

8th Meeting of the European Association of Vertebrate Palaeontologists



Aix-en-Provence

June 7th-12th, 2010

Abstract Volume

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Meeting programme

Monday June, 7th 2010 - Registration

17:00-... : Registration at the entrance of the Museum of Natural History of Aix-en-Provence and icebreaker party in the dinosaur hall (first floor).

Tuesday June, 8th 2010 - Oral presentations & poster session

09:15-09:30 : **Cheyran, G.** : EAVP 2010 opening

Session 1 - Chairperson : Jeff Liston

09:30-09:50 : **Micklich, N.** : Growth patterns in fossil fish and their palaeoecological implications

10:10-10:30 : **Giersh, S., Frey, E. & Cavin, L.** : The swimming bulldog – jaw mechanics and locomotion in ichthyodectiform fishes

Coffee Break - 10:30-11:00

Session 2 - Chairperson : Jean Le Loeuff

11:00-11:20 : **Sanchez-Villagra, M. R.** : Developmental palaeontology in vertebrates: what do we know and what can we learn? A review of published works and case studies

11:20-11:40 : **Marjanovic, D. & Laurin, M.** : Age and relationships of the modern amphibians (Tetrapoda: Salientia, Caudata, Gymnophiona, Albanerpetontidae)

11:40-12:00 : **Kümmell, S. B. & Frey E.** : The grip capacity of non-mammaliaform Therapsida

12:00-12:20 : **Csiki, Z. & Vasile, S.** : Our snake is like theirs: nest-raiding snakes in the Maastrichtian of the Hateg Basin, Romania?

Lunch Break - 12:20-14:00

Poster Session 1 - 14:00-15:30

Session 3 - Chairperson : Eberhard Frey

15:30-15:50 : **Angst, D., Buffetaut, E., Tabouelle, J. & Tong H.** : An ichthyosaur skull from the Late Jurassic of Svalbard

15:50-16:10 : **Fischer, V., Clément, A., Guimar, M. & Godefroit, P.** : An Early Cretaceous ichthyosaur from SE France: implications on the evolution of post-Liassic Ichthyosauria

16:10-16:30 : **Pardo Pérez, J., Frey, E., Stinnesbeck, W., Salazar, C. & Leppe, M.** : Early Cretaceous Ichthyosaurs Graveyard in Torres del Paine National Park, Southern Chile

Coffee Break - 16:30-17:00

Session 4 - Chairperson : Eberhard Frey

- 17:00-17:20 : **Claude, J., De Ploeg, G, Buffetaut, E. & Tong, H.** : Changes in Continental Turtle Diversity accross the Paleocene/Eocene Boundary in Europe: new data from the Paris Basin
- 17:20-17:40 : **Tong, H. & Mo, J.** : A new nanhsiungchelyid turtle from the Late Cretaceous of Jiangxi Province (Southern China) and a review of Nanhsiungchelyidae in Southern China

Wednesday June, 9th 2010 - Oral presentations, EAVP general meeting and auction

Session 5 - Chairperson : Eric Buffetaut

- 09:30-09:50 : **Ősi, A. & Barrett, P. M.** : Dental wear and oral food processing in *Caiman latirostris*: analogue for fossil crocodylians with crushing teeth
- 09:50-10:10 : **Schwarz-Wings, D. & Wings, O.** : The potential knowledge gain of isolated small crocodile teeth in Mesozoic vertebrate assemblages
- 10:10-10:30 : **Rivera-Sylva, H. E. & Frey E.** : First evidence of the genus *Deinosuchus* (Eusuchia, Alligatoridae) from Coahuila, Mexico

Coffee Break - 10:30-11:00

Session 6 - Chairperson : Attila Ősi

- 11:00-11:20 : **Buffetaut, E. & Tong H.** : An azhdarchid pterosaur cervical vertebra from a new Late Cretaceous vertebrate locality at Cruzy (Hérault, southern France)
- 11:20-11:40 : **Elgin Ross A.** : Aerodynamics of pterosaur head crests: the problem with *Nyctosaurus*
- 11:40-12:00 : **Prondvai, E. & Ősi, A.** : Cranial kinesis in pterosaurs — Motile skulls?)
- 12:00-12:20 : **Geist, N. R., Hillenius, W. J., Frey, E., Jones T. D. & Elgin R. A.** : Breath of the air dragons: lung ventilation in pterosaurs

Lunch Break - 12:20-14:00

Session 7 - Chairperson : Gilles Cheylan

- 14:00-14:20 : **Iliopoulos G., Roussiakis, S. & Athanassiou, A.** : Woolly rhinos and woolly mammoths in Southern Greece? Using REE elements to trace the provenance of old museum collections)
- 14:20-14:40 : **Mennecart, B. & Costeur, L.** : First description of the skull of *Amphimoschus* (Mammalia, ???Bovidae???) and taxonomy of the genus
- 14:40-15:00 : **García-Martínez, R., Marín-Moratalla N. & Köhler M.** : Bone histology in extant rodents

Coffee Break - 15:00-15:30

Session 8 - Chairperson : George Iliopoulos

- 15:30-15:50 : **Burkhart, C. & Frey, E.** : Bracing system and locomotor mechanics in Phocinae (Carnivora, Mammalia)
16:10-16:30 : **Jungnickel, S. & Frey, E.** : Anatomy, locomotion and biomechanics of the suricate (*Suricata suricatta*, Herpestidae, Carnivora)
16:10-16:30 : **Hoch, E.** : Cetodiversity: observations and interpretations

General meeting & Auction (I.E.P.) - 17:00-...

Thursday June, 10th 2010 - Oral presentations, poster session and conference dinner

Session 9 - Chairperson : Loïc Costeur

- 09:30-09:50 : **Meyer, C. A., Thüring, B., Marty, D., Costeur, L. & Thüring S.** : Tracking early dinosaurs - new discoveries from the Upper Austroalpine Nappes of Eastern Switzerland (Hautpödonit, Norian)
10:10-10:30 : **Belvedere, M., Rigo, M., Marchetti, L. & Mietto, P.** : Upper Triassic dinosaur tracks from the Dolomites: new dating and material

Coffee Break - 10:30-11:00

Session 10 - Chairperson : Thierry Tortosa

- 11:00-11:20 : **Fechner, R.** : Origin and evolution of the mechanical design of the locomotor apparatus of dinosaurs
11:20-11:40 : **Schwarz-Wings, D., Fechner, R. & Witzel, U.** : Pelvis shape and functional morphology of the pelvic girdle in extant crocodiles and dinosaurs
11:40-12:00 : **Stein, K. & Sander, M.** : Sauropodomorph long bone histology through time and ontogeny
12:00-12:20 : **Chanthasit, P., Cheylan, G., Dutour, Y., Tortosa, T., Florenzano, M., Berthelot, M., Bourdier, C. & Renaudin, N.** : *Rhabdodon* (Dinosaur: Ornithomimidae) from the Late Cretaceous of Aix-en-Provence basin: 3D-modeling of *Rhabdodon* skeleton

Lunch Break - 12:20-14:00

Poster Session 2 - 14:00-15:30

Session 11 - Chairperson : Zoltan Csiki

- 15:30-15:50 : **Díez Díaz, V. & Suberbiola, X.** : Titanosaurian fossil record of Europe: a review
- 15:50-16:10 : **Le Loeuff, J.** : Late Cretaceous sauropods of southwestern Europe: Quid novi?
- 16:10-16:30 : **Tortosa, T., , Dutour, Y. & Cheylan, G.**: New discoveries and review of Late Cretaceous titanosaurs from Provence, France

Coffee Break - 16:30-17:00

Session 12 - Chairperson : Daniela Schwarz-Wings

- 17:00-17:20 : **Tortosa, T., Buffetaut, E., Dutour, Y. & Cheylan, G.** : Abelisaur remains from Provence (Southeastern France) : phylogenetic and paleobiogeographic implications
- 17:20-17:40 : **Le Loeuff, J. & Métais, E.** : New stratigraphical data on North African spinosaurs
- 18:00-18:20 : **Suteethorn, V., Suteethorn, S., Buffetaut, E., Tong, H., Lauprasert, K., Samana, R., Wongko, K., Deesri, U. & Naksri W.** : Biodiversity of Asian vertebrate faunas from the Late Jurassic-Early Cretaceous interval: a new discovery at Phu Noi Locality, NE Thailand

Aperitif and conference dinner in the coffee-restaurant "Les Deux Garçons" - 19:00

Friday June, 11th 2010 - Aix-en-Provence Basin Fieldtrip

Saturday June 12th 2010 - Parc du Luberon Fieldtrip

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Poster presentation

Sharks and rays from the confined Eocene gulf of Corbieres (S France). Review and relationships with the atlantic fauna.

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At the beginning of the 20th century, Maurice Leriche reported the presence of selachian teeth (sharks and rays) recovered by some collectors from the marine Eocene of North Corbières (Doncieux, 1908; Leriche, 1936). Considered in the north-eastern extremity of a long gulf opened toward the Atlantic before the final uplift of Pyrenean chain (e.g. Plaziat 1981), the marine deposits have delivered a very scarce material. Formally dated to Early Lutetian, no supplementary data was available about the fauna frequenting the north-eastern ending of this peculiar continental sea. We propose an updated review of selachian fauna from Corbières and those, from the study of numerous new fossils collected and compiled during the four last decades by local collectors. At least thirty taxa were identified in a dozen of localities with dominance of small Lamniformes (e.g. *Brachycarcharias*), Heterodontiformes (*Heterodontus*), Carcharhiniformes (e.g. *Pachyscyllium*, *Galeorhinus*, *Physogaleus*, *Abdounia*) and Myliobatoids. This new report is accompanied by an inventory of discoveries concerning the fossil selachians from Corbières. The ecology of principal taxa was considered in regard of the living representatives and confirms that these sharks and rays frequented confined seawaters during the Early-Middle Ypresian (local middle Ilerdian stage). Faunal comparison with the contemporaneous Anglo-Franco-Belgian basins suggests a quite homogeneous repartition of fish fauna along the European coasts during the warm Early Eocene.

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Poster presentation

Sexual dimorphism in the villafranchian *Leptobos* (Bovidae, Bovinae) of Spain and France

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The systematics and phylogenetic relationships of the European *Leptobos* have been largely discussed. Some authors have concluded that two species, the small slender *L. (Leptobos) elatus* and the large strong *L. (Smertiobos) bravardi*, coexisted in both Perrier-Les Etouaires and Villarroya sites. An acute sexual dimorphism has been suggested as an alternative to explain the existence of two groups of two sizes in the material recovered from these sites. However, the sexual differences are poorly documented in the postcranial skeleton.

To clarify this, sex-specific differences in size and morphology of bones are explored in *Leptobos* and compared to those of the extant bovids. Metrical data of bone remains from several western European localities (Villarroya, Perrier-Les Etouaires, Saint-Vallier and Senèze) have been included in the statistical analyses (Principal Component Analysis, PCA). Clearly separated size groups have been found for all postcranial elements showing a similar pattern to the sexual groups in greatly dimorphic extant species. Thus, our results support the idea of an acute sexual dimorphism in *Leptobos* and confirm the existence of only one species at the sites. In this sense, we conclude that *L. (Smertiobos) bravardi* represents a junior synonym of *L. (Leptobos) elatus*.

Poster presentation

A heritage management system for dinosaur sites in Aragón (Spain)

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The social use of palaeontological resources as a means of spreading Geodiversity among general public, and the research on fossils of scientific and educational relevancy, are both increasing in Spain. These facts fulfil the social interest in palaeontology and promote the Palaeontological Heritage as a way of economic, cultural and scientific development in several regions of our country, standing out Aragón with Territorio Dinópolis in Teruel.

The Dinópolis team of palaeontologists has developed and maintains a Geographic Information System (GIS) database with the purpose of managing the dinosaur sites information recovered in Aragón. This GIS includes a vast body of palaeontological information dealing with the main characteristics of the fossil sites (i.e., scientific interest, socio-cultural potential exploitation and deterioration risk challenges). The database was produced as an integrated system tool to manage the regional palaeontological resources, including its application to select areas of possible new dinosaur findings and/or of tourist interest. Nowadays we are developing new databases of the dinosaur resources of Aragón (Autonomous Community that has pioneered the Spanish legislation about the protection of Palaeontological Heritage and its social use), with the aim of including all the information already available of the dinosaur sites.

These databases include the faunal lists (at species level when possible) extracted from literature and museum's collections. With all these data, we create new and more complex routines helping in the decision-making processes through a more efficient data management tool, capable of analysing vast amounts of spatial and alphanumerical information. In addition, GIS tools foster mapping the results easily.

This study is part of the Palaeontological research projects subsidized by: Departamento de Educación, Cultura y Deporte; Dirección General de Patrimonio Cultural, and Dirección General de Investigación, Innovación y Desarrollo, (Research Group E-62, FOCONTUR), Gobierno de Aragón; Ministerio de Ciencia e Innovación (project CGL2009-07792, Plan Nacional de I+D+i); and European Funds (FEDER). We acknowledge the Instituto Geológico y Minero de España for supplying the digital geological cartography of Aragón.

Oral presentation

An ichthyosaur skull from the Late Jurassic of Svalbard

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An ichthyosaur skull discovered in the Upper Jurassic of Svalbard in 2004 is described for the first time. It is mainly characterised by a relatively long snout and numerous small teeth, which are characters also found in the Late Jurassic ichthyosaur genera *Brachypterygius* and *Aegirosaurus*. On the basis of more detailed comparisons, the specimen is referred to *Brachypterygius*. This find extends the geographical distribution of that ichthyosaur genus, hitherto known from England, to the high latitudes of the Late Jurassic

Oral presentation

Upper Triassic dinosaur tracks from the Dolomites: new dating and material

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The Dolomia Principale formation is a 1000-m-thick carbonate platform organized in peritidal shallowing-upwards cycles. Since 1985, when the first Italian dinosaur trackways were discovered on a block at Mt. Pelmetto, it has revealed to us many other sites bearing numerous tracks of tetrapods, often of dinosaurs. All these footprints, with the exception of the Mt. Pasubio, occur in isolated blocks, which only seldom can be set back to their original stratigraphical position, thus preventing accurate dating. The discovery of conodonts on the Mt. Pasubio site allowed a precise dating of the surface as uppermost Albian to lower Cenomanian (Middle-Upper Cretaceous), encouraging the research of microfossils in the isolated blocks as well. Unfortunately, no conodonts were found in the fallen boulders. Nonetheless, some holothurian sclerites, despite their weak stratigraphical resolution, revealed an early Cretaceous age, which matches both the supposed stratigraphical position and the footprint-based dating of the isolated blocks of Mt. Pelmetto. Moreover, the holothurian sclerites permitted to constrain the new blocks discovered on Mt. Moiazza as roughly late Albian/early Cenomanian age, comparable to the Mt. Pelmetto boulders.

Thus, while seeking for new and more precise biostratigraphical data, it is possible to recognize at least two periods when dinosaurs could have walked along the Dolomia Principale tidal-flats, that is, the late Albian/early Cenomanian (Mt. Pelmetto, Mt. Moiazza) and the middle/late Cenomanian (Mt. Pasubio).

Oral presentation

An azhdarchid pterosaur cervical vertebra from a new Late Cretaceous vertebrate locality at Cruzy (Hérault, southern France)

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Since the mid-1990s, thanks to more careful excavation techniques, the Late Cretaceous non-marine formations of southern France have begun to yield pterosaur remains. Pterosaur skeletal elements are now known from various localities in Provence (Var, Bouches-du-Rhône), Languedoc (Hérault, Aude) and the foothills of the Pyrenees (Ariège). However, most specimens are fragmentary and often poorly preserved.

In 2009, systematic excavations have been started at the Montplo-Nord locality, near the village of Cruzy (Hérault), by CNRS and the Association Culturelle, Archéologique et Paléontologique de l'Ouest Biterrois. The locality, which is late Campanian or early Maastrichtian in age, has yielded abundant and generally well-preserved remains of various vertebrates, including actinopterygian fishes, turtles (*Foxemys*), crocodilians and dinosaurs (Rhabdodon, titanosaurid sauropods, theropods).

One of the most remarkable specimens from Montplo-Nord is a small (85 mm long) pterosaur cervical vertebra, which was found within the lateral concavity of a large titanosaur cervical vertebra. These peculiar taphonomic circumstances probably explain the good preservation of the pterosaur vertebra, which is virtually complete, although the middle part of the centrum is dorsoventrally crushed. The vertebra is characterised by a remarkably elongate and narrow centrum with a confluent neural arch and an extremely reduced neural spine. The relatively uncrushed articular regions show large pneumatic foramina on both sides of the neural canal.

The specimen shows all the distinctive characters of the cervical vertebrae of azhdarchid pterosaurs and is therefore referred to the family Azhdarchidae. It is the most complete azhdarchid bone hitherto found in France. Much larger azhdarchid specimens have been found in the Late Cretaceous of southern France, and whether the Montplo-Nord specimen belongs to a very young individual of a large species or to an adult individual of a small species is uncertain, all the more so that little is known about azhdarchid growth patterns. However, there is little evidence of small azhdarchid species in the Late Cretaceous, and this may suggest that this vertebra is from a juvenile individual

Oral presentation

Bracing system and locomotor mechanics in Phocinae (Carnivora, Mammalia)

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Within Pinnipedia – or even Mammalia – Phocinae show unique locomotion styles. On land the vertebral column undulates in a vertical plane similar to galloping or ricocheting mammals. Aquatic locomotion of Phocinae is brought about by lateral undulation especially of the lumbar region. Thus, the lumbar vertebral column shows more powered flexibility than any other part of the vertebral column. In contrast to other mammals the limbs of Phocinae do not take any load during terrestrial locomotion. During swimming the hind limbs produce thrust by means of the lateral undulation of the lumbar region. The flipper with adducted and folded toes forms the leading edge, while the other one with spread and abducted toes produces thrust along its palmar face. The front limbs mainly are used for steering. On land they may be applied for grasping and pulling to move the body across barriers even without raising the body off the ground.

Despite the bracing system of Phocinae equals that of any generalized mammal, the lack of limb support restricts the gravity load during terrestrial locomotion to bone supported contact areas of the body with the ground: sternum/thorax and pelvis. The fling and push movement of the body results in gravity induced impacts and is only possible with shock absorbers like contracted muscles under hydraulic tension and/or a coat of blubber. Blubber in Phocinae apparently evolved as a heat insulator in cold waters and/or climates. Therefore, at least the terrestrial type of locomotion in Phocinae must have evolved after a predominantly aquatic life style was achieved.

Oral presentation

***Rhabdodon* (Dinosaur: Ornithopoda) from the Late Cretaceous of Aix-en-Provence Basin: 3D-modeling of *Rhabdodon* skeleton**

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Rhabdodon is one of the most common dinosaurs to have been discovered from the Late Cretaceous continental deposits of southern France. Several localities yielding *Rhabdodon* remains are distributed in Aix-en-Provence Basin. Vitrolles-Couperigne is a remarkable locality that two partially articulated *Rhabdodon* skeletons were discovered in 1995 and 2007 (Garcia et al., 1999; Pincemaille-Quillévéré, 2002; Chanthasit et al., in review). These remains are considered as the most complete skeletons of two distinct individuals of *Rhabdodon* discovered so far in Europe. The most recent material referred to *Rhabdodon* from Aix-en-Provence basin was discovered in 2008 at Pourrières, Le Jas neuf, and La Cairanne sites situated along the A8 Highway. Because of the abundance and the presence of anatomical connection of *Rhabdodon* remains in this area, the Muséum d'Histoire Naturelle d'Aix-en-Provence collaborated with the MAP GAMSAU of École Nationale Supérieure d'Architecture de Marseille has conducted the 3D reconstruction of *Rhabdodon* skeleton project. Some *Rhabdodon* specimens from other localities in southern France are also applied in this project as some specimens from Vitrolles-Couperigne are missing and some are not well preserved. Three main procedures have been processed for the 3D-modeling of *Rhabdodon* skeleton, the first is the 3D imaging by a non-contact 3D scanner, the second is the 3D modification by some specific computer programs and the last procedure is the impression by a 3D printer. This project is still in process but shortly, this skeleton of *Rhabdodon* will be able to be exhibited and will allow the public to understand this animal easier.

