutionary convergence. Terrestrial and aquatic species show accelerated sensory and masticatory module evolution and reduced network linkages compared to above ground species. Extreme feeding ecologies show accelerated sensory and masticatory module evolution yet dissimilar networks. Despite common topological network-like organization of skull elements, macroevolutionary recombination can generate functional networks that link significantly to ecological adaptations. More generally, mammal skull elements exhibit emergent network properties as multi-dimensional form-function linkages on which evolution may act. These findings provide a macroevolutionary framework with which to study complex form-function linkages in the paleontological record.

Funding Sources NSF DEB-1257572 (J.J.F., C.G., Z.J.T., and B.D.), AMNH Frick Postdoctoral Fellowship (C.G. and Z.J.T.), DBI-2128146 (Z.J.T.).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New material of an ornithomimid (Theropoda, Ornithomimosauria) dinosaur from the Upper Cretaceous Kaiparowits Formation of Utah reveals hidden diversity

Tsogtbaatar, Chinzorig[1,2], Titus, Alan L.[3], Sertich, Joseph J.[4,5], Knoll, Katja[6], Zanno, Lindsay E.[1,7]

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The Western Interior Basin (WIB) of Laramidia is well-known for its exceptionally diverse and well-preserved Campanian floral and faunal record, which extends from northern Mexico to the northern slopes of Alaska. One of the richest WIB assemblages stems from the Kaiparowits

Fm of southern Utah, deposited approximately 77.3 Ma to 73 Ma. Ongoing study of Kaiparowits Fm vertebrates has revealed a taxonomically unique and speciose ecosystem dating to ~76.5–75.5 Ma typified by multiple cohabiting clades of megaherbivorous ceratopsians, ankylosaurs, and hadrosaurs, megapredatory tyrannosaurs, and an ample, albeit fragmentary, maniraptoran record. Despite representing one of the most abundantly preserved theropod clades in the formation, to date, the taxonomic diversity of Kaiparowits Fm ornithomimosaurs remains poorly resolved. Multiple partial skeletons preserving portions of the axial column, pelvis, and hindlimbs of Kaiparowits Fm ornithomimosaurs are known (e.g., MNA. PI. 1762A, UMNH VP 20188, RAM 6794), and a plethora of more fragmentary materials have been recovered, including an associated manus (UMNH VP 16386) and a poorly preserved partial skull (UMNH VP 30412). However, the lack of overlapping fore- and hind limb materials and ontogenetic control has complicated attempts at characterizing the identity and diversity of this assemblage. Here, we report a new, small (femur length ~32 cm, body mass ~57 kg) ornithomimid specimen (TAB-22-2) from the Kaiparowits Fm at the Grand Staircase-Escalante National Monument. The specimen was recovered from a winnowed bank collapse deposit within a channel system very low in the informal middle unit, which constrains its age to approximately 76.4 Ma. Recovered materials include partially articulated mid-caudal vertebrae, the proximal half of the right humerus, a complete right femur, an articulated left metatarsus, and pedal phalanges. The arctometatarsalian pes displays a mosaic of primitive and derived traits, including the absence of pedal digit I and ventrally flattened, slightly recurved pedal unguals. Length ratios of the metatarsus are distinct from MNA. PI. 1762A, and are more similar to deinocheirids, despite the relatively diminutive size of the specimen. The new specimen, when coupled with new data from the skull UMNH VP 30412, provides key information on the anatomy and systematics of ornithomimosaurs, revealing hidden diversity within the Kaiparowits Fm and the Campanian dinosaur assemblages of the WIB.

Symposium: Multidisciplinary approaches to skull function & evolution (Saturday, November 15, 2025, 1:45 PM)

Developmental biology shedding light on evolution of the mammalian ear

Tucker, Abigail S.[1], Johnston, Stephen[3], Renfree, Marilyn[2], Anthwal, Neal[1]

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The mammalian ear has several unique characteristics, including a three-ossicle middle ear, deep ear canal, and coiled cochlea. The changes in the middle and external ear are closely linked to the evolution of a new secondary jaw joint between the dentary and squamosal bones during mammal evolution. This new joint freed up the original reptilian jaw joint to play a later role in hearing, ultimately creating the unique mammalian three-ossicle middle ear. A wealth of information on this transformation has been revealed in the fossil record from mammaliaforms such as *Morganucodon*. A complementary line of evidence has been to study extant marsupials and monotremes, where, due to altricial birth, elements of the middle ear play a role in jaw support during early life. In these mammals, the formation of the dentary-squamosal jaw joint, repurposing of the middle ear bones, and creation of a functional ear can be followed in neonates to shed light on the mechanisms that might have driven such transformation during the evolution of mammals.

By analysis of rare postnatal echidna and platypus samples, compared to mouse and opossum, we have followed the transformation of the ear using microCT, histology, and analysis of protein expression. We show that in both extant monotremes, a double jaw joint, functions during development. In both, Meckel’s cartilage persists past postnatal day 50, providing a physical connection between the jaw and the ear.

This connection is removed by the activity of clast cells, freeing the malleus and incus at the end of Meckel's cartilage and allowing them to move to a role in hearing. Cavitation of the middle ear space then occurs to allow the ossicles to vibrate, with retraction of the mesenchyme as the middle ear expands, and formation of an eardrum. In mammals, the eardrum sits at the end of a deep canal, in contrast to the shallow or non-existent canal of other land vertebrates. We show that the deep canal is supported by rings of cartilage in both therians and monotremes, highlighting this as a conserved feature of mammals. The canal is initially closed in the mouse, human, echidna, and opossum, but the central cells undergoing cell death to create an open tube terminating in the eardrum. The study of the cranial region of echidna and platypus neonates fills a gap in our understanding of mammalian ear evolution and highlights the strength of a developmental biology approach to reveal the mechanisms that underpin mammalian novelties.

Funding Sources NERC: Eat, heat and listen: on becoming a mammal

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The earliest fossil evidence of stem polypterids

Tumelty, Molly[1,3], Giles, Sam[1,2], Igielman, Ben[1]

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Actinopterygians diversified significantly in the early Carboniferous following the end-Devonian mass extinction. Crown actinopterygians originated on the Devonian-Carboniferous boundary and today make up ~50% of vertebrate species. The earliest diverging group of actinopterygians are the Polypteriformes, but their fossil record only stems back to the Triassic, despite molecular clock divergence estimates predicting a late Devonian-early Carboniferous origin. Many Palaeozoic actinopterygians have been assigned to 'waste-basket' genera, meaning that their evolutionary position is not fully understood. Redescribing species in these genera using modern techniques like CT scanning is crucial in understanding more about evolutionary relationships of early actinopterygians. Here, a Carboniferous specimen originally assigned to the problematic genus *Elonichthys* is redescribed. The 3D preservation of this specimen reveals its internal cranial anatomy with features like the lateral ectopterygoid process and the morphology of the hyomandibula suggesting an affinity to polypterids. This extends the fossil record of polypterids back by around 70Myr, filling in a conspicuous gap in the early history of this group. Beyond its evolutionary position, the presence of many large, pointed teeth and short, widely-spaced gill rakers in *Elonichthys caudalis* indicates that it was an active predator. Continued focus on the redescription of ray-finned fishes will reveal more about their evolution and diversification throughout the Carboniferous. More specifically, this work further develops the understanding of evolutionary relationships between actinopterygians, enables more accurate estimations of divergence timings between groups, and provides evidence on the feeding styles of fish during that period.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Reconstructing body size of extinct crocodilians based on skeletal remains

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Body size is associated with nearly every aspect of an organism's biology, and estimation of size in extinct animals is regularly used to characterize their life histories. Prior studies have examined correlation of total body length (TL) to skeletal measurements in the American alligator (*Alligator mississippiensis*), with some measurements being better predictors of total length than others. Femur length (FL) has been found to be tightly correlated with total body length in *A. mississippiensis*, and this relationship has often been used to estimate the body size of extinct crocodilians. In this study, we examine correlations of other limb elements (humerus, radius, ulna, and tibia) with TL in a large sample of modern *A. mississippiensis* and their utility for body size estimation of extinct crocodilians. This new approach expands the tool kit available to paleontologists and will enable total length estimation for some extinct crocodilians known from fragmentary remains. Results show multiple limb elements are effective proxies for estimation of size. Application of regression equations to fossil *Alligator* sp. from the Pliocene age Gray Fossil Site of Tennessee and *A. olseni* from the Miocene of Florida yield estimates of 1500–2500 mm and 1750–2250 mm, respectively. These estimates suggest a smaller size relative to modern alligators in North America. In the future, this new approach will be used to estimate the size of a wide range of extinct crocodilians, which will facilitate studies of their evolution.

Funding Sources ETSU Department of Geosciences, The Don Sundquist Center of Excellence in Paleontology

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Revisiting *Lapillopsis nana* from the Triassic Arcadia Formation of Central Queensland, Australia

Turner, Ashlea M.[1,2], Sherratt, Emma[4], Witzmann, Florian[3], Konovalov, Dmitry[1], Bevitt, Joseph[5], Hoskin, Conrad[6], Knutsen, Espen[2,1]

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The Triassic Arcadia Formation (Rewan Group, Bowen Basin) yields exciting specimens every year, yet some historic taxa remain poorly understood. A tiny, endemic fossil amphibian, *Lapillopsis nana* from QML 78 "The Crater" (Central Queensland) was described from complete crania and some postcranial bones in 1990 and was initially recognized as a dissorophoid temnospondyl, like *Micropholis*. Now accepted as a stereospondyl of various and usually basal positions, like other miniaturized tetrapods it continues to pose a challenge for taxonomists. Several specimens have since been referred to *L. nana*, and more recently others into a family of its namesake, Lapillopsidae. While monophyly is often supported, more recent material is less complete, and similarities often recover them in clade or basal polytomy with another stereospondyl, *Lydekkerina*. Most material being cranial, fragmentary, or obscured by hard matrix, directly examinable material provides less than 25% character coverage for this taxon in recent phylogenetic datasets. With the retention of some basal traits in this Triassic-age macrofaunal stereospondyl, *L. nana* tends to destabilize phylogenetic outputs, creating uncertainties regarding its affinities. This project reviews type material held in the Queensland Museum collections and tests the validity of referred and related material. Using Australian Synchrotron CT scans segmented by an internally developed deep learning model, many features obscured by matrix can now be assessed. Preliminary findings indicate that some referred specimens differ distinctly from type material, in both cranial morphology and

the shape of the anterior cultriform process of the parasphenoid. As the family Lapillopsidae was initially erected based on this referred material, a revision of the clade, diagnostic criteria and nomenclature is needed. Furthermore, during digital curation of type and referred material, unpublished and substantial postcranial holotype material was discovered. New data from CT scans and the recently discovered postcranium for *L. nana* and other lapillopsids will be incorporated into a refined character data matrix for analyses using TNT, reducing the influence of problematic characters. This work indicated higher amphibian diversity in the Arcadia Formation than previously appreciated and illustrates the value of revisiting historic collections where new methodologies such as synchrotron CT imaging can reveal previously unknown data.

Funding Sources PhD Position: Australian Government RTP, JCU Research Scholarship.

Beam Time: ANSTO Synchrotron Annual Grant Rounds var.

Field Work: Queensland Museum Network.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Bite at the end of the tunnel: a review of the taphonomic effects of large marsupial carnivores from Pleistocene Australia

Turner, Nerita K., Reed, Elizabeth H.

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Large marsupial carnivores played an important role in the accumulation and modification of vertebrate fossil deposits in Pleistocene Australia. Like all agents of accumulation, these carnivores may introduce biases to the fossil deposits they accumulate or modify. A thorough understanding of the paleontology and taphonomy of these deposits is needed to properly understand these biases. Numerous studies have been undertaken on the paleontology and taphonomy of Pleistocene fossil deposits and actualisitic samples accumulated or modified by large marsupial carnivores from Australia. However, no adequate attempts have been made to review or compile this research. Consequently, it has been difficult to identify trends in the data from these deposits and compare them to deposits accumulated by other agents. To address this, we reviewed the literature on the taphonomy and paleontology of fossil sites and actualistic samples accumulated or modified by four large marsupial carnivores that inhabited Pleistocene Australia—*Sarcophilus* spp., *Dasyurus* spp., *Thylacinus cynocephalus*, and *Thylacoleo carnifex.* The review included journal articles, book chapters, conference proceedings, and theses and was supplemented with data from our own study of carnivore-accumulated fossil deposits from South Australia. Our aims were to report on the current state of research into Australian carnivore taphonomy and compare it to research from other continents, and to produce a database of taphonomic and palaeontological data related to Australian carnivore activity and summarise these data. Our analysis indicates that taphonomic research on Australian carnivores, particularly actualistic research, is less extensive than research on non-Australian taxa. Evidence of carnivore activity is most commonly identified within shallow cave and rock shelter deposits and is most commonly attributed to *Sarcophilus* species. Tooth marks and high degrees of fragmentation are common features of carnivore-accumulated and -modified fossil deposits and tooth marks are a common focus of actualistic studies. By collating the reviewed research into a single source, this review will allow researchers to familiarize themselves with the Australian carnivore taphonomy literature and the current state of research. It also highlights knowledge gaps and avenues for future research, particularly in the field of actualistic carnivore taphonomy.

Funding Sources Australian Research Council Linkage project LP160101249

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Sharks of the English Chalk (Upper Cretaceous); extracting new data from classic collections

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The iconic white coccolith chalks of southern England represent one of the first rock units to be systematically collected for fossils, with large collections of fossils being made from the cliffs and quarries from the early 19th century . These collections were instrumental to the development of palaeontology as a science by the likes of Gideon Mantell. Notable amongst these fossils are teeth and rare skeletal remains of sharks. Whilst uncommon, dark and shiny fossil shark teeth are conspicuous against the white matrix and were easily collected by commercial collectors and quarry workers, whilst there general rarity has limited subsequent collections from sea cliffs and other long term exposures. As a result of this collection, a number of genera were first described on Chalk material. Whilst substantial museum collections were built up over the years, these were typically poorly located stratigraphically and/or geographically, often localised only to a local town, whilst many quarries spanned numerous biozones over several stages. In addition, sharks were historically grouped into a number of "wastebasket" species.

Largely ignored for a century, we have been studying the sharks of the Chalk, focusing on their taxonomy, evolution, and palaeoecology, as part of an extensive study of Chalk sea palaeoenvironments. Nannofossils extracted from the matrix of specimens have allowed many fossils to be dated with considerable precision. This has allowed the study of ecological changes of shark faunas through time, and especially across the Cenomanian-Turonian boundary. Dramatic changes in both diversity and maximum size are recorded within both *Ptychodus* and other lamniforms, allowing correlation of ecological events across trophic groups.

Re-evaluation of the specimens also allows a new insight into their taxonomy. The development of a new taxonomic framework for some groups (such as the Anacoracidae) has allowed hitherto unrecognised species diversity to be recorded. As a result, new life has been breathed into these old collections, revealing the host of data that they contain, including new species that have been hiding in plain sight for 200 years.

Funding Sources NERC, "The evolution of Chalk Sea ecosystems: biodiversity, resilience and ecological function in a warming world"; funding via Imperial College MSc projects

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Barren slopes and teeming rivers; the aquatic-based ecosystem of the Kem Kem deposits (mid Cretaceous, Morocco)

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The sandstones of the Kem Kem Group (mid-Cretaceous) of eastern Morocco are globally famous for their diverse aquatic and amphibious vertebrates, and also for the curious paucity of herbivorous dinosaurs despite the abundance of large theropods.

Whilst there are numerous publications on the fish and tetrapods of the Kem Kem, these are almost all based on macroscopic material, often poorly located and purchased from local collectors. In contrast, there has been little study of the smaller material collected by systematic sieving. In addition, the sedimentology is poorly known, especially in the northern part of the area.

Bulk sampling of numerous fossiliferous sites has revealed that fish strongly dominate all assemblages, and whilst remains of small teleost fish remains are extremely common, numerous species of hybodont and neoselachian sharks are also present. Tetrapods are not only represented by the well-known dinosaurs, crocodilians, and chelonians, but also by common remains of small snakes, frogs, and salamanders where taphonomic conditions are favourable. By contrast, fossils of mammals, lizards, ornithischians, and very small theropods appear to be largely absent. The assemblage therefore not only lacks herbivorous dinosaurs except rare sauropods, but also almost all small facultatively terrestrial taxa other than medium to large theropods.

Sedimentological data suggests that the south of the area comprised arid, steep-sided valleys unsuitable for many herbivorous dinosaurs, with the valleys containing with powerful rivers full of predators, overall presenting a hostile environment for small land-based vertebrates. To the north, vast braided systems and local lakes and ponds with an arid hinterland were again unsuitable for small terrestrial taxa.

The greater abundance of 'blade toothed' theropods than land based dinosaur prey taxa suggest that all of the larger carnivores, whether morphologically adapted for an amphibious lifestyle or not, were part of the rich aquatic-based ecosystem and not the impoverished fauna of the steep and arid land outside the river valleys.

Funding Sources Various small funds spanning 20 years, especially Birkbeck small grants and student fieldclasses.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

When and how did the propatagial structure evolve in the lineage towards birds?

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The establishment of the avian wing was one of the largest morphological changes in tetrapod evolution. So far, paleontological studies have revealed the gradual evolution of wing structure, including the change in skeletal morphology from the forelimb to the wing and the acquisition of flight feathers in pre-avian and early birds, and their developmental bases. However, the evolutionary process of the propatagium and propatagial muscle that connects the shoulder and wrist remained unclear. To solve this problem, we used paleontological and evolutionary-developmental approaches. First, we statistically analyzed elbow joint angles in articulated fossil skeletons of diapsids. We found that angles of elbow joints in fossils are indicators of the propatagium in extant lineages of diapsids, and then used this relationship to narrow down the phylogenetic position of acquiring the propatagium to the common ancestor of maniraptorans. Second, based on direct observations of selected maniraptoran fossils, we found a hitherto unknown soft tissue attachment site on coracoids, which likely corresponds to the muscle attachment site for the propatagial muscle. These two lines of evidence suggest the propatagial structure first evolved within non-avian dinosaurs, before the origin of powered flight. In the evolutionary-developmental approach using embryos of the chicken and outgroup taxa, we rationalized that the propatagium likely evolved through the suppression of programmed cell death along the cranial edge of the limb bud. In addition, we confirmed that in the examined taxa, most forelimb muscles develop in a shared topographical pattern, and found that in the chicken, the propatagial muscle subsequently arises by recruiting cells derived from parts of the four separate developing muscles, in association with the hypertrophied dermis along the cranial edge of the propatagium. There are no tendon progenitor cells associated with the propatagial muscles, suggesting that this skeletal muscle evolved as subdermally developing muscles without establishing de novo muscle-tendon-skeletal connections. The evolution of

the propatagial structure is likely underpinned by suppression of cell death and changes in dermal tissue at the cranial edge of the limb bud, which may have developmental relevance to other avian characteristics, including digit patterning and the positional specification of the flight feather during embryonic development.

Funding Sources JSPS KAKENHI Grant nos. 17H06385, 19K04061, 22H01341, 24KJ0675 and 25H01422; Sasakawa Scientific Research Grant no. 2022-5036

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

A new structural model for the flight patagia of pterosaurs

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The structure of the flight membranes, a unique innovation that underpinned the evolutionary success of pterosaurs, has been investigated and debated for more than a century. The current model, primarily founded on exceptionally well-preserved examples of *Rhamphorhynchus*, has been widely, though not universally, accepted for the last two decades but reassessment of the fossil evidence shows that the model is flawed in several respects. Natural and UV light photography and microscopy was used to compile data from 80+ specimens of pterosaurs from the Upper Jurassic Solnhofen Limestones of Germany in which wing membranes are preserved, including examples of *Anurognathus*, *Rhamphorhynchus*, *Scaphognathus*, *Pterodactylus*, *Aurorazhdarcho*, and *Ctenochasma*. Synthesizing this data yielded a new model for the pterosaur flight patagium which was bounded dorsally and ventrally by a thin, continuous, smooth epidermis lacking any evidence of surficial structures such as pycnofibres. Aktinofibrils, the most frequently preserved patagial elements, were hollow, in *Rhamphorhynchus* at least, composed of collagen and present throughout the flight patagia though varying in stiffness and degree of packing. In all specimens where they are preserved aktinofibrils always exhibit the same geometry: aligned subparallel to limb bones and near orthogonal to free margins. Elastic fibres (previously interpreted as muscle fibres but lacking diagnostic features of these tissues), preserved in multiple examples of *Rhamphorhynchus*, were widely spaced across the patagia and, when the wings were fully extended, oriented near perpendicular to aktinofibrils. These two structural types acted together to form a functional network. Free margins of the patagium had a thickened edge further reinforced by fibres, possibly homologous with aktinofibrils, running parallel to the margin. The patagia also contained a complex and extensive vascular network. This new model includes elements of older models but is distinguished by several unique features, most notably the aktinofibril-elastic fibre network. This dynamic structure, and its consequences for the mechanical properties and performance of the wing membranes, was fundamentally different from the functionally passive model based on aktinofibril dominated wings. Critically, it facilitated precision control of the three-dimensional geometry of individual patagia that, acting in cohort, would have permitted complex and sophisticated modes of flight.

Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

A new *Haplocanthosaurus*-like sauropod dinosaur from the Morrison Formation of Utah, and its implications for the origin of Diplodocoidea

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The Late Jurassic Morrison Formation sauropod dinosaur *Haplocanthosaurus* is problematic because, despite being known from c. 11 partial skeletons, it has a labile phylogenetic position. Over the past three decades, this taxon has been placed as: lying just outside Neosauropoda; an early-branching macronarian; or an early-branching diplodocoid. One of the best preserved *Haplocanthosaurus*-like specimens (Utah Field House of Natural History Museum FHPR 1106) was discovered in the Salt Wash Member of the Morrison Formation on Split Mountain, eastern Utah, in 1999. FHPR 1106 preserves a tooth, portions of the neck and trunk, and nearly complete sacrum, tail, and appendicular skeleton, making it c. 62% complete. This specimen was added to a recently revised and augmented phylogenetic data set comprising 794 characters and 132 taxa—one of the largest data sets for sauropods currently available. Analyses using TNT, under a range of protocols (e.g., equal weights parsimony [EWP], extended implied weighting with an array of different K values), typically place *Haplocanthosaurus delfsi*, *H. priscus* and FHPR 1106 as successively closer sister taxa to other diplodocoids. This result, when combined with the c. 20 autapomorphies in FHPR 1106 (many of which are absent in other *Haplocanthosaurus* specimens), suggests that a new species or generic name may be needed. Although some EWP analyses place *Haplocanthosaurus* specimens as early branching macronarians, none support a position outside Neosauropoda. Difficulties stabilising the phylogenetic relationships of *Haplocanthosaurus* are driven less by missing data than by the possession of a combination of 'traditional' diplodocoid and macronarian features. For example, FHPR 1106 has a slender subcylindrical tooth crown, short cervical ribs and a low humerus: femur length ratio of 0.71 as in many diplodocoids, combined with the coplanar distal ischia and proximally open and non-forked chevrons of Macronaria. The possession of such macronarian features in an early branching diplodocoid implies considerable reversals in later-branching forms such as flagellicaudatans, often resulting in the re-acquisition of eusauropod symplesiomorphies. The evolutionary forces driving these patterns are currently unclear, but are potentially related to the acquisition of lower-level browsing strategies and associated reductions in relative body size (adult lengths of c. 10 m) that characterise the early phases of diplodocoid evolution.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Tooth morphology of *Pepesuchus deiseae* (Itasuchidae: Notosuchia), a Late Cretaceous crocodyliform from south-central Brazil

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The Bauru Basin, located in the central to southeastern portions of Brazil, is notorious for its diverse Late Cretaceous fossil record, specially its wide variety of crocodyliforms. One such species is *Pepesuchus deiseae*, an itasuchid found in Presidente Prudente Formation, São Paulo state, Brazil. Here, we redescribe its tooth morphology, based on five isolated teeth associated with cranial remains, housed at the Laboratório de Paleontologia de Ribeirão Preto, Universidade de São Paulo (LPRP-USP). All teeth were scanned at a GE Phoenix v|tome|x S240 µCT-scanner and segmented using the software Amira 5.3.3. The enamel surface was analyzed using a DigiLab - DI-106T with a 4K camera stereomicroscope. Four teeth are conidont, with a semicircular cross section, and one is folidont, with a lenticular cross section. All teeth can be characterized as "false ziphodont", with both mesial and distal carinae presenting crenulations. The enamel presents an anastomosed pattern, with flutes extending along the labial and lingual surfaces. Most teeth are

incomplete, with fractured root, crown, or sometimes both. The tooth with the most complete crown measures 22.52 mm from the cervix to the apex. The only complete tooth is the folidont one, with some fractures distributed throughout its surface, measuring 28.32 mm from the base of the root to the apex of the crown.

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Colbert Prize Session

Functional evolution of the archosaurian neck and the origin of the avian S-curve

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The amniote neck evolved to support extensive mobility, contributing to both functional versatility and ecological diversification. Among amniotes, extant birds exhibit an S-shaped neck with multiple flexion points, along with considerable variation in cervical vertebral count and morphology, enabling a wide range of foraging and feeding strategies. While the flexibility of the avian neck has been extensively studied from functional and behavioral perspectives, the evolutionary transitions that led to this mobility remain poorly understood. In this study, we analyzed the ratio of lever lengths (RL) for the epaxial musculature as a proxy for joint rotational efficiency to infer the functional capabilities of the cervical vertebral column. RL values were calculated across the presacral series in both extant and extinct archosaurs. In extinct taxa, we additionally conducted a geometric morphometric analysis to identify morphological subregions of the neck based on intraspecific variation among cervical vertebrae.

Our results show that both extant crocodilians and birds exhibit high RL values near the skull and at the cervico-thoracic transition, suggesting shared functional zones at these locations. However, only birds display an additional region of elevated RL values in the mid-posterior cervical series, which corresponds to a morphologically distinct subregion absent in crocodilians. This bird-specific subregion likely contributes to the enhanced cervical flexibility seen in modern birds. Among extinct taxa, RL distributions and cervical morphology similar to those of crocodilians are observed in pterosaurs and ornithischian dinosaurs. In contrast, saurischian dinosaurs, such as sauropod sauropodomorphs and maniraptoran theropods (excluding Therizinosauria), show elevated RL values in the mid-posterior neck, paralleling the pattern seen in birds. These findings suggest that avian-like neck flexibility evolved independently in multiple archosaur lineages and that the S-shaped, flexion-rich cervical architecture characteristic of modern birds may have originated within Maniraptora.

Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Long bone development in the stem tetrapod *Gogonasus*

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Tetrapod appendicular bones are called long bones because they are elongated in almost all existing taxa. The process of elongation results from the development of the growth zone located in the metaphysis, i.e., the region between the shaft and each joint. However, the appendicular bones were short and non-cylindrical in the first stem tetrapods. We do not know whether they had a growth zone and whether it functioned in the same way as the

growth zone in modern amniotes. To answer this question, we conducted a microanatomy and bone histology analysis of the humerus of a basal stem tetrapod, *Gogonasus*, in order to understand the origin and evolution of long-bone development in stem tetrapods. *Gogonasus* is the only known stem tetrapod from the Gogo Formation of Gogo, Western Australia, dating to ~384-380 Mya (Late Devonian). Scans of specimen NMV-P221807 were taken with a voxel size of 1.44 and 3.15 microns at the European Synchrotron Radiation Facility (Beamline ID19). They reveal a thin cortex surrounding well-developed trabeculae, which are denser in the metaphyseal regions, thereby suggesting the presence of a growth zone. Along with the presence of calcified cartilage and chondrocyte lacunae, these observations support an endochondral origin of the humeri as in other more crownward stem tetrapods. Tubular trabecular structures that resemble bone marrow processes run through the metaphyseal regions. These processes are shorter, less numerous, and more highly anastomosed than in *Eusthenopteron*. This suggests that the growth zone was likely organized in longitudinal columns as in extant tetrapods. The remnants of Katschenko's line in the form of calcified cartilage and chondrocyte lacunae adjacent to the inner surface of the cortex suggest the original cartilaginous rod had expanded significantly before bone deposition started. Lines of arrested growth show that this individual was likely over 3 years old but still a juvenile. This study demonstrates that *Gogonasus*, as a basal stem tetrapod, appears to share many appendicular features with more derived tetrapods, such as the presence of a growth zone forming columns of trabeculae of endochondral origin. However, the broad truncated morphology and restricted spatial distribution of the marrow processes in *Gogonasus* support the hypothesis that these marrow processes could not have contributed to limb support, unlike in more derived stem tetrapods.

Funding Sources ERC (LimbEvolution - 101126181)

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

New insights into the morphology and paleoecology of *Kawas benegasorum*, an enigmatic fossil seal from the Puerto Madryn Formation (Tortonian), Patagonia.

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Kawas benegasorum is an enigmatic, extinct seal species known solely from an incomplete, partially articulated skeleton (MPEF-PV 601) found in the Puerto Madryn Formation, Peninsula Valdés, Patagonia, Argentina. Initially identified as a member of Phocinae (Northern Hemisphere seals), *Kawas* represented the first and only documented occurrence of this subfamily in the Southern Hemisphere. However, recent studies challenge this classification, proposing *Kawas* may be a stem phocid or a member of Monachinae, with affinities to extinct seals from Chile, Peru, and South Africa. The preserved gut contents in the holotype of *Kawas benegasorum* also make it one of the few fossil marine mammals with direct dietary information. Thus, *Kawas* offers crucial data that challenge traditional views on seal biogeography and evolution. However, uncertainties surrounding its stratigraphic origin and the absence of a comprehensive analysis of its comparative morphology and stomach contents have limited its contribution to the understanding of phocid evolutionary history and paleoecology. Here, we address these gaps by revising the stratigraphic context of the *Kawas* holotype and describing its preserved remains, including postcanine dentition, postcranial skeleton, and stomach contents. The fossil-bearing level consists of bioturbated, muddy sandstones that accumulated in an inner platform environment, with an estimated age of approximately 9 to 10 Ma (Tortonian). *Kawas* exhibits a mosaic of morphological postcranial characteristics, exhibiting affinities with phocids

from both the Northern and Southern hemispheres. Specifically, *Kawas'* dental morphology aligns with that of extinct Monachinae. Furthermore, analysis of the stomach contents indicates a piscivorous diet, favoring coastal and bottom-dwelling prey, similar to the dietary preferences of eared seal species currently inhabiting the area. These findings enhance our understanding of *Kawas*' morphological and ecological traits, enriching knowledge of fossil seal diversity along the western South Atlantic coast and illuminating the evolution of seals in the Southern Hemisphere.

Technical Session VIII: Mammalian Ecology & Biogeography (Thursday, November 13, 2025, 1:45 PM)

Evidence for deep-time clade interactions in the diversification of Cenozoic carnivores and artiodactyls

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Understanding what drives patterns of biodiversity through time is a major challenge in palaeontology and can inform us about ecological and environmental factors that shape ancient and modern ecosystems. The Cenozoic was a period of extreme changes in global climate and vegetation, and previous work has shown that these changes had large impacts on mammal diversity. For example, faunal turnover in Western Europe was driven by Eocene–Oligocene environmental disruptions. However, diversity dynamics in living systems are shaped by complex factors, including the environment and interactions between species. The impact of clade interactions is much more poorly understood on geologic timescales, and it has been hypothesised that it may be too spatially and temporally localized to influence deep time diversity. Here, we use carnivores and artiodactyls as a case study of the deep-time evolution of groups that exhibit predator-prey dynamics through the Cenozoic. We ask: does Cenozoic diversification correlate with climate (temperature and primary productivity) and/or interaction (both within and between clades) in carnivores and artiodactyls?

To address this question, we reconstructed diversification using Fossil BAMM. This tree-based approach uses random jump Markov chain Monte Carlo to calculate speciation and extinction rates based on the phylogenies of carnivores (Extant: 314, Extinct: 1409) and artiodactyls (Extant: 98, Extinct: 411). These rates were correlated with both climatic variables (temperature and primary productivity) and with the concurrent diversity of their own and the other clade. Carnivores tend to diversify during cooler periods, while artiodactyls diversify with increased primary productivity. This highlights access to resources as an important driver of diversification for herbivores, while carnivore diversification may be more related to the metabolic effects of endothermy in colder climates. Correlations with within-clade diversity provide evidence for niche-filling in both clades, which was stronger in North American species than globally. Artiodactyl diversification negatively correlates with carnivore diversity, implying that predation pressure influences primary consumers over short and long timescales. These results demonstrate the complexity of factors affecting deep-time diversity and the importance of considering clade interactions when reconstructing macroevolutionary patterns over large geographic or temporal scales.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A fracture in the 'whip' of a *Barosaurus* tail provides possible evidence of combat use in flagellicaudatan sauropods

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Flagellicaudatan sauropods, such as *Apatosaurus*, *Barosaurus*, and *Diplodocus*, are amongst the most iconic sauropods, particularly recognizable for their long necks and extremely elongated tails. These elongated tails consisted of over 80 caudal vertebrae, of which the distal ~30 elements formed a sequence of rod-like elements, exhibiting a 'whip'-like appearance in life. Though the role and function has been highly debated, this 'whip' part of the tail has been hypothesized to be used in inter- and/or intraspecific combat.

Here, we report a pathology in the final rod-like caudal vertebra of a remarkably complete specimen of *Barosaurus* sp. The penultimate vertebra appears split transversely in the middle of the vertebra, with a rounded protuberance delimiting the fracture. The last vertebral element is unlike the preceding rod-like vertebrae, instead being hemispherical in shape. To investigate the internal structure of the protuberance and the last vertebra, both elements were scanned using micro-computed tomography. The internal structure (i.e., presence of reactive bone) of the protuberance suggests a partially healed fracture, whereby a callus formed surrounding the fracture. The final vertebra consists of strongly vascularized cortical bone, indicating that this is a legitimate osseous element that articulated with the penultimate vertebra.

Although the number of fractured 'whip'-like vertebrae appears to be low in the fossil record, preservation bias affecting the final caudal vertebrae of flagellicaudatan sauropods may lead to an underrepresentation of these pathological vertebrae. Fractured bones can have several origins, but the distinct callus formation suggests that the origin of the fracture was possibly induced by the 'whip' striking another object. We hypothesize that this may have originated during inter- or intraspecific combat, but other potential causes are not ruled out. We also show that micro-computed tomography can be an excellent alternative for paleopathology studies when osteohistological sectioning is not possible.

Colbert Prize Session

Shaping dental complexity: the role of enamel in bear tooth evolution

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Tooth enamel is the most highly mineralized tissue in mammals and, unlike bone, does not remodel after formation. Its uneven distribution across the occlusal surface often contributes to variation in tooth shape. Ursids (bears) display considerable dental diversity that reflects a wide range of feeding ecologies, from carnivory to herbivory. Especially the Pleistocene divergence of brown, polar, and cave bears provides a test case for how dental anatomy has changed in response to changes in diet. Cave bear molars are particularly notable for their broad occlusal surfaces and intricate cuspal patterns. In contrast, polar bear molars are reduced in size, with fewer occlusal features. Here we examine how much of the observed complexity changes arise from differences in enamel distribution as opposed to the underlying enamel-dentine junction (EDJ). Developmentally, differences in the EDJ are produced during the patterning stage of odontogenesis, whereas differences in enamel distribution arise later, during the secretion of the enamel matrix.

We analyzed second upper molars of bears using high-resolution μCT scanning to reconstruct both the enamel surfaces and the EDJ. Shape complexity was quantified using Orientation Patch Count (OPC), and enamel thickness was measured. We applied a nutrient-limited computational model of enamel matrix secretion and used geometric extrapolation to generate hypothetical tooth surfaces, allowing us to isolate the contribution of enamel distribution to overall surface complexity. Specimens were provided by the Natural History Museums in Finland (LUOMUS) and Denmark (NHMD).

Our results show that cave bear molars achieve their exceptional occlusal complexity not solely through EDJ geometry, but through differential enamel deposition that amplifies minor EDJ features into prominent cusps and basins. In contrast, polar bears exhibit thinner, more uniform enamel and simpler occlusal patterns—consistent with a hypercarnivorous diet. Brown bears display intermediate enamel complexity, reflecting their omnivorous habits. Overall, regulation of enamel thickness and distribution appears to have been a key mechanism in the adaptive divergence of brown, polar, and cave bears. Because enamel matrix formation is regulated more globally during individual tooth development, we postulate that changes in enamel distribution have facilitated the rapid adaptation of bear molars.

Funding Sources Doctoral Program in Oral Sciences (FINDOS), University of Helsinki; Research Council of Finland.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Fossil tests of hypotheses of competitive exclusion and geographic isolation in the evolution of gigantism in *Varanus*

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Varanus includes some of the largest extant squamates and exhibits the most extreme body size disparity of any terrestrial vertebrate genus. Gigantism in the genus has been considered to result from geographic isolation and/or the local absence of eutherian carnivores that would either prey upon, or competitively exclude, large predatory lizards, based on restriction of extant and Pleistocene giants to Indonesian islands and Australia. The fossil record provides the only historical tests of these hypotheses. However, the fossil record of *Varanus* is poorly understood. *Varanus sivalensis* is a large, enigmatic taxon known only from two vertebrae and a distal humerus fragment from the Pliocene deposits of the pre-Pinjor beds of the Siwalik Group exposed near Chandigarh in northern India. It was recovered within a diverse, abundant mammalian fossil record, and provides a unique opportunity to reconstruct community size structure for an extinct *Varanus,* and to test hypotheses of exclusion.

We estimated body size of *Varanus sivalensis* using linear regression models of snout-vent length (SVL) against skeletal measurements of extant *Varanus*, and incorporated results into SVL-Body mass equations to estimate mass. We used published regression equations to calculate mammalian body size. We estimate body mass of *V. sivalensis* between 22–41 kg, similar to the largest extant species, the insular giant *V. komodoensis*. Reconstruction of the terrestrial vertebrate community size structure from the Pre-Pinjor beds indicates that *V. sivalensis* was one of the largest predatory taxa, with only the hyaena *Lepthyaena sivalensis* being slightly larger. In comparison with extant faunas including the largest living *Varanus* species, *V. sivalensis* indicates successful occupation of predatory ecospace by *Varanus* sympatrically with large-bodied carnivores. These results indicate that *Varanus sivalensis* was one of the earliest giants within the genus, and the occurrence of the taxon within mainland South Asia falsifies the hypothesis that gigantism in *Varanus* requires insularity and the absence of competition or predation from carnivores.

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Technical Session XIII: Euarchontoglires (Friday, November 14, 2025, 1:45 PM)

Female driven reduction of sexual dimorphism in hominins

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Sexual dimorphism is a key indicator of social structure and selective pressures in primate evolution, yet its evolutionary drivers in hominins remain contentious. Here, we combine cutting-edge dimorphism estimation methods with Bayesian phylogenetic comparative analyses to disentangle the sex-specific contributions and evolutionary dynamics underlying changes in body mass and canine size across >300 hominin specimens. Our results reveal a consistent reduction in body mass dimorphism over time, driven not by male body size reduction—as is predicted by prevalent hypotheses—but by a significant increase in female body mass. This finding challenges prevailing assumptions about the weakening of sexual selection on males and instead supports a model of positive selection on female size, likely linked to reproductive and ecological demands. In contrast, canine size dimorphism is minimal throughout hominin evolution, with evidence of coordinated size reduction in both sexes, consistent with decreased reliance on canine-based competition. These patterns underscore divergent selective trajectories for different sexually dimorphic traits and highlight female-driven morphological evolution as a dominant force in hominin body size diversification. Our study provides a new framework for interpreting dimorphism in the fossil record and offers fresh insight into the evolutionary mechanisms shaping human ancestry.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Fungal spores found in the dental pulp chamber of *Enchodus* ray finned fish (late Cretaceous) by scanning electron microscopy.

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Residual fungal components have been widely found in soils and contribute to the developing knowledge in palynology. Specifically, spores have also been identified in the dental calculus that has been deposited on teeth of various extinct species. The dental environment has also shown bacterial infiltration of dental decay in extinct species. This study examined the dental pulp chamber as an additional source for the location of ancient microbes. Animal and human teeth often undergo attrition to allow microbes through the coronal surface by decay and crown fracture. An additional pathway is via the apex and periodontal ligament should breeches occur. *Enchodus* was a predator fish with estimated species size varying from 6 cm to 1 metre in length. It had a distinguishing feature of enormous maxillary and mandibular canines relative to its size and is colloquially called ‘sabre tooth herring’ by the general public. These teeth are numerous and readily available for research purposes. Enchodus teeth were split longitudinally by mechanical force using fine bladed wire cutters. This allowed the whole tooth to be examined with no tooth or pulpal canal loss compared with sectioning of the tooth by a diamond disc (partial loss at the point of section). Specifically, the mechanical force was directed along the root of the tooth to expose the pulp chamber and primary root canal. Scanning electron microscopy was performed by a benchtop SEM (JEOL JCM-7000 Neoscope).

The tooth specimen was thoroughly dried and coated with 5nm gold from a target sputterer. SEM parameters were set at 10 kV landing voltage, high vacuum mode, BED-S for signal acquisition, and analytical mode for probe current. Magnification varied from 2000–9500x. Spores were clearly evident in the pulp chamber, primary canal, and major lateral canals but could not penetrate the dentinal tubules (1 micron diameter). Spores were spherical in appearance and 2-3 microns in diameter. Spore showed excellent surface morphology. The dental pulp chamber offers an environment of high protection for the study of microbes and fungal elements. The hard casing of enamel with robust inner dentine can protect biomolecules against chemical exposure compared with porous bone and open soil environments. Multiple entry sites of microbes to the pulp chamber from tooth/root fracture, dental decay, and the root apex provide access for microbes to be uniquely contained for further research.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Tangled titanosaur trees from character, taxon, and specimen discordances

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With over a hundred species currently considered valid, Titanosauria is one of the most diverse clades of sauropods, most of which have been named in the last thirty years. This emergent species-level diversity has not been organized into widely recognized higher level relationships, with results of each new analysis bearing little resemblance to the last. Although recent critiques have faulted analytical methods as sources of discrepancy, we present evidence pointing to the underlying data: character data (characters, character states, scorings) and selected OTUs. Comparative cladistic analyses between pairs of datasets reveal major discrepancies along these lines. Many characters are minimally informative as they come from previous phylogenetic analyses of broader scope than Titanosauria or a different scope altogether, resulting in most putative titanosaurs sharing the same character state. Modifications of these character states (e.g., adding additional character states or changing the boundary between character states) have major impact on tree topologies. Taxon sampling differs significantly between datasets, with some regions (e.g., Europe or Africa) or outgroup taxa (e.g., non-titanosaur somphospondylians) often poorly sampled, with scorings of these taxa favoring topologies in the analyses where they are present. Some OTUs, in addition, are suspected to be taxonomic chimeras that can strongly affect tree topology (as either wildcard taxa or generating homoplasy). For example, five clade specifier genera (S*altasaurus, Muyelensaurus, Lirainosaurus, Ampelosaurus* and *Malawisaurus*) are based on bonebed collections that are suspected to include more than a single taxon. Our recommendations include more considered character statement formulations (characters, character states, scoring), better represented taxonomic geographic sampling, and the narrowing of bonebed-based taxa to holotypic material or closely associated specimens in the absence of taxonomic revisions.

