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Poster Session III, (Friday)

A DACENTRURINE STEGOSAUR FROM THE LATE JURASSIC OF ASTURIAS (NORTHERN SPAIN)

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Omosaurus armatus Owen, from the early Kimmeridgian of England (Wiltshire), was the first articulated stegosaur described in the world and is the type species of *Dacentrurus* Lucas. *Dacentrurus* has been subsequently cited in the Late Jurassic of France (Upper Normandy region), Portugal (Leiria and Lisboa districts) and Spain (Teruel and Valencia provinces), and also in the Early Cretaceous of Spain (Burgos province). *Miragaia longicollum*, a stegosaur closely related to *Dacentrurus* has been recently described in the late Kimmeridgian-early Tithonian of Portugal (Lisboa district). Both genera form the Dacentrurinae clade (all stegosaurs more closely related to *Dacentrurus* than to *Stegosaurus*). Here we present a new locality with dacentrurine remains from Villaviciosa (Asturias, north Spain), recovered in the Kimmerdigian Lastres Formation, deltaic in origin. The stegosaur remains were found disarticulated and mixed with remains of bony fishes, turtles, plesiosaurs and theropods. Most of the bones were broken prior to fossilization, and are unidentified fragments. The best preserved fossils are cervical vertebrae, dorsal centra and ribs; there are also fragments of the sacrum, girdles and limb-bones. The degree of fusion of the neurocentral suture in the vertebrae indicates that at least two individuals are represented in the assemblage, a juvenile one and an adult one. Two of the four unambiguous synapomorphies of Dacentrurinae can be tested in the Asturian material: cervical ribs fused to para- and diapophyses of cervical vertebrae and centra of dorsal vertebrae wider than long, so the remains are here assigned to Dacentrurinae indet. The fossils from Burgos, Teruel and Valencia, assigned to *Dacentrurus* by previous authors mainly on the basis of ribs fused to cervical vertebrae and/or dorsal centra wider than long, currently regarded as synapomorphies of Dacentrurinae, should be restudied in order to clarify its belonging to *Dacentrurus*, *Miragaia* or another unrecognized dacentrurine.

Poster Session III, (Friday)

THE OLDEST CERATOPSID CRANIAL MATERIAL (FOREMOST FORMATION, MIDDLE CAMPANIAN) FROM NORTH AMERICA

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In 1958 Wann Langston, Jr., collected ceratopsian cranial remains from a low-density bonebed within the Foremost Fm (lower Middle Campanian) of southern Alberta. The material includes portions of the braincase, quadrates, quadratojugals, squamosals, and numerous isolated triangular epimarginal ossifications and parietal fragments. Recent preparation of previously unopened field jackets has revealed the remains of three partial parietals from at least two adult-sized individuals. The most complete parietal preserves three epiparietals along the posterior margin of the frill adjacent to the midline; the central epiparietal forms a massive, flattened triangular spike that is flanked medially by a short, broad-based, procurving hook (with a base perpendicular to the base of the spike), and laterally by a much smaller, very low, elongate epiparietal. A parietal fenestra is present, but apparently relatively small compared to most Campanian-aged ceratopsids. The largest parietal bar preserves a fused procurving hook, but has an inflated sutural surface for the large, but unfused, triangular spike. This suggests that the order of epiparietal fusion differs from that outlined for centrosaurs, and that complete fusion did not occur until full adult size was achieved. It also calls into question the previously proposed homology of epiparietals between centrosaurs and chasmosaurs. As presently interpreted, the remainder of the parietal frill margin is made up of a series of cup-shaped depressions, similar to those seen on some specimens of *Triceratops*, that mark the fusion points of the smaller isolated epiparietals. Foremost Formation sediments date between 78-79 million years old making this material the oldest putative ceratopsid remains from North America. The preserved parietal ornamentation is unique amongst ceratopsids and indicates that the material belongs to a new ceratopsid taxon, possibly of chasmosaurine affinity.

Technical Session VI, Thursday 2:00

THE INTERRELATIONSHIPS, PALEOBIOGEOGRAPHY AND THE P-TR EXTINCTION EVENT SURVIVAL RATE OF THE PARAREPTILE CLADE PROCOLOPHONOIDEA