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Oral presentation

Changes in Continental Turtle Diversity accross the Paleocene/Eocene Boundary in Europe: new data from the Paris Basin

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While continental turtle assemblages are rather well documented in Western Europe for the Late Cretaceous and the Early Eocene, Palaeocene turtles are less well known. However, several Paleocene localities have yielded turtle fossils, in particular in the Paris Basin (Bracheux, Cernay, Berru). Although they are often too fragmentary to be precisely identified from a systematic point of view, these records however provide clues for understanding faunal turnover at a key period. The recently discovered locality of "Le Petit Patis", sixty kilometers north-east of Paris has yielded a rich Palaeocene vertebrate assemblage. Within this assemblage, continental turtles demonstrate an important diversity, which is at first evidenced by the different ornamentations of the isolated bony plates. Within this diverse assemblage, two trionychid forms can be recognised -one referred to *Paleotrionyx*-, at least two other taxa are represented by smooth bony plates, and one taxon displays an ornamentation made of small pits, ridges and tubercules which is to some extent reminiscent of the North American form *Compsemys*. In this presentation, the turtle assemblage from "Le Petit Patis" is compared to what is known in Europe in the late Palaeocene, and the European Palaeocene turtle apparent diversity is compared with the turtle apparent diversity of the Early Eocene and Late Cretaceous.

Poster presentation

Application of radiometric surveying method in Miocene fossil sites in Tajo Basin (Spain)

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A serie of radiometric surveyings were performed in different Miocene fossil sites in the Tajo Basin (Spain). The goal of this work has been to show the validity of this method to detect new fossil sites or to enclose the existing ones. Jones & Burge (1998) applied this method in the detection of subsuperficials fossil remains in different U.S sites. Crusafont & Quintero described a new Miocene fossil sites located through the utilization of this method, applied in the detection of uranium ore deposits in Spain. All these researchers ensure that this method is valid in sites where the uranium have been uptaken by the fossil bones in large amounts or present radioactive mineralization.

This work is based on the premise that natural radiation from fossil remains exits in nature without previous mineralization and it is not longer necessary the presence of significative amounts of radionuclides (U and Th among others) in the bones to be detected. Likewise, we have checked the parameters on which depend this methodology, its limits of detection and its error sources.

Five fossil sites, with different lithogies and characteristics features, have been successfully mapped scattered in the Tajo Basin (Cuenca, Guadalajara and Madrid provinces). This method has been used in fossil sites where mineralization is presented, and in fossil sites currently excavated that don't present it. Besides, new areas for the search have been successfully prospected.

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Poster presentation

Review of different technologies applied to prospecting of vertebrates sites

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As is generally known, a lot of fossil sites are discovered by actions that take place in the civil engineering. Sometimes these sites are a big problem for the companies which perform various negligent actions to not reveal this discovery, which involves loss of an unknown but probably large amount of paleontological remains of big value.

It has been make a revision of the different technologies applied to the detection of vertebrate fossil sites and a comparative model of different methods. and its application in the paleontological research and civil engineering. The goals are to show the variety of applications that exist and provide the prospection, digging works and reduction of cost involved in the protection of this remains.

In addition, it should be noted the geophysical exploration method applied to the detection of vertebrate fossil sites, Ground Penetration Radar (GPR), Electrical Tomography Resistivity (ETR), and Ground Diffraction Tomography (GDT), Proton Free-Precision Magnetometer (PFPM) Radiometric Surveying (RS) and Gravity Surveying (GS). These are divided into those that delimit and locate subsuperficials fossil remains GPR, GDT, PFPM and RS. And those that delimit and locate natural tramps (like caves, pipes and paleokarst...) these are GPR, ETR and GS.

Besides, it should be emphasize the non-geophysical methods applied to the prospection of fossils remains or those that predict favourable sites for its search. One of them is the fluorescence of hydroxylapatite method (very useful for the prospection of microvertebrate) and another one is the application of GIS for predict the appearance of new fossil sites.

This review intended to be useful for researchers and engineering companies, as compendium for future reference of the different applications use in the paleontological prospection.

Poster presentation

New fossii sites with mammal footprints in the Oligocene of south-eastern France

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The early Oligocene sedimentary record of south-eastern France already yielded 3 sites with mammal footprints (Demathieu et al., 1984; Costeur et al., 2009). New excavations on one of them and new discoveries enrich the fossil record of footprints in the area of the Parc Naturel Régional du Luberon (Vaucluse). New odd-toed ungulate trackways were found and are here described together with several new sites showing various records, from one footprint to several long trackways ascribed to even-toed and odd-toed ungulates. In the last few years, the track-record in the “Parc du Luberon” largely increased to reach about ten sites spread in the early Oligocene calcareous lacustrine sediments. Such track levels indicate emersion episodes in the complex history of the Apt-Manosque-Forcailquier basin that formed a large lake during the whole Oligocene (Lesueur, 1991). They also testify to the presence of mammal faunas at a period when no or very few bone remains are known, they bridge the existing gap between the late Eocene faunas (e.g., La Debruge) and the middle Oligocene records (e.g., Murs or Aubenas-les Alpes). Fieldwork is currently developed to locate early Oligocene mammal bone remains.

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Poster presentation

A new palaeontological journal

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The "Swiss Memoirs of Palaeontology" ("Schweizerische Paläontologische Abhandlungen") have been published by the Natural History Museum Basel since 1874. The journal published one monograph per year on various aspects of palaeontology with a special focus on taxonomical studies. Many of the contributions were tremendous work that ensured the Memoirs' identity in the palaeontological community. However, the "Abhandlungen" were never really very widely distributed preventing them to become an authoritative journal.

The Swiss Commission for the Memoirs decided to raise the Memoirs to an international standard and to gain a larger visibility. From 2011, The "Schweizerische Paläontologische Abhandlungen" will be renamed "Swiss Journal of Palaeontology" (SJP) and will have an internet portal under the scientific edition of Birkhäuser/Springer. As it was not the case before, we now work with an international editorial board to handle the submissions, and with a professional editorial team to assure the quality of the publication. We will publish one volume with 2 issues per year allowing standard articles to be published along with the opportunity to propose monographs or collection of papers when desired. The focus of the SJP still remains on taxonomy but other papers in the fields of palaeontology will also be considered.

You're all most welcome to submit your contributions from now on to the editorial office of the SJP. The first issue in January 2011 is already booked but the second one in the second half of 2011 is waiting for you!

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Poster presentation

The extant mammal osteological collection of the Natural History Museum Basel

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The comparative osteological collection of the Natural History Museum Basel (NMB) hosts more than 7300 mammal specimens, mostly skulls that were gathered in the last 160 years. Until very recently, this collection was not digitally registered and not properly stored to be made available to the scientific community. It is now done, and an analysis of the collection shows that all orders and more than 80% of all the living mammal families are here surprisingly represented. Almost half of the 1230 mammal genera are also stored in the collection. To date, we registered 1047 species of mammals. Some of these are represented by growth series with several individuals spanning the life range of the species. As developmental studies become more and more important to understand mammalian phylogeny, such series prove to be useful. We currently work on the type specimens (holotypes (several rodents from Africa or Indonesia) or paratypes, etc) amounting to about 40 objects and improve the storage condition of the whole collection.

This analysis shows us where the holes in the systematics are and we would now like to enlarge the spectrum of this collection. For instance, the collection does not host any skeleton or skull of the famous Platypus (*Ornithorhynchus anatinus*) among many others.

We open our doors to all scientists: biologist, palaeontologists, or phylogeneticians who would be interested in studying this material. We encourage the loan of specimens for any kind of investigation, from non intrusive methods such as CT-scans to, much more rarely though, intrusive methods (e.g., DNA analyses, or specific teeth-based studies) when the material allows it.

Together with the very large fossil mammal collection of the NMB (several hundred thousands specimens), this comparative osteological collection is now a useful tool worth visiting.

Oral presentation

Our snake is like theirs: nest-raiding snakes in the Maastrichtian of the Hateg Basin, Romania?

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Snakes are rather diverse in the Upper Cretaceous deposits from Gondwana, but exceedingly rare to non-existent in contemporaneous deposits of the northern Tethyan areas. In Europe, these were reported only in the Campanian of southern France and the Upper Campanian-Lower Maastrichtian of northern Spain, and, based on one partial vertebra, in the Maastrichtian of the Hateg Basin, Romania. All these were referred to madtsoiids, a basal clade of alethinophidian snakes, widely distributed in the Cretaceous and Cenozoic of the southern continents.

Here we report on the discovery of a large sample of snake remains from the Maastrichtian of the Hateg Basin; it contains over 50 elements, mainly complete and fragmentary vertebrae and ribs. Morphological characters of the remains suggest that they also belong to madtsoiids, thus both extending the Romanian (and Eastern European) record of the group and representing the largest available sample of a madtsoiid in Europe.

The most significant aspect of this new madtsoiid is, however, its taphonomy. It was discovered at Tustea, a dinosaur nesting site yielding megaloolithid eggs and nests associated with hadrosaur embryos, as well as a diverse vertebrate assemblage. Taphonomic features of the site support its largely autochthonous setting, transport of the elements into the, or within, the site being minimal. The presence of vertebrae still in articulation, their commensurate size and autochthonous position suggest that these elements derived from one single snake skeleton. Moreover, it was found intimately associated with a dinosaur nest, suggesting a nest-raiding behaviour, as already reported for other madtsoiids.

Oral presentation - Supported by The Raymonde Rivoallan Fund

Titanosaurian fossil record of Europe: a review

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Since the publication of “European Titanosaurs” by J. Le Loeuff in 1993 no detailed analysis of the European fossil-sites of these sauropods has been made. In the last years, new localities have been found in Spain, France, Great Britain and Romania. The number of fossil-sites has almost been triplicate since 1993 - from 25 to approximately 70 -.

Most of the titanosaurian fossil-sites of Europe are assigned to the Late Cretaceous (Campanian-Maastrichtian), although a few Early Cretaceous fossil-sites are known in Spain and Britain. In fact, the earliest titanosaurian remains from Europe are from the Valanginian of Sussex (England) (Upchurch, 1995; Upchurch *et al.*, 2004).

Up to now, three titanosaurian species are well-known in Europe: *Lirainosaurus astibiae* (Late Campanian-Early Maastrichtian of Laño, Treviño, Spain), *Ampelosaurus atacis* (Early Maastrichtian of Campagne-sur-Aude, Aude, France), and *Magyarosaurus dacus* (Maastrichtian of Sânpetru, Transylvania, Romania), although they are in need of a revision. Other taxa will be soon described from the Late Campanian-Early Maastrichtian of Velaux (Bouches-du-Rhône, France) (García *et al.*, in press) and from the Maastrichtian of Nălaț-Vad (Hunedoara, Romania) (Csiki *et al.*, in press). Exceptionally well preserved material has been recovered from the Late Campanian-Early Maastrichtian of Fuentes (Cuenca, Spain) and will be described in the next years (Ortega, Sanz *et al.*, in progress). *Hypselosaurus priscus* from the Late Cretaceous of Provence and *Iuticosaurus valdensis* from the Early Cretaceous of Britain are regarded as *nomina dubia* (Upchurch *et al.*, 2004). The picture that emerges is that of a diversified titanosaurian fauna at the end of the Cretaceous, with at least five – and probably more – species living in the European archipelago during the Campanian-Maastrichtian. This high diversity is in agreement with previous interpretations made by Le Loeuff (1993, 1998).

Oral presentation

Aerodynamics of pterosaur head crests: the problem with *Nyctosaurus*

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Many authors have speculated on the function of the pterosaurian cranial crest; proposing that it assisted flight performance by acting as a forward rudder, an airbrake, and/or an aerodynamic counterbalance. More recently the aerodynamics of the North American pterodactyloid *Nyctosaurus* were calculated where, contra to fossil evidence, a membranous sail was reconstructed and interpreted as an auxiliary form of flight control. This highlights the dangers of ignoring fossil evidence and relying on aerodynamic data alone to arrive at conclusions about past performance.

The “aerodynamic benefits” of a cranial crest are difficult to disprove from numerical data alone as larger structures will naturally be correlated with an increase in both the torques and forces acting on the skull. However, the diversity in crest size, material composition, and relative location throughout the pterosaur lineage strongly suggests that the evolution of such a feature cannot be tied with a universal form of aerodynamic enhancement; “performance” must have varied greatly between taxa.

Aerodynamic studies on the crania of pterosaurs may still prove useful even when no benefits are noted as many pterodactyloids develop large skulls/crests; the acting forces and torques are unknown and are an important consideration due to yawing and pitching movements of the head. Here we report on the aerodynamic characteristics of a number of derived pterodactyloid taxa, recorded during wind tunnel experiments, as part of a larger study into the aerial characteristics of these Mesozoic fliers.

Poster presentation

When all else fails: ct scanning in pterosaur research

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The Romualdo Formation of NE Brazil is well known by pterosaur researchers as an excellent source of three dimensionally material; where fossil material is encased within a protective concretion. Removing the sediment surrounding such specimens can, however, be problematic as it is both time consuming and damage can occur from either mechanical preparation, or acid seeping into the hollow interior of the bones; slowly destroying portions of the skeleton. Such a condition is found within an almost complete azhdarchoid torso housed within the collections of the SMNK. The specimen itself is scientifically important, reaching a state of morphological maturity unknown from the Romulado Formation where an epineural plate has immobilized the entirety of the vertebral column and mineralized tendons of the *m. spinoarticularis* and *m. articulospinalis* are present along the lateral margins of the neural arches and their spinous processes. Further preparation of the specimen, mechanical or acid, is unlikely to occur in the near future for the above noted reasons. Instead computed tomography (CT) scans, conducted by the Royal Veterinarian College London (RVC), provides a means to determined the three dimensional shape of the bones, observe their internal architecture, and map the extent of the pneumatic system known to have penetrated the majority of the pterodactyloid skeleton. The extent of the pneumatic system, here present throughout the vertebrae and most of the pelvic girdle, is compared with that observed in CT scans of *Anhanguera*.

Poster presentation

Ankylosaurian evidence from the Upper Cretaceous of South-Central Pyrenees (Lleida, Spain): a reappraisal

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One of the most important dinosaur fossil areas from the European Upper Cretaceous is located in the South-Central Pyrenees of Spain. From this fossil record highlight both dinosaur eggs and footprints. Up to date, the represented dinosaur fauna is composed of sauropods, theropods, ornithopods and ankylosaurs. Among them, the remains of ankylosaurs are scarce. Nevertheless, Upper Cretaceous ankylosaurs from the Iberian Peninsula have been reported from several localities, such as Chera (Valencia), Laño (Condado de Treviño, Burgos), Quintanilla del Coco (Burgos) and, Fontllonga and Biscarri (Lleida). Two isolated teeth from these last localities and a new isolated humerus attributable to ankylosaur individuals are discussed here. These ankylosaur remains come from three different sites: Biscarri, Fontllonga-6 and Suterranya, all of them located at the Lleida Province. All these sites belong to the Upper Cretaceous part of the Tremp Formation. The right humerus is a slender bone and has a wide deltopectoral crest that is proximally placed. Both features are shared by nodosaurid ankylosaurs. The teeth are labiolingually compressed and the crowns have marked vertical ridges that are confluent with the preserved marginal denticles. Moreover, both teeth have a conspicuous basal cingulum that is more developed on one side. The characters combination shown by these two teeth are shared by nodosaurid ankylosaurs. In spite of the scarceness of the available information, the nodosaurid affinities of the undescribed humerus and the combination of features of the teeth confirm the presence of undetermined nodosaurid ankylosaurs in South-Central Pyrenees.

Oral presentation

Origin and evolution of the mechanical design of the locomotor apparatus of dinosaurs

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The locomotion of an organism is of fundamental importance for its biology, enabling the organism to, actively foraging for food sources and social interaction. The reconstruction of the locomotion of an extinct organism, however, is either hampered by the incompleteness of the fossil record or the by lack of appropriate methods. This holds also true for dinosaurs. Although the fossil record of basal dinosaurs is relatively good – both basal saurischians and ornithischians are known from more or less complete skeletons – the interpretation of their locomotor function appears to be rather based on the intuition of the particular author than on a strict biomechanical approach. Thereby, the body posture of the extinct organism should be reflected in the morphology of the bones associated to the locomotor apparatus based on their specific loading (*sensu* Wolff's law). I will present here a strict biomechanical approach to reconstruct the body posture of an extinct tetrapod. By applying this approach on dinosaurs and their predecessors, I will reconstruct the origin and evolution of the mechanical design of their locomotor apparatus.

Oral presentation

An Early Cretaceous ichthyosaur from SE France: implications on the evolution of post-Liassic Ichthyosauria

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A complete ichthyosaur rostrum with 124 associated teeth was recently discovered in Laux-Montaux locality, department of Drôme, southeastern France. The associated belemnites and ammonites indicate a late Valanginian age (*Neocomites peregrinus* Zone, *Olcostephanus nicklesi* Subzone) for this fossil, which consequently represents the first diagnostic ichthyosaur ever reported from Valanginian strata. Despite its incompleteness, this specimen is perfectly consistent with *Aegirosaurus leptospondylus* WAGNER 1853 and is therefore referred to this rare taxon. This specimen thus greatly increases the temporal and geographic biozones of this taxon, which was previously restricted to the Tithonian (Upper Jurassic) lithographic limestones of Bavaria (southern Germany). Moreover, it indicates that Late Jurassic ichthyosaurs actually crossed the Jurassic-Cretaceous boundary with a much lighter diversity drop than previously supposed. Finally, tooth morphology and wear pattern suggest that *Aegirosaurus* belonged to the “Pierce II/Generalist” feeding guild sensu Massare (1987; 1997), which was hitherto not represented in post-Liassic ichthyosaurs.

Poster presentation

Functional morphology in Temnospondyli, the most diverse group of early tetrapods

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Temnospondyls exhibited the greatest degree of morphological diversity among the early tetrapods and occupied wide diversity of ecological niches, from fully aquatic taxa to terrestrial adapted forms with an amphibious lifestyle. The outline resembled salamander or crocodile-like with sizes varying from small to gigantic forms.

Skull morphology diversity was tested using Finite Element Analysis (FEA) in 2D models of selected Temnospondyli's skulls in bilateral, unilateral and lateral biting cases to get biomechanical data. Maximum deformation and Von Mises stress was recorded for each model to compare within the group.

In general terms, our results show that fully aquatic temnospondyls as archegosaurids, trematosaurids and metoposaurs displayed an important amount of deformation and stress (mainly in the orbital region). In similar way, terrestrial adapted forms, as Eryops, displayed important deformation and stress, mainly distributed in the posterior part of the skull. In both cases, our results suggest weak bite process during prey.

In contrast, semi-aquatic forms as capitosaurids and some brachyopoids held up a tendency to reduce stress and deformation, suggesting a powerful predation.

Finally, some groups of semi- and fully aquatic temnospondyls as edopoids (*Cochleosaurus*), dvinosaurids, plagiosaurs and dissorophoids (e.g. branchiosaurs) resulted in a moderate stress and deformation with a varied stress distribution pattern. *Cochleosaurus* possibly occupied an ecological niche similar to capitosaur forms while the stress distribution in dvinosaurids, plagiosaurs and branchiosaurs, mainly in the borders and less present in the central and posterior part of the skull, is probably consequence of hyobranchial skeleton, key element in these suction feeders.

Oral presentation

Bone histology in extant rodents

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Although bone histology has become a powerful tool to reconstruct life history strategies and physiology in living and extinct reptiles, this approach is uncommon in mammals due to its determinate growth and important bone remodeling. Dormice (Gliridae) are, in theory, a good candidate group for assessing the relation between bone microstructure and life history due to their long life span, marked physiological cycles and negligible bone remodeling. In order to determinate the reliability of these special features, this study aims to compare the bone histology pattern of the dormice with other rodents.