Funding Sources Marie Sklodowska Curie Actions grant (EvoSaurAf 101068861)

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

Survival and recovery in the Triassic Karoo Basin: insights from Bayesian age models and paleoecological patterns

Viglietti, Pia A.[1,2], Angielczyk, Kenneth D.[3,4], Huttenlocker, Adam[5], Botha, Jennifer[6], Smith, Roger M.[7,2], Crowley, James[8], Browning,

Claire[9], Abbott, Caroline P.[10,1], Seerane, Thabile M.[6]

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The Permo–Triassic mass extinction (PTME, 251.9 Ma) profoundly reshaped terrestrial ecosystems, yet the timing and geographic patterns of survival and recovery are poorly resolved, with some suggesting PTME biotic responses were diachronous even within geographically confined regions like South Africa's Karoo Basin. The Karoo Basin preserves an exceptional fossil record, offering a unique opportunity to investigate vertebrate community responses to extreme environmental change. Our investigation integrates high-resolution stratigraphy, Bayesian age modeling, and paleoecological analyses (Disaster taxa, Lilliput effect, and food webs) to test hypotheses about the timing and probability of survival and recovery. We present preliminary geochronology results. We applied a modified BChron R package to 42 CA-TIMS dated Permo–Triassic zircons from 6 samples to create Bayesian age depth models of two Karoo Basin Permo–Triassic Boundary sites. Our working group is analyzing over 40 samples, but so far, the results support the traditional placement of the Permo–Triassic Boundary, and a synchronous extinction event across the basin. The paleobiological insights of the Disaster taxon *Lystrosaurus*, such as its high abundance, juvenile aggregations, burrowing, growth, and life history patterns, and broad environmental tolerance, may have all been factors that contributed to its success during a protracted extinction and recovery. Comparisons to other PTME terrestrial records suggest a similar pattern of protracted extinction and "post crisis" faunal assemblages that began in the latest Permian. Body size analyses suggest smaller-bodied taxa dominated Early Triassic assemblages, but with varying patterns in different clades and in resident versus immigrant taxa, suggesting 'Lilliput patterns' were complex as in other extinctions. Generally, smaller faunivores and burrowers were resilient to the effects of the extinction. Food web reconstructions indicate reduced community stability post-extinction, with true recovery delayed until the Middle Triassic. These findings provide critical insights into the origin and evolution of the dominant tetrapods of the Mesozoic (archosaurs, mammaliaforms) and today (birds, crocodilians, mammals). Our high time resolution geochronological framework is central to timing survival and recovery from the PTME across the Karoo Basin, and linking those events to global patterns of environmental change in marine and terrestrial environments.

Funding Sources PAV and KDA: NSF DEB-2325380, Field Museum Grainger Bioinformatics Center; AKH: NSF DEB-2325381

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A new anguine lizard (Squamata, Anguidae, Anguinae) from the late Miocene (Vallesian) of the Vallès-Penedès Basin (NE Iberian Peninsula)

Villa, Andrea[1], Bolet, Arnau[1,2], Klembara, Jozef[3,4], Serrano-Martínez, Alejandro[1], Luján, Àngel H.[1], Fortuny, Josep[1], Delfino, Massimo[5,1], Schillinger, Burkhard[6], Alba, David M.[1]

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Conventionally, post-Paleogene anguids from Europe have been referred to three extant genera: *Anguis*, *Ophisaurus* (including *Dopasia* and *Hyalosaurus*), and *Pseudopus*. In recent years, a higher generic diversity has started to be recognized, with extinct genera described from both Neogene and Quaternary localities. We present a new genus and species of anguid lizard based on a large articulated skull from the Vallesian (late Miocene) of Sant Miquel de Toudell, in the Vallès-Penedès Basin, on which we also performed neutron CT scanning. This stands out as one of the few applications of this imaging technique in paleontology and was pivotal to investigating the inner morphology of the fossil. The new lizard differs from all other anguid species from Europe, both extant and extinct, in a set of characters, most notably the combination of widely laterally extended anterolateral processes and medially directed anterior end of the anterolateral ventral crests in the parietal. Phylogenetic analyses, using maximum parsimony and Bayesian methodologies, support the placement of this new genus and species as a member of the Anguinae, which is currently the only anguid subfamily confidently present in Europe after the Paleogene/Neogene transition. Based on our tip-dating Bayesian analyses, the divergence of this new anguid from its sister taxon within the Anguinae largely predates this transition, but uncertainties still surround its detailed phylogenetic relationships. An isolated parietal from the middle Miocene of Griesbeckerzell 1a, Germany, strongly resembles the morphology displayed by the holotype of this new species, but differs from it in the sculpturing type. We refer this fossil from Germany to the same genus, implying a wider stratigraphic and geographic distribution.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Phylogenetic insights into Mesozoic elasmobranch evolution

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Elasmobranch fishes represent one of the most outstanding success stories in vertebrate evolution, with a fossil record dating back more than 400 million years. Throughout their long and complex evolutionary history, elasmobranchs have survived multiple mass extinction events as well as smaller-scale environmental crises and have demonstrated a remarkable capacity to adapt to a wide range of aquatic environments, ranging from open sea and deep-sea habitats to freshwater systems.

The biotic recovery and turnover following the Permian–Triassic mass extinction (PTME; ~252 mya) marks a key episode in the history of life on Earth. This event is regarded as the most severe biotic crisis ever experienced and led to profound shifts in the global biosphere paving the way to the rise of modern marine faunas. Only two lineages of elasmobranchs, the

hybodontiforms and the neoselachians (modern sharks, rays, skates, and their immediate fossil relatives), thrived in the aftermath of this crisis. Despite the importance of the PTME in shaping elasmobranchs evolution, our understanding of Mesozoic elasmobranch evolution is hampered by persistent ambiguities concerning the phylogenetic relationships of taxa. To address this, the present study presents a comprehensive phylogenetic framework for elasmobranchs. This framework is based on a newly assembled data matrix that includes an extensive dataset, including representatives of all neoselachians orders along with a broad outgroup.

The resulting matrix was analysed using Maximum Parsimony and Bayesian inference approaches. The resulting topologies were time calibrated (a posteriori when needed) and compared. By examining the differences in relationships, divergence times, and estimated rates of evolution across multiple analyses and topologies, this study aims to provide a more complete understanding of elasmobranch evolution during the Mesozoic. Overall, this research advances our knowledge of the complex evolutionary pathways that have shaped modern elasmobranch diversity offering new insights into major evolutionary changes that shaped the rich diversity observed in modern forms.

Funding Sources Austrian Science Fund (FWF) [10.55776/P33820] to J.K.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Extinction and human niche construction lead to a reduction of functional ecology in terrestrial mammal communities across the Caribbean

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Defaunation events since the late Quaternary have been accelerating globally at an alarming rate, causing significant losses in biodiversity. These extinction events, along with human activities, have reshaped ecosystems on a global scale. However, the degree of these impacts in the transition from ancient to modern communities, as well as their legacies, is not well understood, particularly in insular systems. To address this issue, I quantified the functional loss of land mammal communities in the Caribbean, a region that lost nearly 80% of its native land mammals, suffering one of the largest diversity losses in the world in the last 11,000 years. Using radiocarbon dates, museum specimen records, and dental measurements, I reconstructed the Last Appearance Datum (LAD) of extinct land mammals, their distribution ranges, and body sizes. Dietary ecology of mammalian terrestrial communities was inferred from carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$) stable isotope values derived from 340 samples of enamel hydroxyapatite, from 48 species representing 80% of the known regional mammalian diversity. Results suggest niche partitioning within multispecies communities, with distinct $\delta^{13}C$ values even among closely related taxa. Despite variation in island size and species richness, there was isotopic niche conservatism across taxa and weak evidence for niche expansion following ecological release. I also found that most carbon values of native rodents reported in previous archaeological studies, which suggested a human influence in the diet of these species, fall within the ranges of values found in fossils, emphasizing the importance of paleo-baselines for interpreting anthropogenic impact. The isotopic proxies reveal a once-diverse array of C3 browsers, C4 grazers, mixed feeders, and faunivores occupying a wide ecological isospace that drastically contracted. When considering LAD and species traits, the analysis revealed that defaunation generally preceded large-scale habitat losses and deforestation, revealing that the Caribbean suffered from an Empty Forest Syndrome for hundreds of years. These findings indicate that Caribbean defaunation represents not just species loss, but a profound simplification of ecological roles, and highlight the urgency of conserving remaining native

species using deep-time ecological reconstructions to guide restoration strategies in post-defaunation landscapes.

Funding Sources Florida Museum of Natural History (Miss Lucy Dickinson Fellowship); National Science Foundation EAR-204817

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Dental microwear textures of archaic ungulates from the early Paleocene of the Denver Basin

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Archaic ungulates ('condylarths') were among the most speciose mammalian groups following the Cretaceous–Paleogene mass extinction in North America. Corral Bluffs, an exposure of the lower Paleocene D1 sequence of the Denver Formation in the Denver Basin of Colorado, is emerging as one of the most exceptional records of early archaic ungulates, yielding numerous skulls and associated jaws. These specimens are also tightly linked to mega- and palynoflora fossil records in a well-resolved chronostratigraphic framework, permitting comparisons between macroevolutionary and ecological trends among mammals and plants in the first ca. 1 Ma of the Paleocene. Dental microwear texture analysis (DMTA) serves as an approach independent of gross morphology that directly reflects the mechanical properties of foods an animal was eating in their final days or weeks. Here, we present DMTA of five archaic ungulate taxa: *Baioconodon denverensis*, *Carsioptychus coarctatus*, *Ectoconus ditrigonus*, *Eoconodon coryphaeus*, and *Loxolophus* sp. DMTA Images were captured with a Leica M205C microscope with an imaging area of 880 µm by 610 µm and measurements and counts taken with ImageJ using the 'Measure' and 'Multi Point' tools. DMTA was conducted on the M1 protocone occlusal wear facet of *Baioconodon*, *Carsioptychus*, *Ectoconus*, and *Eoconodon*, and the m1 protoconid of *Loxolophus*. *Baioconodon* has 37 anisotropic scratches 278 µm long on average. Loxolophus has 10 scratches and 2 gouges, measuring 201.2 µm and 65.5 µm on average. Ectoconus has 7 pits 10.3 μm^2 on average, 54 scratches 156.3 µm on average, and 4 gouges 304.5 µm on average. *Eoconodon* has 10 pits 9.4 μm^2 on average, 12 scratches 39.6 µm on average and 2 gouges 122.7 µm on average. *Carsioptychus* has 20 pits 9.6 μm^2 on average and 41 scratches 77.2 µm on average. DMTA results for *Baioconodon* closely resembles those of the herbivorous *Macropus giganteus* (grey kangaroo); *Loxolophus* closely resembles the omnivorous *Dasypus novemcinctus* (nine-banded armadillo); *Ectoconus* closely resembles the durophagous to carnivorous *Acinonyx jubatus* (cheetah); and *Eoconodon* and *Carsioptychus* closely resemble the durophagous *Crocuta crocuta* (hyena). These preliminary findings can be used alongside gross tooth morphology to infer archaic ungulate diets and their potential relationship to plant community changes through the early Paleocene in the Denver Basin.

Funding Sources National Science Foundation (Frontier Research in Earth Sciences grant EAR-2317666); Lyda Hill Philanthropies; Stephen and Mary Lynne Kneller

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The endocranial anatomy of the derived ankylosaurid *Ziapelta sanjuanensis* (Dinosauria, Ornithischia): endocasts of the brain, inner ear and nasal pathways reveal unique anatomical innovations with biological and ecological implications

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The endocranial anatomy of ankylosaurs (Dinosauria, Ornithischia) is understudied relative to other groups of dinosaurs because well-preserved skulls are comparatively rare. Previous work shows that they exhibit anteroposteriorly short brain endocasts with an expanded forebrain, large pituitary and olfactory bulbs, intricate looping nasal pathways which may have played a thermoregulatory role, and diverse inner ear morphologies that indicate broader hearing capabilities than in other dinosaurs. We describe the endocranial anatomy of the holotype *Ziapelta sanjuanensis* (NMMNH P-64484), an exquisitely preserved skull of a derived ankylosaurid from the Upper Campanian Kirtland Formation (~73 Mya), New Mexico. We subjected the specimen to CT scanning and manually segmented endocasts of the brain, cranial nerves, inner ear, olfactory region and nasal pathways to produce one of the most complete endocranial reconstructions for an ankylosaur. The morphology of the brain is distinct from ornithischian outgroups and the basal-most ankylosaur endocast from *Kunbarrasaurus*. It is largely consistent with other derived ankylosaurids (*Euoplocephalus*, *Tarchia*, *Talarurus*) but possesses less expanded cerebral hemispheres and has a dural peak on the anterodorsal surface of the cerebellum. The olfactory bulbs are globular and coalesce posteriorly with a very short olfactory tract. Statistical analyses from linear measurements of the olfactory bulbs and cerebral hemispheres revealed an olfactory ratio of 68%, higher than most other ankylosaurs, indicating *Ziapelta* may have possessed strong olfactory acuity. The endosseous labyrinth has stocky semi-circular canals and a complete cochlear duct. Standardized equations based on basal papillar length calculated the range of hearing of *Ziapelta* as between 1-2.9 kHz, similar to other derived ankylosaurids such as *Euoplocephalus* (1.1-3.1 kHz) and *Tarchia* (1.2-3.3 kHz). The nasal pathway of *Ziapelta* exhibits an extreme looping morphology which is unique and possibly more complex than *Euoplocephalus*, the only other ankylosaurid for which the nasal pathways have been reconstructed from CT data. It has three distinct loops, and can be divided into an anterior and posterior region. This morphology, in addition to the presence of turbinates within the nasal cavity, reinforces the hypothesis that the nasal pathways of ankylosaurs acted as physiological mechanisms for thermoregulation.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new multituberculate skull from the Upper Jurassic Morrison Formation of Utah: implications for the taxonomic validity of the genus *Glirodon*

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Multituberculates, an extinct order of mammals defined by blade-like premolars, existed from the Middle Jurassic (ca. 165 Ma) to the late Eocene (ca. 35 Ma). The earliest multituberculates belong to the 'Plagiaulacida,' a likely paraphyletic grade that persisted from the Middle Jurassic to the early Late Cretaceous. Compared to the likely monophyletic Cimolodonta, the principal multituberculate group from the late Early Cretaceous onward, the paleoecology and evolutionary relationships of earlier 'plagiaulacidans' remain poorly understood. Here, we use X-ray micro-computed tomography to reconstruct and describe the partial skull of a new multituberculate specimen (OMNH 79317) from the Cisco Mammal Quarry of the Morrison Formation in eastern Grand County, Utah, an exceptional locality that has yielded well-preserved, even articulated Late Jurassic mammal skulls and skeletons. This specimen fits the diagnosis of *Glirodon grandis*: it exhibits restricted enamel bands on the upper second and lower incisors and a primitive

'plagiaulacidan' dental formula of five upper and four lower premolars. *G. grandis* was formerly known from two partial skulls from Dinosaur National Monument in Utah and the Fruita Paleontological Area in Colorado, but OMNH 79317 preserves a more complete dentary, dentition, and petrosal. *G. grandis* is regarded as the oldest multituberculate to exhibit 'gliriform' incisors (i.e., with restricted enamel bands), a feature that has confounded its phylogenetic position among Multituberculata and was previously considered unique among 'plagiaulacidan' taxa aside from the Early Cretaceous *Eobaatar*. However, our study shows that the Morrison Formation genus *Ctenacodon* also exhibits 'gliriform' incisors, undermining that trait as diagnostic for *Glirodon*. Further, the cheek teeth of assigned *G. grandis* specimens are nearly identical to those assigned to species of *Ctenacodon*, differing primarily in size. Thus, we conclude that *Glirodon* is not distinct from *Ctenacodon* and refer cranial material of this genus to *Ctenacodon*, and we provisionally retain the species epithet as *Ctenacodon grandis* comb. nov. We further revise the diagnosis for *Ctenacodon* to include the presence of restricted enamel bands on the second upper and lower incisors. This study complicates prior hypotheses on evolutionary relationships among 'plagiaulacidan' genera and emphasizes the need for further research on the taxonomy, phylogeny, and paleoecology of early multituberculates.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

The first ceratopsian tracksite of the Lance Formation

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A new track site from the lower-half of the Lance Formation of Glenrock, Wyoming is described. The site consists of a ceratopsian trackway and a lone hadrosaurian track referable to the ichnospecies *Ceratopsipes goldenensis* and *Hadrosauropodus langstoni*, respectively. The *Ceratopsipes* trackway records ten sequential tracks, four manual and six pedal prints from one individual. The ten prints represent the longest lone ceratopsian trackway yet described. Using standard equations and an inferred hip height of 2.3 meters, the trackmaker is estimated to have been walking at a speed of 1.5 meters per second.

Funding Sources The College of Charleston's SSME grant.

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Mammalian functional diversity and functional rarity in North America throughout the Cenozoic

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Functional trait diversity is an important component of biodiversity as it represents the role organisms play in their environment. Functionally rare species, such as specialized species at the edges of trait space and/or unique species occupying areas of low redundancy, may be particularly important to maintaining functional diversity. There is a growing interest in modern conservation biology to focus conservation efforts and resources on the most functionally rare species, under the assumption that they contribute the most to functional diversity. The fossil record offers an opportunity to investigate the relationship between functional rarity and functional richness through deep time and assess whether preserving functionally rare species also preserves functional diversity and thus ecosystem functioning. We constructed a multidimensional trait space including all Cenozoic North American mammal species and calculated each species' functional specialization and functional uniqueness, then computed functional richness,

mean functional specialization, and mean functional uniqueness during each North American Land Mammal Age and epoch. Since the Miocene, mean functional uniqueness has increased, while mean functional specialization has decreased. Functional richness has largely remained level through this interval, but increasing uniqueness and decreasing specialization leave North American mammalian communities more vulnerable to future erosion of functional diversity. For most transitions between epochs, species that persisted were not more ecologically rare than those that went extinct. Functional richness is associated with both uniqueness and specialization, suggesting that ecological rarity plays a role in shaping functional diversity. Integrating the fossil record into functional diversity analyses reveals long-term shifts in key metrics of interest to both paleontologists and conservation biologists. A deep-time perspective underscores the importance of conserving extant species that are functionally rare.

Funding Sources Vanderbilt University (Dept. of Biological Sciences and Evolutionary Studies Initiative)

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

Theoretical morphospace shows most flying vertebrates evolve suboptimal wing shapes for flight style

Walters, Benton, Liu, Yuming, Rayfield, Emily, Donoghue, Philip

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Comprehending the relationship between form and function is often a difficult task, obfuscated by the assumption that evolution has resulted in the development of optimal morphologies. Creating a theoretical morphospace permits analysis of possible shapes for a certain form, thus allowing identification of functionally optimal shapes unconstrained by the extent of empirical variation. Theoretical shapes can be subjected to functional analysis and their locations in morphospace compared with those of empirical taxa to determine whether animals evolve toward functionally optimal shapes. We create a theoretical morphospace of vertebrate wing planforms and examine the functional performance of planform shape for metrics a priori associated with seven flight niches. This allows identification of the optimal wing shapes for varying flight styles with differing degrees of active control from soaring to hawking and hovering. We then compare the resulting performance surfaces with a tree-spanning dataset of birds, bats and pterosaurs encompassing 1,139 birds, 193 bats and 10 commonly depicted pterosaurs. These disparate vertebrate groups show high convergence in morphospace, demonstrating the strong constraint flight places on wing planform morphology. This general convergence, however, does not appear to center around any performance peak, and only some taxa groups have evolved wings that are optimal for their flight style. Birds and pterosaurs evolve similarly towards more efficient soaring wing planforms though even the most extreme long-winged taxa fall short of optimality. Of the tested metrics, highly agile flight (such as hawking) has the greatest optimising effect on wing planform morphology with both bird and bat groups converging on the same optimal shape. Greater functional constraint is seen with more biomechanically intensive flight styles and the evolutionary path towards optimal wings is similar across the varied lineages of flying vertebrates.

Funding Sources University of Bristol Scholarship, Templeton Foundation grant # JTF62574

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

Oligocene ruminants from Saint Jacques, North China

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Saint Jacques is one of the classic fossil sites on the Mongolian Plateau of Asia. Contrary to previous knowledge that Saint Jacques contains two Oligocene mammal assemblages, recent fossil discoveries and new biostratigraphic analysis of small mammals show that the area documents successive faunal transition from the Eocene to possibly the early Miocene, bracketing an entire Oligocene sequence within. Ruminants are the most abundant and diverse group of large mammals collected in Saint Jacques. Based on jaw and tooth materials, 13 species representing eight genera of ruminants have been identified. Non-pecoran ruminants, found only in early Oligocene strata in Saint Jacques, comprise four genera (*Lophiomeryx*, *Paragelocus*, *Praetragulus*, and *Gobiomeryx*) and seven species, including three new species (*Lophiomeryx triangularis*, *Praetragulus ordosianus*, and *Gobiomeryx santaohoensis*) which are notable for being the last representatives of their respective genus. Pecoran ruminants, present in both early and late Oligocene strata in Saint Jacques, comprise four genera (*Eumeryx*, *Amphitragulus*, *Hanhaicerus*, and *Palaeohypsodontus*) and six species. Our cladistic analysis shows that the non-pecoran taxa in Saint Jacques represent three evolutionary lineages, with close phylogenetic relationships with North American and European taxa. *Praetragulus* is found to be closely related to the North American ruminants *Leptomeryx* and *Hypertragulus*. *Paragelocus*, characterized by a distinct longitudinal lingual cristid on p4, is recovered as a sister taxon to *Pseudomeryx*, and they form a monophyletic group with *Gobiomeryx* and *Pseudogelocus*. Overall, our findings suggest a flourishing and complex evolutionary history of ruminants in Asia during the early Oligocene. The long, successive sequence in Saint Jacques makes an important record for studying the Eocene–Oligocene Transition, a time period marked by one of the most profound global climate changes in the Cenozoic. Further study on ruminant fossils in the area will contribute to a range of paleontological and paleoenvironmental questions.