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The parareptilian group Procolophonoidea has been increasingly studied in recent years, and a high survival rate during the P/Tr extinction event has been estimated for the clade. Procolophonoid interrelationships, however, have remained poorly known because of many taxa have lacked adequate descriptions. Recent publications on several South African and Chinese procolophonoids, along with my redescriptions of the European procolophonids *Anomoiodon liliensterni* and *Leptopleuron lacertinum*, and the putative Permian Russian procolophonoids enable a more in-depth phylogenetic study. Thirty-nine procolophonoid taxa were included in the study, and the results suggest novel compositions of the procolophonid clades Leptopleuroninae and Procolophoninae; the monophyly of the genus *Kapes* is questioned; the phylogenetic position of *Suchonosaurus*, *Pintosaurus* and *Phaanthosaurus* among the other basal procolophonids remains unresolved; and the results cast doubt on Procolophonoidea being divided into the two generally accepted clades, Owenettidae and Procolophonidae. However, when stratigraphically-calibrated, the results of the phylogenetic analysis support separate Owenettidae and Procolophonidae; biogeographically Owenettidae remains restricted to Gondwana, and Procolophonidae either originated in the Permian of Laurasia, or a migration to Laurasia took place among the basal members of Procolophonidae during the Late Permian. Furthermore, in contrast to previous survival estimates, the topology with the best stratigraphic fit indicates that only 57% of procolophonoid lineages might have survived through the P/Tr boundary. Alternatively, it is possible that up to 80% lineages crossed the boundary, but this requires a scenario that maximizes the number of ghost lineages.

Poster Session III, (Friday)

POSTCRANIAL MORPHOLOGY AND THE LOCOMOTOR HABITS OF LIVING AND EXTINCT CARNIVORANS

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Living carnivorans display a broad range of locomotor habits, including cursorial, scansorial, arboreal, semi-aquatic, and semi-fossorial species from multiple families. Ecomorphological analyses have been used successfully in prior studies of carnivores and rodents to accurately infer the locomotor habits of extinct species. This study uses 20 postcranial measurements that have been shown to be effective indicators of locomotor habits in rodents and incorporates an extensive sample of over 200 individuals from more than 50 living carnivore species. Statistical analyses including analysis of variance (ANOVA) and stepwise discriminant function analysis were performed using a set of functional indices (ratios). Our ANOVA results revealed consistent differences in postcranial skeletal morphology among locomotor groups. Aquatic and semi-aquatic species display relatively shortened, robust femora with large femoral epicondyles and elongate metatarsals. Semi-fossorial species display relatively short, robust limbs with enlarged muscular attachment sites and elongate claws. Both aquatic and fossorial species have relatively elongate olecranon process of the ulna. Cursorial species displayed distal elongation of the limbs and relatively narrow humeral epicondyles. Arboreal, scansorial, and unspecialized terrestrial species show intermediate values for most indices. These differences effectively discriminated locomotor groups and allowed accurate classification of the carnivorans studied. Both within and between families, species with similar locomotor habits converge towards similar postcranial morphology despite their independent evolutionary histories. The discriminant analysis worked particularly well to correctly classify members of the Canidae, Felidae, and Mustelidae, but not as well for members of the Ursidae or Herpestidae. Extinct species from several families were included in the discriminant function analysis for locomotor classification, including *Smilodon fatalis, Panthera atrox, Felis lacustris, Dinictis felina, Hoplophoneus occidentalis, Barbourofelis loveorum, Canis dirus, Arctodus simus, Agriotherium africanum*, and *Satherium piscinaria*.

Romer Prize Session, Thursday 11:30

MYOLOGY AND FUNCTIONAL MORPHOLOGY OF BITING IN AVIAN AND NON-AVIAN DINOSAURS

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Biting is a key adaptation in vertebrate evolution and an understanding of its functional morphology and biomechanics provides a valuable insight into the behavior and ecology of feeding in animals that direct observations are all but impossible, e.g. extinct dinosaurs. However, biomechanical models of musculoskeletal systems are affected heavily by parameters associated with muscles, conditions that are virtually unknown in extinct organisms. For such taxa, one must rely on muscle reconstructions or on muscle parameters extrapolated from extant relatives. To date, efforts in constraining errors associated with muscle parameter estimation in the jaw adductor muscles of archosaurs is limited. Here, I provide an overview of the anatomy, architecture, and cross-sectional areas (CSA) of the jaw closing muscles in extant birds and crocodilians to form a basis for reconstructing muscle parameters in extinct non-avian dinosaurs. Further, functional metrics, primarily mechanical and displacement advantages, were calculated from digitized landmarks of the origin and insertion points of muscles in extant bird specimens. Muscle scars were investigated in dinosaurs to identify presences and positions of jaw adductor muscle attachment sites, the digital coordinates of which were used to compute mechanical and displacement advantages. Muscle CSA were estimated in theropods using several extrapolation techniques. Functional metrics in most theropods are comparable with each other, with tyrannosaurs and carnotaurines dominating the upper and lower extremes in mechanical and displacement advantages respectively, confirming these two groups as above-average biters. The opposite is true of baryonychines with an extremely low mechanical advantage and extremely high displacement advantage, comparable in range to modern long-billed birds, indicating a weak-bite, fast-shutting jaw function. Preliminary CSA estimates show strong correlation with skull size, indicating a strong size influence in the estimation procedure, establishing the need for further groundwork.