We carried out the most comprehensive study so far analyzing 28 wild individuals of unknown age belonging to two species of dormice (*Glis glis* and *Eliomys quercinus*) and two species of murids (*Rattus rattus* and *Rattus norvegicus*). Ground thin sections of long bones and mandible of each specimen were prepared.

This study provide the first results on the reliability of bone histology in extant rodents to reconstruct life history strategies, which may be useful in the studies of fossil and extant small mammals.

Oral presentation

Breath of the air dragons: lung ventilation in pterosaurs

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As actively flying vertebrates, Pterosauria require an efficient ventilation of the pulmonary system. Recently a sternal pump mechanism combined with an airsac system analogous to that of birds has been suggested for the Pterosauria. However, the skeleton of many pterosaur taxa is characterized by fusion of many bones of the trunk, resulting mechanical constraints on the mobility of the thorax that do not allow movements of the sternum sufficient for an avian-like lung ventilation. This is confirmed by an analysis of the lever systems associated with joints between the ribs, vertebrae, sternum, and pectoral girdle that reveals very limited mobility of the entire thorax. Comparisons with modes of lung ventilation in extant amniotes and the application of an “Extant Biomechanic Bracket” suggests that stiffening of the pterosaurian thorax, coupled with mobile gastralia and prepubic bones, was most consistent with a crocodilian-like hepatic piston respiration as the primary means of breathing.

Oral presentation

The swimming bulldog – jaw mechanics and locomotion in ichthyodectiform fishes

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Ichthyodectiformes, an extinct order of basal teleosts, are commonly called „bulldog fish“ due to their dorsally pointing mandibles. The order was erected by Bardack & Sprinkle (1969) and to date includes about 26 nominal genera. Ichthyodectiformes are reported from the Middle Jurassic to the Late Cretaceous of Europe, Middle East, North America, South America, Antarctica, Africa and Australia. Here, we present some cranial characteristics in ichthyodectiform skulls, which indicate unique jaw mechanics for basal teleosts. The latter either possess massive jaws, which allow inertial feeding by grasping and biting or suspended mobile jaws for suction feeding (Gosline 1973, Lauder 1980). The opening mechanics of Ichthyodectiform jaws are aligned with a lateral jaw and suspensorium movement during the expansive phase of the oral cavity like in some filter feeders. Some of the Cretaceous ichthyodectiforms have a median predentary bone. The discovery of such a predentary in the Mexican *Vallecillichthys* indicates that this bony structure was probably a common feature in ichthyodectiforms, which protected the flexible mandibular symphysis from pressure deformation during fast swimming.

The fusiform to elongated body with its high aspect ratio tail and pectoral fins suggests a pelagic lifestyle with sustained and fast swimming. Elongated and strong epineurals reduced lateral undulation of the body to an oscillatory movement of its caudal fourth. This locomotion style combined with the dorsally directed mandibles forming a fish trap like gape suggests that these sea bulldogs attacked their prey from below. Gastric contents provide evidence that ichthyodectiforms fed on schooling fish.

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Poster presentation

“Browridge transplantation” – How the pieces of a fossil lemur skull became reunified after a century

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Hadropithecus stenognathus is a fossil archaeolemurid that inhabited Madagascar during the Holocene. The first remains of this rare extinct taxon were discovered in 1899 at the Andrahomana cave in Southern Madagascar and have been since housed in the Natural History Museum of Vienna, Austria. Among these remains is an incomplete skull of a subadult individual.

In 2003, a US-Malagasy team including D. BURNEY (National Tropical Botanical Garden, Hawaii) and L. GODFREY (University of Massachusetts-Amherst, USA) returned to Androhamana Cave for excavation at the type *Hadropithecus* locality and found more fossil bones of *Hadropithecus*, some of them belonging to the same subadult skeleton.

In 2007, T. RYAN and A. WALKER (both Penn State University, USA) conducted a project based on computed tomography technology to virtually reconstruct the incomplete skull of *Hadropithecus* for biomechanical and anatomical analysis.

In this connection they made an extraordinary virtual discovery: Two frontal portions, excavated in 2003, forming the orbital “eyebrow”-arches, fitted exactly in the bony gaps of the Vienna *Hadropithecus* skull recovered in 1899.

Their fit was proven by CT-scans based digital images, although the frontal pieces and the “Vienna skull” had never been together in one room.

Finally in 2008, the missing orbital portions were reunified to the rest of the Vienna skull of *Hadropithecus* – the “happy end” of a 100 years lasting puzzle and a curatorial stroke of luck.

Poster presentation

What the P⁴-M¹ complex tells about the origin and evolution of myodont rodents

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Together, Dipodoidea and Muroidea constitute the infraorder Myodonta which encompasses *circa* 30% of present-day mammalian diversity. The controversy over the origin of Myodonta and the split between Dipodoidea and Muroidea is longstanding. Historically, muroids were defined as possessing only molars while dipodoids conserve a P⁴. Recent discoveries of P⁴ in basal muroids and the occurrence of some dipodoids lacking premolars underline the need for new dental diagnoses for these groups. We performed phylogenetic analyses on basal myodonts and relatives, complemented by dental observations on a large sample of extinct and extant Myodonta. Results demonstrate that the North-American genus *Armintomys* is a stem Myodonta. Stem muroids are then shown to constitute an Asian monophyletic group, whereas dipodoids could originate from North America. Character analyses reveal that muroids differ from dipodoids in having a true anterocone on M¹ and a complete cricetid plan. During Late Eocene, muroids displayed constant size increase of the anterocone correlated with a M¹ mesial enlargement consecutive to P⁴ loss. In contrast, the occurrence of an anterocone-like cusp in dipodoids is highly variable and not correlated to the P⁴ loss. These results might indicate that in Muroidea and Dipodoidea the P⁴ loss is achieved by different processes. Interestingly, regression or disappearance of P⁴ can involve an enlargement of the first two molars. In conclusion, the P⁴-M¹ complex is source of crucial characters for better understanding the various evolutionary modalities of Myodonta. Its comparison with M₁ development may distinguish different modalities of tooth reduction during mammalian evolution.

Poster presentation

Deep sea fish fauna as paleoecological indicator of the Oligocene sediments of the Carpathians

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The representatives of the families of Gonostomatidae, Phosichthyidae, Sternoptychidae and Myctophidae are typical by the presence of the light organs and form mesopelagical and bathypelagical part of the marine fauna. All these families are present in the Oligocene sediments (Menilitic Formation) of the Carpathians (Czech Republic, Poland, Ukraine, Rumania) and of the Caucasus. Some of the gonostomatids and sternoptychids are also present in the fish assemblage of the Iranian and Switzerland (Glarus) localities. On the contrary these fishes are not present in the same stratigraphical level (NP23, NP 24) in the Central Carpathian Paleogene basin, North Hungarian Paleogene Basin and in the Rhine graben. There could be different explication: 1. Different stratigraphical level in the frame of NP 23 and NP 24 Zones but more probably different depth conditions. The presence of the deep sea fishes in the sediments as for instance Chert member and Dynow marlstone confirms the salinity water column stratification hypothesis. Based on the presence of calcareous nannofossils, Krhovský (1981b, 1991) inferred a higher salinity during deposition of the Dynow Marlstone than the Chert Member. The absence of stenohaline planktonic foraminifers, however, suggests that the salinity of the surface layer was still below about 27 per mille. The deep sea fauna is an evidence of the normal salinity in the basin bottom. From the point of view of functional anatomy the presence of the light organs on the fossil specimens demonstrate the similar paleoecological conditions as in the recent fauna. The vertical migration can be also supposed. The number of the common taxa between Carpathians and Caucasian localities and Iranian and Glarus localities show a connection or relation between Paratethys and Tethys in the beginning of the Oligocene.

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Poster presentation

Morphological and Biometrical study of the postcranial remains of Ruminants : a proxy for environmental changes (Swiss Molasse Basin, Oligo-Miocene transition)

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The morphology and the biometry of postcranial bones of Ruminants (Mammalia, Artiodactyla) show a high correlation with some ecological parameters, especially body mass and locomotion. These two parameters permit us to characterize different anatomic types adapted to different habitats (Köhler, 1993).

A morphological and biometrical analysis was applied on ruminant postcranial remains from the Swiss Molassic Basin, from the early Chattian (MP26) to Burdigalien (MN3) in order to reconstruct terrestrial environmental changes.

At the early Chattian (MP26), the Swiss Molassic Basin corresponded to a rainforest environment. During late Chattian (MP29-30), the environment was still wooded but more open. From the late Aquitanian to the Burdigalien (MN2-3), Ruminants show morphologies principally adapted to open environments. However, the presence of small forms suggests a slightly wooded cover. Furthermore, in a small number of localities, some ruminants adapted to rain forest could indicate a huge diversity of environments.

The evolution of terrestrial palaeoecosystems during the Oligo-Miocene transition is characterized by an progressive opening of environments, from a rain forest to a mosaic-like environment with tree grassland and rainforest.

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Oral presentation

Cetodiversity: observations and interpretations

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This year, 2010, is proclaimed by the United Nations to be the International Year of Biodiversity. Hereby is appealed for the protection of the manifold variety of the organisms, and for conscientious regard for all life's interdependence. It is an optimistic appeal to a civilization that values humans and their commodities above other species and their needs. The request is aimed at the Present and the Future. In wider perspective, biodiversity has evolutionary and historical dimensions.

Basically, the concept of biodiversity has no application in palaeontology. Even instantaneous burial of all life would preserve traces of only a fraction of its species because dead organisms have unequal fossilization potentials. Nevertheless, biodiversity is as old as life and evolved along with the plants, the animals and the environments.

Historically, man's perception of biodiversity has changed along with his outlook upon life. Early humans, like other mammals, were alert to the peculiarities of the organisms around them, not least for the sake of survival; no less important were humans' spiritual ties with the living and nature, as we know from many sources. Prehistoric cave paintings and rock carvings are not attempted accounts of biodiversity: their motive was the animals and man, not the diversity; their inspiration was animism, not science. It was the Classical scholars who began scientific registration of nature. Aristotle's natural history influenced Medieval and later Western scholarship, as is well known. Melville listed Aristotle as the first named contributor to cetology (Melville, 1851).

Studies of a beaked whale (Ziphiidae, Odontoceti) pertaining to a Tortonian (late Miocene) NE Atlantic whale fauna inspired to search for records of NE Atlantic beaked whales and whale diversity, the topic of this presentation. The extant ziphiids (26+ spp) are deep-diving whales in the oceans and some marginal basins. Mostly submerged, also during sleep, and foraging at depth (dive of *Ziphius* measured at 1888 m, Tyack et al., 2006), they tend to elude man's mental grasp. Live ziphiids are rarely observed, excepting the North Atlantic *Hyperoodon* which approaches boats from curiosity; it was heavily exploited, but is now protected by law; the Pacific *Berardius* is still hunted by Japanese whalers (pers. comm. H. Ichishima, 2009). Cranial features of the Tortonian ziphiid, demonstrated at the 2009 EAVP meeting, show it was a deep-diver. Neck-shortness supports this interpretation. The fossil was found in inner North Sea deposits (Gram Fm, Denmark), but skeletal adaptations as well as geological conditions (Schwarzhan, 2010) corroborate the view that the species was part of contemporary NE Atlantic cetodiversity. It was referred to the *Ziphirostrum-Messapicetus-Ziphius* complex. Free cervicals, interpreted as a

plesiomorphism when compared with cetaceans generally, will be interpreted as an ecofunctional specialization when compared with *Ziphius*.

Scholarly reporting of the Beaked Whale (: *Hyperoodon*) at Iceland began no later than 800 years ago. During more than 500 years the Nordic scholarly informants were men of the church. An annotated illustration from 1590 of the NE Atlantic cetodiversity will be discussed.

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Oral presentation

Woolly rhinos and woolly mammoths in Southern Greece? Using REE elements to trace the provenance of old museum collections

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The Mediterranean peninsulas of Europe are commonly included in the glacial distributions of cold-adapted faunas, particularly with respect to their most iconic animals: the woolly mammoth (*Mammuthus primigenius*) and the woolly rhino (*Coelodonta antiquitatis*). The presence of both taxa is well documented by rather scanty, though identifiable, remains from Northern Greece, as well as from Megalopolis in Peloponnese, a quite southern locality (37°N).

The incompatibility of cold-adapted elements with the rest of the Megalopolis fauna, which is of forest/woodland type, together with the presence of physically similar specimens from Ukraine in the collections of the Museum of Palaeontology and Geology, University of Athens, raised many doubts about the provenance of the alleged Megalopolis finds. The Ukrainian fossils come from “Kiev, Telichka” locality and were donated to the museum more than a century ago. To test our doubts we used Rare Earth Elements (REE) analyses. Small quantities of bone, dentine and sediment samples were pulverised and analysed on an ICP-OES spectrometer. The normalised REE signal of the analysed samples showed clearly that the supposed woolly mammoth and rhino samples from Megalopolis were completely different from a specimen that definitely comes from this locality, but matched with another, unquestionably Ukrainian sample, evincing a quite plausible Ukrainian provenance. Our results contradict the referred presence of woolly mammoths and rhinos in southern Greece (possibly due to specimen mixing), which is in accordance with the regional faunal data.

Oral presentation

Anatomy, locomotion and biomechanics of the suricate (*Suricata suricatta*, Herpestidae, Carnivora)

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Although the locomotor apparatus of the mongooses is mostly uniform in its appearance, they show a pattern of morphological characters that allow for digging and either ambling or cursorial locomotion. *Suricata* is a skilled digger but also an agile runner. The distal limb segments are indicative of cursorial capabilities in being slender; the autopodia are narrow and digitigrade. The forearm can be supinated while the extension of the manus is blocked; a feature typical for diggers.

In *Suricata*, the long brachial levers result from shoulder muscles that extend about 12% further distally than in Mustelinae. Furthermore, mm. latissimus dorsi et cutaneus trunci in *Suricata* are stronger than in most other Fissipedia.

Mm. pectorales consists of several portions including m. xiphihumeralis and m. pectoantebrachialis (Radlanski, 1985). The thorax is approximately conic but stable relative to other Fissipedia. The pubic symphysis is short relative to the pelvic length while the rami ossis pubis and ischii are thin; features indicative for semi-fossoriality.

During scratch-digging, *Suricata* balances on its hind limbs, the trunk suspended by the epaxial muscles, acting on the broad lumbal procc. transversi and by the retractors of the femur, with only sagittal oscillations occurring at the pelvic girdle. However, terrestrial locomotion includes mediolateral motion. The pubic symphysis can resist shearing and tensile forces and thus allows for a rapid terrestrial locomotion; unlike in true burrowers.

Suricata is able to stand upright without tail support, and can also climb, despite mm. adductores femoris being weaker compared to other Fissipedia.

Oral presentation

The grip capacity of non-mammaliaform Therapsida

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In most Therapsida, especially Gorgonopsia, Therocephalia and the non-mammaliaform Cynodontia digit I in manus and pes was opposable. This movement is mainly carried out in the distalometapodial joint I, which is irregularly saddle-shaped. In Gorgonopsia, Therocephalia and the non-mammaliaform Cynodontia the distale I is characterized by a ventrally or ventrolaterally situated convexity, around which metapodiale I could be rotated. Because of the transverse autopodial vault distale I is tilted about 35° against distale III. The amphiarthrosis between centrale I (manus) or naviculare (pes) and distale I as well as the basal digital joint I participated to the opposition movement of autopodial ray I. Due to the transverse vault in the distalia and the proximal termini of the metapodials II to V and the distalometapodial joints II-V the autopodia of Therapsida were prehensile. When strongly flexed the digital joints did not participate in the prehensibility, because under flexion they could not be abducted and only minimally rotated. However, flexion caused best coherent fit of the digital joints and thus stability against torsion and shear. The opposable digit I, the prehensile autopodium and the stability of the flexed digital joint of the digits II to V render the autopodia of most non-mammaliaform Therapsida prehensile. Prehensile autopodia of carnivorous Therapsida could have been utilized to fix prey and thus avoid fractures of the laterally compressed fangs.

Poster presentation

Insights into the brain of two hadrosaurid dinosaurs from Kundur, Russia

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We describe the brain of two species of hadrosaurid dinosaurs (Dinosauria: Ornithischia) from the Kundur locality (Amur Region, Far Eastern Russia). This description concerns the lambeosaurine *Olorotitan arharensis* and the hadrosaurine *Gryposaurus asiaticus*. Brainscans of these specimens were scanned and the endocranial space was reconstructed thanks to Artec Studio. We consider that the endocranial space is a good approximation of the brain in view of the work of Evans (2005; 2006) and personal observations. The brain of these species shows a typical hadrosaurid condition, with a nearly straight brain, enlarged cerebral hemispheres, and a marked constriction after the pineal peak.

Oral presentation

Late Cretaceous sauropods of southwestern Europe: Quid novi?

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Sauropod diversity in the Late Cretaceous of southwestern Europe is nowadays considered as much higher than what was previously thought. For almost one century the hypothesis of Depéret (1900) and Lapparent (1947) that two forms coexisted (namely *Hypselosaurus priscus* Matheron 1869 and *Titanosaurus indicus* Lydekker 1877) has been widely accepted. However both species are now considered as *nomina dubia* (Le Loeuff, 1993; Wilson & Upchurch, 2003). In the last fifteen years three new species have been named: *Ampelosaurus atacis* Le Loeuff, 1995 from the Upper Aude Valley in southwestern France, *Lirainosaurus astibiai* Sanz *et al.*, 1999 from the Contado de Trevino (northwestern Spain) and *Atsinganosaurus velauciensis* Garcia *et al.*, 2010 from the Aix Basin in Provence (southeastern France). These three species come from roughly contemporaneous strata of Late Campanian to Early Maastrichtian age.

The distinction between *T. indicus* and *H. priscus* was based primarily on differences between caudal vertebrae although Lapparent did refer various appendicular elements to the two genera. A careful examination of several series of articulated caudal vertebrae from the locality of Bellevue (the type locality of *A. atacis*) suggests that there is a considerable variation in the shape of these vertebrae throughout the tail, a striking difference with classical saltasaurids such as *Baurutitan britoi* Kellner *et al.*, 2005. This variation should not be underestimated when trying to identify isolated specimens. Alternatively there seems to be more differences than previously thought in the morphology of titanosaur teeth. All studied localities have yielded a single morphotype of sauropod tooth. The three well defined species show indeed a different tooth morphology and at least two more morphotypes are yet unnamed. Although morphometrical approaches (i.e. Vila *et al.*, 2009) may be useful to deal with the abundant disarticulated material, a rather good estimate of sauropod diversity in the Latest Cretaceous of Southern Europe may be based on odontology.

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Oral presentation

New stratigraphical data on North African spinosaurs

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Early Cretaceous vertebrates are known from many locations in Africa. In Libya they have been reported by various authors since Lapparent (1960). A preliminary report on the vertebrates from the Cabao Formation, a continental unit with marine influences, was recently published (Le Loeuff *et al.*, 2010). On the basis of its palaeontological content (including the shark *Priohybodus*, a baryonychine spinosaurid, a possible camarasaurid, etc.) and stratigraphical correlations, it was suggested that the Cabao Formation is probably Neocomian or Barremian in age. The overlying Kiklah Formation is also a sandy unit with strong marine influences which has yielded a shark assemblage similar to what is known in the Tunisian Ain El Guettar Formation (Aptian-Albian). A single dinosaur tooth was also discovered in the course of sedimentological exploration for Total Libya. It is a spinosaurid tooth belonging to a spinosaurine close to *Spinosaurus*, known in the Ain El Guettar Formation. The vertebrate assemblage of the Kiklah Formation is thus similar to that of the Tunisian unit and very different from that of the Cabao Formation.

