Saturday 1:30

EVOLUTIONARY STASIS IN THE FUNCTIONAL DENTAL SHAPE OF *ECTOCION*, A "CONDYLARTH" LINEAGE SPANNING THE PALEOCENE/EOCENE BOUNDARY

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Past studies of evolutionary mode in fossil mammalian lineages have often been limited to univariate traits (e.g. molar crown area). It is reasonable to assume that tooth shape, a multivariate trait, reflects more of the functional portion of the tooth; the part that is more likely to experience selective pressures. Previously, we studied the tooth margin shape and cusp configuration in the lower dentition of *Ectocion*, a phenacodontid "condylarth" from the Paleocene/Eocene (P/E), using geometric morphometric techniques. Our results indicated stasis in tooth margin shape and cusp configuration over the sampled time interval spanning the P/E boundary. Admittedly, these aspects of tooth shape in *Ectocion*, the most herbivorous of phenacodontids, may not contain the true shape differences resulting from selective pressures on the full masticatory abilities of the lower dentition.

Here we present the results of a new geometric morphometric study of the shearing crest shape of the lower dentition (p4, m1, m3) of *Ectocion osbornianus* and *E. parvus*. Teeth with little to no wear were sampled over a 1.5 million year interval. Principal cusps were used as landmarks, and semi-landmarks were digitized along the highest edge of the shearing crests. Principal components analyses showed no separation between time intervals at all temporal resolutions. Multivariate tests characterize the crest time series as consisting of counteracting changes with less change (i.e. stasis) than expected under a random walk. Permutation F-tests show that the shape variation within each biozone is not significantly different than variation for the entire sampled interval, providing further proof of stasis.

Currently, these methods are being extended to the Eocene perissodactyl genus *Hyracotherium*. Chronospecies of *Hyracotherium* show distinct molar sizes during the early Wasatchian with the smallest species, *H. sandrae*, occurring during the Paleocene/Eocene Thermal Maximum. The purpose of the new study is to study change in the functional tooth shape and tooth wear shape between the *Hyracotherium* chronospecies.

Wednesday 3:30

A NEW "MIDDLE" CRETACEOUS ZALAMBDALESTID MAMMAL FROM NORTHEASTERN CHINA

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Fossils from a new mid-Cretaceous locality near Gongzhuling City in Jilin Province, China, include two incomplete dentaries, which represent a newly described genus and species (*Zhangolestes jilinensis*) referable to the eutherian family Zalambdalestidae. Both dentaries possess an enlarged, procumbent first incisor combined with an interesting mosaic of both plesiomorphic and derived dental characters compared to the early zalambdalestid *Kulbeckia kulbecke*. For example, the new specimens appear to show five premolars (including an almost fully molariform ultimate premolar) combined with only three incisors and a low but single-rooted canine. The trigonids on p5 and m1 are relatively open and not as compressed as in later zalambdalestids. *Kulbeckia*, from Turonian deposits in Uzbekistan has four premolars, and other than the typical procumbent incisor its anterior dentition is different in detail (e.g., four incisors plus double-rooted canine) compared to the Chinese material. Cenomanian *Bobolestes* (now including *Otlestes*) has an almost fully molariform ultimate premolar but no sign of enlarged incisors. Other early eutherians such as *Eomaia*, *Prokennelestes*, and *Montanalestes* have a trenchant, non-molariform ultimate premolar. *Zhangolestes* may therefore extend the range of certain, presumably derived eutherian characters to an earlier time than previously known.

More work is needed on interbasinal correlation, but at present it seems unlikely that *Zhangolestes* could be younger than Cenomanian. The locality is in basin-margin outcrops of the Quantou Formation, which is widespread in the subsurface of Songliao Basin and which has been assigned ages ranging from Aptian to Cenomanian. Songliao Basin is tectonically and sedimentologically distinct from the smaller but more numerous basins in western Liaoning. The Gongzhuling locality is likely to emerge as an important source of new information on "middle" Cretaceous vertebrates as additional mammalian, dinosaurian, and other specimens already collected are described from it.

Poster Session III

A STUDY OF *CAMARASAURUS'* (DINOSAURIA: SAUROPODA) TORSO AND ITS BIOMECHANICAL IMPLICATIONS

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This project examined the torso shape through articulating casts of both dorsal vertebrae and ribs and its biomechanical implications of the well-known sauropod *Camarasaurus*. The project resulted in a new curve in the dorsal vertebrae series, a torso which is more narrow and volumetrically smaller than previous models, the first attempt in reconstructing intercostal musculature, and a scapulocoracoid angle of 20-30° based upon scapular facets.

Background knowledge for the reconstruction was gained through dissection of *Alligator mississippiensis, Iguana iguana,* and *Gallus domesticus*. The dorsal vertebrae were articulated based on the position of the zygopophyses and centrum spacing. The dorsal ribs were articulated onto the vertebrae based upon the tuberculum/diapophysis, capitulum/parapophysis articulations, and the flat lateral edge of the ribhead. The results are not consistent with published models, however they are consistent with the information obtained in dissections.