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

A Middle Triassic marine tanysaurian with soft tissue preservation from Yunnan, China

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Archosauromorpha represents a dominant clade of Mesozoic reptiles, including not only well-known archosauriforms such as dinosaurs, pterosaurs, crocodilians, and their ancestral relatives, but also diverse non-archosauriform archosauromorphs, including the enigmatic allokotosaurs, the beaked rhynchosaurs, and the polyphyletic “protorosaurs.” Recent phylogenetic studies have clarified the relationships among “protorosaurs,” establishing Tanysauria as a monophyletic group representing one of the earliest diverging archosauromorph lineages. Fossil evidence from the Triassic marginal seas of the Tethys Ocean, primarily in present-day western Europe and southwestern China, provides critical insights into the biotic recovery and the early radiation of archosauromorphs after the end-Permian extinction.

Here, we describe a new, nearly complete tanysaurian skeleton from the Middle Triassic of Yunnan Province, southwestern China. According to the osteological anatomy and our phylogenetic results, this skeleton exhibits a series of synapomorphies of Tanysauria such as the premaxilla having six teeth, elongate cervical vertebrae and ribs, and a semi-circular scapula. Furthermore, this specimen can be assigned to Trachelosauridae based on the absence of palatal teeth, the presence of more than 13 dorsal

vertebrae, and dorsoventrally broad, wing-shaped transverse processes on the dorsal vertebrae. However, it also exhibits distinct diagnostic features differentiating it from previously known trachelosaurids. Similar to *Dinocephalosaurus orientalis*, this new tanysaurian possesses an exceptionally elongated neck and torso, a laterally compressed tail, and flipper-like limbs, collectively indicating an aquatic lifestyle. Remarkably, the specimen preserves rare soft tissues, including gut contents containing fish fragments and possible visceral remains, potentially referable to the stomach, liver, and intestines. Scanning electron microscopy and elemental analyses revealed ferruginous accumulations in the hepatic region and elevated phosphorus concentrations in the cololites. The discovery of this new tanysaurian from the eastern Tethys highlights the early aquatic diversification of archosauromorphs and the exceptional taphonomic conditions facilitating soft tissue preservation in Middle Triassic (~240 Ma) marine sediments.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Latest Hemphillian Carnivora of Yepómera Basin, Chihuahua, Mexico

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The Yepómera Basin in western Chihuahua, Mexico produces one of the richest and most diverse mammal assemblage in North America. Because of its abundant and well-preserved fossils, the Yepómera Fauna has been used to characterize the latest Hemphillian (Hh4) North American Land Mammal age, correlated to magnetic Chron 3n.4n, 4.997–5.235 Ma in the early Pliocene. We present a systematic treatment of Yepómera carnivorans (order Carnivora), known for its biochronologic significance due to their frequent intercontinental migrations, and as apex predators, are of ecological importance in the faunal transition of late Miocene to early Pliocene.

Seven species in four families are recognized, including two felids: *Adelphailurus kansensis* Hibbard, 1934 and *Amphimachairodus alvarezi* Ruiz-Ramoni, Rincón, and Montellano-Ballesteros, 2019; three canids: *Borophagus secundus* (Matthew and Cook, 1909), *Vulpes stenognathus* Savage, 1941 and *Canis ferox* Miller and Carranza-Castañeda, 1998; one ursid: *Agriotherium schneideri* Sellards, 1916; and one mustelid: *Taxidea mexicana* Drescher, 1939. The felids are represented by one early sabertooth, *Ad. kansensis*, with initial specialization toward sabertooth adaptation and another of more specialized sabertooth, *Am. alvarezi*, as the last occurrence of its North American lineage. The latter from Yepómera also preserves a healed fracture in its proximal phalanx. The canids are represented by an advanced bone-crushing borophagine, *B. secundus*, an ancestral fox, *V. stenognathus*, and an early coyote-sized dog, *C. ferox*. While all three canids are widely distributed in much of the western North America, *V. stenognathus* is the first Mexican record in the Neogene whereas *Borophagus* and *Canis* have been previously documented in San Miguel Allende Basin. The giant bear, *A. schneideri*, represents an immigrant event in North America in the late Hemphillian (Hh3–Hh4), which is also reflected in Mexican records. The ancestral American badger, *T. mexicana*, is the earliest and most primitive member of the genus.

Overall, the Yepómera carnivorans are that of a typical latest Hemphillian fauna widely available in known localities of North America. Of these, *Agriotherium* has been designated as a key immigrant taxon for latest Hemphillian (Hh4). *Amphimachairodus alvarezi* and *Taxidea mexicana* are confined to Mexico. Yepómera carnivorans also feature three early species of modern genera, *Vulpes*, *Canis*, and *Taxidea*, showing the importance of Mexican records.

Funding Sources This research was supported by a grant from the National Science Foundation (EAR-1949742).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Morphological and size evolution of medium to large Jurassic theropods from China

Wang, Xueyan, Ju, Ning, Yu, Congyu

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Multiple theropod lineages evolved gigantism during the Mesozoic, such as the Tyrannosauridae and Allosauria, but the morphological and size evolution of early medium to large-sized theropods remains unexplored. Numerous medium to large theropod taxa have been unearthed from the Jurassic strata in west China, including *Sinosaurus triassicus* from the Lufeng Formation in Yunnan, *Yangchuanosaurus shangyuensis* from the Shaximiao Formation in Sichuan, and *Sinraptor dongi* from the Shishugou Formation in Xinjiang, representing early gigantism among theropods. However, they are often ignored in large-scale geometric morphometric studies, hindering our understanding of the early history of theropods and factors driving large body size. Here, we integrate geometric morphometric, body size estimation models and comparative phylogeny to investigate the morphological and size evolution of medium to large Jurassic theropods from China. We collected data from seven medium to large Jurassic taxa in west China, ranging from 201 Ma to 156 Ma, and supplemented with other taxa from different regions and ages. We compared the skull morphology of Jurassic taxa from China and other medium to large theropods of different ages from worldwide. Our findings reveal that medium to large Jurassic theropods from China already occupied a large portion of the volume defined by medium to large taxa in the morphospace. The early occupation indicates the synchronous emergence of morphological diversity and body size gigantism during the early evolution of theropod dinosaurs.

The previously overlooked diversity of early theropod dinosaurs suggests more frequent occurrences of gigantism in theropods across the Mesozoic, which seems to be independent from environments. The co-existence of medium to large theropods and sauropods from our samples and many other sites from across the globe suggests a parallel trend of body size increase between theropod and sauropods, at least during their early evolution.

Funding Sources Chengdu University of Technology.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Interspecific and intraspecific variation in the horncores of the merycodonts (Mammalia, Artiodactyla, Antilocapridae, Merycodontinae) with implications for merycodont systematics

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Merycodonts represent a paraphyletic subfamily of antilocaprids that were present throughout North America during the early to middle Miocene and included five genera (*Cosoryx*, *Merriamoceros*, *Merycodus*, *Paracosoryx*, and *Ramoceros*) with nearly two dozen species described between them. A characteristic feature amongst antilocaprids of the past and present, is the occurrence of prominent horns, preserved as bony horncores in fossil species. Previously, merycodont taxonomy had a large emphasis placed on differences between horn morphologies to diagnose species. However, in the 80+ years since the original taxonomy was published, many authors have cautioned against such a reliance on horncores for merycodont

species diagnoses, largely due to the inherent variability within those structures. Here we examined the degree of morphological variability in the horns of antilocaprids, by comparing the morphological range of horn variability of the modern species, *Antilocapra americana*, to the that of merycodont species. The huge sample size of merycodont horncores and jaws in the Frick Collection at the American Museum of Natural History, provides a vital resource for qualitatively examining the interspecific and intraspecific variation of horncores in the context of less variable, quantitative traits like tooth row measurements (molar and premolar row lengths). We illustrate that horn morphology is variable among modern populations of *Antilocapra americana* and support the idea that it is dubious to put too much taxonomic weight on horncore morphology alone to diagnose a species. This is highlighted in our findings from a sample of merycodont horncores and jaws from the Siebert Fm. in Tonopah, Nevada, housed in the Los Angeles Museum of Natural History Collections; it provides evidence of a single population (and possibly only one species) displaying a wide range of horncore morphologies. We also used tooth row measurements to calculate and compare the Coefficient of Variation (CV) between the modern genus *Antilocapra* and the five merycodont genera. The CV in the molar and premolar length dimensions, for the modern pronghorn and for each of the merycodont genera are similar, suggesting a similar degree of species variability may be expected for merycodonts. Ultimately, this research presents the wide range of horncore variation among the merycodonts and we discuss the implications of these findings for revised merycodont systematics.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Dinosaurs as ecosystem engineers: evidence from facies changes at the K–Pg boundary

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Cretaceous–Paleogene boundary (KPB) sections have been globally identified via direct geochemical and mineralogical evidence of the Chicxulub bolide impact. North American continental KPB sections identified via Chicxulub ejecta invariably exhibit a marked shift in sedimentary facies at or very near the reported boundary level. Uppermost Cretaceous strata are often characterized by hydromorphic paleosols and small, single-storied fluvial sandstones, reflecting water-logged soils and unstable meandering-river deposits. Lowermost Paleogene strata are often characterized by coals, large, multi-storied fluvial sandstones, and associated lateral accretion deposits, reflecting coal swamps and broad, stable meander-belt deposits. Causal links between facies shifts at the KPB and the end-Cretaceous mass extinction have been largely dismissed in favor of time-transgressive drivers such as transgression of the Cannonball Sea. Here, we report five new KPB sections, representing the first KPB sections from the Bighorn Basin of Wyoming and a new KPB section from southeastern Montana; all five coincide with a formational contact (Lance–Fort Union and Hell Creek–Fort Union, respectively). We then demonstrate that these facies changes reflect fundamental shifts in fluvial geomorphology that were (i) coincident with the KPB, (ii) geographically widespread, and (iii) unlikely to be driven by eustatic, climatic, or tectonic changes. We hypothesize that the

continental KPB facies shifts were driven by the extinction of dinosaur megafauna and consequent restructuring of terrestrial ecosystems. Large-bodied dinosaurs likely promoted an open vegetation structure that permitted frequent fluvial avulsion and clastic sediment input to distal floodplains. After the end-Cretaceous mass extinction, dense forests could establish, stabilizing meander belts and starving the distal floodplain of clastic sediment, promoting the accumulation of organic-rich strata. Facies change in continental KPB sections thus suggests dinosaurs were ecosystem engineers that promoted habitat openness in the Late Cretaceous, and their extinction likely led to a dramatic reorganization of landscape and ecosystem structure in the earliest Paleogene.

Funding Sources David B. Jones Foundation.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Impact of axial patterning on ribcage composition and regionalization in Xenartha

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The fixed mammalian cervical count is a remarkable case of constraint. Three mammal species have escaped this, two of which are sloths that fall within the clade Xenarthra. In addition to variation in cervical count, Xenarthra exhibits high variation in thoracic count (10 to 24) relative to other mammals, suggesting widespread homeotic shifts in axial patterning. Variation in rib identity is patterned by anteroposterior expression of the same transcription factors as the vertebral regions, so we might predict similar effects to be present in the ribcage. However, little is known about regionalization of the ribcage relative to the vertebral column, nor the impact of homeotic shifts in one on the other. Here, we ask if homeotic shifts in vertebral regions impact the composition (rib types) and regionalization of the xenarthran ribcage.

To address this question, we collected data on ribcage composition and rib shape (3D geometric morphometric) in 10 xenarthrans (nRib = 140) and compared their craniocaudal variation. We found evidence for three morphological regions: the first rib, the true ribs, and the false and floating ribs. Elevated rib counts in some species are achieved by adding ribs to both true and false/floating regions, maintaining regional proportions despite thoracolumbar shifts. Despite presumed developmental constraints on the first rib, its morphology was highly variable and potentially adaptive, varying among groups with digging and suspensory behaviour. By contrast, the aberrant cervical count in sloths had no apparent impact on first rib morphology or craniocaudal variation in rib shape. Therefore, modular patterns in the xenarthran ribcage appear unaffected by homeotic shifts in vertebral regions, suggesting relative independence in their evolutionary patterning.

Funding Sources UK Biotechnology and Biological Sciences Research Council Doctoral Training Partnership (DTP3 2020-2025 entry - BB/T008725/1).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Threespine stickleback (*Gasterosteus doryssus*) fossil fish reveal taphonomic factors throughout Miocene time series

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The Truckee Formation near Hazen, Nevada, presents a sequence of approximately 100,000 years of fossilized threespine stickleback fish

(*Gasterosteus doryssus*) dating back to the late Miocene. This formation consists of instances of genetic and morphological evolution, stasis, and local extinction of stickleback populations. These fossils are primarily preserved in diatomite, silicious shells of ancient diatoms that accumulate on aquatic beds upon death, with intermittent layers of volcanic ash and mudstone. The near continuous deposit of diatomite grants high temporal resolution for the stickleback fossils, allowing for in-depth research of the past lacustrine environment and the evolution of stickleback populations. Here, we present an analysis of the various taphonomic factors in a series of fossil stickleback fish from this formation spanning 16,000 years. This series displays an evolutionary replacement period of armor gain from low-armored stickleback to high-armored variants.

We photographed the approximately 6,000 stickleback fossil specimens from this series, then noted trends in coloration and post-depositional bone alteration, assigning them to environmental phenomena. Black discoloration was observed on fossil samples and interpreted as post-depositional stickleback being exposed to volcanic activity in non-aquatic environments. Disarticulation throughout individual fossil fish was attributed to post-mortem bloating from bacterial decomposition, indicating warm water temperatures for bacteria to thrive. Evidence for tetany of the jaw and fins was observed through the disarticulation of only these features, suggesting death by asphyxia for some fish. A varying degree of scattering of bones for each individual specimen was observed, suggesting the presence of both macroscopic scavengers (e.g. amphipods or crayfish) and microscopic scavengers (e.g., bacteria).

With this formation having high temporal clarity, documenting the taphonomic factors of this fossil series could greatly increase understanding of stickleback fish evolution as well as late Miocene lacustrine environments. While these variables have been found, we expect to identify more upon continued analysis.

Funding Sources National Science Foundation: EAR Sedimentary Geology and Paleontology; Carbon Undergraduate Research Fellowship, Loyola University Chicago

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Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Comparative finite element analysis of differently sized mammalian crania reveals substantial mechanical impact of size variation on absolute biomechanical performance

Weisbecker, Vera, Mitchell, Rex

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Comparative finite element analysis (FEA) is widely used to examine the performance of skulls under equivalent loading conditions. Most often, this equivalency is achieved by assessing skull shape relative to performance such that model comparisons explicitly remove variation in size and, depending on the hypothesis, mechanical advantage. However, if the research question regards the ability of differently shaped skulls to bite the same piece of food, an additional standardization needs to be performed to account for the effect of different skull sizes on the absolute performance of the skull. We here use FE simulations to show that the three standardization methods reveal substantially different estimations of cranial stress and strain in 13 skulls of potoroids, a radiation of small kangaroo relatives with varied skull sizes and divergent mechanical advantage. We thus propose three main lines of investigation, each answering a different research question and based on separate muscle-scaling approaches: (1) to purely compare how effectively different skulls transmit muscle force to the bite point, muscle force is scaled relative to skull size; (2) to compare structural adaptations for biting purely based on cranial geometry, size-corrected bite simulations are also scaled to standardize mechanical advantage; and (3) to compare how different skulls bite an identical food item, muscle forces are scaled to produce identical bite reaction forces. We use these approaches to

show that the biomechanically highly efficient skull of the short-faced desert rat-kangaroo (*Caloprymnus campestris*) would have been estimated to withstand harder bites than the long-nosed potoroo (*Potorous tridactylus*) under conventional standardization of size and mechanical advantage. However, due to the mechanical impact of the potoroo's much larger skull size, the two species display similar mean brick stress when simulating an identical absolute bite reaction force. This shows that comparative FEA requires careful consideration of the intended nature of comparison.

Funding Sources Australian Research Council Centre of Excellence for Australian Biodiversity and Heritage (CE170100015).

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

The evolution of terrestrial pseudosuchian body size and posture through the Triassic

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Pseudosuchian archosaurs radiated during the Triassic, evolving diverse body forms and ecologies. The demise of most of this diversity during the end-Triassic mass extinction (ETE) and the subsequent ecological replacement by dinosaurs is a classic example of terrestrial vertebrate faunal turnover. Past studies of this faunal replacement have typically relied on character-based disparity or qualitative comparisons of ecomorphology. However, metrics of body mass and locomotory posture present a novel means of comparison in this context because of their predictive relationship with vertebrate ecology and their broad applicability across terrestrial lineages. To assess the evolution of Triassic pseudosuchian body mass and posture, we compiled a large dataset of limb measurements for terrestrial pseudosuchians and their archosauromorph outgroups. We then estimated body mass and posture (bipedal/quadrupedal) using regression models and predictive statistics based on measurements from extant mammals and reptiles. Results were mapped onto a time calibrated phylogeny of pseudosuchians, with Bayesian estimations for ancestral state values. Our results suggest that early branching loricatans were the largest members of the clade, with *Prestosuchus* having the largest body mass at over 900 kg. Furthermore, the large body mass (ranging from 300 kg to over 900 kg) of terrestrial pseudosuchians only persisted until the earliest members of the crocodylomorphs, with a significant reduction in mass amongst later branching crocodylomorphs and stem crocodyliformes (ranging from less than 1 kg to 20 kg). We also find evidence for three separate origins of bipedality amongst pseudosuchians: in ornithosuchids, poposauroids, and in the loricatan/crocodylomorph transition. When compared with early dinosaurs, the main competing fauna in the ecosystem, pseudosuchians show different macroevolutionary patterns. The large-bodied pseudosuchian taxa did not survive the ETE and were replaced by large-bodied theropods. Secondly, pseudosuchians experimented with locomotory shifts at varying size classes, which is not observed in theropods, who remain bipedal throughout their evolution. These contrasting broad-scale evolutionary trajectories within closely related archosaur lineages undoubtedly played a role in the effects of the ETE on ecosystem assembly.

Funding Sources GENUS, National Research Foundation, University of the Witwatersrand, and Stony Brook University.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Drivers of the mammalian Grande Coupure in Western Europe at the Eocene–Oligocene transition

Weppe, Romain[1], Guinot, Guillaume[1,2], Condamine, Fabien[1], Lihoreau, Fabrice[1], Vianey-Liaud, Monique[1], De Bonis, Louis[3], Blondel, Cécile[3], Orliac, Maëva[4]

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One of the main focuses of evolutionary biology studies today is investigating the evolutionary and ecological processes responsible for the diversification and decline of clades. The '*Grande Coupure*' corresponds to a major turnover in the European fauna during the severe biological and climatic crisis of the Eocene–Oligocene transition (EOT), 33.9 million years ago (Ma). In Western Europe, this biological event is characterized by the dramatic extinction of insular European mammals, coupled with the massive arrival of modern Asian clades. Several hypotheses have been proposed to explain this extinction, including abiotic factors such as temperature, sea level, and seasonality, as well as biotic factors such as competitive interactions. However, these hypotheses have never been formally tested. Here, we examined the diversification of Western European mammals to determine the primary drivers of the Grande Coupure and to understand how the modern mammal fauna became established in Western Europe 34 Ma. Using Bayesian birth-death models considering the preservation bias of the fossil record, we analyzed a high-resolution fossil occurrence dataset (578 species, >3,300 occurrences) from Southern France spanning the late Eocene-Oligocene interval and estimated the regional diversification and diversity dynamics of endemic and immigrant European mammals. Our results show that a combination of multiple abiotic factors played a significant role in the diversification of European endemic mammals and that the major environmental changes at the EOT were responsible for the extinction of 65% of species. Importantly, our results do not support the hypothesis of competitive interactions between endemic and immigrant taxa. Instead, our results suggest that immigrant species opportunistically replaced endemic species after the EOT by colonizing new ecological niches left vacant. Interestingly, the diversity recovery of European mammals during the early Oligocene was not rapid, but occurred over three million years, indicating a gradual arrival of immigrant mammals in multiple migratory waves.

Funding Sources This work was financially supported by the ANR program DEADENDER and ENLIVEN (grant. no. ANR-18-CE02-0003-01 and ANR-22-CE02-0014-01).

Technical Session III: Carnivora (Wednesday, November 12, 2025, 1:45 PM)

When did spotted hyenas become social? Evidence from fossil endocasts

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The extant spotted hyena, *Crocuta crocuta*, is one of the most social carnivores, with several unique traits linked to its advanced social behavior. This includes female rank dominance, matrilineal rank inheritance, masculinized sexual organs in females, and fission-fusion clan system. Studies of the brain of living spotted hyenas have shown that the anterior cerebrum is enlarged relative to total brain size, a feature linked to sociality in other carnivores, such as lions and wolves. However, it is not known

when sociality evolved in spotted hyenas. This is of special interest due to the apparently negative fitness effects of some spotted hyena traits, such as umbilical cord shorter than birth canal, leading to excess mortality in first births. Studies of extinct spotted hyena species, including the 'cave hyena', *Crocuta spelaea*, have shown that these do not share the large anterior cerebrum of the extant species, setting an upper bound at ca 2.5 Ma for the evolution of spotted hyena sociality. The close fit of the brain to the endocranium in mammals allowed us to use computed tomography (CT) scanning to study the endocranium of a 500-350 Ka spotted hyena from Megenta, Afar Regional State, Ethiopia. We then compared it to a sample of modern specimens representing the four species of living Hyaenidae. In addition to the spotted hyena, these include *Hyaena hyaena* (striped hyena), *Parahyaena brunnea* (brown hyena), and *Proteles cristatus* (aardwolf). We also compared our results to published analyses of fossil hyena endocrania. We found that the brain of the Megenta fossil specimen is indistinguishable in morphology and proportions, including relative anterior cerebrum size, from that of the extant spotted hyena but is different from all other studied fossil and extant hyena brains. This places a minimum age of 350 Ka on the evolution of spotted hyena sociality and makes it possible to eliminate factors such as selective pressure from early *Homo sapiens* as a potential driver of spotted hyena sociality.