At the scale of the Continental intercalaire and neighboring formations of North Africa it seems that early baryonychine spinosaurids (now known from Libya, Niger, Cameroon) were replaced by spinosaurine spinosaurids (known from Algeria, Morocco, Egypt, Tunisia: see Cavin *et al.* 2010), possibly in the Late Barremian or Early Aptian. The disappearance of the hybodont shark *Priohybodus* may have been contemporaneous.

Many Early Cretaceous continental formations of Africa have yielded fossil vertebrates only and are thus rather difficult to date (e.g. in Mali, Niger, Cameroon, etc.). Marine incursions on the margins of the African craton can help, however, to date some vertebrate localities in Africa (e.g. in Tunisia, Libya, South Africa, Tanzania). The analysis of different vertebrate assemblages from these areas may help to build a stratigraphy of the African Continental Intercalaire based on fossil vertebrates.

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Poster presentation - Supported by The Raymonde Rivoallan Fund

Biometrical study of post-cranial deer material from the Late Pleistocene of Crete and Karpathos

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A characteristic endemic fauna, restricted to the island of Crete occurred during the Late Pleistocene, in which the ungulates were by far the most successful forms (0.3-0.01 Mya) ranging from dwarf to relatively gigantic size. They probably occupied different ecological niches in the insular isolated environment and belonged either to one genus (*Candiacervus*) on the basis of monophyly or to more implying different ancestors.

In the present study, the biometrical analysis of size variation and limb morphology of the Cretan cervids and comparison with nearby Karpathos endemic Pleistocene deer were attempted. The studied fossil material, currently stored in the Natural History Museum of Crete, was originally collected from numerous cave localities in the late sixties and early seventies by the German palaeontologist S.E. Kuss. The widely spread and abundant smallest or dwarf-sized groups were mainly distinguished from scatter plots of combinations of several measurements on full grown bones while the recovered larger sizes were extremely rare. These were likely the last representatives of the Cretan deer that had short and massive limbs displaying a much greater degree of robustness than continental cervids. Furthermore, multivariate analysis (PCA) resulted in a definite morphological distinction between the post-cranial fossil material from the two islands. The Karpathos cervids differ significantly from the deer remains found on Crete both in size and morphology, bearing unique anatomical features, and implying no direct link with the Cretan stock. Furthermore, despite insufficient evidence, the existence of two different species in Pleistocene Karpathos is also suggested.

Oral presentation

Age and relationships of the modern amphibians (Tetrapoda: Salientia, Caudata, Gymnophiona, Albanerpetontidae)

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The origins of the frogs, salamanders, caecilians, and the extinct Albanerpetontidae remain controversial. Three groups of hypotheses persist in the literature: the mentioned taxa may form a clade (Lissamphibia, a crown-group of which Albanerpetontidae may be a member or the sister-group), which could be nested within the temnospondyls, making the lepospondyls stem-amniotes (temnospondyl hypothesis/TH), or among the lepospondyls, making the temnospondyls stem-tetrapods (lepospondyl hypothesis/LH); alternatively, the frogs and the salamanders may be temnospondyls while the caecilians may be lepospondyls (polyphyly hypothesis/PH). We have tried to discriminate between these alternatives both directly (by phylogenetic analysis) and indirectly (the PH predicts a much older divergence date between the modern amphibians than the TH and the LH). Three partly novel dating methods support a Permian date, compatible with the TH and the LH but not the PH. All three hypotheses have recently been supported by phylogenetic analyses. Having made changes to three data matrices that supported the TH or the PH to make them congruent with the descriptive literature and personal observations, ordered potentially continuous characters, merged correlated characters, and scored ontogeny-affected characters as unknown in morphologically immature specimens, we find that these matrices (including the largest published one, which bolstered the TH) support the LH upon reanalysis. This agrees with previous findings that small changes to a data matrix can cause large differences between the resulting trees. The TH is only a little less parsimonious than the LH in two of them, but the PH is much less parsimonious in all three.

Poster presentation

Extraordinary sauropod trackways from the Late Jurassic Béchat Bovais tracksite (Canton Jura, NW Switzerland): implications for sauropod locomotor styles

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In 2008 and 2009, the Béchat Bovais tracksite, located on the future course of the A16 highway (Canton Jura, NW Switzerland), was excavated over a surface of more than 4000 m². On level 515, 2100 dinosaur tracks were uncovered and 28 sauropod trackways identified and documented by means of classical ichnological techniques, laser scanning, and photogrammetry. Layer 515 is a 5-15 cm thick, calcareous marl and its bedding plane (level 515) is a palaeosurface characterized by the presence of a dense network of reddish *Thalassinoides* burrows and true tracks with a wide range of morphologies indicating that substrate properties were not uniform across the site. Generally, on the underlying, desiccation-cracked level 510, no or only very shallow and faint undertracks are visible, indicating that level 510 was already well indurated at the time of track formation on level 515. Level 510 only broke occasionally under the pressure of the sauropod feet, leading in some places to the formation of deep tracks with steeply inclined track walls. Pes tracks are oval in shape, longer than wide, only rarely exhibit digit and never claw impressions, and their mean length and width vary from 35.8 to 59.3, and 27.4 to 45.4 cm, respectively. Manus track morphology varies from horseshoe-shaped over semi-circular to sub-circular without any evidence for pollex claw impressions. Manus imprints are always wider than long, and their mean length and width varies from 8.5 to 28, and 20.9 to 34.3 cm, respectively. Many of the trackways show different patterns and configurations, and marked distinctions also occur along single trackways (e.g. changes: from pes/manus to pes-only, in relative position of pes and manus tracks, in trackway gauge, in track rotation). Two extraordinary long and parallel trackways (S18 with 115 m, S19 with 105 m) show several small turns. The mean ratio between the width of the angulation pattern and the pes length characterizes 10 trackways as narrow, 9 as intermediate, and 9 as wide gauge. However, along several trackways (e.g., S18, 19, 21) these values change between narrow and wide over a couple of steps and demonstrate that these two locomotor styles could have been used by one and the same sauropod trackmaker. The long, continuous sauropod trackways of Béchat Bovais can be used for detailed studies on the environmental and taphonomical controls of track geometry and morphology, and they may provide important new data on the habitual locomotor characteristics of sauropods such as unsteady locomotion and changes in locomotor behaviour. Locomotor variation within ichnospecies can be addressed statistically, and ontogenetic effects of size on locomotor function can be analyzed.

Oral presentation

First description of the skull of *Amphimoschus* (Mammalia, ???Bovidae???) and taxonomy of the genus

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Amphimoschus is an early Miocene ruminant (MN3-MN5) from Western Europe. Few is known about it, thus its taxonomy at the species level and its position within the ruminant phylogeny remain unclear. It is classically ascribed to Bovoidea (Gentry et al., 1999) but was also embedded within the Cervoidea (Leinders, 1984). This problem arises from the absence of cranial material, although Leinders (1984) did mention the presence of a skull from Germany.

Two partial skulls have been discovered in the MN3/4 Benken locality (Switzerland). They are nicely preserved and show few deformations. These specimens seem to belong to *Amphimoschus artenensis*. Another complete skull from a young individual has been recovered from the MN4b Langenau 1 locality (Germany). The latter fossil is bigger and shows typical tooth characteristics of the other species, *Amphimoschus pontileviensis*.

Amphimoschus shows cranial features of evolved Pecora, differing from the superfamily Cervoidea: no lacrymal fossa (but perhaps an internal lacrymal bulla), a single lacrimal orifice, although this alone proves rather not diagnostic (Janis & Scott, 1987). The tympanic bullae and the external auditory meatus are elongated, with a lamina vaginalis anteriorly placed. The shape of the mandible is similar to that of extant mixed-feeders Bovidae. The Benken skull possesses heavy supraorbital crests that are difficult to interpret. They look like structure that could be associated to the presence of cranial appendages.

If *Amphimoschus* did possess horns, it is the oldest true Bovidae known, slightly older than the oldest to date known bovid *Eotragus*. But other skull material does not really support this assertion.

This study is supported by the Swiss National Foundation project (n°115995 and 126420) on the large mammal evolution in the Swiss Molasse Basin during the Oligocene and Early Miocene.

Oral presentation

Tracking early dinosaurs - new discoveries from the Upper Austroalpine Nappes of Eastern Switzerland (Hauptdolomit, Norian)

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We report here on the discovery of new sauropod and theropod footprints from the middle and upper part of the Hauptdolomit Group (HDG; Mid to Late Norian) from the Upper Austroalpine Ela Nappe in the Natural Park Ela (Canton Graubünden; South-eastern Switzerland). Field studies and aerial surveys in 2009 revealed trampled surfaces in the middle part of the HDG (Late Alaunian to Early Sevatian) at two different locations that display rounded footprints with no signs of digits and can therefore be assigned to advanced sauropods. Close to the summit of Piz Mitgel (3127 m.a.s.l.), the uppermost part of the HDG displays a surface with well-preserved prosauropod pes prints and small- to medium-sized tridactyl footprints of theropod affinity. The summit of the Piz Ela is formed by steeply inclined, east-dipping bedding planes (816 m²) of the higher part of the HDG with three vertebrate footprint levels. The lowermost surface shows several imprints of small theropods (?*Grallator*). The intermediate level (main surface) exhibits a long trackway with large tridactyl footprints with a pes length of about 33 cm, which can be assigned to the ichnogenus *Eubrontes*. Furthermore, a trackway with large footprints of a bipedal animal is present on the same level. The highest level, just below the summit, shows tridactyl tracks of small theropods and faint, large, rounded imprints that were most probably left by prosauropods. Higher up in the stratigraphic sequence at the boundary between the HDG and the overlying Kössen Formation (Sevatian), we found a dolomitic layer that shows a trackway with deep and possibly tridactyl imprints with mud rims of a bipedal animal.

Up to now, seven levels with dinosaur tracks have been detected in a stratigraphic range spanning the Norian (Alaunian) to Late Rhaetian. The large theropod footprints attributed to the ichnotaxon *Eubrontes* reported here and those from the Swiss National Park together with the record from the coeval Dolomia Principale of the Tre Cime di Lavaredo (? Tuvalian; Dolomites, Italy) are the oldest unequivocal evidence of very large theropod dinosaurs in the Triassic. They predate the fossil remains of *Liliensternus liliensterni* from the Late Norian Knollenmergel of Southern Germany. If, the presence of footprints of advanced sauropods can further be substantiated these tracksites will become a key-element for the reconstruction of the evolutionary scenarios of saurischian dinosaurs developed in the last few years.

Oral presentation

Growth patterns in fossil fish and their palaeoecological implications

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Fossil fishes provide us with a broad range of tools for palaeoecological reconstructions. Growth cessation marks (GCM) in otoliths, scales, and other hard-tissue structures elements are frequently used for age and growth studies in various extant fish species. The same type of information can be derived from fossil species as well. Different growth of populations from different localities and/or different horizons of the same locality, e.g., may indicate palaeonevironmental shifts and modifications. The bowfin *Cyclurus kehreri* (ANDREAE, 1893) and percoids (e.g., *Palaeoperca proxima* MICKLICH, 1978) are typical elements of the ichthyofauna of the UNESCO World Heritage Monument Messel Pit. Otoliths are not preserved in Messel and other internal hard tissue elements are often obscured or incompletely preserved. Scales as dermal ossifications are more frequently object of external modifications than internal elements like the vertebrae. Not rarely they are regenerated and do not show the full GCM pattern. Vertebrae do not undergo such modifications and, therefore, are better suited for such investigations. Based on GCM on vertebral centra, the oldest individuals of *C. kehreri* may have been up to 11 years old. This is in good agreement with the largest scales, which at least show eight GCM. According to the percoids, the vertebrae of most Messel specimen are too small for the identification of GCM. But there is one very large isolated centrum, in which six to seven GCM were counted. Its size is in good correspondence with a 14 cm long fragment of the vertebral column of a *Palaeoperca*-like percoid, suggesting an original standard length of about 60 cm. This fragment also shows six to seven GCM in preserved scale remains. Regular sized specimens of *P. proxima* (16-21 cm SL) show three to four GCM only. Since the palaeolatitude of the ancient Messel maar lake was only 38°N, the effects of the seasonal photoperiod and of the temperature probably played a minor role in formation of the GCM. Seasonal nutrient input associated with rainfall and dry seasons maybe a more parsimonious explanation. According to the low number of GCM in the majority of specimens, the Messel ichthyofauna was clearly dominated by juveniles. This also means that the reproduction cannot have taken place inside the ancient Maar lake. Therefore, it also cannot have been a completely isolated structure at those periods of time when the oilshale deposition occurred.

Poster presentation

Pterosaur flight membranes – good for tents?

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Building with membranes is an expanding market in modern architecture. Membranes are used for mobile and foldable roofing of sport arenas, airports, train stations and squares. The membrane materials used today can take over wrapping functions only. This strongly limits their application options. Another big problem with foldable membranes is the delamination along the folding joints, which restrict their durability. However, architects demand multi-functional membrane and mostly wear-free materials, which existing materials cannot accomplish. Biological membranes such as the wing membranes of bats, insects and pterosaurs are multi-functional, foldable and wear-free. In some bats the flight membrane has to survive more than thirty years of intensive usage without trace of wear. This makes membrane fliers very interesting objects of study for engineers and architects. In the frame of a multidisciplinary project, which is financed by the German state project BIONA, we started a detailed analysis of the structural composition of wing membranes of bats, insects and pterosaurs. The aim of this project is to understand the mechanical and structural features of biological high performance membranes and, based on this, develop innovative composite membrane materials with the longevity and smart characteristics of biological membranes. In order to reach this aim, biologists, architects, stress analysts and construction engineers co-operate within this project. Pterosaurs here are of special interest, because their wing membranes were multilayered and multifunctional, especially concerning stabilisation and thermoregulation.

Poster presentation

A *Bernissartia* (crocodyliformes, neosuchia) individual from the Barremian of La Rioja (Spain)

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The advanced neosuchian *Bernissartia* was originally described on the basis of an almost complete skeleton from the coalmine of Bernissart (Belgium). Since then, many crushing and bulbous teeth from the Upper Jurassic to the Lower Cretaceous (and even from the early Upper Cretaceous) have been commonly assigned to members of this genus, or to closely related forms, usually gathered as undescribed “bernissartids”. In particular, these crocodiles are one of the most conspicuous representatives of the vertebrate faunas of the Lower Cretaceous of Western Europe, but nevertheless, there are few samples to illustrate their cranial anatomy. The *Bernissartia* skulls are just represented by two individuals from Bernissart and other one from the Barremian locality of Galve, in Spain. A new partial skeleton attributable to *Bernissartia* was found in the Spanish locality of El Sobaquillo (Munilla, La Rioja). The specimen comes from lacustrine sediments belonging to the Enciso Group, which were dated as Barremian-lower Albian on the basis of its charophyte record.

The specimen preserves the anterior part of the skeleton, including the complete skull and mandibles. The available character combination, including morphology and disposition of teeth, morphology of the periorbital bones and caudal part of the mandible is compatible with the diagnosis of *Bernissartia*. As occurs with the specimen from Galve, the new evidence represents a small crocodile, probably belonging to a juvenile individual, which allows a discussion about the cranial anatomy and diagnosis of the members of the genus.

Poster presentation

New evidences of the sauropod *Turiasaurus* from the Portuguese Upper Jurassic

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The Portuguese Upper Jurassic sauropod fauna is to date constituted by four species including *Lourinhasaurus alenquerensis*, *Dinheirosaurus lourinhanensis*, *Lusotitan atalaiensis* and *Turiasaurus riodevensis*. In addition, material closely related with Morrison sauropods, such as *Camarasaurus* and *Apatosaurus*, have also been cited. Here, two isolated sauropod teeth from the upper Kimmeridgian beds of Praia da Corva (Praia da Amoreira-Porto Novo Member of the Alcobaça Formation, Lourinhã Group) and the Tithonian beds of Cambelas (Freixial Formation, Lourinhã Group) from the Torres Vedras Municipality are discussed. The teeth have the morphology assigned to *Turiasauria* (*Turiasaurus* and *Neosodon*): heart-shaped, spatulated and asymmetrical maxilar or dentary crowns and enamel ornamented by numerous small bumps and wrinkles. Furthermore, their lingual and labial sides possess a central ridge that is weaker in the lingual side, but conspicuous in the labial side. This lingual character reminds of *Turiasaurus* teeth rather than *Neosodon* tooth, with a flat lingual face. The only known species of *Turiasaurus* was described from the Villar del Arzobispo Formation at Barrihonda–El Humero site in Riodeva (Teruel, Spain), that are middle Tithonian to lower Berriasian in age. *Turiasauria* had been described previously in Portugal with a tooth from S. Martinho do Porto and, recently *Turiasaurus* has been documented in early Tithonian beds, relatively synchronous with Cambelas beds. The new teeth assigned to *Turiasaurus* increase its stratigraphical and geographical range, making it one of the sauropod genera with a broader record in the Upper Jurassic of the Iberian domain.

Oral presentation

Dental wear and oral food processing in *Caiman latirostris*: analogue for fossil crocodylians with crushing teeth

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Almost all of the 23 extant species of crocodylians are opportunistic predators that consume their food without extensive intraoral food processing. Posterior bulbous crushing teeth with heavy dental wear in two specimens of *Caiman latirostris*, however, unambiguously indicate that oral food processing can be an important factor during feeding. Wear pattern analysis in two specimens of *C. latirostris* clearly indicates crushing of hard food items that produced large wear surfaces on tooth crowns in the posterior part of the tooth row. This type of wear suggests that the diet was predominantly composed of durable, hard-shelled prey (e.g. molluscs, crustaceans, turtles), a supposition confirmed by recent studies on the stomach contents of several *C. latirostris* specimens. The absence of similar wear patterns in other ontogenetically mature specimens of *C. latirostris*, however, indicates that specific, regional differences in food resources might affect the degree and type of dental wear. The dental features we report in *C. latirostris* can provide an important extant analogue for fossil forms with similar dentitions (e.g. *Bernissartia*, *Unasuchus* and globidontan eusuchians).

Oral presentation

Early Cretaceous Ichthyosaurs Graveyard in Torres del Paine National Park, Southern Chile

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The Early Cretaceous ichthyosaurs graveyard at the Tyndall Glacier in the Parque Nacional Torres del Paine, South Chile, is an outstanding locality both nation and worldwide. During two field campaigns in the years 2009 and 2010 40 articulated and semi-articulated ichthyosaur skeletons were discovered, comprising adults, juveniles, babies and embryos. The majority of the ichthyosaur specimens preserve diagnostic features permitting their identification to species level. Until now four different ichthyosaur species were identified in the field: *Platypterygius hauthali* (v. Huene, 1927) (Pardo et al. 2010 in preparation), ? *Platypterygius platydactylus* (Broili, 1907), ? *Caypullisaurus bonapartei* Fernández, 1997 and another hitherto unknown species that is different to the other three. This diversity is highly important for the understanding of the diversity in paleocommunities of ichthyosaurs during the Early Cretaceous. The taxonomic and the palaeobiogeographic analysis of the Tyndall ichthyosaur graveyard will throw new light on the evolutionary history of Cretaceous ichthyosaurs prior to their final extinction at the beginning of the Late Cretaceous. The abundance of near complete articulated ichthyosaur skeletons in the Tyndall area suggests mass mortalities caused by high-energy mudflows travelling down along submarine canyons. The ichthyosaurs were either caught directly by these mudflows or were dragged down into the abyss by the suction wave behind them. Their bodies ended up in an abyssal anoxic environment and were rapidly covered by fine sediment, which explains the excellent preservation.

The finding potential of the site as well as the quality of preservation and the quantity of specimens are unique for South America and place the Tyndall ichthyosaur locality among the best fossil sites for marine vertebrates worldwide.

