Symposium: Cretaceous Faunas of Appalachia: Systematics, Paleoecology and Taphonomy: A Symposium Dedicated to the Memory of Donald Baird (Thursday, October 18, 10:45 am)

VEGETATION AND CLIMATE RECONSTRUCTION OF DINOSAUR-BEARING LATE SANTONIAN, EARLY CAMPANIAN UNITS IN ALABAMA AND MISSISSIPPI

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Pollen, leaves and charcoal from the near-shore marine Late Cretaceous (L. Cret.) (Late Santonian – Early Campanian) Eutaw Sand and Mooreville Chalk Formations in Alabama and Mississippi indicate a unique taphonomic bias for each plant part. Previous reconstructions of L. Cret. flora from the Southeastern United States (SeUS) indicated a dominance of angiosperms in both leaf and pollen data. Wood data have been lacking. Leaf data are skewed towards foliage resistant to physical degradation in the high-energy environment of deposition. Pollen is the best indicator of diversity in the overall flora, but for many angiosperm taxa, stature of the plant is unknown, and diversity does not necessarily equal total biomass. Pollen taphonomy is affected by varying degrees of aqueous flotation; some taxa may not be particularly relevant for floral reconstructions unless complimented by other plant parts. Data from charcoal (n=125) indicates that conifers comprised 95% of tree-sized flora. A smaller sample (n=12) of petrified wood indicates conifers comprised 92% of the tree-sized flora. Although charcoal taphonomy can be affected by differential flotation among taxa, similar results from charcoal and petrified wood indicate the dominance of conifers is not an artifact. Six new dicotyledonous taxa have been identified from charcoal. Growth rings in trees vary considerably among taxa, and the identity of taxa must be known for growth ring analysis to be relevant. Growth ring morphology in conifers and dicots and carbon isotopes from a single conifer indicate seasonal variation in rainfall, and suggest a monsoonal climate regime. Pollen indicates dicots comprised 46%, pteridophytes 27%, gymnosperms 24%, and monocots 3% of the flora, and a warm, humid climate. Angiosperm diaspore size indicates a closed forest canopy. Conifer dominance of the tree-sized component of the flora differs from other contemporaneous sites in the SeUS. This may reflect the lack of wood data in most floral reconstructions. Climate simulations, the presence of hummocky-bedded sands, and localized sand lenses entrained within the Mooreville Chalk Formation indicate the occurrence of paleo-hurricanes. A hurricane/fire disturbance regime may explain the prevalence of conifers, although data reflect knowledge only of coastal areas. Flooding, drowning and flotation may explain the presence of a high concentration of associated dinosaur carcasses in the study area. Dinosaur carcasses are concentrated near barrier island inlets, and storm runoff may explain how dinosaur carcasses and eggs are transported across the high-energy shore-face to be deposited in shallow marine chalks. Dinosaur bone preservation is strongly controlled by bottom water oxygenation.

Technical Session V (Wednesday, October 17, 3:30 pm)

THE ARCHAIC BEAKED WHALE *NINOZIPHIUS PLATYROSTRIS*: CLUES ON THE EVOLUTIONARY HISTORY OF THE FAMILY ZIPHIIDAE (CETACEA, ODONTOCETI)

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Beaked whales (Family Ziphiidae) are a species-rich clade of medium to large size odontocetes (toothed whales). In most extant species the dentition is drastically reduced, a feature interpreted as related to suction feeding. Only one or two pairs of mandibular teeth are usually retained, transformed in tusks in adult males. Shared with sperm whales, the habitat of ziphiids can be described as extreme; several species have been recorded performing feeding dives at depths greater than 1000 m, locating their prey in the darkness using their sonar. *Ninoziphius platyrostris* has long been considered as the best-known fossil ziphiid, based on the holotype, a skull from the early Pliocene of Peru with associated ear bones, mandible, and several postcranial elements. However, the poor preservation of the dorsal surface of the skull, including the diagnostic vertex and rostrum base, proved to be an obstacle for the analysis of the phylogenetic relationships of this key archaic species, displaying a full set of functional upper and lower teeth on its elongated snout, as well as several other plesiomorphic characters. The addition to the sample of two newly prepared skulls from the same Peruvian locality and level as the holotype (Sud-Sacaco, Pisco Formation) leads to a reappraisal of *Ninoziphius* in the light of numerous recent discoveries of fossil ziphiids. In the frame of an updated phylogenetic tree, with *Ninoziphius* as the most basal stem ziphiid, this review yields clues for the early steps of the evolution of the specialized feeding technique, habitat, and social behavior of beaked whales. Thanks to morphological data from various parts of the skeleton of *Ninoziphius* and other archaic ziphiids (proportions and size of snout, degree and types of tooth wear, asymmetry of the facial region, size and topology of the pterygoid sinuses, proportions of the vertebrae, development of mandibular tusks, compactness and pachyostosis of rostral elements, sexual dimorphism, body size) we test and refine the potential factors, both ecological (for example the shift to deep water predation) and behavioral (for example sexual selection), of the successful Neogene diversification(s) of this family.