Funding Sources The Megenta Research Project was supported by the National Research Foundation of South Africa (Grant Number: 150524)

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Chondrichthyan teeth from Upper Cretaceous Coleraine Formation at the Hill Annex paleontological site in northern Minnesota, USA

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The Hill Annex mine is an inactive open-pit iron mine complex in Itasca County, Minnesota, USA. Irregularly overlying sedimentary deposits in this iron mining district include the Upper Cretaceous Coleraine Formation, deposited along the eastern margin of the Western Interior Seaway during the Cenomanian. Since 2014, the Hill Annex Paleontology Project hosted at the Minnesota Discovery Center, Chisholm, Minnesota, USA, has cultivated dozens of volunteers to collect isolated teeth and bones of various fossil vertebrates, such as chondrichthyan and osteichthyan fishes as well as reptilians, including crocodiles, turtles, plesiosaurs, and a few dinosaur bones from the formation in northern Minnesota. While much of the paleontological work is ongoing, together with a few previously published accounts, we here report the fossil chondrichthyan components of the fossil assemblage based on materials housed in the Minnesota Discovery Center in Chisholm, Minnesota. The identified taxa consist of the following six elasmobranchs: *Protolamna* sp., *Cretodus gigantea*, *Archaeolamna* sp., *Cretalamna* cf. *C. appendiculata*, *Squalicorax* sp., and *Onchopristis dunklei*. They are all pelagic lamniform sharks except *O. dunklei*, a benthic sclerorhynchoid 'sawskate.' *Squalicorax* sp. from the Hill Annex site is represented by a large, robust crown relative to the teeth of contemporaneously known *S. curvatus*, and together with *Cretodus gigantea*, they constitute distinctive taxonomic components not found at, or not commonly represented by, other known Cenomanian localities of the Western Interior Seaway deposits. This may be due to the Coleraine Formation's geographically unique position during the Late Cretaceous, where paleontology has been poorly surveyed. The area likely represented the northwestern coastline of the Appalachia landmass, where the northwesterly extended Western Interior Seaway split from the northeasterly directed Hudson

Seaway, providing important insights into the poorly understood Late Cretaceous marine paleoecology of the region.

Funding Sources Minnesota Discovery Center

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Modelling the functional effects of changing canine tooth length in sabertoothed predators

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The sabertooth morphology represents one of the most specialized feeding adaptations in the fossil record. Since the Permian, there is evidence of repeated evolution of elongated canines in separate lineages, most of which are concentrated in the Cenozoic. These canines show a wide range or morphological diversity between groups. The controlling factors that limit canine length have been discussed in the past, but the lack of quantitative data and use of biomechanical analysis methods impede drawing evidenced conclusions.

Here, we used finite element analysis (FEA) simulations of six species, representing different sabertooth groups and morphotypes to evaluate the differences in mechanical stress distribution associated with increasing canine length. The crania were tested with increased canine length models in 10% increments to a total of 50% its original length.

Our results demonstrate distinct differences between the analysed species: fossil species exhibited higher cranial stability and lower stresses when compared to extant analogues, as well as smaller changes in von Mises stress with each set of variant models. We further tested whether jaw gape, root length, or stress distribution imposed morphological limitations. Using maximum principal stress, morphological features such as the zygomatic arch and the orbital region are highlighted as significant in the process of distributing mechanical stress, providing an explanation for the morphological diversity between taxa. *Inostrancevia alexandri* was found to have unexpectedly low stress values in all simulations which may represent a different hunting style. Further analysis of other variables showed that jaw gape was a major limitation to the size of the canines, with root length having a slightly lesser impact. The increased optimisation in morphology of the zygomatic arch of extinct species emphasizes the trade-off between robusticity and specific hunting styles (e.g. in *Acionyx jubatus* and *Homotherium serum*). These trends reinforce the idea that the skulls of sabertooth predators have highly specialised crania adapted to mitigate these stresses; but the limiting factor that controls canine length is the evolutionary trade-off between jaw gape and the optimisation of the killing bite.

Colbert Prize Session

Testing the utility of reptilian enamel microstructure for taxonomic assessment: *Alligator mississippiensis* enamel microstructure shows substantial ontogenetic variation reflecting scaling and changing biomechanical demands

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Enamel microstructure—the three-dimensional arrangement of enamel hydroxyapatite crystallites—is generally considered a stable morphological character often used for taxonomic assessment of isolated fossil teeth. In mammals, enamel microstructure frequently reflects biomechanical demands dictated by feeding ecology, resulting in strikingly similar schmelzmusters in distantly related ecologically convergent taxa. Large-bodied reptiles, including many crocodilians and non-avian

dinosaurs, increase in body size by orders of magnitude throughout ontogeny. In the process, they 1) occupy multiple dietary niches, 2) exhibit changes to tooth form and size and 3) experience substantially different dental biomechanical stresses due to changing bite forces and diets. Given the strong association in mammals between biomechanics and enamel microstructure, this raises the question whether such reptiles, experiencing vast biomechanical shifts through ontogeny, might similarly show changes in schmelzmuster to address these varying stresses. Here, I used scanning electron microscopy to examine the enamel microstructure of the American alligator (*Alligator mississippiensis*) across ontogeny, from neonate to somatically mature adult. Our results reveal substantial ontogenetic change. Neonate teeth exhibit layers of parallel-oriented crystallites—the primitive reptilian condition. Later stages show increasingly complex microstructures with multiple crystallite bundles weaving in three-dimensions. Such changes occur in both caniniform and molariform teeth, each ultimately reaching distinct end-stage morphologies. Theropod teeth are additionally analyzed in exploration of whether similar patterns occur in non-avian dinosaurs. The marked differences in juvenile and adult microstructural phenotypes challenge the assumption that enamel microstructure is a stable taxonomic character. These ontogenetic changes present a new consideration for phylogenetic studies into enamel microstructure—juvenile taxon-representatives could cause stemward slippage due to their plesiomorphic schmelzmusters. Notably, the results imply that polyphyodonty may provide reptiles with the evolutionary opportunity to ecologically-tune enamel fabrics to meet the changing feeding demands of ontogenetic niche shifts—tuning that would be detectable in the fossil record. Such findings emphasize the importance of further investigations into the structural-functional attributes of reptilian enamel microstructures.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Bringing paleontology to life: engaging community college students through hands-on, specimen-based labs at the UC Museum of Paleontology

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Advancing Community College Education and Student Success (ACCESS) is a University of California Museum of Paleontology (UCMP) program that has introduced paleontological concepts through specimen-based labs to community college students since 2017. The program was initiated by UCMP graduate students and has provided significant benefits to students involved in creating and delivering the labs.

Current ACCESS focus areas include: (1) paleobiology internships at the UCMP for Bay Area community colleges students, (2) support for instructors in the ACCESS Professional Learning Community (PLC), and (3) graduate student-led redesign of ACCESS learning units incorporating active learning Model-Based Inquiry practices (MBI) to better highlight paleobiological phenomena. Designing labs that incorporate MBI take the student learning process into consideration and key content elements are introduced through overarching phenomena interpreted from the fossil record. This approach fosters natural discovery, enabling students to actualize learning concepts and draw their own conclusions. During the 2024–25 academic year, UCMP graduate students developed three new labs using these practices, focused on paleobotany, invertebrate paleontology, and vertebrate paleontology.

In the presentation we will share the ACCESS vertebrate paleontology lab that was created in partnership with the Wolf RACE (Resource

Availability and Competition in Ecosystems) project. It focuses on Pleistocene predatory canids preserved in Rancho La Brea and McKittrick tar seeps in southern California. A range of paleobiological concepts and paleoecological methods are introduced, including morphometrics, geochemistry, food web, and trophic level dynamics. In spring 2025 we began to test the labs with students from Merced Community College whose instructor was a participant in the ACCESS PLC. We directly observed the transformational impact that hands-on, specimen-based paleontology lessons can have, particularly if the lab is supplemented by datasets and fossil image databases. As we continue to observe and assess the impact of these ACCESS learning opportunities on science literacy at the community college level, our goal is to continue enriching students' engagement in paleobiology and geology.

Funding Sources National Science Foundation and David B. Jones Foundation

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Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

Long bone histology of Early Triassic Antarctic reptiles reveals ectothermic adaptations to polar environments

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The Lower Triassic of Antarctica represents a unique place and geological period to examine adaptations to polar environments. While more habitable than today, ancient ecosystems of Antarctica were subject to extreme seasonal light availability that included regular periods of complete darkness and complete sunlight. As a result, the flora and fauna of these ecosystems would have to modulate their physiologies to accommodate this seasonally extreme habitat. Further, the Early Triassic represents a period of recovery following the End-Permian mass extinction and the Antarctic proto-continent is hypothesized to have served as a refugium from the climatic events leading to this extinction. For these reasons, reconstructing the seasonal physiologies of Antarctic vertebrate species preserved in the Lower Triassic Fremouw Formation provides valuable insight into both seasonal adaptations and extinction recovery dynamics. Previous studies have found impacts on the seasonal growth of synapsid fossils recovered from the Fremouw Formation whose thermoregulatory capacity is a relatively unknown factor. Here, we present histological data on the growth patterns of, presumably ectothermic, archosauromorph and procolophonid reptiles from the Fremouw Formation.

The sampled archosauromorph femur is characterized by moderately abundant and organized vasculature that is primarily longitudinal and radial in orientation. The cortex is composed of parallel-fibered bone and marked by at least one, possibly two, annuli in the mid-cortex and towards the periosteal surface. The femur of the procolophonid sample is also moderately vascularized with longitudinal canals embedded in a parallel-fibered to lamellar matrix. This sample is marked by regular and frequent growth marks that fluctuate between annuli and lines of arrested growth.

Comparing these findings to previous descriptions of related archosauromorphs and procolophonids from coeval rocks in South Africa’s Karoo Basin reveal that these groups maintained similar baseline patterns of bone deposition. Our polar sample, however, documents growth punctuated by regular

cessations, indicating a modulation of growth at regular increments of bone deposition. Early Triassic polar reptiles appear to have adapted to their extreme environment by undergoing seasonal physiological quiescence that could be similar to estivation or another form of torpor.

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Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Machine learning applied to modern and fossil biomolecules reveals the evolution of the vertebrate biomineralization toolkit

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Biomineralized tissues show a unique evolvability in vertebrates. The evolutionary drivers behind the emergence of templated biomineralization in denticles, teeth, bone, and eggshells from non-biomineralized precursors are, however, obscured in the fossil record: original biominerals rarely survive without chemical alteration in deep time, and often experience dissolution; soft tissues, however, commonly attract secondary minerals resembling biominerals. Due to the lack of a proxy that allows for the distinction of biological and diagenetic mineralization, the timing of vertebrate biomineral evolution and its potential covariance with environmental parameters is still considered enigmatic.

Here, we analyze n=150 modern and carbonaceous fossil vertebrate hard and soft tissues that were sampled systematically across Phanerozoic clades in search for a signature of original biomineralization. With alteration of the mineral phase, our proxy targets remnants of the macromolecular template: Among these samples, n=100 represent vertebrate tissues with known biomineralization status, while n=50 represent (predominantly Paleozoic) samples with debated biomineralization status. A supervised Random Forest (RF) model trained on Raman spectral fingerprints (500–3000 cm^{-1}, 10 replicates; Near-Infrared) was complemented with ^{13}C solid-state Nuclear Magnetic Resonance structural elucidation, and assessed via simulated test data: the model classifies modern and fossil biominerals based on features of the macromolecular template and its fossilization products with >96% accuracy. Features diagnostic for original biomineralization are linked to an increased abundance of coordinating ligands in the original macromolecular template. Projection of the RF predictions on an unsupervised principal component analysis of the training data reveals distinct clustering of biocarbonate and biophosphate templates among modern and fossil taxa, regardless of phylogenetic affinity. Incorporation of fossil unknowns into the model illuminates the diversification of skeletal materials and reveals convergent origins of a variety of carbonate and phosphate vertebrate biominerals.

Our analyses reveal that independently co-opted template macromolecules experience convergent functionalization in order to precipitate certain mineralogies. Template optimization represents an evolutionary prerequisite to the emergence of vertebrate skeletal elements.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Restoring scientific access to historically mounted fossils containing asbestos-based texturing

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During the early 20th century, most fossil preparation and display mounting at the Sam Noble Oklahoma Museum of Natural History was conducted by Works Progress Administration workers. This included several nearly complete skeletons of *Cotylorhynchus* from the Permian of Oklahoma. These specimens are embedded in a plaster plaque mount, a common historical practice. Unfortunately, this style of mounting obscures substantial portions of the fossil, masking morphology and limiting accessibility for high-resolution imaging and 3D analysis. A desire for such work required the dismounting of the bones. Informal communication within the scientific community alerted us that some plaque mounts may have been augmented with asbestos-containing materials. Tests on our material revealed that the underlying plaster, which formed the base of the mount and a 1-inch ring around the fossils, contained no detectable amount of asbestos. However, tests revealed noteworthy levels of asbestos in the highly textured fibrous material used across the mount for decorative purposes and to mimic the texture of rock matrix.

To explore safely removing the specimens, we chose to cover the bones with Polyethylene wrap, securing it to the uncontaminated plaster near the bones with Van Aken plastilina clay. We then applied polyester resin (404 Isophthalic Tooling Resin, catalyzed with MEKP) in a paint booth to the contaminated areas, embedding and thus preventing any fibers from becoming powdered or airborne during manual preparation. Some texturized areas beneath fragile suspended fossil elements could not be treated with resin initially. A Dremel cutting wheel for metal (#426) was used to cut the supports holding the ribs in place. This allowed us to lift the ribs out in a few large, connected pieces. We then applied resin to the previously inaccessible areas, securing the asbestos fibers. The bones were removed by trenching around each one with a pin vice, working exclusively on the non-contaminated plaster. Through these techniques, we were able to mitigate health risks while preserving the scientific integrity of the specimen. By safely dismounting and stabilizing these embedded fossils, we restored access to previously obscured anatomical features, significantly enhancing their research potential for modern imaging. This project not only improves the safety of our collections but also unlocks critical data for future paleontological investigation.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Correlating masticatory muscle and skull morphology across mammals

Williams, Harrie[1,2]

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The mammalian masticatory apparatus is a useful model system for understanding relationships between extrinsic environmental and intrinsic biological factors in vertebrate evolution. Masticatory function and performance are underpinned by the anatomy of both bony and muscular morphology, but currently few macroevolutionary studies have considered both tissues in an integrated fashion. This study attempts to address this knowledge gap by quantifying variation in muscle and skull morphology across extant mammals in the context of phylogeny and diet. Statistical correlation tests were conducted on muscle mass data (sourced from dissections and literature), as well as quantifications of skull size. Deterministic Atlas Analysis, a landmark-free approach, was used to quantify both cranial and mandibular morphology. Results highlight a strong correlation between proportional masses of the masseter and temporalis muscle groups with phylogeny and diet. Taxonomically, Carnivora and Chiroptera exhibit proportionally the largest temporales, Rodentia proportionally the largest masseters, and Euungulata and Cetacea the largest pterygoids. Functionally, we

find major differences in herbivores and carnivores in the proportional mass of the temporalis and masseter, while the pterygoid is found to be particularly pronounced and relatively enlarged in grazing mammals and piscivores. Statistical correlations between the masses of the masticatory musculature and the skull suggest that variations in the proportional masses of these muscle groups correlate significantly with skull shape. Specifically, the proportional masses of all three muscles are linked to the overall length and width of the crania, as well as the width of the mandible. However, only the pterygoid is statistically correlated to the height of the mandible. These correlations reiterate the influence of phylogeny and function on the hard and soft tissues of the masticatory apparatus, suggesting it may be possible to develop predictive relationships between the two, thus allowing more accurate estimation of muscle mass in extinct animals from fossilised osteology.

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Are functional traits and tooth shapes conserved along the shark tree of life?

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Sharks have a remarkable 400-million-year evolutionary history, traversing multiple environmental shifts and extinction events. Yet reconstructing their evolutionary history remains a challenge. While molecular phylogenies of living sharks are well resolved, integrating extinct taxa is difficult due to a restricted fossil record composed primarily of isolated teeth. As a result, studies of fossil shark taxonomy, palaeoecology, and functional morphology rely heavily on dental remains. This dependence introduces several challenges, including pronounced heterodonty, variation in shape by jaw position, and convergent evolution driven by dietary specialisation, both of which can obscure phylogenetic signal.

Despite these complexities, recent studies suggest shark teeth retain meaningful evolutionary information, as they are not only taxonomically diagnostic, but can also serve as reliable proxies for functional traits. If such traits are not only ecologically informative but also phylogenetically conserved, tooth morphology may offer insights into evolutionary relationships. We hypothesise that shark functional traits and tooth morphology exhibit phylogenetic conservatism and could provide a framework for more accurately inferring the phylogenetic positions of fossil species.

To address this hypothesis, we asked: Do functional traits and tooth morphology in living sharks exhibit phylogenetic signal? We first created a molecular phylogeny of living sharks using 15 genes across 402 species. A comprehensive trait dataset was then mapped onto this tree and tested for phylogenetic signal. We also compiled 1,459 tooth images representing 108 species from museum collections and extensive literature searches. These were processed using a novel analytical pipeline combining deep learning outline extraction, elliptical Fourier analysis, and dimensionality reduction via UMAP to generate continuous shape data. This shape data was then mapped onto the phylogeny and tested for phylogenetic signal.

Our results reveal moderate to strong phylogenetic signal in functional traits and a highly robust signal in overall tooth shape. This indicates that even isolated teeth, despite convergent evolution, retain sufficient evolutionary information to inform phylogenetic inference. This will enable more confident integration of fossil taxa into shark evolutionary trees, providing the foundation for future studies of trait evolution, lineage diversification, and deep-time biodiversity.

Funding Sources Swansea University Research Excellence Scholarship (SURES) - RS227 to LW PRIMA grant (no.185798) from the Swiss National Science Foundation to CP

Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

AI and deep learning in taxonomy

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Baseline data on species richness are critical for understanding how environmental changes impact diversity and distribution through time. Accurate taxonomy is therefore the essential underpinning of any macroevolutionary analysis. Without these data it is not possible to determine the true pace and scale of responses to major environmental perturbations and macroecological events. Taxonomic errors undermine such studies, reducing their predictive power. Taxonomy as a discipline is suffering from a lack of training globally and numbers of trained taxonomists are falling, at a time when the need to accurately document biodiversity is urgent and increasing. Other approaches are therefore needed that can be used alongside traditional taxonomic expertise.

The growth of artificial intelligence (AI) has revolutionised many scientific disciplines but is not yet used widely in taxonomy, where most workflows still rely on manual, and in many cases subjective, input and measurement. The application of AI to taxonomic datasets has the potential to alleviate some of these problems. Work on fossil taxa offers additional challenges, such as the incomplete and fragmentary nature of the fossil record, and the corresponding lack of training data that impact on the predictive power of AI approaches.

Here we describe the development of image deep learning models to classify isolated fossil vertebrate teeth using convolutional neural network architectures based on 3D CT volumes of individual teeth. A challenge addressed in this study is the limited availability of labelled fossil datasets. We employed transfer learning and data augmentation techniques to mitigate the problem of small sample sizes, achieving improved model generalization and classification accuracies of over 90%.

The classification results indicate the robust performance of AI deep learning models when applied to image data and imply the potential for such a framework to be applied to other paleontological datasets.

Technical Session XVI: Dinosauria II: Aves (Saturday, November 15, 2025, 8:00 AM)

The evolution of palatal development in the common ancestor of living birds

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The origin of living birds from their reptilian ancestors is one of the most striking transitions in vertebrate evolution, and constraining the ancestral crown bird (neornithine) state is a key component of understanding this transition. The earliest divergence of crown birds produced two lineages, the Pan-Palaeognathae (‘ratites’ and their kin) and Pan-Neognathae (all other birds). Paleognaths have a rigid palate, a condition long maintained to be plesiomorphic, whereas the neognathous condition is better suited for cranial kinesis and is morphologically divergent from the palates of non-avian reptiles. Surprisingly, a recently discovered Cretaceous toothed bird, *Janavis finaldens*, was found to possess a

pterygoid which is remarkably similar to those of extant members of Galloanserae (fowl). This has been taken to suggest that the plesiomorphic condition for Neornithes is more similar to the neognathous condition, with the paleognathous palate being derived. Investigating this hypothesis using the fossil record alone has proven difficult, because the fossil record for early crown birds is incredibly sparse. As such, novel research avenues are necessary to investigate the ancestral avian condition. Developmental biology is a powerful tool for the study of evolution because developmental patterns inform the mechanisms underlying evolutionary trends. To investigate the ancestral avian palatal condition in an evolutionary developmental context we characterized the three-dimensional anatomy of avian musculoskeletal tissues at early developmental stages, prior to ossification, and placed these data into a comparative context of extinct and living bird anatomy. We employ a novel high-fidelity clearing and immunostaining pipeline with lightsheet microscopy to visualize early embryonic palatal tissues earlier than previously possible. We found that in both the non-kinetic crocodylian (*Alligator*) and neognathous (*Gallus*, *Coturnix*) palate, the embryonic precursors to skeletal tissues resemble their adult, ossified form. We will next characterize early palate organogenesis in paleognaths (*Nothoprocta*, *Struthio*) to phylogenetically bracket the ancestral avian developmental condition and test whether the paleognathous condition is also present prior to ossification. Constraining the ancestral avian palatal condition will have important implications for the diagnosis of stem paleognaths and characterize the origin of a key avian feature, the kinetic palate.