Poster presentation

A new eucryptodiran turtle from the Lower Cretaceous of the Iberian Range (Spain)

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In the Lower Cretaceous of the Cameros Basin (NW of the Iberian Range, Spain) are recognized several taxa of turtles, which so far have hardly been studied. One of them, which has not been previously described, is assigned to the node Eucryptodira. This turtle has several autapomorphies, as well as an exclusive combination of characters, allowing their assignment to a new taxon. Some of the characters present in this taxon are: absence of mesoplastra; presence of a single and large suprapigal; distinctive morphology of the vertebral scutes; contact of the plastron with the shell by suture; presence of inframarginal scutes; distinctive ornamental pattern. The specimen described preserves both the posterior half of carapace and the relatively complete plastron. It was found in the Western Cameros Basin, in the “Castrillo de la Reina” Formation, deposited in the Upper Barremian-Aptian.

However, the presence of this species or of other closely related taxa can be recognized in other areas of similar age in Spain, for example in the Galve fossil sites (El Maestrazgo Basin, Central Iberian Range), in the Lower Barremian of the Camarillas Formation.

In addition to describing in detail this new taxon, it is discussed in a phylogenetic context.

Although basal eucryptodires was almost unknown for the European Lower Cretaceous record, new studies show that this group of turtles had a wide diversity in the Iberian Peninsula, identifying several taxa at fossil sites located in different basins.

Poster presentation

Turtles from the Cameros Basin (Spain): An example of the European Lower Cretaceous chelonian diversity

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The information concerning to the European Lower Cretaceous turtles is very limited. However, in the Cameros Basin (NW of the Iberian Range, Spain) have been recorded several Cretaceous formations in which turtles are relatively abundant. Despite this, until now, they have been scarcely analyzed.

It can be recognized several representatives of Pancryptodira. The first reference was in the XIX century, referring a plate recently reassigned to Solemydidae (basal Pancryptodira), group from which it have been found more specimens later, that remain unpublished. In that Basin was described the holotype and the unique specimen hitherto assigned to *Salasemys pulcherrima*, a representative of Eucryptodira that was assigned to the non-monophyletic group "Macrobaenidae". A revision on its phylogenetic position is in process. Although it had been cited the presence of Pleurosternidae (Paracryptodira), a review of this material allows its reassignment to *Salasemys*, which, together with other new specimens, provides a better understanding of the taxon. In addition, two other indeterminate representatives of Eucryptodira are identified. One of them, to which are assigned several specimens, is a representative of Eucryptodira not Cryptodira, closely related to others found in the Maestrazgo Basin (Eastern Iberian Range). The other, which is a new taxon, is also present in that basin.

Moreover, the Cameros record is completed with specimens from the Upper Cretaceous, which can be assigned to Bothremydidae.

The study of the chelonians from the Cameros Basin will provide information on the succession of taxa along the Iberian Lower Cretaceous. In addition, this will allow establishing palaeogeographical hypotheses.

Poster presentation

A new eucryptodiran turtle from the Lower Cretaceous Konservat-Lagerstätten of “Las Hoyas” (Cuenca, Spain).

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A turtle skeleton from the Barremian (Lower Cretaceous) of “Las Hoyas” (Cuenca, Spain) preserving a high percentage of its elements is discussed. This skeleton is one of the most complete known in the European Lower Cretaceous. However, although since the 1980s this specimen has been quoted in several publications, it was never been presented in detail. It has been considered as an undefined new form related to different groups of Pancryptodira, such as Toxochelyidae, Cheloniodea, Centrocryptodira or a turtle “chelydroid” in aspect, but without the autapomorphies of the family Chelydridae. Until now, there has been published any detailed description or any justified discussion on the phylogenetic position of this new turtle. A detailed description of this turtle is here presented, and its phylogenetic position is established, taking into account the current more consensuated phylogenetic hypotheses.

This specimen is considered as belonging to a freshwater eucryptodiran taxon that is out of Cryptodira. The record of European pancryptodiran turtles in the Barremian is very scarce and the “Las Hoyas” turtle can not be assigned to any previously described taxa. Although this specimen has not reached its full ontogenetic development, it is possible to diagnose the new taxon on the base of characters that are not expected to change during the final stages of the ontogeny by some autapomorphies and by an exclusive characters combination.

This study confirms the distribution of nonmarine basal eucryptodiran turtles in Europe during the Early Cretaceous and increases significantly the knowledge about the European Mesozoic pancryptodiran turtles.

Poster presentation

Systematic of the European Upper Cretaceous turtle *Elochelys* (Panpleurodira, Bothremydidae)

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Bothremydidae is one of the most abundant groups of turtles in the Upper Cretaceous fossil sites of Europe, where have been identified four genera. Furthermore, scarce information on the morphological variability of these bothremydids is available.

So far *Elochelys*, represented by the species *E. perfecta* and *E. convenarum*, was the least known taxon due to its scarce record. *E. perfecta* is represented by a shell and the anterior half of another, from the Campanian of Fuveau (France). *E. convenarum* was only known by a relatively complete shell, from the upper Maastrichtian of Haute-Garonne (France). However, *E. convenarum* has recently been identified in the upper Campanian-lower Maastrichtian fossil site of “Lo Hueco” (Cuenca, Spain). There, it is represented by several specimens, so its record has been significantly increased.

The specimens from this site show differences among them and with respect to the holotype of *E. convenarum* that allow identify that some character states previously considered diagnostic for this species are actually subject to variability. This allows extending the known morphological variability of the species. The variability observed is not limited to *E. convenarum* because some of these characters can be variable for the genus *Elochelys* and even for other representatives of Foxemydina.

A cladistic analysis and the comparison of some specimens from “Lo Hueco” with that recognized to date reinforce the validity of its two species and allow amend the diagnosis of *Elochelys* and of its two known species.

Poster presentation

Preservation and interpretation of hyaena coprolites from the Miocene mammalian site of La Roma 2 (Teruel, Spain)

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The fossil locality of La Roma 2, (Late Miocene, Late Vallesian, MN10) is located in the northern part of the Teruel Basin, between the villages of Peralejos and Alfambra. The fossiliferous level of grey clay marls is interpreted within the context of a marginal lacustrine environment with episodic floodings with external lutitic supplies. The mammalian remains would have been swept to these zones and preserved under reducing conditions.

The site is characterized by a rich and unusual concentration of mammalian coprolites. These coprolites contain residues that provide direct evidence on the diets of the organisms that produced them. A variety of inclusions can be found inside the coprolites, including bone fragments, pollen grains, fungal spores, etc. These little bone fragments show evidence of heavy digestion, being corroded with a characteristic highly rounded and polished fracture surfaces. The coprolites from La Roma 2 have a circular section, with convex, concave, or even pointed ends. Their shape and size fit within those of the excrements produced by the extant *Crocuta crocuta*. The results obtained from X-ray diffraction analyses indicate that the composition of the coprolites is mostly calcium phosphate with small percentages of quartz and gypsum. All these traits suggest that these coprolites correspond to the defecated remains of digested bones, like those produced by hyaenas, and thus they are attributed to *Lycyaena chaeretis*.

Pollen assemblages preserved in coprolites may not correspond to the floral communities of the area, thus complicating any environmental interpretation. Nevertheless, they can provide an approximate characterization of these communities. The results obtained from the palynological analysis points towards an open environment under climatic conditions that were relatively cool and with a certain availability of water, with pines as the dominant taxa, but also with presence of oaks, hazels and birches.

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Oral presentation

Cranial kinesis in pterosaurs — Motile skulls?

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The term cranial kinesis refers to a variety of intracranial movements between skull elements excluded that of the lower jaw. From different types of cranial kinesis streptostyly — anteroposterior rotation of the quadrate about the otic joint — was the only form of kinesis ever suggested for pterosaurs (for the Early Jurassic *Dorygnathus banthensis* and the Upper Triassic *Eudimorphodon ranzii*). However, based on more derived pterosaurs with firmly fused skull bones, most pterosaurologists have regarded the pterosaurian skull as universally akinetic. On the other hand, based on the apparent affinities of pterosaurs to dinosaurs, for which cranial kinesis has been proposed on several occasions, and on certain morphological attributes of some pterosaurian skulls it seems reasonable to pay more attention to the potential of intracranial movements in pterosaurs.

Our comparative anatomical, morphological and phylogenetic considerations show that whereas skeletally mature pterodactyloids have completely fused, rigid, doubtlessly akinetic skull, the skulls of more basal pterosaurs and skeletally immature pterodactyloids possess key morphological correlates that are suggestive of cranial kinesis, mainly streptostyly. Nevertheless, the fact that other anatomical requirements such as permissive kinematic linkages (achieved by elimination or mobility-modification of the surrounding bony elements), which are also prerequisites of all types of cranial kinesis, are absent refers to an akinetic skull. Thus, the presence of the morphological attributes indicative of intracranial movements in some pterosaurs could have been of mechanical and/or ontogenetic importance; alternatively it can be considered as the remnant of a real, kinetic skull of the predecessor of pterosaurs.

Poster presentation

Specialized basal eusuchian crocodylians in the Late Cretaceous of Europe: evidence for the hylaeochampsid affinities of *Acynodon* and its implication on alligatoroid biogeography

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Acynodon was a small, blunt snouted, heterodont crocodylian widely dispersed in the Late Cretaceous (?Santonian–Maastrichtian) European archipelago. Previous studies considered *Acynodon* closely related to North American blunt-snouted globidontan alligatoroids and placed it as the basal most member of the group. A reexamination of two published skulls of *A. iberoccitanus* from the Fox-Amphoux locality (southern-France) led us to the conclusion that *Acynodon* is not an alligatoroid but a basal eusuchian hylaeochampsid lying close to *Iharkutosuchus makadii* from the Santonian of Hungary and *Hylaeochampsia vectiana* from the Barremian of England. *Acynodon iberoccitanus* shares the following unique combination of characters with *Iharkutosuchus* and *Hylaeochampsia*: the posterior process of the maxilla reaches the level of the lateral temporal fenestra, the medial wall of the posterior alveoli is formed by the ectopterygoid, enlarged last two alveoli, nasal–lacrimar contact absent, lateral flanges of pterygoid reduced, quadrate very short lying almost in a horizontal plane. Other common characters with *Iharkutosuchus* (not preserved in *Hylaeochampsia*): blunt and short snout, caniniform tooth absent from both the dentary and maxilla, heterodont dentition, nasals form most of the posterior wall of the external nares, mandibular fenestra absent, wide shelf along the medial side of the dentary. Preliminary comparisons indicate that *Acynodon* shares more characters with *Hylaeochampsia* than with *Iharkutosuchus*, however a closer relationship has to be confirmed with a phylogenetical analysis. The hylaeochampsid relationship of *Acynodon* questions the presence of alligatoroids in the Late Cretaceous of Europe though recent studies suggested the alligatoroid affinities of *Massaliasuchus* and *Allodaposuchus*. However, the material of *Massaliasuchus* is too poorly preserved and the position of *Allodaposuchus* should be tested in a more comprehensive phylogenetical frame. Thus, our results question former paleobiogeographical scenarios as the alligatoroid affinities of *Acynodon* has been considered the most important evidence for vertebrate faunal connections between Europe and North America during the Late Cretaceous. Our results also support a North American origin for Alligatoroidea.

Oral presentation

First evidence of the genus *Deinosuchus* (Eusuchia, Alligatoridae) from Coahuila, Mexico

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We here report on the first fossil evidence of the giant alligatorid crocodilian *Deinosuchus* (Eusuchia, Alligatoridae; Colbert & Bird, 1954) from the Mexican State of Coahuila, which is also the second report for Mexico. The material was recovered from the lower section of the Aguja Formation (Late Cretaceous, Late Campanian) that outcrops near the locality called La Salada, northwestern Coahuila, Mexico. Previous discoveries of *Deinosuchus* in Mexico are reported from the Late Cretaceous (Campanian) of Chihuahua (Brown *et al.*, 2004).

The remains assigned to *Deinosuchus*, which were collected during the 2007 and 2008 field seasons, comprise six teeth, and postcranial material such as osteoderms and a dorsal vertebra. These specimens are attributed to the genus *Deinosuchus* sp. based on morphometric analyses, such as the thickness of the tooth enamel and the osteoderms. These specimens from Coahuila represent the southernmost known record of *Deinosuchus* until now and may be referable to *Deinosuchus rugosus* (Schwimmer, 2002; Rivera-Sylva *et al.*, 2007).

At the same site we found an associated fossil assemblage, comprising ganoid scales of gar pikes, osteoderms of trionychid turtles, as well as remains of Hadrosauridae and Ceratopsidae. The foraminifers associated with the vertebrate fossils belong to the genus *Heterohelix*, corresponding to the Late Cretaceous Campanian-Maastrichtian interval (Rivera-Sylva *et al.*, 2007).

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Oral presentation

Developmental palaeontology in vertebrates: what do we know and what can we learn? A review of published works and case studies

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The study of fossilized ontogenies in vertebrates is largely restricted to late stages of growth, but nevertheless can deliver great insights into life history and evolutionary mechanisms affecting all aspects of development. A thorough review of the literature provided a database of hundreds of references organised taxonomically and thematically (www.developmental-palaeontology.net). Examination of ontogenetic trajectories is used to establish criteria to identify fossil growth series and solve taxonomic issues. Many morphological innovations in skeletal structures are associated with growth heterochronic changes, whereas sequence heterochronic changes remain largely unstudied but are a potential avenue of research. Fossils provide evidence of developmental plasticity determined by ecological factors, as when allometric relations are modified in species which invaded a new space with a very different selection regime, e.g. islands. Skeletochronological studies are restricted to the examination of growth marks in bones or teeth. In the case of mammals, dental replacement data considered in a phylogenetic context can provide life-history information such as maturation time and longevity. Palaeohistology and dental replacement data document the more or less gradual but also convergent evolution of mammalian growth features during early synapsid evolution. Extinct adult phenotypes can reveal information on development, as in the discovery of polydactyly in diapsids, the examination of vertebral number evolution, and its relation to somitogenesis and Hox-gene boundaries, and signs of tissue regeneration provided by anatomical peculiarities following caudal autotomy.

Oral presentation

Pelvis shape and functional morphology of the pelvic girdle in extant crocodiles and dinosaurs

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The pelvis is of great functional importance in tetrapods because it supports a large part of the body weight, provides a rigid connection between the hindlimbs and the vertebral column, and provides insertion areas for important limb muscles. The three basic pelvic types present in dinosaurs are propubic, mesopubic, and opisthopubic, which refer to a cranial, ventral, or caudal orientation of the pubis. In contrast, the extant relatives of dinosaurs, crocodiles and birds, have a pro- and opisthopubic pelvis, respectively. The differences in the pelvis shapes of dinosaurs and extant archosaurs have never been satisfyingly explained under mechanical and evolutionary viewpoints. Pelvis shapes can be studied by the innovative technique of Finite Element Structure Synthesis (FESS), which allows precise identification of shape-forming mechanical influences on the pelvis. Different hypotheses about the distribution of mechanical stresses acting on the pelvis during locomotion and ventilation can be tested for dinosaurs, but first have to be validated on the pelvis of extant crocodylians and birds. In extant crocodiles, important muscles involved in respiration attach to the pubis, whereas muscles involved in terrestrial locomotion are mostly found on ilium and ischium. First tests of loading the pelvis show that in particular the pubis, together with the dorsal margin of the ilium, shows a great plasticity, which gives first hints on the development of pelvis shapes in dinosaurs.

Oral presentation

The potential knowledge gain of isolated small crocodile teeth in Mesozoic vertebrate assemblages

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The teeth of fossil crocodiles are often described as undiagnostic, although especially the distinct variability of tooth morphologies in Mesozoic crocodylomorphs allows determination of isolated teeth. This can be used in microvertebrate samples of different localities to identify hitherto unknown faunal components. Two examples are crocodylomorph assemblages from the Berriasian of Bornholm/Denmark, and from the Oxfordian Qigu Formation of the Junggar Basin/Xinjiang, China. The Bornholm locality represents with *Theriosuchus*, *Goniopholis*, and *Bernissartia* the most northern record of a typical neosuchian assemblage of Late-Jurassic to Early-Cretaceous Europe. In contrast, the Qigu Formation in China yields a mixture of the neosuchian *Sunosuchus*, a different but undetermined mesoeucrocodylian and the basal crocodyliform *Nomimosuchus* (Shartegosuchidae). The wide distribution of *Sunosuchus* through Central Asia, and the occurrence of the small shartegosuchid *Nomimosuchus* in both Asia and North America contradict hypotheses of endemism for the Central Asian basins. The presence of basal crocodylomorphs in the Early Cretaceous of Central Asia is explained by the continental and increasingly arid climate, and represents more a relict fauna than true endemism. Thus, microvertebrate research on crocodylomorph teeth might help to explain biogeographic patterns and, even if determination to the genus level is impossible, increases the known biodiversity for a particular region.

Poster presentation

Cairanoolithid eggs from Pinyes site (Coll de Nargó area, Lleida Province, Spain): a preliminary review on its parataxonomic classification and implications

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Here is reported for the first time the presence of *Cairanoolithus* oögenera from Pinyes site (Coll de Nargó area, Lleida Province, Spain). Some isolated eggs and abundant eggshell fragments have been found in sandstone and marls belong to the Lower Tremp Fm., which is dated as near Campanian-Maastrichtian boundary in age. These new specimens represent the first remain of this type of fossil egg out of France, which was considered as endemism from this region.

Classically, *Cairanoolithus* eggs were considered as belonging to Megaloolithidae oöfamily and the sister oötaxa of *Megaloolithus* eggs, which are related with titanosaurian sauropods. However, we observe enough macro- and micro- structural differences between both oögenus to conclude that *Cairanoolithus* probably doesn't belong to Megaloolithidae. Indeed, many structural characters displayed by cairanoolithid eggs are present in other types of dinosaur fossil eggs as *Spheroolithus* and *Ovaloolithus*. All these spherical eggs show fan/columnar-shaped shell units, with parallel margins and frequently interlocking, and sagentotuberculate ornamental pattern. Despite, they differ among themselves in pore canals system. The phylogenetic analysis also show the relationship between these three oötypes, being *Cairanoolithus* the sister oötaxa of *Spheroolithus* and *Ovaloolithus*. If interpretations are right, and according to embryonic remains found within spheroolithid and ovaloolithid eggs, *Cairanoolithus* had been also probably laid by ornithischians dinosaurs. During the Late Campanian two groups of ornithischian were present in the Pyrenees. In one hand, ornithomimids were represented by different species of *Rhabdodon*, while thyreophors were only represented by *Struthiosaurus*; both could be a potential "*Cairanoolithus*-laying".

Oral presentation

Sauropodomorph long bone histology through time and ontogeny

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Sauropods grew to be the largest terrestrial animals to ever roam the earth. However, the ancestral sauropodomorphs started out as dog sized animals. The evolution of sauropod body size is correlated with growth rates, as can be observed in the microstructure of the bones with the highest local apposition rates, i.e. the long bones. We studied the change from cortical zones of fibrolamellar bone with annuli and/or LAGs in early sauropodomorphs and prosauropods like *Saturnalia*, *Thecodontosaurus* and *Plateosaurus* to an uninterrupted bone cortex of fibrolamellar bone in the earliest sauropods (*Isanosaurus* and *Spinophorosaurus*). The same fibrolamellar bone tissue found in sauropodomorphs is present in the earliest dinosaurs and dinosaur ancestors. It is a composite tissue also seen in mammals and birds, which have high metabolic rates and are generally endothermic. Metabolic Theory of Ecology suggests that for rapid bone growth and high somatic growth rates, a high metabolic rate is required.

Sauropods also secondarily evolved small body sizes under certain circumstances. *Europasaurus* from the Late Jurassic of Germany, and *Magyarosaurus* from the Late Cretaceous of Romania are hypothesized to be island dwarfs. They only reached the size of a modern day horse by lowering their growth rate. *Europasaurus* reintroduced growth stops in the fibrolamellar bone cortex. The condition in *Magyarosaurus* is equivocal, as it shows an extremely remodelled long bone cortex, but a high amount of parallel fibred compared to woven bone in the fibrolamellar cortex suggests *Magyarosaurus* had also slowed its growth rate.