Saturday 9:30

USING LIMB CIRCUMFERENCE AND BODY MASS TO ESTIMATE SAUROPOD DINOSAUR GROWTH RATES

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Sauropod dinosaurs were the largest terrestrial animals and their growth rates remain a subject of debate. Based on counting growth lines in histologic sections and relating bone length to body mass, it has recently been estimated that *Apatosaurus* attained its adult body mass of about 25,000 kg in as little as 15 years, with a maximum growth rate of 5,466 kg/yr. This rate exceeds that projected for a precocial bird or eutherian mammal of comparable estimated body mass. Using an alternative method of estimating limb circumference and body mass for each growth line, and fitting the resulting age/mass data to the von Bertalanffy growth equation, a revised growth curve suggests that *Apatosaurus* adult mass was reached by 70 years with a maximum growth rate of 520 kg/yr. This alternative method for growth rate determination was also applied to histological studies of two titanosaurid sauropods. At only about half the mass of *Apatosaurus*, *Janenschia* took between 20 and 30 years to attain its adult size (~14,029 kg). This result is supported by independent evidence of estimated bone apposition rates. Despite having an adult body mass greater than *Apatosaurus*, the titanosaurid *Alamosaurus* attained a mass of about 32,663 kg within 45 years and a maximum growth rate of 1,090 kg/yr. Titanosaurids may have been the fastest growing of all sauropods. Even so, the growth rate estimates produced using the von Bertalanffy equation for all three sauropods fall within the interval between those projected for reptiles and those for birds or mammals of equivalent projected body mass. These results are comparable to those found for smaller dinosaurs, and suggest that sauropods grew at rates similar to other dinosaurs in spite of their great size.

Wednesday 2:45

EARLIEST KNOWN BIRD TRACKS FROM THE CEDAR MOUNTAIN FORMATION, UTAH

WRIGHT, Joanna, Univ. of Colorado, Denver, Denver, CO; KIRKLAND, James, Utah Geological Survey, Salt Lake City; FOSTER, John, Museum of Western Colorado, Grand Junction, CO; DEBLIEUX, Donald, Utah Geological Survey, Salt Lake City, CO; GASTON, Robert, Gaston Design, Fruita, CO

The earliest known bird, *Archaeopteryx*, is known from the Upper Jurassic deposits of Solnhofen in Germany but all other fossil bird remains are Early Cretaceous or younger. Similarly, the oldest known fossil bird tracks are Early Cretaceous in age, with the possible exception of some bird-like tracks reported from the Triassic of South America.

The Cedar Mountain Formation of western Colorado and eastern Utah is renowned for producing diverse Early Cretaceous terrestrial fossils, and several tracksites have also been reported. However, these are the first bird tracks reported from the Cedar Mountain Formation. The tracks are preserved in the Yellow Cat Member, which is probably Barremian in age.

These bird tracks were discovered in summer 2005 by JRF and RG on a fallen sandstone block. Further investigation of the site turned up two further blocks, found by JIK and JLW respectively. A ripple-marked fourth slab preserves two small theropod tracks. All the tracks are preserved in concave epirelief on a thin medium-grained sandstone layer at the top of a meter thick erosional-based coarser sandstone with a rippled top surface, which may be of crevasse splay origin. This lithology is very distinctive and it was therefore possible to definitively locate it in the measured cliff section, although no tracks were found *in situ*.

The tracks are 35-45mm in length and have pace lengths of 130-150mm. Some preserve faint phalangeal pads and small claw marks but there are no traces of interdigital webbing. Several preserve a hallux impression. The divarication angle of digits II-IV is 105-115 degrees. The tracks are toed-in about 15 degrees. Approximately 50 tracks are preserved on the three slabs and there are several short trackways. We believe these to be the earliest known bird tracks in the world.

Saturday 3:45

A REVIEW OF THE EVIDENCE FOR A HUMAN ROLE IN THE EXTINCTION OF AUSTRALIAN MEGAFAUNA AND AN ALTERNATIVE INTERPRETATION

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Arguments that megafaunal extinctions in Australia were anthropogenically mediated have focused on establishing terminal appearance ages. This approach has been underpinned by three principle tenets: (1) if megafauna disappeared before significant climate change, but after human colonisation, then it can be inferred that extinctions were human mediated; (2) climate change within the last glacial cycle was unremarkable relative to previous cycles; and (3) all or most Pleistocene megafauna were present when people arrived on the continent. We review the evidence for human causation and note mounting evidence suggesting that the last 400-300 ka in Australia has been characterised by escalating aridity and climatic variability, culminating in the breach of a hydrological threshold within the last glacial cycle. Only 21 species (35%) of megafauna whose disappearance has been attributed to human activity are known to have persisted after the Penultimate Glacial Maximum (*c*. 130