Funding Sources Princeton University Department of Geosciences

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Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

The food the fire beasts ate: testing the universality of mesowear angles in bilophodont South American ungulates

Wilson, Oscar E.[1], Bergqvist, Lílian P.[2], Gelfo, Javier N.[3], Zanesco, Tábata[2], Saarinen, Juha[1]

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Mesowear angles (MAs) have been previously applied to reconstruct diet in fossil herbivores with variable tooth morphologies, including proboscideans, xenarthrans, and notoungulates. In deinotheres, wear facet inclinations can be converted to MAs in the absence of dentine valley angles, from which MAs were originally measured. This suggests MAs can be used in other bilophodont herbivores, though this has never been tested. We measured MAs in modern herbivore species (seven marsupials and four tapirs) with known diets to calibrate threshold angles between dietary categories and compared these to results from other tooth morphologies. We found consistent thresholds across morphologies, with an MA threshold between browsing and mixed feeding of 106°, for example. These calibrations were used to assess the diet in two bilophodont orders of South American native ungulates: Xenungulata (Paleocene—Eocene) and Pyrotheria (Eocene—Oligocene), and fossil tapirs from South America (Pleistocene). Our reconstructions include all described species of xenungulates and pyrotheres. All seven xenungulate species were reconstructed as browsers, presumably eating leaves, branches, and soft fruits, given the absence of abrasive wear. This matches results from other proxies for *Carodnia vieirai*. Browsing was also observed in the Pleistocene tapirs, with all species matching their modern counterparts in having mean MAs < 106°. The pyrotheres were more variable in their dietary ecology. Three species (*Griphodon peruvianus*, *Carolozittelia tapiroides,* and *Pyrotherium romeroi*) were reconstructed as pure browsers,

whereas the two putative Eocene pyrotheres *Colombitherium* and *Proticia* were reconstructed as pure grazers, consistent with previous hypotheses that link them to sirenians. *Pyrotherium macfaddeni* from Salla had a mean MA of 112°, suggesting mixed feeding, consistent with other paleoenvironmental reconstructions for Salla. Rounded shallow facets in *Propyrotherium saxeum* are interpreted to be evidence for frugivory in this species. *Baguatherium jaureguii*, from the late Eocene, was represented by two teeth with a high degree of wear, and consequently high MAs. The case of *B. jaureguii* highlights the importance of tooth choice for MA analysis, when possible. The close match between the MAs in bilophodonts and herbivores with other tooth morphologies supports the potential universality of this method and application for dietary comparisons across continents and time.

Funding Sources Research Council of Finland grant NEPA - Non-analogue ecosystems in the past [340775/346292], Nordenskiöld-Samfundet, University of Helsinki Geodoc travel grant

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Cranial and postcranial remains of a new species of *Cimolodon* (Mammalia, Multituberculata, Cimolodontidae) from the Upper Cretaceous (Campanian) El Gallo Formation of Baja California, México

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Late Cretaceous mammals from North America are predominantly known from isolated teeth and fragmentary jaws and from localities representing coastal lowlands along the Western Interior Seaway. Here, we report craniodental and associated postcranial remains of a new species of the cimolodontid multituberculate genus *Cimolodon* from the Upper Cretaceous (Campanian) El Gallo Formation of Baja California, México. The specimen was deposited in a semi-arid paleoenvironment along the Pacific Coast between 75.17 + 0.30 Ma and 74.55 ± 0.18 Ma. It represents the most complete mammal known from the Mesozoic of México and one of the best-known cimolodontan multituberculates from North America. Morphologically, the new species is most similar to *Cimolodon nitidus*, but differences include upper anterior premolar shape, molar cusp formulae, and relative length proportions of the cheek teeth. Phylogenetic analysis supports placement of the new species within *Cimolodon* and Ptilodontoidea, but uncertainties remain regarding relationships among cimolodontan families. Using the craniodental and postcranial data, we quantitatively reconstruct the new species as a small-bodied (~100 g), animal-dominated omnivore with a scansorial locomotor mode. With the new taxonomic occurrence, the El Gallo mammalian local fauna is now known from 16 specimens referred to three multituberculate species (*Mesodma* cf. *M. formosa*, *Stygimys* sp., and the new species), one metatherian (*Pediomys* sp.), and one eutherian (*Gallolestes pachymandibularis*). Although further sampling is needed, the local fauna presently shows greatest biogeographic affinities with the Terlingua local fauna of western Texas.

Funding Sources UC MEXUS-CONACYT, Dirección General de Asuntos del Personal Académico, and UW College of Arts and Sciences, UW Department of Biology, the American Philosophical Society

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A new kurmademyine turtle from the Late Cretaceous–Paleocene intertrappeans of Upparhatti (Karnataka State), India

Wilson Mantilla, Jeffrey A.[1,3], Mohabey, Dhananjay M.[2], Dhobale, Anup[2], Samant, Bandana[4,2], Tholt, Andrew J.[5,6], Renne, Paul[5,6], Anantharaman, S.[7], Tobin, Thomas[8], Wilson Mantilla, Gregory P.[9,10]

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The timing and duration of physical connections during Indo-Pakistan's progressive disengagement with Gondwanan landmasses during the late Mesozoic and its engagement with Asia in early Cenozoic are expected to have profoundly influenced its terrestrial vertebrate fauna as well as that of neighboring landmasses. Most paleocoastline reconstructions predict a phase of geographic isolation for Indo-Pakistan that may have lasted for tens of millions of years during the Late Cretaceous. Somewhat surprisingly, however, many of the terrestrial vertebrates known from that time period in India and Pakistan show biotic connections to species from other Gondwanan landmasses, such as Madagascar, South America, and Africa. Thus far, only one terrestrial vertebrate clade is hypothesized to be endemic to Indo-Pakistan during the late Mesozoic–early Cenozoic: the side-necked turtle clade Kurmademydinae, which includes species from the Late Cretaecous (*Jainemys pisdurensis*) and Paleocene (*Sankuchemys sethnai*) of central India and the Late Cretaceous of southern India (*Kurmademys kallamedensis*). Here we report on the discovery of a fourth member of that group, represented by a beautifully preserved, complete skull. The specimen was collected from intertrappean horizons in Karnataka State that are latest Cretaceous to earliest Paleogene in age. The specimen was found association with partial and complete turtle shells that are as yet unprepared. The skull is approximately 6.5 cm long and characterized by double triturating surface on maxilla and a well marked pterygoideus fossa. These and other features suggest close affinities with *Kurmademys* and *Sankuchemys* within Kurmademydinae, broadening the spatiotemporal distribution of this endemic Indo-Pakistani clade.

Funding Sources National Science Foundation, National Geographic Society; Ministry of Earth Science and Science and Engineering Research Board (India).

Technical Session XIV: Mammalian Phylogeny & Function (Saturday, November 15, 2025, 8:00 AM)

Evolvability, evolutionary currencies, and the decline of multituberculates in North America

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Despite multituberculates' long-lasting evolutionary success, the clade's taxonomic diversity declined precipitously in the latest Paleocene, coinciding with the first appearance of rodents in North America and the continued diversification of plesiadapiform primates. These lineages shared qualitatively similar craniodental morphology with multituberculates, leading to the hypothesis that competitive exclusion by early eutherians caused the decline and eventual extinction of multituberculates.

Here, we test the hypothesis that multituberculates were competitively excluded by plesiadapiform primates and rodents using a dataset of dental measurements of 3,000+ specimens from the Cretaceous–Paleogene of North America, building on previous work by investigating the hypothesis across multiple temporal and spatial scales. If supported, the decline in multituberculate taxonomic diversity should coincide closely with the rise of rodents and primates, and there should be evidence of ecological displacement—particularly in body size and abundance at the local scale (i.e., mirrored trends across multiple 'evolutionary currencies').

Although the expectations of the competitive exclusion hypothesis are supported when looking at the continental scale and/or across North American Land Mammal Ages (NALMAs), we find that patterns of species diversity, relative abundance, and body size disparity are inconsistent with competitive exclusion at the locality or regional assemblage scale, remaining relatively stable across the Tiffanian/ Clarkforkian (i.e., rodent first appearance) boundary. By the mid-Clarkforkian (~0.5 million years after rodent first appearance), multituberculates, rodents, and primates co-occur and overlap substantially in body size.

If not competitive exclusion, what accounts for the decline of multituberculates? We propose an alternative explanation rooted in evolvability. Using the inhibitory cascade model (ICM) of tooth morphogenesis as a proxy for developmental flexibility, we find that rodents and primates exhibit broad molar proportion variation and frequent deviations from ICM predictions. In contrast, multituberculates—particularly those with specialized plagiaulacoid (blade-like) premolars—cluster tightly in a narrow region of morphospace. This suggests a developmental constraint tied to dental specialization, which may have limited the clade's capacity for ecological innovation during times of environmental change.

Symposium: Ancient Biomolecules (Thursday, November 13, 2025, 1:45 PM)

Quantitative detection of melanin pigments in fossil vertebrates using mass spectrometry

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Melanins are important pigments that are responsible for the coloration of skin, hair, feathers, and eyes of animals. Fossilized melanins and melanosomes (melanin-containing organelles) that have been found in recent years have thus attracted the interest of paleontologists, in particular with regard to a potential reconstruction of the paleocolor of extinct organisms. However, the unequivocal detection of melanins in fossil samples is still a challenging task due to the macromolecular nature of this group of pigments. Non-destructive methods like Raman spectroscopy can be easily applied to fossil samples, but provide only limited structural information. On the other side, destructive chemical analysis of valuable specimens is limited (or excluded) by the rarity of the fossil material and the small amounts of potentially preserved biomolecules. Currently, the most reliable methods for the identification of melanins are based on chemical degradation of the pigments followed by analysis of the products by chromatography with UV detection or mass spectrometry. These methods have only been applied to a few fossil specimens, because they require relatively large sample amounts of several milligrams. Moreover, the selectivity of UV detection is not sufficient for distinction from interfering compounds. Here, a highly selective and sensitive method based on alkaline hydrogen

peroxide oxidation followed by liquid chromatography–multiple reaction monitoring mass spectrometry is shown that provides chemical evidence for different melanin pigments in small fossil samples of well below one milligram. Quantitative measurements on several classes of vertebrates from the Pliocene of the Willershausen Lagerstätte (Germany), including the famous specimens of the mouse *Apodemus atavus* with preservation of fur, reveal differences in the composition of melanin pigmentation. The results have general implications for the assessment of melanin pigmentation in fossils and the reconstruction of paleocolor. Future work will include various taxa from different localities and periods, potentially providing new insights into the occurrence, composition, and fossilization of melanin pigments in deep time.

Funding Sources Deutsche Forschungsgemeinschaft (DFG) project number WO 1491/5-1 to Klaus Wolkenstein.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

A new specimen of the Early Triassic ichthyosauriform *Chaohusaurus zhangjiawanensis* from Yuan'an, Hubei Province, South China

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Ichthyosauriforms were a group of Mesozoic marine reptiles that evolved a fish-shaped body profile. Within ichthyosauriforms, the genus *Chaohusaurus* represents the sister group to ichthyopterygians (ichthyosaurs) and is crucial for understanding their early evolution. Numerous fossils of *Chaohusaurus*, representing three species—*Ch. geishanensis*, *Ch. chaoxianensis*, and *Ch. brevifemoralis*—have been recovered from the Early Triassic Chaohu fauna in Anhui Province, South China, providing valuable insights into the morphology, paleobiology, and evolutionary history of the genus. However, one species—*Chaohusaurus zhangjiawanensis*—is known only from the Early Triassic Nanzhang-Yuan'an fauna of Hubei Province. This species is represented by only a few incompletely preserved specimens, and many aspects of its morphology remain poorly understood. Here, we report a new specimen of *Ch. zhangjiawanensis* from Yuan'an County, Hubei Province, South China. The specimen is an almost complete skeleton, approximately 1.1 meters in length, exposed in ventral view. It reveals previously unknown or poorly documented anatomical features, including details of the dentition, vertebral column, limb girdles, and hindlimb. The new specimen also enables reinterpretation of several previously reported anatomical features, such as the morphology of the forefin and sacral ribs. Quantitative analysis shows that the posterior, bulbous teeth of *Ch. zhangjiawanensis* are the most robust among all known species of *Chaohusaurus*. Phylogenetic analysis incorporating the new anatomical data indicates that *Ch. zhangjiawanensis* is the earliest-diverging species of *Chaohusaurus*, with *Ch. geishanensis* forming the sister group to a clade comprising *Ch. chaoxianensis* and *Ch. brevifemoralis*. Collectively, our results suggest that *Chaohusaurus* evolved in a shallow-marine environment, where it was a predator with a diet relatively rich in hard-shelled prey—an ecological stage represented by *Ch. zhangjiawanensis*—and later became increasingly adapted to a deep-marine lifestyle, as seen in the species from Chaohu. This hypothesis is consistent with geological evidence indicating a shallow-marine setting for the Nanzhang-Yuan'an fauna and a deep-marine setting for Chaohu. Our new finding highlights the significance of the Nanzhang-Yuan'an fauna for understanding the early evolutionary history of ichthyosauriforms.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

A new occurrence of a caecilian (Lissamphibia: Gymnophiona) from the Upper Triassic Tecovas Formation of Texas, reveals that caecilians were widespread in the western USA

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Today, there are two groups of Lissamphibia (living amphibians): Batrachia (salamanders + frogs) and Gymnophiona (caecilians). Of these groups, caecilians have the poorest fossil record, with only approximately eleven known occurrences over ~230 million years. A significant chronologic and geographic gap exists between their hypothesized Late Paleozoic origins and their next known occurrence in the Late Triassic, where *Funcusvermis gilmorei* represents the earliest definitive stem-caecilian. This gap is most likely because of their small body size, fossorial lifestyle, and the lack of identification of fragmentary elements. Here, we describe a partial caecilian pseudodentary from the Upper Triassic Tecovas Formation of Texas, a region where caecilian fossils had yet to be reported. The two mm in length jaw fragment was recovered during microvertebrate screenwashing and has two rows of pedicellate tooth attachment bases—a key diagnostic feature of caecilians. These features, along with the presence of a shallowing of the lingual subdental groove towards the anterior part of the jaw, indicate that this element is a left caecilian pseudodentary. To enhance our understanding of the morphology of this specimen, we used µCT scanning, which revealed some of the same anatomical features present in *F. gilmorei*, a caecilian from the Chinle Formation of Arizona—such as the labial subdental groove, symphyseal tooth row, posterior exit external branch cranial nerve, and pits. However, some morphological features are not preserved because of the fragmentary nature in the Texas jaw like the posterior terminus adsymphyseal tooth row and external branch cranial nerve. The biggest difference between the two specimens is their size, mainly the mediolateral width of the Texas jaw being wider. Also, the slope of the lingual subdental groove is steeper in our new specimen. Based on these differences, we hypothesize this new specimen is within its own taxon in the Tecovas Formation. We predict additional caecilian fossils will be recovered from Adamanian deposits in New Mexico. We also hypothesize that when using microvertebrate collection techniques, caecilian fossils can be found in other equatorial regions from the Triassic, consistent with their extant tropical distribution.

Funding Sources NSF EAR 1943286 to S.J.N.; David B. Jones to S.J.N., M.R.S.

Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Evolution through space and time: the fossil record of *Podarcis pityusensis,* the Ibiza wall lizard, as a system to link form-function-environment trajectories across scales of varying magnitude

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A great outstanding problem in paleontology is ‘The Paradox of Stasis’; rapid evolutionary rates we can observe today stand in direct contrast to slower rates observed across longer timescales deeper in the fossil record. To overcome this, we need case studies in which directly-comparable evolutionary trajectories can be investigated across scales of magnitude, known as ‘evolutionary scaling.’ An icon across its natural range of Eivissa, Formentera and 42 surrounding islands, the Ibiza wall lizard, *Podarcis pityusensis*, is a unique case study due to its modern-day phenotypic diversity and its high-

resolution Quaternary fossil record provided by the Es Pouàs cave site. Here, evolutionary scaling of form-function-environment relationships are assessed with the hypothesis that evolution will appear 'faster' over finer-resolution time and geography bins, and 'slower' over coarser-resolution bins. Form is quantified through geometric morphometrics of fossil and modern mandibles and Orientation Patch Count (OPC) is used to quantify tooth complexity. Function is quantified through in-vivo bite force measurements across diverse modern populations, which are used to validate Finite Element models of fossil layers. Biotic and abiotic environmental selection pressures are directly measured in each modern population, while fluctuating asymmetry is used to estimate environmental stress in the fossil record. These lines of investigation are brought together using adaptive landscape techniques to investigate how populations of *P. pityusensis* traverse a rugged fitness landscape across time and geography, and whether this traversal appears different when varying magnitudes of evolutionary isolation are assessed. Results reveal incongruence in trajectories. Whereas phenotypic divergence can be observed over extremely small scales, this is masked by apparent stabilizing selection on greater scales. However, when and if 'stasis' is reached apparently depends on the trait investigated. I conclude here that 'The Paradox of Stasis' appears simply a problem of resolution, and I draw parallels with other fields to discuss how our drive to define fundamental laws or principles in science can hold us back in our understanding of the natural world.

Funding Sources Deutsche Forschungsgemeinschaft (DFG Mu 1760/11-1).

Symposium: Evolution of Triassic non-marine tetrapod communities through time I (Friday, November 14, 2025, 8:00 AM)

New digital data advances our understanding of Early Triassic reptile diversity at the bottom of the world (Fremouw Formation, Antarctica)

Woolley, Charles H.[1,2], Sidor, Christian A.[3,2], Smith, Nathan D.[1], Whitney, Megan[4], Makovicky, Peter[5], Shinya, Akiko[6], Benson, Roger B.[7], McIntosh, Julia A.[8]

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The Lower Triassic Fremouw Formation of the central Transantarctic Mountains preserves one of the best fossil datasets for investigating high-latitude terrestrial vertebrate ecosystem dynamics in the wake of the End-Permian Mass Extinction (EPME). Recent work focused on synapsids and temnospondyl amphibians from the Fremouw has yielded remarkable discoveries that uncover novel patterns in biodiversity, paleoecology and physiology. However, fewer studies have examined the reptilian components of the vertebrate assemblage, which include the parareptile *Procolophon*, the enigmatic diapsid *Palacrodon*, and the archosauromorphs *Antarctanax* and *Prolacerta*. This may be due in part to differing preservation modes of Fremouw reptiles (particularly archosauromorphs) compared to synapsid and temnospondyl components. While synapsid and temnospondyl components of the Fremouw assemblage contain numerous representative articulated skulls and skeletons of single individuals, archosauromorph fossils from the lower Fremouw Formation are frequently preserved in small (~40 cm^2), highly clustered, disarticulated bone aggregates. This preservation mode makes physical fossil preparation nearly impossible and has historically hindered work to describe these

specimens. Here, we present three-dimensional data from recent computed tomographic (CT) scans of five undescribed microvertebrate 'bonebeds' from the lower Fremouw Formation. First, we describe a potential new species previously unreported from the Fremouw. Second, we explore previous hypotheses regarding the preferential preservation of juvenile *Prolacerta* to the near exclusion of adults as well as potential insights into sociality and precociousness in the species. Finally, we discuss the biogeographic implications of these discoveries and highlight local and regional trends in reptile biodiversity during recovery from the EPME.

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Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Age estimation and life history traits of modern and fossil mysticetes from Southern Africa

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Tympanic bullae histology was used in the mid-to-late 1900s to age individual whales to develop age-length relationships and set catch size limits during whaling times. However, it has since been used to provide information on other life history traits. In the current study, tympanic bullae from all three modern mysticete families (~5 species) were studied histologically. The southern right whale (Balaenidae), Bryde's whale (Balaenopteridae), and the pygmy right whale (Neobalaenidae) samples included tympanic bullae from individuals in different age classes allowing for assessment of the bone development through ontogeny, and the identification of age-related traits aside from growth marks. Most adult individuals in the sample showed distinct growth marks in the ventral region. Based on skeletochronology, the adult pygmy right whales were estimated to be between 9 and 11 years, whereas the southern right adults were 25+ years old. There were no growth marks in the Bryde's whales' tympanic bullae, which may be a species-specific trait, but it is more likely that they are all young individuals as there are growth lines in the related adult minke and sei whales. A possible pathology was noted in one of the tympanic bullae of a southern right whale, which was evident by extensive resorption cavities through the bone interior. This information from the modern mysticetes was then used to make inferences about the fossil balaenopterids from the Mio-Pliocene locality, Langebaanweg. Preliminary results suggest that the fossil whales were all subadults as no growth lines have been noted, although some secondary remodelling indicates that they were not neonate or very young calves.

Funding Sources GENUS: DSTI-NRF Centre of Excellence in Palaeosciences, Past Africa, Harry Crossley Foundation.

Technical Session VII: Laurasiatheria (Thursday, November 13, 2025, 8:00 AM)

Role of body size in shaping the dietary ecology of the North American 'Hell Pig' (*Archaeotherium*) revealed through dental microwear texture analysis

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Archaeotherium was an entelodont that persisted for over 14 million years (~37–23 Ma) despite major global environmental changes, yet their paleoecology remains poorly understood. Here, we use dental microwear texture analysis (DMTA) to reconstruct the paleobiology of multiple *Archaeotherium* species and morphotypes from wide geographic and temporal ranges—offering new insight into their dietary strategies and ecological roles. DMTA

measures surface-texture features including complexity (*Asfc*), associated with the consumption of brittle items like bone, seeds, and woody-browse; and textural fill volume (*Tfv*), which reflects feature depth and is often indicative of durophagy. Our results show that *Archaeotherium* exhibited substantial dietary variation at the genus level—but there is limited evidence for hard-food consumption (durophagy or "bone-crunching" behaviors) when compared to extant groups with known diets. As a whole, *Archaeotherium* were more similar to peccaries that sheared their food, as opposed to those with bunodont teeth that engaged in crushing harder foods. However, when we consider size, *Archaeotherium* reveals size-driven dietary partitioning. Three *Archaeotherium* morphotypes are recognized: a smaller-bodied "standard" form and two large-bodied forms (enormous "Subgenus A" and robust "Subgenus B"). The smaller-bodied forms have *Asfc* values similar to extinct peccaries (*Protherohyus*, *Platygonus*) and to the extant felid *Acinonyx jubatus*, with *Tfv* values closely matching *Acinonyx jubatus*—both suggesting consumption of softer foods with minimal durophagy, indicative of limited bone consumption or scavenging behavior. In contrast, the large-bodied forms exhibit significantly higher *Asfc* values, statistically indistinguishable from the extinct peccary *Mylohyus* and extant feliforms (*Panthera leo*, *Parahyaena brunnea*) that exhibit moderate degrees of bone processing, with *Tfv* values similar to both peccaries and hyenas—consistent with consumption of harder and/or more brittle foods that could include nuts, tubers, and bone. Together, these results indicate that *Archaeotherium* occupied diverse ecological niches, with dietary strategies strongly influenced by body size. This ecological flexibility may have contributed to their evolutionary persistence across dynamic paleoenvironments. In short, smaller *Archaeotherium* species should not be inferred to have had similar ecological roles as the larger morphotypes—*Archaeotherium* ecology scales with size.