Osteocyte lacunar density, is addressed here for the first time in extinct vertebrates. Preliminary results suggest that osteocyte lacunar density is much higher in sauropodomorphs than in mammals of similar body mass. The results also suggest a strong negative correlation between the sauropodomorph's lacunar density and body mass, similar to extant mammals. This feature deserves more attention as it may provide further insights into local bone apposition rates, and in general into sauropodomorph and other dinosaur growth rates and physiology.

Oral presentation

Biodiversity of Asian vertebrate faunas from the Late Jurassic-Early Cretaceous interval: a new discovery at Phu Noi Locality, NE Thailand

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The vertebrate assemblages of Thailand in the Late Jurassic-Early Cretaceous were diverse and widespread through the northeastern and northern regions, a few elements only having been found in the southern peninsula. They are known from the Phu Kradung Formation on the Khorat Plateau of the Indochina Block and the Khlong Min Formation on the Shan-Thai Block. They include freshwater sharks, actinopterygian fishes, temnospondyl amphibians, turtles, crocodylians and dinosaurs. Although the age of the Phu Kradung Formation is controversial, its vertebrate fauna is similar to those from the Late Jurassic of China. However most of the vertebrate remains are known from a few bones. A recent discovery at Phu Noi has yielded an abundant and diverse vertebrate assemblages including a partial articulated sauropod skeleton with skull elements, theropod teeth, a crocodile skull and articulated vertebrae, turtles and fishes. Comparative studies from this locality may lead to a better understanding of the palaeobiogeographical events linked with faunal change during the Late Jurassic/Early Cretaceous in Southeast Asia.

Poster presentation

***Hungarobatrachus szukacsi* Szentesi et Venczel 2010, an advanced frog from the Late Cretaceous (Santonian) of Hungary**

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The *Hungarobatrachus* is known by seven isolated ilia and tibio-fibulae from the Iharkút site (Late Cretaceous, Santonian), Bakony Mountains, Hungary. The ilia are interpreted as belonging to one species, *Hungarobatrachus szukacsi*, because the specimens exhibit two autapomorphies: (1) a heavily built, extremely high iliac crest that is about 2.5 times higher than the iliac shaft and is covered by anteroposteriorly elongate grooves and posteriorly anastomosing ridges and (2) a huge interiliac tubercle that is developed at the level of the preacetabular region and has a broad medial surface for strong sutural contact with its counterpart. Details of the iliac crest and ilioischial junction argue for the Hungarian frog being a member of the Neobatrachia and possibly, closely related to ranoids. The unusual combination of a prominent iliac crest (which is typical of extant frogs that are strong jumpers) and the broad interiliac contact involving an enlarged interiliac tubercle (which is analogous to the condition in pipids and palaeobatrachids, both are strong swimmers) suggests that *H. szukacsi* was an aquatic frog that descended from more terrestrial ancestor. Assuming that *Hungarobatrachus* is a neobatrachian, it documents the geologically oldest occurrence of a neobatrachian in Laurasia and extends the record of neobatrachians in Europe from the Late Paleocene back to the Late Cretaceous (Santonian). The first wave of neobatrachians to enter Europe likely arrived from Africa across Tethys, either overland using the Apulian route that intermittently connected the two continents. Another way that amphibians may have crossed by Tethys is to have been accidentally transported areally by birds or along surface waters, either floating on rafts of vegetation.

Oral presentation

A new nanhsiungchelyid turtle from the Late Cretaceous of Jiangxi Province (Southern China) and a review of Nanhsiungchelyidae in Southern China

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A complete shell of a new nanhsiungchelyid turtle (Cryptodira: Trionychoidea) is reported from the Latest Cretaceous Nanxiong Group of Ganzhou, Jiangxi Province, in southern China. It is close to *Hanbodgemys* known from the Late Cretaceous of the Eastern Gobi, Mongolia, but different from the latter in having a boot-shaped second marginal scute reaching the first vertebral scute, a larger first suprapygals, a large fifth vertebral extending onto the tenth peripheral, narrower lateral marginal scutes and a narrower posterior plastral lobe.

Known since the Early Cretaceous, the nanhsiungchelyids flourished during the Late Cretaceous in Asia, from Central Asia to Japan, with a great concentration in Mongolia. Nevertheless, nanhsiungchelyids from the Nanxiong Basin in Southern China represent one of the best records of the group, including complete skulls and shells, some of them associated. The stratigraphical distribution in the Nanxiong Group shows that nanhsiungchelyids have been collected in all major formations and probably persisted up to the end of the Cretaceous.

Poster presentation

Preliminary analisys of the microvertebrate fossils of "Lo Hueco" (Upper Cretaceous, Cuenca, Spain)

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"Lo Hueco" site was discovered in 2007 during the construction of the Madrid - Levante highspeed railway. More than 8500 macrovertebrate rests were recovered which constitutes one the most abundant assemblage of the South-Western European upper Campanian-lower Maastrichtian continental vertebrate fauna. Also more than 25 tons of material taken from different geological levels were taken for microvertebrate study. A preliminar study of the material obtained by screenwashing and picking have disclosed us a diversity composed mainly of species typical of lacustrine or shallow waters coastal environments. The most abundat remains correspond to fishes, mostly different morphologies of ganoid scales that can be related to medium and posterior positions in the body and can be attributed to Lepisosteidae indet. Numerous teeth typical from lepisoteids and others assigned to Pycnodontoidea, Amiidae and Albulidae have been recovered too together with several postcranial elements including an atlas of cf. Lepisosteidae. Several postcranial rests, mainly diaphyses of appendicular bones, of lissamphibians have been collected as well as a mandibular fragment attributed to a scincomorph, probably a lacertoidea and cranial bones of squamates preliminarily assigned to iguanids. Crocodiles are represented by numerous teeth assigned to cf. *Musturzabalsuchus* and *Eusuchia* indet. Theropod remains, mainly teeth, are fewer but representative of Coelurosauridae indet., cf. Dromaeosauridae indet. and cf. Velociraptorinae indet. This preliminary analysis suggests a high potential of "Lo Hueco" site to understand the palocommunities of the Iberian Upper Cretaceous.

Poster presentation

Presence of cf. *Richardoestesia* teeth in "Lo Hueco" (Upper Cretaceous, Cuenca, Spain)

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The theropod remains found in "Lo Hueco" site are composed mainly of theropod teeth and more scarce postcranial material. Preliminary studies have disclosed the presence of two morphotypes. The characters that are present in the first and second morphotypes makes possible that the first morphotype can be attributed to Dromaeosaurinae and the second one to Velociraptorinae.

Here we discuss a third morphotype from "Lo Hueco" corresponding to small teeth, (>1 cm of height) and with a slightly biconvex general morphology. The denticles of this morphotype are small (> 9 denticles/milimeter in distal carina) with a square morphology. They have morphological and morphometric features similar to those of the teeth attributed to *Richardoestesia* in North America. They have been compared with a sample of teeth attributed to *Richardoestesia gilmorei* from the Royal Tyrrell Museum (Alberta, Canada) and their numerical data adjust perfectly with the ones from the North American sample. In Europe, teeth attributed to cf. *Richardoestesia* have been found in sediments from the Upper Jurassic of Portugal and the Lower Cretaceous of Cuenca in Spain. The measurements of these teeth and their morphological characteristics are compatible with this third morphotype. In the Upper Cretaceous it has been also described a tooth attributed to *Richardoestesia*. The density and morphology of the denticles of this latter is congruent with teeth described as similar to those of *Richardoestesia*, however this tooth is bigger than the described here. Taking these into account, we consider that this third morphotype can be attributed to cf. *Richardoestesia*.

Oral presentation

Abelisaur remains from Provence (Southeastern France) : phylogenetic and paleobiogeographic implications

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Abelisauridae is a group of ceratosaurian theropod dinosaurs mainly known from Gondwana. Some quite complete skeletons have been discovered in Argentina (*Aucasaurus*, *Carnotaurus*, *Skorpiovenator*) and in Madagascar (*Majungasaurus*). Other partially preserved skulls found in Argentina (*Abelisaurus*, *Ekrixinatosaurus*), Niger (*Rugops*) and India (*Rajasaurus*) provide a better understanding of their phylogeny and palaeobiogeographical distribution.

Since the end of the 1980s, a number of large theropod remains have been discovered in the Upper Cretaceous of Europe, including *Tarascosaurus salluvicus* from the Lower Campanian of southern France. Although the attribution of these remains to Abelisauridae made no doubt for the authors of these discoveries, several reviews of this group did not take into account French discoveries or dismissed them because of their fragmentary nature.

This study presents for the first time the description of remains of a large theropod discovered in southeastern France, clearly attributable to Abelisauridae. Cranial (including a complete braincase) and post-cranial elements coming from the same site and very likely belonging to the same individual, and a number of teeth, demonstrate that this group of Gondwanan dinosaurs was present in Europe in the upper Cretaceous.

The analysis of the bones reveals a strong resemblance with the Madagascan taxon *Majungasaurus* and the presence of primitive characters known in the basal abelisaurid *Rugops*, discovered in Niger. The similarities observed between taxa coming from continents separated since the Cenomanian ask for a reassessment of the palaeobiogeographical evolution of this group.

Oral presentation

New discoveries and review of Late Cretaceous titanosaurs from Provence, France

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Titanosaurs from Provence (Bouches-du-Rhône and Var) were among the first dinosaurs described in France with the erection of *Hypselosaurus priscus* by Matheron in 1869. More recently, De Lapparent review of French dinosaur concluded on the presence of two morphotypes in Provence: *H. priscus* and *Titanosaurus indicus* already known in India. However, in recent reviews of Southeastern titanosaurs, remains were considered as *nomen dubium* (Le Loeuff, 1993, Wilson *et al.*, 2004).

Since twenty years, the study of European localities rich in titanosaur remains has known a renewed interest. New taxa were erected (*Lirainosaurus astibiae* from Northern Spain, *Ampelosaurus atacis* from Southwestern France) or in course of review (*Magyarosaurus dacus* from Romania).

In the same time, excavation became intensified in Provence and a number of titanosaur remains were discovered. However, excepted the discovery the titanosaur from Velaux (Bouches-du-Rhône) and a braincase from Fox-Amphoux (Var), all collections of Provence remained widely underexploited and suffered of the lack of synthesis on known material.

Between 2006 and 2007, the Museum of Natural History of Aix-en-Provence, funded by the highway company ESCOTA, have conducted along the A8 highway the most important excavation campaign realized in Provence. This has allowed the brought to light of several new localities spaced out in Upper Campanian, and rich in titanosaur remains. One of these sites has delivered a number of postcranial elements including some belonging very likely to the same individual. For the first time advanced comparisons are possible between titanosaur remains from Provence.

This preliminary study sums up the discoveries of titanosaures from three of the biggest titanosaur collections of the Southeastern France (MHN Aix-en-Provence, MHN Marseille and Mechin's private collection), and presents updated data on titanosaur biodiversity from this region.

Poster presentation

The Velaux-Bastide Neuve locality (Upper Cretaceous, Bouches du Rhône): an example of margino-littoral ecosystem from Provence

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We report preliminary results on a vertebrate site located at Velaux in Provence (southwestern France). This locality is remarkable for the taxonomic diversity of its assemblage (at least 10 taxa including dinosaurs, pterosaurs, chelonians, crocodilians and fishes) and also for the high concentration and preservation quality of the fossil remains.

Among the dinosaurs, new specimens of the endemic ornithomimid *Rhabdodon* from the Late Cretaceous of Europe contribute to improve our knowledge of its cranial anatomy. An abundant and well preserved material confirms the presence of a new titanosaur in southern Europe. This new genus, *Astinganosaurus velauciensis*, is mainly diagnosed by a combination of characters which differentiates it unambiguously from other European Late Cretaceous titanosaurs: *Lirainosaurus*, *Ampelosaurus* and *Magyarosaurus* (Garcia et al., 2010).

Another interest of this locality named Velaux - Bastide Neuve is the occurrence of marine elements (glauconite, selachians and decapods) that might suggest an estuarine environment, as it has been already reported by Catzigras (1957) for the Upper Campanian of the Aix Basin.

This new site offers new perspectives on the diversity and evolution the vertebrate ecosystems of southern Europe and their environments during the Campanian-Maastrichtian.

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Fieldtrip 1 - Friday, June 11th

Aix-en-Provence Basin - Between eggs and dinosaurs

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Introduction

The Aix-en-Provence Basin, located in the current Arc Valley, stretched out on the south side of the Sainte-Victoire Mountain immortalized by the painter Paul Cézanne (Fig. 1). The fluvio-lacustrine formations of the continental Upper Cretaceous present a continuous succession, which brought the famous local geologist, Philippe Matheron, to create several geologic stages. So, in the southern part of the Arc Basin, it can be observed: the Valdonian (Matheron, 1878-80), the Fuvelian (Matheron, 1878-80), the Begudian (Villot, 1883), the Rognacian (Villot, 1883) which marks the Cretaceous end, and the Vitrollian (Matheron, 1878-80) which is the base of Paleocene (Fig.2). These local stages were defined at the extreme West of the Arc Basin on the edge of the Etang de Berre.

This sedimentary series includes lacustrine deposit (limestone, lignite) as well as fluvial deposits (marls and sandstones) which contain a number of reptiles remains and in particular dinosaurs. The abundance and the variety of these remains had led Philippe Matheron to erect two new genus of reptiles: *Rhabdodon priscus* and *Hypselosaurus priscus* (which will be interpreted later as dinosaurs), and to describe the first fossilized eggs. The works of Abbé De Lapparent, then Raymond Dughi and François Sirugues confirmed the richness of the Aix Basin in dinosaurs' eggs.

The Roques-Hautes localiy, where dinosaurs' eggs are particularly plentiful was classified in 1964 and the "Réserve Naturelle Nationale et Géologique de la Sainte-Victoire" was created in 1994.

For more than 20 years, the excavations conducted by various research teams on the whole basin allowed the brought to light of new localities presenting a major paleontological interest.

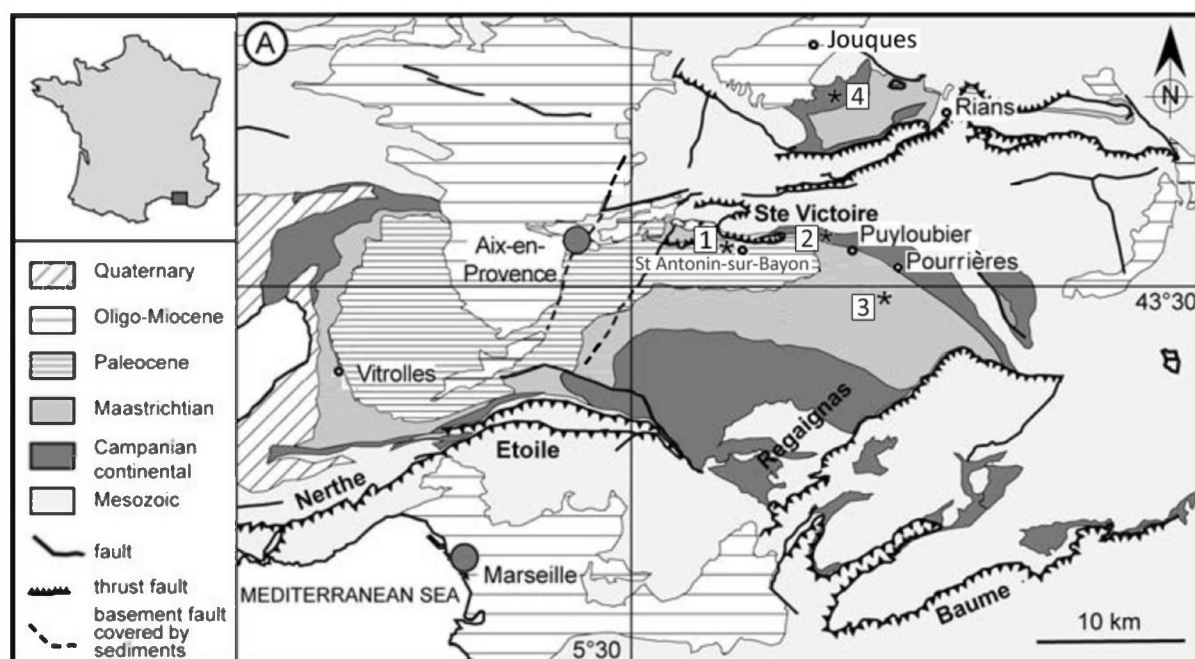


Figure 1 : Location map and schematic geological map of the Aix-en-Provence basin. Visited site : Maison de la Sainte-Victoire exhibition (1), St-Ser's slab (2), Jas-Neuf site (3) and Chateau de la Révelette (4) (modified after Cojan et Moreau, 2006).

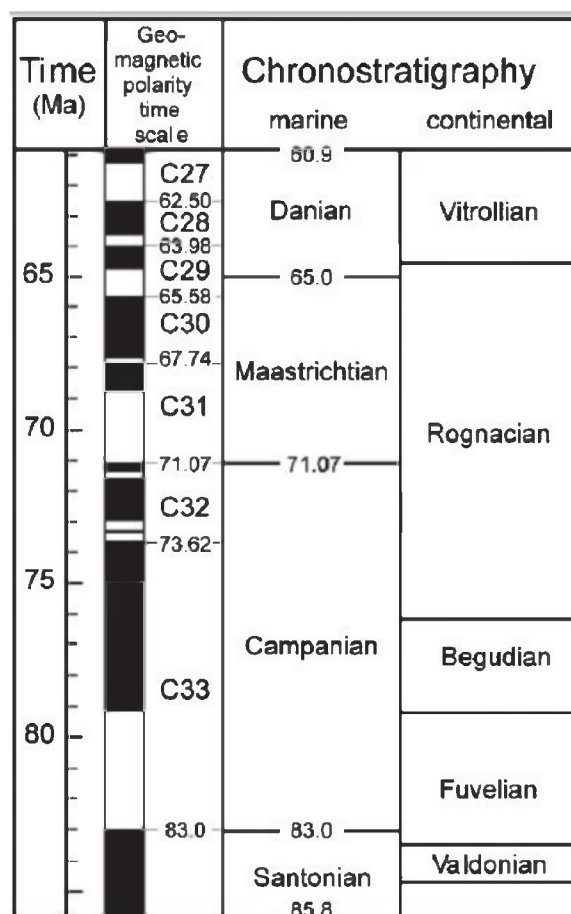


Figure 2: Chronostratigraphic framework of the Upper Cretaceous–lower Tertiary continental succession from the Aix-en-Provence Basin (modified after Cojan and Moreau 2006).

Program of the day

- 08:30 : departure from Aix-en-Provence
- 09:00-10:30 : visit of Maison de la Sainte-Victoire (Saint-Antonin-sur-Bayon)
- 11:00-12:00 : visit of the St Ser's slab containing dinosaur eggshells (Puylobier)
- 12:30-14:30 : lunch at « Relais de Saint Ser » (Puylobier)
- 15:00-16:00 : visit of Jas-Neuf site (Pourrières)
- 17:00-18:30 : visit of « Château de la Révelette » domain (Jouques)
- 19:00 : Arrival in Aix-en-Provence

Geological context

The Aix-en-Provence Basin, limited to the North by the Sainte Victoire Mountain and to the southeast by the Aurélien Mount stretched out Etang de Berre. The continental sedimentary formations began to deposit at the end of Santonian in a vast depression. In the lower Campanian, equivalent of Fuvelian and Begudian, a vast lake lined with luxuriant forests occupies the region. It is at the bottom of this lake that form lignite of Gardanne Basin which delivered numerous remains of vegetables, molluscs, fishes, crocodiles and dinosaurs.