Technical Session VII (Thursday, October 18, 2:00 pm)

TOWARD A QUANTITATIVE WAY TO IDENTIFY ANCESTORS IN THE FOSSIL RECORD: A BAYESIAN APPROACH

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The only direct evidence of the diversity of life through geologic time is contained in the fossil record, and this record is biased and incomplete. Fossils provide information that cannot be obtained from studying living organisms alone, but they bring with them unique methodological challenges. When a fossil lineage is densely sampled through time and space, it is possible to characterize patterns of morphological change through time. When an unbroken transition in morphology is observed between older and younger forms, it can be argued that the stratigraphically older fossils represent ancestors and the younger fossils their descendants. However, the fossil record rarely provides the kind of evidence needed to make a strong argument for an ancestor-descendent relationship. Moreover, fossils must be treated as terminal taxa in order to be included in phylogenetic analyses. For this reason, they are constrained to represent extinct side-branches on the tree of life. However, fossils can also be sampled from lineages that lead to other fossil or living taxa. This study presents a novel quantitative approach toward evaluating the ancestral status of a fossil taxon. Birth-death processes provide a natural, tractable and formal framework for modeling a wide variety of biological processes. Consider such a process with constant birth rate λ , constant death rate μ , beginning with a single lineage at time 0 and ending with at least one lineage at time T. In this context, we express the probability that a single fossil selected at random from among the lineages that exist at time $0<t<T$ does not have at least one descendent at time $T>t$. Interestingly, this expression is independent of the number of lineages that existed at the time t when the fossil is sampled. These results can be implemented as a prior distribution and combined with models of morphological character change to obtain the posterior probability that a particular fossil lies directly ancestral to another sampled lineage.

Technical Sesssion XII (Friday, October 19, 4:00 pm)

TOOTH VARIATION IN *VARANUS KOMODOENSIS* AND IMPLICATIONS FOR INTRASPECIFIC VARIATION IN EXTINCT XIPHODONT CARNIVORES

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Understanding the range of intraspecific variation of taxonomically informative characters is essential when recognizing species based on morphological characters, particularly in the fossil record. In fossil datasets, this information is often lacking due to small sample sizes, with many fossil vertebrate taxa known only from single specimens. *Varanus komodoensis*, the largest extant lizard and the largest living terrestrial animal with xiphodont (laterally compressed, serrated) teeth, has often been used in palaeobiological studies as a model for theropod dinosaur feeding behaviour and tooth and jaw biomechanics. Here we use *V. komodoensis* to illustrate variation in the teeth of an extant xiphodont faunivore. Fifteen skulls of adult *V. komodoensis* were measured in order to quantify morphological variation of the dentition present in the species. Three gross tooth measurements, as well as mesial and distal tooth denticle size, were measured for each of ten teeth across the tooth rows. The number of tooth positions varies little between specimens; maxillary and premaxillary tooth counts remain identical in all specimens, but the smallest specimens have one fewer dentary tooth position than the largest skulls. Denticle size and tooth width in regionally equivalent teeth also remain essentially constant (negative allometry) across the size ranges even though tooth length and height increase isometrically with respect to skull size. These findings suggest that some aspects of tooth morphology are remarkably consistent between individuals and robust to differences in body size. Data from multiple individuals and comparison to other varanids indicate the potential of diagnostic characters in teeth.

These results have implications for understanding the diversity of small theropods, as extensive information on their abundance and diversity is derived from isolated teeth. Comparison with specimens of the dromaeosaurids *Atrociraptor marshalli*, *Bambiraptor feinbergi*, and *Dromaeosaurus albertensis* indicates that the standard deviation of denticle size is similar (~0.2–0.4) to that of individual specimens of *V. komodoensis*, showing that within-individual denticle size is consistent. However, comparison to the large number of isolated teeth referred to these same species shows much greater disparity than would be expected from intraspecific variation in *V. komodoensis*. This suggests that hidden ontogenetic or taxonomic factors are likely contributing to fossil tooth disparity. Although ontogenetic variation of teeth is not well understood in theropod dinosaurs, these results are consistent with a growing body of evidence that alpha diversity of small theropods is underestimated.

Symposium: Vertebrate Paleontology in the Northern Neotropics: Cradle and Museum of Evolution across Geological Time (Wednesday, October 17, 8:15 am)

THE CRETACEOUS NEOTROPICS: COLOMBIAN VERTEBRATES AT THE BOUNDARY OF SHIFTING ENVIRONMENTS AND THE MESOZOIC MARINE INTERCHANGE

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Jurassic and Early Cretaceous times in northwestern South America witnessed dramatic geographic changes. The Tethys seaway penetrated southwestward through present day Colombia to unite with the Pacific Ocean. This seaway expansion would mark the separation between North and South America for the next 150 million years. Fossil marine invertebrates of this region have seen much attention to models of biogeographic interchanges and local