Funding Sources National Science Foundation Graduate Research Fellowship Program under Grant No. 1937963 and 2444112.

Colbert Prize Session

Vertebral fusion in the terminal caudal series of an ornithopod dinosaur from the Lower Cretaceous Khuren Dukh Formation, Gobi Desert

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The pygostyle, a structure formed by the fusion of the terminal caudal vertebrae, is one of the key morphological innovations associated with the origin of birds. Its presence in various phylogenetically more basal coelurosaurian theropods than Avialae supports the dinosaurian origin of birds, suggesting that pygostyle-like structures may have evolved prior to true avian flight. However, the report of a pygostyle-like structure in an ornithopod dinosaur, *Bayannurosaurus perfectus* from Inner Mongolia, China in 2013, that is phylogenetically distant from theropods, raises the possibility that such structures evolved convergently in non-theropod lineages. At the same time, several pathological studies suggest that similar vertebral fusions can result from post-traumatic healing, complicating interpretations of such morphology.

In this study, we investigated a fused series of four distal caudal vertebrae in an iguanodontian specimen from the Lower Cretaceous Khuren Dukh Formation at the Khuren Dukh locality in

Dundgovi Province, Mongolia, to assess whether the structure represents a pathological fusion or a potentially homologous or convergent pygostyle-like morphology. Macroscopic observation revealed gradual changes in centrum shape from rectangular to trapezoidal distally, lateral curvature of the fused series, asymmetric neural arches (with the right side larger than the left), and fracture traces aligned sagittally. Computed tomography (CT) imaging demonstrated tight fusion of the vertebrae without intervertebral gaps. Internally, the trabeculae were directionally aligned from posterodorsal to anteroventral and the dorsal cortical bone was absent. These features indicate that fusion proceeded anteriorly from the distal end, a pattern similar to pygostyle formation in extant birds. While external signs of trauma (curvature and fracture lines) suggest initial injury, the absence of irregular internal morphology supports normal remodeling and fusion post-healing. This study implies that pygostyle-like structures may have evolved independently in ornithopods and potentially other non-theropod dinosaur groups. Furthermore, it broadens the morphological and evolutionary context of tail reduction and terminal vertebral fusion in Dinosauria.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The difference in locomotor style between two saurischian clades, theropod and sauropodomorph, inferred from trackways

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Theropods include the largest fully bipedal animals to have ever existed, while sauropodomorphs comprise the largest quadrupedal terrestrial animals in Earth's history. Both groups belong to Saurischia and achieved extreme body sizes within their respective locomotor modes, bipedal and quadrupedal. Theropods generally evolved adaptations favoring increased locomotor speed, whereas sauropodomorphs exhibited the extreme graviportal adaptation. Comparing locomotor evolution and its body size in these clades reveals how bipedality and quadrupedality constrain graviportal adaptation and whether similar or distinct factors limit gigantism in each lineage.

Dinosaur trackways offer locomotor insights independent of body fossil. We investigated the temporal changes in locomotion inferred from theropod and sauropod trackways. We conducted the literature survey and collected data from 671 theropod trackways and 690 sauropod trackways. We specifically focused on the pace angulation, stride length (SL) and body size. We used the footprint length (FL) as an index of body size and ratio of stride length to footprint length as an index of relative speed.

Our analysis revealed that sauropodomorphs experienced a significant reduction in pace angulation from the Jurassic to the Cretaceous ($p < 0.0001$), while theropods showed no such temporal trend. Furthermore, theropod pace angulation remained largely unchanged with increasing relative speed (slope = 0.61), in contrast to sauropodomorphs, where pace angulation increased with speed (slope = 6.21). These differences suggest distinct locomotor strategies and evolutionary trajectories: sauropodomorphs underwent continued gait modification associated with increasing body size and cranial shifts in center of mass, while theropods maintained a consistent, cursorial bipedalism inherited from their ancestors.

There was a negative allometric relationship between footprint length and stride length among theropods (regression slope = 0.56), and the degree of this relationship was considerably weaker in sauropodomorphs (regression slope = 0.85). That is, in both clades, stride length becomes relatively smaller as body size increases, but this trend is more pronounced in theropods. This result potentially indicates that in theropods, which had high locomotor capabilities, the constraints on locomotion imposed by increased body size were

significantly greater compared to sauropods that generally had lower locomotor abilities.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Tail shedding in two Cretaceous lizards: autotomic structures revealed by X-ray CT scanning

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In amniotes, lizards are the only lineage that can lose and regrow a part of their body, typically the tail. In modern lizards, this self-controlled tail amputation occurs at weak points known as fracture planes, found in the caudal vertebrae. However, little is known about the morphological and developmental variations of these fracture planes in fossil lizards. Utilizing high-resolution X-ray CT, we examined the fracture planes in two Early Cretaceous fossil lizards: *Yabeinosaurus* and *Dalinghosaurus*. In *Yabeinosaurus*, the fracture plane first appears at the sixth caudal vertebra, while in *Dalinghosaurus*, it appears at the ninth caudal. In *Yabeinosaurus*, the fracture plane is located within the transverse processes, resembling the condition seen in modern skinks. In *Dalinghosaurus*, the fracture plane is found posterior to the transverse processes, similar to the condition found in modern lacertids. Morphological variations of the fracture planes in the two fossil species indicate they could have employed different methods of self-controlled tail amputation. In addition, *Dalinghosaurus* demonstrates fused neural spines and divided vertebral centra in the posterior caudal vertebrae—a condition known in extant adult lizards to restrict the ability to shed the tail. This fusion in *Dalinghosaurus* implies that this species could adapt escape strategies at different developmental stages. Most early squamates were small, and the increase in CT and synchrotron studies on damaged and compressed specimens enhances our understanding of the anatomical details, behavior, and growth of fossil squamates.

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Technical Session XV: Reptile'O'Rama (Saturday, November 15, 2025, 8:00 AM)

The Chinese pareiasaurs revised: taxonomical validity and phylogenetic framework of late Permian pareiasaurs

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Pareiasauria is a specialized clade of herbivorous tetrapods that existed throughout Pangaea during the mid to late Permian. The phylogenetic relationships of Chinese pareiasaur species have remained controversial for several decades, primarily due to the poor preservation of the known specimens. Although eight Chinese pareiasaur species have been described since the 1960s, only *Shihtienfenia completus* is based on a complete skull; others were established based on either postcranial material or incomplete cranial elements.

The latest study describes a mid-sized pareiasaur, *Yinshanosaurus angustus*, from the Naobaogou Formation. It provides the complete cranial and articulated postcranial details of Chinese pareiasaurs for the first time. In phylogeny, *Y. angustus* and *S. completus* form a monophyletic clade characterized by a unique combination of features, including the extremely

pointed snout, orbit dorsoventrally expanded to form an elliptical shape, the presence of a prominent postfrontal horn, a pineal foramen located midway along the interparietal suture, and tabular sutures in the midline that encircle the postparietal. Furthermore, the postorbital region of the skull is shorter than the preorbital region. This newly identified monophyletic group forms a sister clade to Pumiliopareiasauria, distinguishing it from other pareiasaurs.

In this study, extensive additional preparations were conducted on the holotype of *Huanghesaurus* and *Shihtienfenia*. A comprehensive cranial and postcranial description of Chinese pareiasaurs is provided, and the autapomorphies of the named species are revised. The abundant disassociated postcranial elements from the Baode locality can be categorized into two morphotypes; one represents *Honania* and *Yinshanosaurus*, and the other represents *S. permica* and *S. completus*. Additionally, *Shansisaurus* and *Sanchuansaurus* are classified as *Shansisaurus*, while *Huanghesaurus* is retained for the unique osteoderms. The proposed phylogenetic framework supports a stable monophyly that includes all mid-sized Chinese pareiasaurs. The closer relationship between African and Chinese pareiasaurs is confirmed.

Funding Sources National Natural Science Foundation of China (No.42472023).

Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

Structural mechanics of the earliest dome-headed dinosaur, and the origin of the unique cranial structure

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Pachycephalosauria is a unique group of Cretaceous ornithischian dinosaurs characterized by an extremely expanded dome structure on the skull roof. Previous studies on the structural mechanics of the dome are limited to simulations of a few taxa, and its function remains debated. Here, we conducted Finite Element Analysis (FEA) on the three-dimensionally preserved skull of the earliest dome-headed pachycephalosaur (MPC-D 100/1209) discovered from the Lower Cretaceous Khuren Dukh Formation at the Khuren Dukh locality in Mongolia. The Finite Element Model (FEM) of the MPC-D 100/1209 skull was created by Slicer and Blender, using μCT scan data. We employed twenty simulations (292.5 N force) on the FEM using FEBio, differing in location and direction, assuming three different modes of head impacts (frontal-, side-, and diagonal-butting), and constrained the area of the muscles (only the occipital condyle vs. combination of the occipital condyle and cervical muscles). Our results show that, when constrained at the occipital condyle, the skull was strong for impacts in the front region but exceeded the fracture limit in the back region. However, when adding neck muscle constraints, the skull mitigates stress and is lower than the fracture limit in all ten locations, especially from the transverse force on the lateral sides as well. Also, the skull experienced the minimum stress when the impact was applied at the dome apex. The dome mechanics of MPC-D 100/1209 provide new insights that the earliest pachycephalosaur was osteologically resistant enough to front forces, as would be induced by head-butting. The simulations also suggest that the expansion of the occipital region increases the attachment site of the cervical muscles, mitigating the stress from transverse forces and strengthening against multiple oriented forces in addition to front-to-front impacts. Furthermore, the minimum stress in the model where the impact force is applied at the dome apex, and is

constrained by both the occipital condyle and the cervical muscles, suggests that the skull structure is mechanically optimized for head-butting. MPC-D 100/1209 was small-bodied and skeletally immature with its primitive dome structure, but it likely employed head-butting behavior, possibly for intra- and interspecific communications. Our in-depth FEA reveals the origin of the unique skull transformation coupled with the mechanics, function, and behavior of the earliest pachycephalosaur from Mongolia.

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Direct evidence of scavenging on a large Paleozoic terrestrial herbivore

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Three well-preserved juvenile skeletons of the herbivore *Diadectes* from the early Permian of Texas exhibit numerous tooth markings indicative of postmortem scavenging. Based on the fauna of this locality, probable scavengers include various possible predators like *Varanops* and large temnospondyls like *Acheloma*, as well as boring arthropod larvae. However, coeval sphenacodontid synapsids not preserved at this locality are also possible candidates. This discovery represents the earliest direct evidence of predator-prey trophic interactions during the initial stages of amniote evolution, exemplifying the increasingly complex terrestrial food web during the late Paleozoic.

Funding Sources Natural Sciences and Engineering Research Council (NSERC) Undergraduate Student Research Award (USRA); NSERC Vanier Canada Graduate Scholarship; NSERC Discovery Grant

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Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Exploring the phylogenetic relationships of thalattosuchian crocodylomorphs

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Thalattosuchia was a diverse clade of crocodylomorphs known from the Jurassic and Cretaceous Periods. Within Thalattosuchia, the subclade Metriorhynchidae made the transition from land to sea, evolving from semi-aquatic forms with a bauplan reminiscent of extant crocodylians, into species adapted to an aquatic existence (evolving hydrofoil-like forelimbs, hypocercal tail, and smooth body integument). Thalattosuchians have been one of the most intensively studied crocodylomorph clades, especially during the 19th and 20th centuries. While thalattosuchian fossils were first described in 1758 (Yorkshire, UK), and dozens of species have been named, their origins within Crocodylomorpha have remained elusive. Over the past two centuries there has never been a consensus as to where in Crocodylomorpha they pertain, and there are four commonly recovered positional hypotheses: 1) outside Crocodyliformes, 2) outside Metasuchia but within Crocodyliformes, 3) an early branching member of Neosuchia, and 4) a member of the 'longirostrine' clade with Tethysuchia. We analysed our revised phylogenetic dataset and ran it under equal weights and extended implied weights. We then ran topological constraint analyses to enforce the differing hypotheses. In our unconstrained analyses, Thalattosuchia was recovered in position two (outside Metasuchia but within Crocodyliformes). However, we are unable to statistically differentiate between the four positional hypotheses, although hypotheses one and two (= non-neosuchian origin) have the best stratigraphic congruence. We posit that

crocodylomorph phylogenetic datasets have a missing data problem (due to the dearth of key fossils from the Norian–Pliensbachian), which causes a noise problem in our analyses. For Thalattosuchia, these problems are magnified as the characters uniting the group reflect clade specialisations, with few characters providing a link to other branches (and many of these characters conflict on which branch Thalattosuchia belongs to). Without new discoveries from the Norian–Pliensbachian, the origins of Thalattosuchia will remain a mystery.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Craniofacial and histological ontogeny of *Psittacosaurus mongoliensis* and *P. lujiatunensis:* toward evidence for the developmental underpinnings of species differences

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Psittacosaurus is an important Eastern (China, Mongolia, Russia) clade of early horned dinosaur (Ceratopsia) known from many complete specimens. Despite a large sample size, their growth series are incompletely understood. Previous work on *Psittacosaurus* growth was limited to describing variation of 'juveniles' and 'adults' based on craniofacial and histological characters, but without recovering growth series. The goal of this study was to recover growth series using cladistic methods; the advantage of a cladistic approach is that it combines all relevant developmental data into a single hypothesis. Qualitative and quantitative skeletal characteristics of the skull, teeth, and tibia were derived from the literature and compiled into data matrices (*P. mongoliensis* craniofacial matrix; four specimens, seven characters; tibia histology matrix, five specimens, six characters; *P. lujiatunensis* craniofacial matrix, eight specimens, 15 characters; tibia histology matrix, six specimens, 10 characters). In *P. mongoliensis*, one growth series of three stages was recovered (TL = 9, CI = 1.0, RC = 1.0), one growth series of four stages was recovered from the tibia histology matrix (TL = 11, CI = 1.0, RC = 1.0). In *P. lujiatunensis*, one growth series of six stages was recovered (TL = 16; CI = 0.94; RC = 0.85), one growth series of three growth stages was recovered from the tibia histology matrix (TL = 19, CI = 1.0, RC = 1.0). A posteriori comparison of the craniofacial growth series identified two growth changes, a decrease in orbit diameter relative to skull length and deepening of the suborbital bar, which occur in the same order. These changes are evidence of the ancestral growth series of the *P. mongoliensis*+*P. lujiatunensis* clade. The shared jugal horn character occurs early in growth in *P. mongoliensis*, whereas in *P. lujiatunensis* it occurs late. Comparison of the tibia histology growth series identified two growth changes, the change to longitudinal and reticular diaphyseal vascularization and the presence of secondary remodeling, which occur in the same order. The shared change to dominant fibrolamellar bone tissue occurs late in growth in *P. mongoliensis*, whereas in *P. lujiatunensis* it occurs early.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Skeletal indicators of webbed feet in birds and their applications to *Spinosaurus*

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Since the discovery and subsequent destruction of the holotype of *Spinosaurus* during WW2, there has been a lengthy debate over its true ecology. Material from its relatives likely indicated that *Spinosaurus* was a wading piscivore. The discovery of the neotype in 2014 provided more complete fossils of *Spinosaurus*. These remains included unusually short hind limbs, flat bottomed pedal unguals and an elongate digit I. It was hypothesized that *Spinosaurus* was actually an aquatic pursuit

predator that propelled itself in the water potentially using webbed feet, though not well-adapted for terrestrial locomotion because of its short hind limbs. However, this has been sharply criticized, and since then, no morphometric studies of the pedal anatomy of *Spinosaurus* have been conducted to assess whether it actually had webbed feet. The present study compares the pes of *Spinosaurus* to a variety of avian and non-avian species.

Measurements were collected for the lengths of pedal digits II, III and IV, average mass, and interdigital angles for 69 species. All species were categorized into 10 foot types, primarily based upon the type of webbing possessed or lack thereof, and the orientation of each pedal digit. Data was gathered specifically from large terrestrial and aquatic birds, and after appropriate scaling, the data was used to code for a PCA in R to best visualize differences. Based upon a restored 3D printed reconstruction of the pes of *Spinosaurus*, with certain metatarsal elements taken from *Suchomimus*, the strongest similarities were found with large terrestrial birds, especially the greater rhea. More aquatic birds like cormorants or pelicans were completely different from *Spinosaurus*, as they proportionally had longer pedal digits, and wider interdigital angles. This indicates that the feet of *Spinosaurus* were most likely not webbed as previously suggested, and had few adaptations for swimming and an aquatic lifestyle.

Funding Sources Queen Mary University of London - Masters Thesis Budget.

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A partially articulated skeleton of a possible dwarf boa (Tropidophiidae) from the early Oligocene of the Fayum Depression, Egypt

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The Paleogene deposits of the Fayum Depression in northern Egypt are known for a highly diverse vertebrate fauna including fish, reptiles, and mammals. The reptiles include a number of snakes previously described from the Eocene Birket Qarun Formation, especially from locality BQ-2; among these is an unnamed putative dwarf boa (Tropidophiidae). Extant dwarf boas are distributed in Central and South America and the Caribbean, but fossils referred to the family from Europe and Egypt suggest a previously broader geographic distribution. Here we describe a new partially articulated snake skeleton from the early Oligocene (~30 Ma) Jebel Qatrani Formation (Quarry I) and discuss its affinities with previously described Fayum material and extant species. The vertebral morphology agrees quite closely with that of the previously described putative tropidophiid from BQ-2, providing a temporal extension of the taxon in Egypt into the Oligocene. The specimen is contained in two blocks, and includes segments of articulated vertebrae from all regions of the vertebral column, allowing confirmation of material referred to as belonging to a single species at BQ-2. The material additionally includes a three-dimensionally preserved, disarticulated skull. Digital preparation of the material enables examination of the individual cranial elements and reconstruction of the articulated skull. If the taxonomic identification of this material is correct, it provides further evolutionary information of the extant family Tropidophiidae, expanding their known range into the Old World and providing a hint at unknown diversity in the clade. It also expands our knowledge of the

herpetofauna of the Oligocene of North Africa, a time that is characterized in other global regions by an extinction event that severely affected certain snake clades.

Funding Sources Nazareth University.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

A comparison of 3D models created using photogrammetry and 3D models created using CT scanning using Orientation Patch Count (OPCr)

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Orientation patch count (OPC) is a measurement used to quantify the complexity of a 3D surface. Previous studies have used OPC to correlate high feeding surface complexity with herbivory in a wide spectrum of vertebrates, from horses and primates to lizards and turtles. In order to employ OPC, a specimen must first be digitized into a 3D model. One of the most common methods of digitization is computed tomography (CT) scanning, but as technology for the creation of 3D models has become cheaper and thus more accessible, other methods have gained popularity. This includes photogrammetry, which can vary greatly in cost and accessibility depending on desired setup. Paleontologists can create high-quality 3D models using either of these methods, and those models can then be utilized for 3D printing, analysis, and/or educational purposes. However, there is little research analyzing the impact of these different scanning techniques on the surface complexity of the resulting mesh. This study therefore seeks to determine how much variation exists in the OPC value of a 3D model depending on the scanning technique used. Nineteen turtle skulls previously digitized using photogrammetry were CT scanned to create 3D models of the occlusal surface of each skull. The skulls ranged in size from a 1.5 cm wide *Terrapene carolina* to an 11 cm wide *Macrochelys temminckii*. We then analyzed these surfaces using OPC. Finally, we compared the OPC value of each CT-scanned specimen to its photogrammetric counterpart in order to explore variation in surface complexity between these scanning methods. We found that the difference in OPC between models made using each method varied depending on several factors, including the color and reflectiveness of the original specimen and the actual width of the specimen. In particular, the photogrammetric models tended to exaggerate morphology in bright white specimens as well as those under 2.5 cm wide. However, we found no significant difference in the two groups on average, suggesting datasets could possibly be combined provided specimens are selected carefully.

Funding Sources University of Washington Department of Biology; Stephen and Ruth Wainwright Endowed Fellowship, University of Washington; Cohen Award, Society of Vertebrate Paleontology

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Technical Session I: Dinosauria I: Ornithischia & Theropoda (Wednesday, November 12, 2025, 8:00 AM)

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-EMBARGOED-

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Evolution of the antorbital fenestra in Archosauriformes: insights from craniofacial morphometrics

Zariwala, Juned[1], Stott, Iain[1], Ruta, Marcello[1], Hayden, Matthew[1], Venditti, Chris[2], Meade, Andrew[2], Sutton, Gregory[1], Sakamoto, Manabu[2]

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Archosauriformes, a diverse clade including both extinct (dinosaurs & pterosaurs) and extant groups (crocodiles & birds), are characterized by a distinctive excavation in their snout known as the antorbital fenestra (AOF). Despite the widespread occurrence of the AOF among both extinct and living archosauriforms, its function remains debated. It is now widely accepted that it housed an air sac, contributing to the lightening of the skull. However, its potential role in cranial biomechanics has yet to be explored. As an initial step toward a comprehensive biomechanical investigation, we present a dataset of 2D linear measurements of the AOF and skull across 454 Mesozoic archosauriform species to investigate changes in AOF proportions. Using Bayesian phylogenetic comparative methods on a time-scaled supertree, we examined the relationships between AOF proportions and skull size. Both AOF surface area and AOF height scale isometrically with the skull surface area and height, respectively. In

contrast, AOF length exhibits a positive allometric relationship with the skull length, likely owing to variation in snout length. AOF scaling isometrically, or in a positively allometric relationship with increasing skull size, indicates that its impact on structural support to counter compressive forces is minimal. That is, physical forces do not constrain size increase in the AOF. These results provide a foundation for a broader, deep-time comparative analysis into the evolution of AOF size in Archosauriformes and offer valuable insights into the mechanical trade-offs influencing changes in AOF size relative to skull dimensions.