From the Upper Campanian to Danian, equivalent to Rognacian and to Vitrollian, the lake leaves the place to a flood plain crossed by fluvial channels. Red clays which deposit in the plain contain numerous eggs of dinosaurs, while the sandy levels of the channels deliver bones of a varied fauna. In the North of this plain, the relief is eroded and breaches come in between in clays layers. Within this fluvial series, several lacustrine episodes can be observed and formed calcareous deposits ("Calcaires de Rognac", "Calcaires de Vitrolles"). Red clays of the Cingle plateau delivered fragments of tertiary birds eggshells.

During Eocene, new NNE-SSW compressions led to the fold of the relief, creating again breaches deposits. The tectonic constraints are strong enough so that the fold recumbs and eventually breaks, so Jurassic limestones overlap Upper Cretaceous and Eocene levels. The Chateau Simone locality, in Palette, is known since Deperet works for its rich fauna of mammals and reptiles.

In Oligocene, a lake extended in the North and in the West of Aix-en-Provence. Its lacustrine deposits delivered several plants fossils studied by Gaston De Saporta, as well as insects, fishes, reptiles and mammals remains.

In Tortonien, the Miocene sea recovered a part of Aix-en-Provence Basin, affecting reliefs and depositing shell limestone which the rests can be observed on the Bibemus plateau, between Aix-en-Provence and Sainte Victoire Mountain.

Finally, the last effects of the alpine orogeny gave to the region its current aspect.

Aix-en-Provence Basin's palaeontological richness

Until the last 20 years, the Aix-en-Provence Basin was essentially known for its dinosaur eggshell deposits of the Sainte Victoire Mountain. Nowadays, recent excavations (in 2000 and 2004) conducted by the museum in the Aix en Provence city centre allowed the brought to light of more than thousand eggs of the Megaloolithidae oofamily (Garcia *et al.*, 2003). So, the exceptional character of the region for the eggs preservation was widely confirmed, as the numerous studies about dinosaur eggshells of Provence show it. (Cousin *et al.*, 1994; Vianney-Liaud *et al.*, 1994; Vianey-Liaud and Garcia, 2000; Garcia, 2000; Garcia and Vianey-Liaud, 2001a, b).

In addition numerous excavations were realized in Aix-en-Provence by the Museum of Natural History of Aix-en-Provence, the Conseil Général des Bouches-du-Rhône (assembly of the department), the National Museum of Natural History of Paris, the Institute of the Sciences of the Evolution of Montpellier and University of Poitiers .They put in evidence that the palaeontological richness of the region was not limited to the only dinosaur eggshells. Indeed, some localities have revealed an unexpected biodiversity (Garcia. *et al.*, 1999, 2000; Chanthasit *et al.*, in review).

So the Vitrolles-Couperigne locality has delivered in 1995 and 2007, the remains of the two most complete *Rhabdodon* ever found which certain elements of the skeleton were still in connection (Garcia *et al.*, 1999; Pincemaille-Quillevéré, 2002; Chanthasit *et al.*, in review).

The excavations of Trets locality, led in 1995 and 1996, have allowed the discovery of several elements of the skeleton of a large-sized titanosaur.

Two genera of Dromaeosauridae were described : *Variraptor mechinorum* Le Loeuff and Buffetaut 1998 from Roques-Hautes at Beaurecueil and *Pyroraptor olympius* Allain and Taquet, 2000 from La Boucharde at Trets.

A new genus of Titanosauria (*Atsinganosaurus velauciensis* Garcia *et al.*, 2010) was brought to light on the site of La Bastide Neuve at Velaux.

The first formal discovery of hadrosaure was done at Vitrolles-La Plaine. This site has also delivered mammal remains (*Valentinella vitrollense* Tabuce *et al.*, 2004). A second discovery of mammal was made at La Cairanne near Rousset in 2007.

Finally, recent preventive paleontological series of excavations, along the A8 highway, dunded by ESCOTA Company, has revealed an important fauna of the upper Cretaceous (Fig. 3, 4c,d), as well as for dinosaurs, with the discovery of a new Abelisauridae, *Rhabdodon*, Titanosauria, Nodosauridae and Dromaeosauridae, than for the other reptiles (crocodilia, turtles, pterosaurs, squamates) (Buffetaut, 2008).

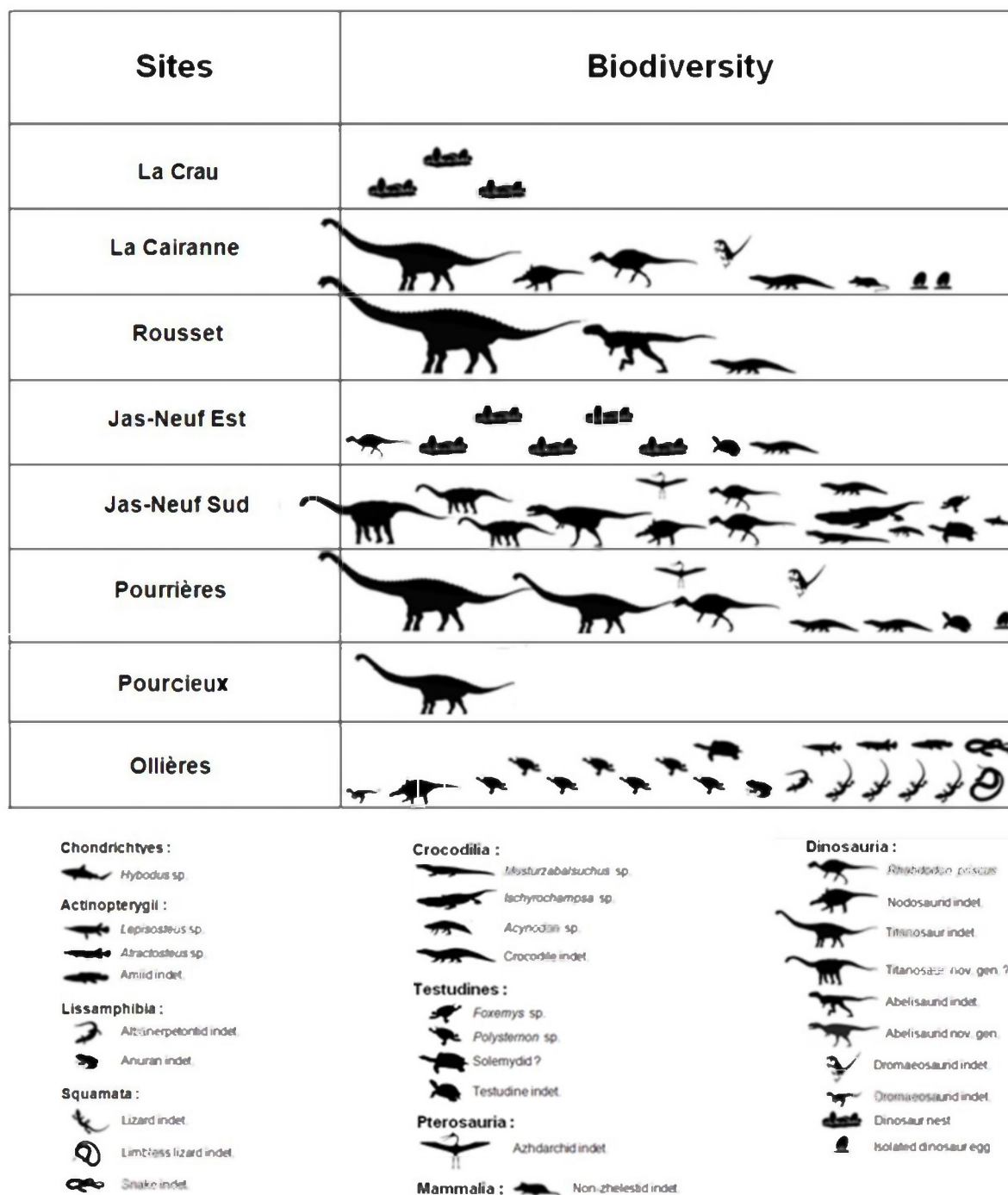


Figure 1. Biodiversity results of the excavation along the 100 m long, 10 m wide, 10 m deep, 10 m high excavation conducted by the Museum of Natural History of Aix-en-Provence and funded by ESCOTA Company.

Fieldtrip

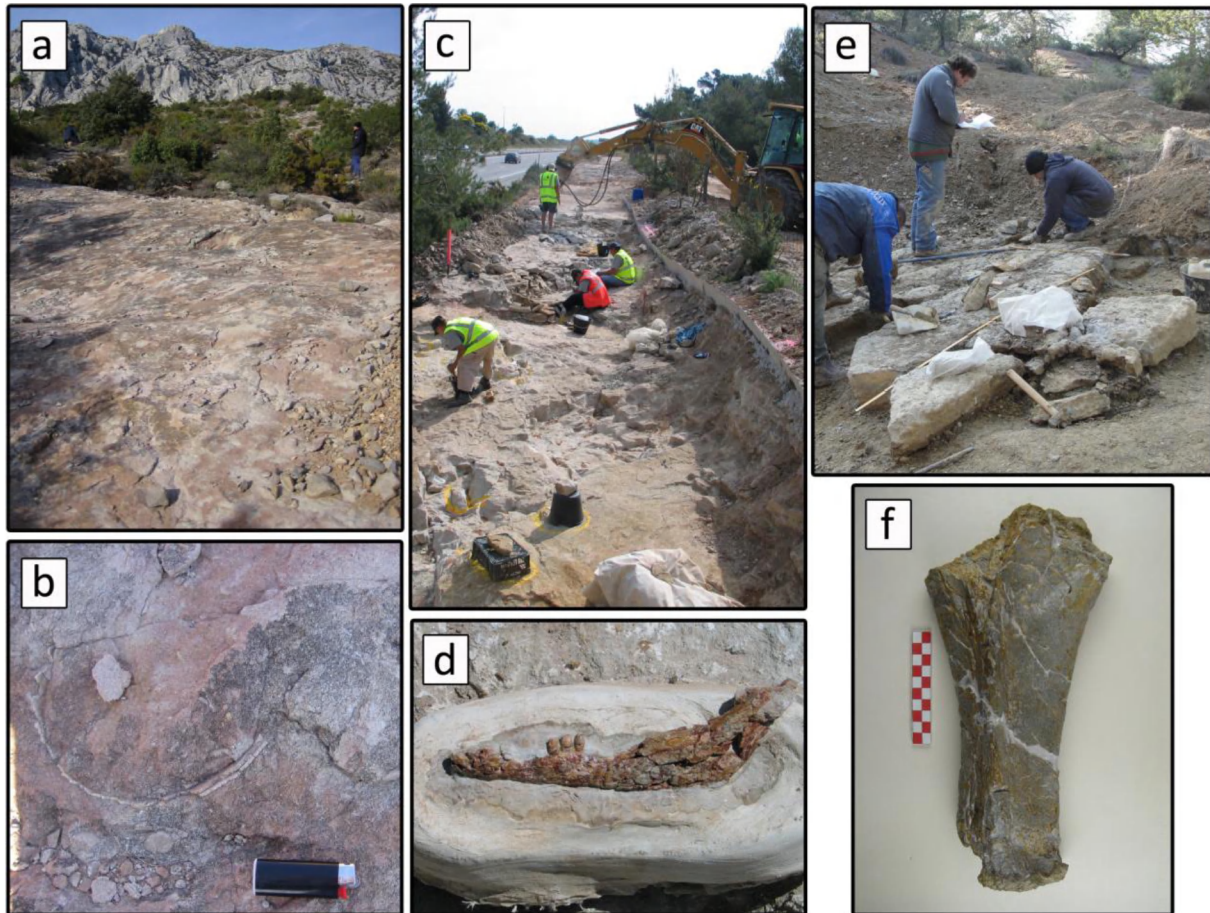


Figure 4: Pictures of visited site during the fieldtrip, with examples of discoveries. a: St-Ser's slab containing dinosaur eggs. b: Dinosaur's egg section. c: Site of Jas Neuf Sud located along the A8 highway. d: one of the several fossils discovered in Jas Neuf Sud - *Musturzabalsuchus*' dentary. e: Excavations in the domain of Chateau de la Révelette and one of the discovered bones : titanosaur's ulna (f).

Stop 1: Maison de la Sainte-Victoire exhibition

Situated at the foot of the Sainte Victoire Mountain, this welcome and information area of the Conseil Général des Bouches du Rhône offers to the visitor a show about the men activity in the region by since the Neolithic until nowadays. A small museum reveals the fauna and the characteristic flora of this mountain. A temporary exhibition realized by the museum of Aix-en-Provence presents the most recent and important discoveries made in the Aix-en-Provence Basin for ten years. A oral presentation of the A8 excavations will be presented by Samuel Maurice (ESCOTA company) and will explain the implementation and the progress of the excavations conducted by the Museum of Natural History and funded by ESCOTA company.

Stop 2: Saint Ser's slab (Fig. 4a, b)

The Saint Ser's slab, situated on the municipality of Puyloubier, is constituted by sandstone slab on which we can observe several dinosaur eggs sections attributed to Megaloolithidae.

Stop 3: Jas-Neuf (Fig. 3, 4c, d)

Jas-Neuf site belongs to sites excavated along the A8 highway in 2006 and 2007. This locality is exceptional by the quality, the quantity and the variety of the discovered fossils. It is the site which has yielded the largest number of bones. More than 200 bones were extracted from a sandstone layer. Among the numerous specimens are:

- shark teeth of *Hybodus*;
- fragmentary remains of turtles which a magnificent skull of *Foxemys mechinorum* and a near complete shell and plastron of this genus;
- on the base of teeth, fragmentary dentaries, skull elements and vertebrae, at least three already known taxa and two new ones have been identified. Among these: *Musturzabalsuchus*, *Ischyrochampsia* and *Acynodon*;
- a hollow bone has been identified as a quadrate of Pterosaur, one of the scarcest taxa discovered in Provence;
- a femur belonging to a nodosaurid, the only postcranial element of this taxa discovered in the Aix-en-Provence Basin;
- various *Rhabdodon* postcranial bones such as small fragmentary maxilla, fibula, scapula and ungula phalange;

But the most significant discoveries are titanosaur and Abelisaurid remains. There are presented in the Maison de la Sainte-Victoire exhibition.

Stop 4: Chateau de la Revelette (Fig. 4e, f)

Situated in the North of the Sainte-Victoire Mountain, the domain of Chateau de la Révelette presents clays in which fragments of dinosaur eggshells were collected. Some titanosaur bones were also discovered in a limestone layer during excavations conducted by the Museum of Natural History of Aix-en-Provence. Operations not finished and several limestone blocks are in course of preparation in the Aix-en-Provence museum's storage. The visit ends by a tasting of wine in the wine cellar of the Chateau de la Révelette which is one of the most appreciated wine of the designation of Coteaux d'Aix.

Acknowledgement

The "Maison de la Sainte Victoire" institution is thanked for the welcome and the exhibition access. We thank Samuel Maurice for his presentation and ESCOTA society for their interest and support in the palaeontological research. Peter Fischer, owner of the Chateau de Revelette estate, is also warmly thanked for his welcome, the visit of the excavated site and the wine tasting. Pictures presented in this fieldtrip guide are used with the permission of Berton Séverine, Turini Eric and Tortosa Thierry.

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Fieldtrip 2 - Saturday, June 12th

The "Parc Naturel Régional du Luberon": A palaeontological paradise

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Introduction

The Parc Naturel Régional du Luberon represents a geographical zone limited to the North by the Ventoux and Lure massifs and to the East and South by the Durance River. It is a sedimentary basin that accumulated several thousand meters of marine and continental sediments. Today, sediments from the Late Jurassic to the Recent outcrop (Fig. 1). The diversity of the landscapes reflects the variety of rocks exposed there (from coal, to limestones, marls, sandstones, sands, clays or plattenkalke, etc.), as well as the dynamics of particular structures, such as Oligocene massive salt diapirs in the East side near Manosque. The area is protected since 1987 because of this great geological richness and because many palaeontological sites with a worldwide fame are spread all over the "Parc Naturel Régional du Luberon", just to cite two of them: the Aptian stratotype or La Débruge, a reference level of the Palaeogene mammal biochronological timescale.

The "Parc Naturel Régional du Luberon" has the duty to protect these sites against despoilers and to pursue scientific work to improve the geological and palaeontological knowledge of the region. This has been the case since the Parc opened more than 20 years ago, and collaboration between the geologists of the Parc and the Natural History Museum Basel hosting many fossils coming from the area results in this excursion and in the opening of new excavations on several Cenozoic sites.

Besides these scientific issues, the Parc is situated in an exquisite region, touristically very appreciated. The excursion will not really allow discovering the fine products of the Luberon, or of the Provence, but it's a first approach and no doubt that you will enjoy them later!

Simplified Geological Map

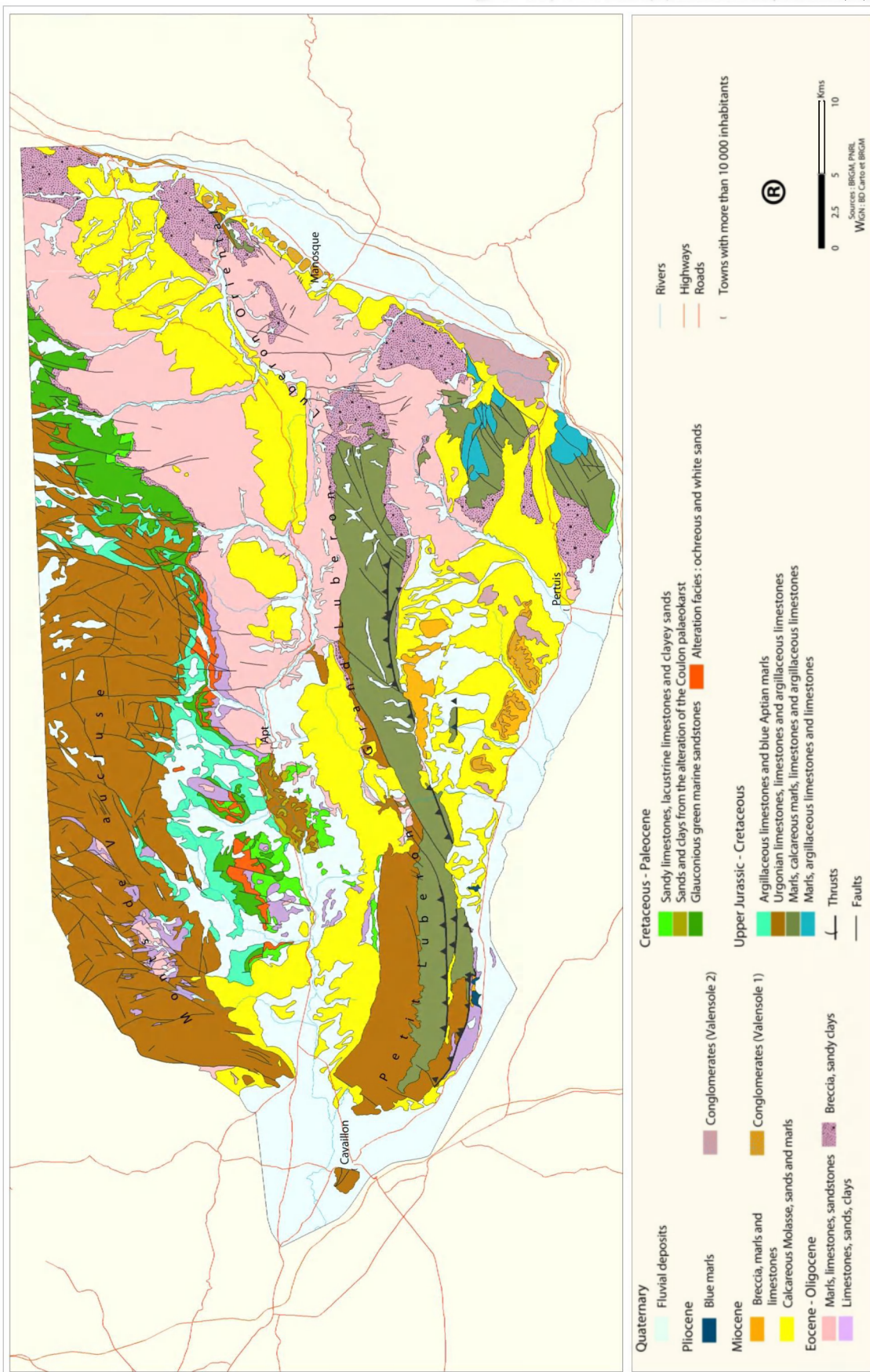


Figure 1 : Simplified geological map of the Parc Naturel Régional du Luberon (courtesy Parc Naturel Régional du Luberon).

Program of the day**08:30** Departure from Aix

Arrival in Apt, visit of the Museum and introduction to the sites

Visit of Gignac – fossil footprints/soft sediment deformation – 1h

Arrival in Viens – Lunch in Viens – Red clay quarry

Visit of Viens – fossil footprints/ongoing excavations – 1h

Visit of Cereste –

19:00 Arrival in Aix**Geological context**

Geologically, the Parc du Luberon is the Apt- Forcalquier-Manosque basin (Lesueur, 1991, see Fig. 1 for a simplified geological map of the Parc). It is mostly a palaeogene endoreic basin that saw the deposition of siliciclastic alluvial sediments together with the formation of calcareous deposits in the context of fluctuating shallow lakes. Two tectonic phases structure the Palaeogene basin: the pyreneo-provence tectonic phase creating the East-West structures in a compressive context (Montagne du Luberon to the South, Mont Ventoux and Montagne de Lure to the North) and the alpine cycle creating the broad European rift system in an extensive context and thus opening the basin. Two different adjacent basins coexist during the whole Cenozoic, a very subsident one (the Manosque-Forcalquier basin) limited to the East and controlled by the Durance fault and the Apt basin to the West, far less subsident (Lesueur, 1991).

Prior to the Cenozoic sedimentary deposition, the Mesozoic cover is mostly composed of marine sediments (marls and carbonates). The Aptian Cretaceous stage (and correspondingly the Bedoulian and Gargasian, lower and upper Aptian, respectively) is referenced after the town of Apt near which the stratotype outcrops. The Aptian sees deeper marine deposits succeeding to the carbonate platform sediments of the Jurassic and Early Cretaceous. The end of the Lower Cretaceous shows siliciclastic deposits (sands) indicating shallower conditions ending by an emersion probably lasting up to the Palaeocene. This emersion under subtropical climatic conditions led to the alteration of the exposed Albian sands ultimately creating the famous and touristic "Ocre de Provence" (Ochre).

The Palaeogene of the basin really starts in the Late Eocene with a coastal plain to supratidal flat environment temporarily covered by salt lakes or flood plains and progresses further to a truly endoreic lacustrine basin towards the Early Oligocene (Lesueur, 1991).

The Late Eocene of the basin is known worldwide through the "La Débruge" mammal fauna serving as a reference locality to the European biochronological timescale. The

very abundant fossil remains were found in a brown coal deposit indicating a pond-like environment.

The Oligocene broadly sees the installation of a fluctuating fluvial/lake-system with calcareous, clay and siliciclastic deposits. Many mammals and other vertebrate fossil remains are known from this period all over the region (see below).

The Neogene returns to marine conditions with the Burdigalian transgression, leaving large thicknesses of molassic sediments in the context of the rising Alp Mountains. A marine regression controlled by the N-S compressive alpine phase in the Late Miocene involves a re-emersion of the area and the nice mammal fauna of Cucuron testifies to the new terrestrial conditions.

Palaeontological richness of the Parc du Luberon

The Parc Naturel Régional du Luberon was created as a protected geological and natural reserve in 1987. The great landscape diversity and the related palaeontological content of the rocks found in the area is the result of the long geological history of southeastern France. We will not review all the fossil sites spread over the territory of the Parc, but a couple of highlights are worth noting. The excursion will be "Cenozoic-oriented", so that it is not the objective of this short paper to explain what comes before, but the sedimentary formations prior to the Cenozoic are worldwide known, mostly because of the stratotype sections for the Cretaceous Aptian age.

During the Palaeogene and Neogene, about 15 terrestrial faunas (fossil remains of all kinds: plants, aquatic and terrestrial invertebrates, microfossils, vertebrates, mammal footprints) record the biotic evolution of the area making the Parc Naturel Régional du Luberon one of the best places to carry out palaeontological studies (notwithstanding its nice "Provence climate and wines"...).

The record starts in the Eocene with the type locality of the biochronological Palaeogene timescale MP18 reference level La Debruge – Late Eocene (mammals). La Débruge was found in the 19th century in a lignite formation and yielded a great diversity of mammals (more than 30 species, see Aguilar et al., 1997). It was already mentioned in 1846 (Gervais, 1846) and was subsequently extensively studied (e.g., Gervais himself in a series of papers in the 1850s; Bonis, 1964; Truc & Demarcq, 1967). It slightly precedes the "Grande Coupure" event which saw a complete renewal of the worldwide faunas at the Eocene-Oligocene boundary. Figure 2 illustrates a fossil from La Débruge (Fig. 2a), among others.

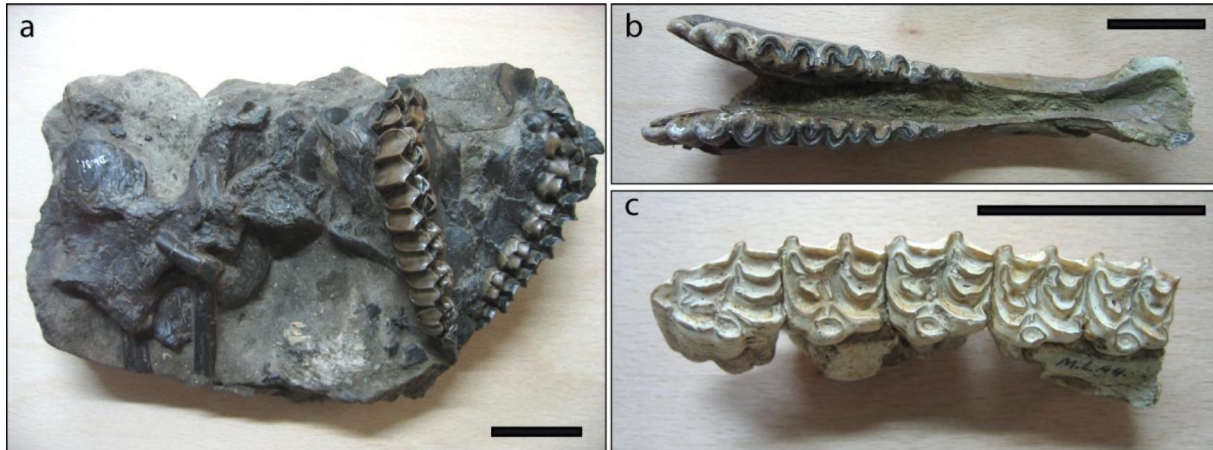


Figure 2: Three specimens of mammals from three Cenozoic localities from the Parc Naturel Régional du Luberon stored at the Natural History Museum Basel. a, Skull of *Palaeotherium curtum* from La Débruge, late Eocene (NMB Db.31). b, Mandible of *Plagiolophus huerzeleri* from Murs, early Oligocene (NMB O.V.76b). c, Upper tooththrow of *Hipparion gracile* from Cucuron, late Miocene (NMB M.L.44). Scale bar: 5 cm.

The Oligocene of the Parc du Luberon is also very rich in fossils, with an unusual variety of fossil forms. The diverse lacustrine sedimentary record allows different kinds of preservations, from jellyfishes preserved as imprints, to birds preserved with feathers (Mayr, 2005; Louchart et al., 2007), plants, amphibians, insects (Nel et al., 2008) mammals preserved as whole skeletons (bats, ruminants, Bouvrain & Geraads, 1985, or mammal footprints (Costeur et al., 2009). Several localities are largely known (e.g., the finds known under the name Céreste, see below) and others are unpublished or only partially described despite their good preservation state (e.g., Murs, Remy, 2000 and Fig. 2b).

The Miocene is also represented in the Parc du Luberon, mostly with the molassic sediments of the Early Miocene but a Late Miocene rich and characteristic fauna, that of Cucuron (also known as Mont Luberon), was discovered in the 19th century by A. Gaudry (REF). With a good record of many different mammals (rodents, antilopes, rhinos, elephants or lipothyphlans; Fig. 2c), Cucuron is one of the richest Late Miocene locality of Europe.

We will visit a couple of these Oligocene localities in the frame of the field trip (see Fig. 3 for the geological context of the localities).

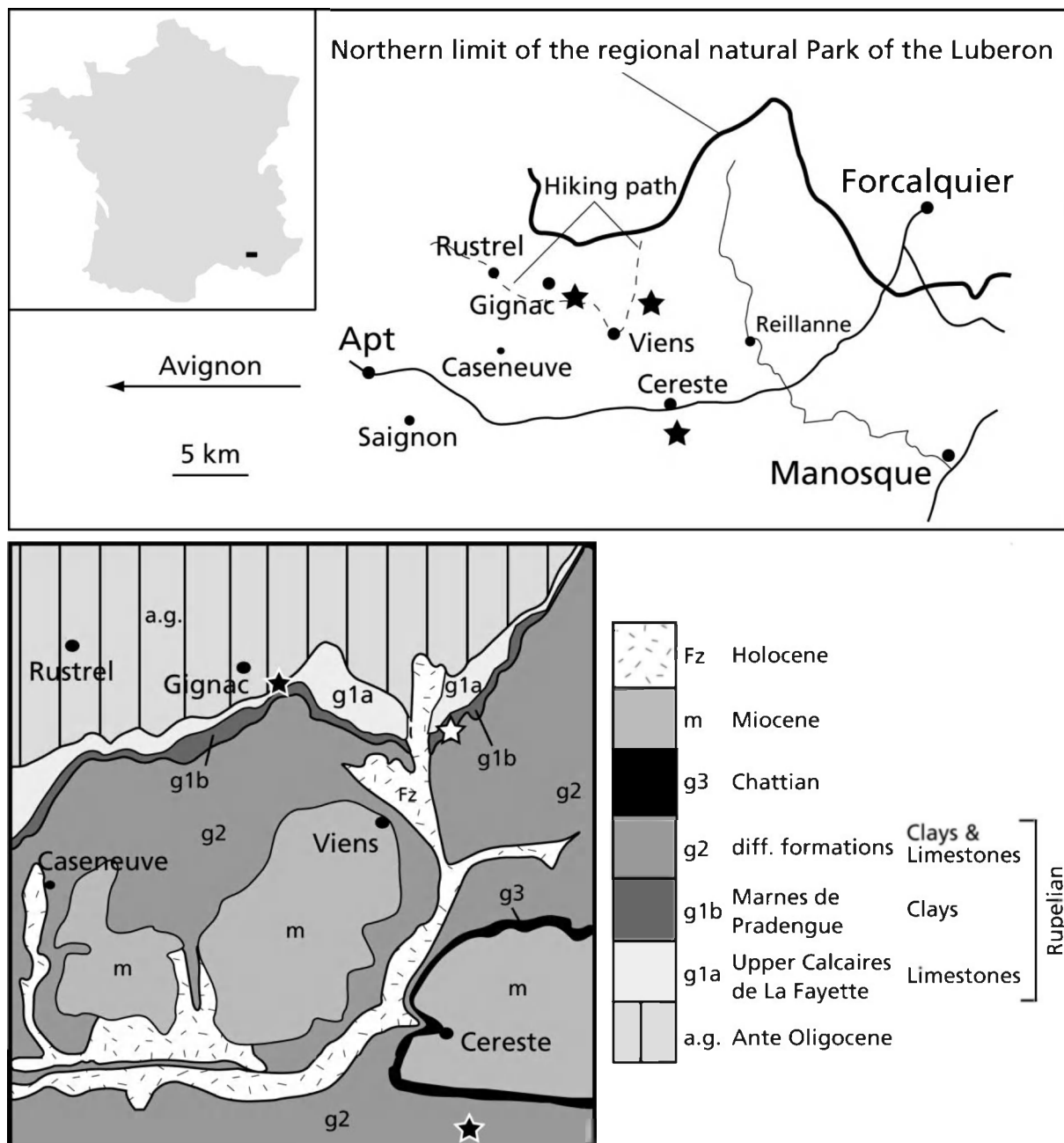


Figure 3: Geographical and geological context of the 3 localities visited during the excursion. Stars indicate the sites (Gignac, Viens and Céreste).

Field trip

Stop1: The Museum "La Maison du Parc" in Apt (Fig. 4a)

Apt is a small town and is an administrative city of the Vaucluse district. Apt was already a prosperous city during Roman times but the first settlements date back to 9000 years BC making the archaeological record around the city very rich. Today with a little more than 10000 inhabitants it is the portal to the touristic Luberon. As the Parc is a protected area, an institution with scientists dedicated to increase the knowledge of the region was set up and a Museum was built to provide information on the Geology and Palaeontology to the public. We will first visit the small Museum

and explain the Geology, Palaeontology of the area together with the course of our field trip.

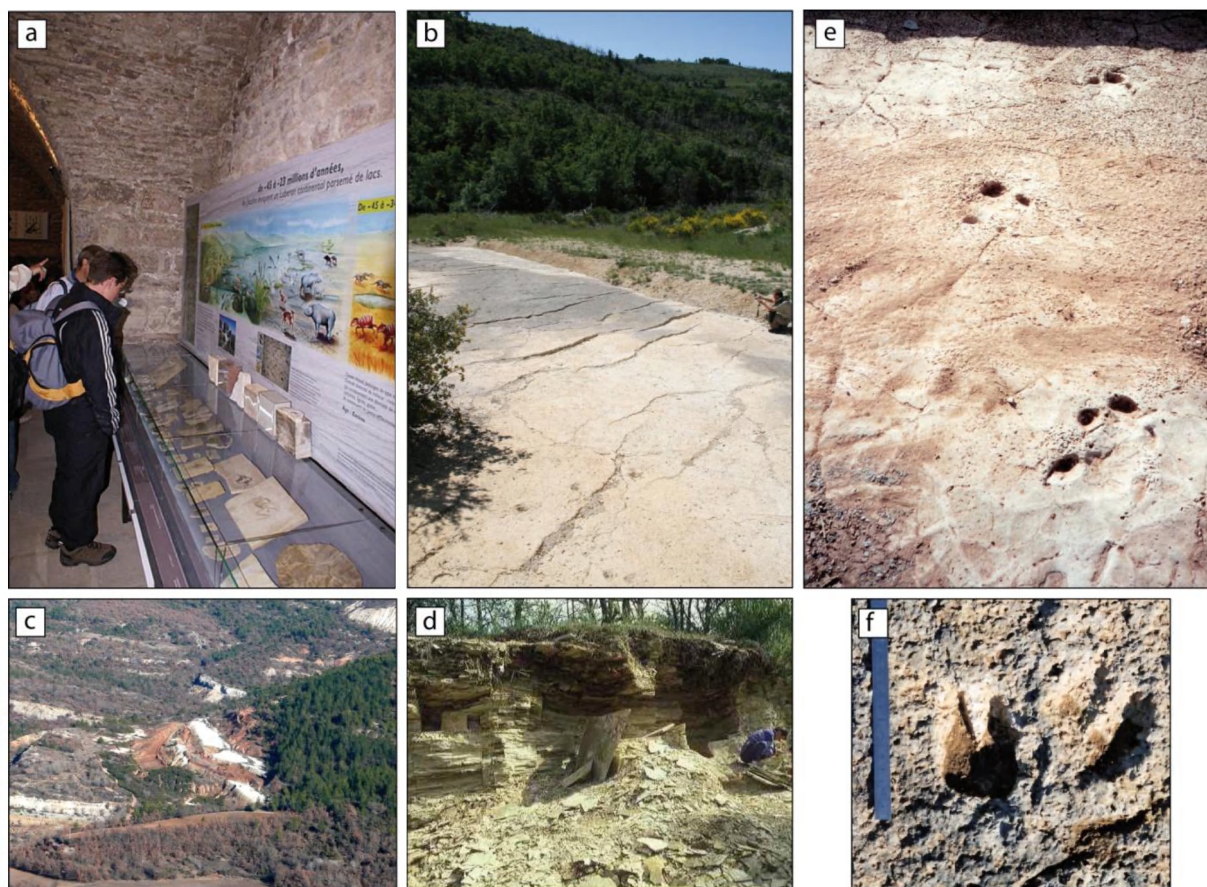


Figure 4: Pictures of the 4 stops of the excursion with examples of ichnofossils. a, The Museum "La Maison du Parc" in Apt. b, the site of Gignac, note the syn-sedimentary parallel faults, and mammal footprints in the foreground. c, the Viens Quarry, viewed from the village of Viens, a few hundred meters away. d, the locality of Céreste in the famous "calcaires en plaquettes". e, Rhinoceros trackway on a limestone slab at the Viens Quarry, note three sets of pes-manus footprints. f, two even-toed ungulate footprints at Gignac.

Stop 2: The site of Gignac (Fig. 4b)

Gignac is one the best fossil site with mammal footprints to be seen in the world. The surface of several hundred square meters shows more than 400 footprints of even-toed ungulates (small ruminants, together with larger forms, possibly the suiform entelodontids, Fig. 4f) and rhinoceroses. Many of the footprints are organized in trackways sometimes totalling more than 20 meters in length (which is long for the record of mammal trackways). The site was first mentioned in the 60's (Bessonat et al., 1969) and was extensively published recently (Costeur et al., 2009). Together with the footprints, the site exposes syn-sedimentary micro-faults, whose centimeter-high walls are sometimes crushed by footprints testifying to the soft-sediment deformation. These structures are all aligned with the normal large Durance fault, 30 km to the East, and could be the result of seismic activity related to this accident.

Stop 3: The site of Viens (Fig. 4c)

The site of Viens is exposed in a quarry surmounted by the nice perched village of Viens. Several layers of calcareous limestones yielded mammal footprints, most probably always of Rhino affinities (Costeur et al., 2009). New excavations (done in April 2010; not yet undertaken at the time this paper is written...) should result in new findings. We will enlarge two outcrops that already yielded beautifully preserved rhino trackways (Fig. 4e). The site was previously known for a rhinoceros mandible (*Ronzotherium velaunum*) that was found in the 70's within the lacustrine limestones that compose the base of the quarry (Demathieu et al., 1984). Unfortunately this specimen appears to have been lost. The base of the quarry records the very early Oligocene and the Eocene-Oligocene transition can be followed in the vicinity, which is pretty promising since this transition, the famous "Grande Coupure" of Stehlin (1909), sees a large renewal of the European faunas. The purpose of the field work in April 2010 is also to assess the palaeontological potential of this area.

Stop 4: The site of Céreste (Fig. 4d)

Céreste is known worldwide for the numerous discoveries of various kinds (insects, plants, amphibians, bats, etc) which were also extensively excavated by amateurs before the protection of the Parc (this resulted in many private collections often with wonderful specimens). One knows "Céreste" as the common name for many finds made in the fine laminated lithostratigraphic limestones of the Parc, but several localities, besides Céreste itself, actually yielded fantastic fossils (including many extraordinary birds) such as:

- A complete skeleton of the Oligocene ruminant *Bachitherium insigne* from Vachères (Bouvrain & Geraads, 1985)
- A complete Oligocene hummingbird with modern feathering from a locality situated near the Viens quarry, called "Le Grand Banc" (Louchart et al., 2007).
- The first and only complete fossil Pelican beak (Louchart, com. pers.), a crane precursor and a rare cuckoo all from Vachères (Mayr, 2005, 2006)
- An early Passeriformes (Mayr & Manegold, 2006).

The most common discoveries are the hundreds of complete fish skeletons (species *Dapalis macrurus*) from several places in the lithographic limestones. The locality Céreste itself we will be visiting is located in the middle Oligocene formation "Calcaires de Campagne-Calavon" and is an outcrop of lithographic limestones where fishes, insects, plants, vertebrates, bird feathers etc. were previously found.

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