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Bayesian tip-dating integrating discrete and continuous morphological characters

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In phylogenetic inference using paleontological data, traditional analyses primarily rely on discrete morphological characters, often ignoring or discretizing continuous traits. This limitation arises largely from the absence of models and computational tools capable of jointly analyzing both data types, a challenge that is further compounded by the prevalence of missing data. To overcome these obstacles, we developed a Bayesian framework that integrates both discrete and continuous morphological characters for total-evidence tip-dating analyses. In this approach, discrete traits are modeled using the Mkv model, while continuous traits follow a Brownian motion model, allowing for the comprehensive use of morphological information. Simulation studies demonstrated that this integrated method yielded more accurate estimates of divergence times compared to analyses based solely on discrete characters. To further assess its performance, we conducted empirical analyses using pterosaur and primate datasets, which confirmed the method's effectiveness. The approach has been implemented in the MrBayes software, enabling its straightforward integration into standard phylogenetic workflows.

Funding Sources National Key Research and Development Program of China (2023YFF0804502).

Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

The latest well-dated occurrence of *Mammuthus meridionalis* in Western Eurasia: insights from the Vallparadís Section

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The Pleistocene fossil record of mammoths (genus *Mammuthus*) presents an outstanding case study for precisely characterizing the tempo and underlying ecological drivers of speciation-turnover episodes in a megaherbivore lineage, with exceptionally well-resolved chronological and paleoenvironmental contexts. Within the European fossil record, the *Mammuthus meridionalis-trogontherii* turnover episode is a key biostratigraphic event across the Early-Middle Pleistocene Transition (EMPT). Understanding the tempo and mode of this turnover, however, has remained challenging as European mammoths from the EMPT interval (1.2–0.6 Ma) exhibit varying forms of mosaic molar tooth morphology, with respect to

nominotypical forms of both *M. meridionalis* and *M. trogontherii*. Furthermore, a number of candidate terminal occurrences of *meridionalis*-type mammoths remained slightly equivocal in their exact geologic age. Discovered during construction works in Terrassa, Catalonia, the Vallparadís Section exhibits a rare case of latest European *M. meridionalis* associated with well-defined radiometric, magnetostratigraphic, and faunal context. The studied specimens were unearthed from horizons EVT7 and CGRD7 with a chronology of 0.86 Ma (latest Early Pleistocene), and correlated with marine isotope stage 21. A pair of complete lower adult molars from Vallparadís Section EVT7 show greatest morphological resemblance to late *meridionalis*-type samples from Saint-Prest, France and Sinyaya Balka in Ciscaucasian Russia, while also readily separable from the earliest examples of *M. trogontherii*. Dental mesowear of the Vallparadís Section mammoths show browse-dominated foraging signal that closest resemble those from Fuente Nueva 3, another Spanish late *M. meridionalis* sample.

Funding Sources Research Council of Finland (HZ and JS); Departament de Cultura de la Generalitat de Catalunya (JMM).

Regular Poster Session III (Friday, November 14, 2025, 4:30 - 6:30 PM)

Molar enamel thickness of late Miocene *Lufengpithecus lufengensis*: dietary adaptations and paleoecological implications

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Enamel thickness provides dietary insights in hominoids. Yet, 3D enamel analysis of late Miocene *Lufengpithecus* from Southwest China is lacking. We digitally reconstructed 68 unworn or lightly worn *Lufengpithecus lufengensis* molars using micro-CT. Comparisons with modern humans, Asian *Homo erectus*, extant/fossil *Pongo*, *Pan*, and *Gorilla* reveal *L. lufengensis* has 'intermediate/thick' enamel, thicker than *Pongo* and *Gorilla*, but thinner than humans and *Homo erectus*. Enamel thickness distribution aligns more with *Homo* than *Pongo*, *Pan*, and *Gorilla*, favoring upper molar parts. Relatively thicker enamel atop molar crowns and its uneven distribution may enable *L. lufengensis* to endure dietary variation, notably hard foods in a seasonal habitat linked to the late Miocene Tibetan plateau uplift.

Funding Sources Strategic Priority Research Program of CAS (XDB26000000); Research Fund for International Scientists of National Natural Science Foundation of China (42350410443)

Technical Session VI: Mesozoic Seas & Skies (Thursday, November 13, 2025, 8:00 AM)

New anatomical information of *Atopodentatus unicus* (Sauropterygia, Reptilia) from the Middle Triassic of South China

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The Middle Triassic *Atopodentatus*, the earliest known herbivorous marine reptile, exhibits highly specialized skull and dental morphology that has long made it considered an aberrant sauropterygian. The paucity of specimens has constrained detailed anatomical features and morphofunctions of this taxon. We restudied *A. unicus* based on a new specimen from the Upper

Member of the Guanling Formation near Luxi County, Yunnan Province, China that clarifies previously ambiguous anatomical information through exceptional three-dimensional preservation of neural spines and forelimbs. Newly added or modified diagnostic characters include: the vertebral column consists of 12 cervical vertebrae, 24 dorsal, and 3 sacral (rather than 14 cervical, 22 dorsal, 2 sacral vertebrae); the hatchet-shaped scapula is strongly concave posteriorly with a short dorsal blade (rather than strongly convex anteriorly); the manus larger than pes (rather than smaller); the straight ulna and medially curved radius are of the same length; two carpals and two tarsals; the phalangeal formula is 2-3-4-5-3 for the manus, and 2-3-4-5-4 for the pes. The skull morphology remains consistent with the holotype. The slight difference in the articulation of the frontal with the parietal is individual variation and/or a result of preservation. The dentition and jaw morphology of this specimen provide further confirmation of its herbivorous adaptation, thereby expanding our understanding of the diversification of feeding strategies during the recovery of the marine ecosystem. These findings critically refine *A. unicus*'s diagnostic framework and offer new insights into the phylogenetic position of this taxon. The specimen not only extends the spatiotemporal distribution of this taxon in South China, but more importantly, demonstrates that marine trophic networks had achieved full functional recovery by the Anisian.

Funding Sources Funding for this work was provided by the National Natural Science Foundation of China (NSFC).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

A new genus of Dayongaspidae (stem-Gnathostomata) from the Silurian of Jiangxi, China, and a new interpretation of galeaspid oral apparatus

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Early vertebrate evolution has been characterised as a progressive trends toward increasingly active food acquisition, from filter-feeding invertebrate chordates through to predatory jawed vertebrates. The phylogenetically intermediate, extinct, jawless ostracoderms have been envisaged as ecologically intermediate deposit feeders, even though their feeding ecology and even the nature of their mouths has been poorly constrained. This is no more clear than in debate over the nature of the mouth of galeaspids, interpretations of which range from fixed and fully open—because no oral plates have been found among the many disarticulated heads of galeaspid fossils—to closed by an all-encompassing opercular plate—for which there has been no evidence. Here we present evidence from a new genus and species of Dayongaspidid galeaspid from the early Silurian of Jiangxi Province (China) that the mouth of galeaspids was bordered ventrally by a cresent-shaped plate that articulated from the branchial plate caudally, and occluded with the rostral margin of the mouth. Comparison to other groups of galeaspids suggests that an oral plate is general for the clade. A singular oral plate is reminiscent of the condition in the heterostracan *Poraspis*, which occluded the mouth ventrally, hinging from the rostral margin of the post-oral plate; other heterostracans exhibit differentiation of the oral plate field into a number of distinct oral plates, ranging in number from 1–13, while osteostracans possessed a pair of oral plates. Given the phylogenetic position of heterostracans, galeaspids and osteostracans,

related by degree to the jawed vertebrates, these data suggest that ventrally-articulating oral plates were a general feature among the ancestors of jawed vertebrates and may represent the condition from which the dermal component of jaws arose.

Funding Sources National Natural Science Foundation of China (42130209, 92255301).

Technical Session XVII: Dinosauria III: Macroevolution & Sauropodomorpha (Saturday, November 15, 2025, 1:45 PM)

Wedl tunnels in dinosaur and extant vertebrates: reevaluating fungal bioerosion in paleohistology

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Wedl tunnels refers to microscopic traces left by fungal activity that erodes the hard tissues of vertebrates. Since its initial description by Wedl in 1864, the link between fungal erosion and Wedl tunnels has been repeatedly confirmed. While extensively studied and applied in fields such as archaeology, forensic medicine, and taphonomy, records of Wedl tunnels in paleohistology remain scarce. Despite its potential biological significance, this phenomenon is likely underestimated due to misidentification and oversight. A considerable number of paleohistologists misclassify Wedl tunnels as vascular canals, cracks, or entirely overlook its presence. Such errors can compromise interpretations of bone growth rates and developmental patterns. In this study, we provide detailed descriptions of Wedl tunnels observed in a broad range of extant vertebrates and many dinosaur specimens from the Jehol Biota, Lower Cretaceous. On that basis, we further distinguish Wedl tunnels from other commonly confused microstructures and highlight cases of misidentification. To improve diagnostic accuracy, we propose key features to reduce the risk of misidentification. This study aims to enhance paleohistologist's ability to confidently identify Wedl tunnels in fossils, advancing our understanding of fungal interactions with vertebrate hard tissues through geological time. Moreover, the presence of fungal erosion in fossils may offer insight into the burial environment. The observation of fungal erosion in a significant number of dinosaur fossils from the Jehol Biota indicates that the Jehol Biota does not invariably preserve the immediate post-mortem state of the animals. The presence of numerous Wedl tunnels precludes the possibility that these animals died in a pyroclastic flow.

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Regular Poster Session IV (Saturday, November 15, 2025, 4:30 - 6:30 PM)

Skeletal reconstruction and locomotor mode of *Xingxiulong yueorum*, a sauropodomorph dinosaur from Lower Jurassic Lufeng Formation, China

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Sauropodomorph dinosaurs were one of the most spectacular clades of terrestrial vertebrates. From omnivorous taxa of modest size from the Late Triassic to giant sauropods, the evolution of Sauropodomorpha is characterized by a marked increase in body size and a transition in locomotor mode. Evolving from the bipedal ancestral condition of dinosaurs, the acquisition of quadrupedality in this clade probably first emerged in the Late Triassic, followed by a few independent reversions to bipedality. The transformation in their locomotor mode was accompanied by corresponding changes in limb proportions and anatomical features. Previous studies have revealed that the relationship between humeral and femoral shaft

circumferences can effectively indicate locomotor modes.

The species of non-sauropodan sauropodomorphs discovered in the Lufeng Formation of China have significantly advanced our understanding of the evolutionary history of this clade in Early Jurassic, particularly regarding the timing for the acquisition of quadrupedality. In this study, we investigated the locomotor mode of *Xingxiulong yueorum*, a recently discovered species that was larger than the type species *X. chengi*. The holotype of *X. yueorum* lacks forelimb material, rendering the paradigm proposed in previous studies inapplicable in this case. Consequently, we created a precise 2D skeletal model in AutoCAD using measurements obtained from first-hand examination or a 3D scan, with particular attention to the ribcage restoration. For the missing anatomical elements, we restored the absent parts using species with close affinity based on the phylogenetic tree, including *X. chengi* and *Jingshanosaurus xinwaensis*. We employed the cross-sectional method, a recently developed 2D volumetric-density approach, to estimate the body mass and center of mass. Seven cross-sections were generated to model the gradual transition of body shape along the longitudinal axis.

Our results indicate that *X. yueorum* was likely quadrupedal in life, similar to the previously proposed mode for the type species *X. chengi*. When minimal soft tissue was added to the ribcage, the estimated body mass was approximately 1.5 tons, which we consider the lower limit. Our model represents one of the first attempts to employ volumetric-density methods to infer the locomotor mode of non-sauropodan sauropodomorph dinosaurs from the Lufeng Formation, thereby providing a case study for rigorous skeletal reconstruction in future research.

Funding Sources This work was supported by the Strategic Priority Research Programme of the Chinese Academy of Sciences (XDB26000000).

Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Three-dimensional dental vascular system and enameloid structure of Synechodontiformes from the Late Permian to the Middle Triassic of China

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Synechodontiformes, with fossil records ranging from the Early Permian to the Paleogene, represent the earliest confirmed neoselachian sharks. Their teeth exhibit a distinctive pseudopolyaulacorhize vascularization pattern, characterized by a series of unroofed canals located within the labial depression of the basal root face. This feature holds particular taxonomic significance, as most synechodontiforms are known solely from isolated teeth. Another important trait of this group is the presence of two- or three-layered tooth enameloid, in contrast to the consistently three-layered enameloid found in extant neoselachians (Despite the exception of one species). However, the evolutionary trajectory of neoselachian enameloid remains poorly understood. In terms of dental histology, the occurrence of unroofed canals on the labial basal face in some hexanchiforms—albeit without a labial depression—suggests that this trait may have evolved convergently. Therefore, clarifying the relationship between these unroofed canals and the internal vascular canal system is critical. In this study, we examined the dental histology, including the three-dimensional vascular architecture, of five synechodontiform taxa from the Late Permian to the Middle Triassic of China using high-resolution micro-computed tomography (micro-CT). Our findings offer new insights into pseudopolyaulacorhize vascularization and provide histological data that may help resolve phylogenetic relationships within the group. All five taxa exhibit the orthodont histotype, potentially representing the plesiomorphic condition for neoselachian sharks. Their vascular systems show a high degree of structural consistency, comprising longitudinal

vascular canals, labial and lingual transverse canals, and an ascending pulp cavity. Notably, the labial transverse canals extend obliquely toward the basal face, where they transition into unroofed canals. Additionally, we employed focused ion beam scanning electron microscopy (FIB-SEM) to reconstruct the enameloid in three dimensions, aiming to investigate the evolutionary origins of stem neoselachian enameloid, and also constituting the first investigation of enameloid structure in Paleozoic Synechodontiformes.

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Technical Session II: Paleozoic Fishes (Wednesday, November 12, 2025, 8:00 AM)

Diversity of Silurian maxillate placoderms: insights from historical and recent discoveries

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Since 2013, a series of late Silurian stem gnathostomes, collectively termed maxillate placoderms, have been reported from South China. These fish are characterized by marginal jaw bones (premaxilla, maxilla, and dentary) and provide key insights into the origin of crown gnathostomes (osteichthyans and chondrichthyans). Although the monophyly of maxillate placoderms remains uncertain, our investigations indicate that several previously reported Silurian jawed vertebrates can be assigned to this group. These include *Silurolepis*, which was first reported as an antiarch, and later redescribed as a maxillate placoderm. Another taxon, represented by fossils bearing distinctive concentric ornament, was first discovered in 1977, and is the first discovered and the stratigraphically oldest maxillate placoderm. Subsequently, many specimens of this taxon were collected from two geographically distant sites in Yunnan and Hunan Provinces. Although named in 1986, this taxon remained a nomen nudum due to the lack of formal description or holotype designation. Our description confirms that this is a maxillate placoderm closely resembling *Qilinyu* and *Bianchengichthys* in the pattern of skull roof and trunk shield plates. However, the three differ in body sizes, morphology of the rostrum, and the positions of nostrils and orbits, suggesting rapid ecological radiation shortly after their divergence. With possible occurrences in Chongqing and the Lower Yangtze region, this taxon may have been geographically widespread, a rarity among the Silurian vertebrates. Additionally, two previously unreported taxa are now known from Hunan and Xiaoxiang Fauna, Yunnan respective. The two are similar in body size and patterns of head and trunk shield plates but differing in ornament to the aforementioned taxa. Both exhibit specialized optic anatomy with elongated eye capsule fused to the skull roof, a condition also seen in *Entelognathus*. Fossils close to the dermal plates of these maxillate placoderms were also reported from North Vietnam. Growing data on the anatomy and diversity of maxillate placoderms enable new insights into their character evolution, systematics, and paleogeography.

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Romer Prize Session (Thursday, November 13, 2025, 8:00 AM)

Reassessment of North American mosasaur morphology and diversity as informed by extant squamates

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Mosasaurs are an extinct clade of gigantic marine lizards that lived in the world's Late Cretaceous oceans. Their fossils have been

found on all seven continents in deposits representing both marine and freshwater environments, and they occupied a diversity of dietary niches, predating upon everything from fish, to hard-shelled invertebrates, to other marine reptiles. Although mosasaurs have been studied for over 250 years, several fundamental questions about them—e.g., how many times they evolved flippers—are yet contested. With respect to questions dependent on ingroup relationships, the problem lies in nearly all phylogenetic analyses of Mosasauroidea having relied upon a single data matrix that has not been substantially updated since its publication in 1997. Even as new taxa with novel morphologies are discovered, the number of characters has decreased over time to 124 (as of 2023), as many potentially problematic characters have been removed but only three new ones have been added. The goal of this work was to revise the mosasaur phylogenetic character list through the addition of 50 new characters and reassessment of existing ones informed by detailed comparative descriptions of new and existing taxa, and a critical reassessment of proposed intraspecific variation in the group informed by comparison to extant lizards. I describe two new mosasaur species, redescribe two historic and important holotypes, redescribe and resurrect one species from synonymy using new CT scan data. My comparison to skeletal variation in a variety of extant lizards finds that previous hypotheses of mosasaur skeletal ontogeny are flawed; hypothesized mosasaur ontogenetic changes are either not observed in extant lizards (i.e., similar character variation when present is interspecifically, not intraspecifically, informative), or in direct conflict with the mechanism of their variation in extant lizards (e.g., proposed ontogenetic migration of the parietal foramen is developmentally impossible). These analyses collectively inform the revised phylogenetic character list for Mosasauroidea, which I then use to analyze tylosaurine mosasaurs, yielding a novel topology of interrelationships for the clade. In reassessing tylosaurine intra-specific variation, informed by extant lizards, I find at least three new tylosaurine species from the United States alone, in addition to the two currently accepted, suggesting that mosasaur diversity more broadly is likely underestimated.

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Regular Poster Session I (Wednesday, November 12, 2025, 4:30 - 6:30 PM)

Do what you can, with what you have, where you are: tracing the evolution of locomotory wing use diversity in theropods

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Powered flight is a rare and extraordinary thing, and thus it is not surprising that much of the work on the origins of wing-based locomotion in theropods has focused on it. Yet flying isn't the only possible locomotory use of wings. Studies of living birds have shown wings to aid in facilitating escape behaviors in pre-flight capable juveniles (W.A.I.R., controlled flapping descent), increasing maneuverability in terrestrial locomotion (turning, braking) as well as aiding in terrestrial stability during prey capture. Given the recent discovery of physical evidence of wing assisted running amongst non-avian theropods the topic of how wings were used in non-flight capable taxa deserves more investigation. Here, using a large dataset of taxa from across the theropod to bird transition, we look at the evolution and diversification of locomotory functions for wings amongst feathered theropods. We discuss how our findings both open new possibilities for behavioral morphospace reconstructions within theropods as well as integrate with our understanding of pre-avian physiology to have broader ecological implications. When coupled with a discussion of other behavioral drivers (display, thermoregulation) our findings flesh

out the diverse path wing evolution took across the last 100 million years of the Mesozoic era.

Regular Poster Session II (Thursday, November 13, 2025, 4:30 - 6:30 PM)

Dental ecometrics as a tracer of climatic change during Late Neogene in the Siwaliks

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In this study, we aim to provide a new integrative understanding of Siwaliks palaeoecological contexts using dental ecometrics and prediction models for the first time in the Miocene (~18–6 Ma) of the Siwaliks of Pakistan. Dental ecometrics is a functional trait analysis of faunal communities which relies on dental durability and occlusal characteristics to study variability of ecosystems through time, using traits including mean hypsodonty, bunodonty and the longitudinal loph count. We score dental traits of large mammalian herbivores including Artiodactyla, Perissodactyla, Proboscidea and Primates. We use predictive linear and non-linear models for our analysis. The reason for using multiple models is to investigate how reliably these models, which have previously been used in temperate and tropical regions, reconstruct environments in sub-tropics. These models are trained on current and present-natural (PN) species ranges from Eurasia extracted from the PHYLACINE database. PN ranges represent estimates of where species would live if there were no anthropogenic effect. We then fit these models on the trait data to estimate mean annual temperature (MAT) and precipitation (MAP) of the Siwaliks during the Miocene. Our comparative analysis across multiple proxies indicates that we can reliably reconstruct paleoenvironment of the Siwaliks using dental ecometrics and predictive models. We find a shift in the dental traits, including an increase in hypsodonty and bunodonty and decrease in exclusively acute lophs after 11 Ma. Our results show that there was a considerable decrease in MAP, which was 2300 mm/year before 12 Ma and decreased to 900 mm/year between 8–9 Ma. There was an initial decreasing trend in temperature after the Middle Miocene Climatic Optimum (MMCO) from 14.7 (17°C) until ~12.5 Ma (14°C) which then increased to 18°C around 8 Ma. Our non-linear models predict MAT was < 0°C for some sites, which does not seem likely for the Siwaliks, but the overall temperature and precipitation trends are consistent with other proxies e.g. stable isotopes and palaeosols. Comparisons with these proxies show that models trained on PN ranges provide more reliable outputs than those using current ranges. Therefore, we suggest that dental traits support a climatic regime shift around 11–12 Ma.

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