Poster Session III (Friday, November 1, 2013, 4:15 - 6:15 PM)

NEW MATERIAL FROM THE RARE AMPHICYONID GENUS *PARADAPHOENUS* AND ITS IMPLICATIONS ON THE VALIDITY OF CANIFORM CARNIVORES IDENTIFIED WITHIN CHADRONIAN THROUGH ARIKAREEAN COLLECTIONS

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A recent study of fossil canid material in the Cedar Pass fauna, within the Badlands National Park collections reposited at the South Dakota School of Mines and Technology, has revealed a new stratigraphic occurrence of the miniature amphicyonid *Paradaphoenus*. This is the first recognized occurrence of *Paradaphoenus*within the Poleslide Member (Whitneyan) of the Brule Formation in South Dakota. Material from *Paradaphoenus* is incredibly rare, with only eight specimens known in vertebrate collections from the Orellan through early Arikareean in Nebraska, South Dakota, and Oregon. However, *Paradaphoenus* is infrequently known in South Dakota, with occurrences exclusively known from the Scenic Member (Orellan) of the Brule Formation and the Sharps Formation Wounded Knee Fauna (Arikareean). Four specimens represent the taxon in the Cedar Pass fauna, but the material is fragmentary and limited, containing three isolated molars and a dentary with partial dentition. Nonetheless, the material is representative enough to include *Paradaphoenus* and *P.* cf. *minimus* as faunal constituents in approximation to the Whitneyan-Arikareean transition, based on other representative mammalian taxa. The aforementioned Cedar Pass faunal specimens were previously misidentified as material from *Hesperocyon*. This is likely due to the overall scarcity of *Paradaphoenus* material, stemming from the lack of awareness on this carnivore's presence. Though *Paradaphoenus* is similar in size to co-occurring canidae, a close study of the dental morphology clarifies the distinctions of concurrent small caniform carnivores. These *Paradaphoenus* specimens clearly demonstrate the widening of the M1 through an exaggerated and distinct parastyle in addition to a strong medial expansion of the labial cingulum. The dentary attributed to *P. tooheyi* exhibits premolars lacking accessory cusps and an m2 with the talonid encompassing 80% of the tooth length. Comparable morphology is described in some Arikareean specimens of the early canine *Leptocyon*, calling into question the validity of collection identifications within Caniformia. Misidentifications such as these have been elucidated before, but seem to persist. This study ultimately calls for more attentiveness to evaluating caniform carnivore identification in similar collections of similarly sized caniforms representative of the Chadronian through Arikareean.

Technical Session XVII (Saturday, November 2, 2013, 4:00 PM)

MORPHOLOGICAL AND SPECIES DIVERSITY OF COELACANTHS FROM THE LOWER TRIASSIC SULPHUR MOUNTAIN FORMATION OF BRITISH COLUMBIA, CANADA

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Coelacanths, which have a large temporal range (~407 million years), are traditionally considered to be a morphologically static group. However, early in their evolutionary history, the morphological diversity of this group peaked (Devonian–Mississippian), followed by a drop in diversity that led to evolutionary conservatism. We assess this interpretation of this decline in coelacanth morphological diversity by describing a number of new forms from a single locality in British Columbia, Canada. Coelacanths from the Lower Triassic Sulphur Mountain Formation (Wapiti Lake) have been known for nearly 100 years and are only now being described. Preliminary works attributed all of the coelacanth material from this locality to a single undescribed species of *Whiteia*; however, after extensive study, six distinct species have been identified. These include several new genera and a member of a newly described family of active predators, the Rebellatricidae. These new forms add to the growing number of coelacanths from the Early Triassic, which has the highest recorded species diversity. Two of the new coelacanths, *Rebellatrix* and another currently undescribed genus, had body forms that significantly departed from the typical coelacanth bauplan. Features such as a forked tail, denoting an active predatory nature, or an everted caudal fin, with a short supplementary lobe and elongate principal lobes, are non-typical features for coelacanths. These specimens represent the first major change in the coelacanth body form since their initial radiation in the Devonian and Mississippian. Fast-swimming, predatory forms such as *Rebellatrix* indicate that coelacanth morphological diversity was not as conservative as it had long been assumed.

Symposium 1 (Wednesday, October 30, 2013, 8:15 AM)

WHAT ARE WE ACTUALLY MEASURING? AN EVALUATION OF OSTEOHISTOLOGICAL INDICATORS OF DINOSAURIAN GROWTH RATE

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Histological studies have established specific relationships between the microstructural features of bone and the growth rates of primary cortical bone. For animals of a given body size, the density and connectivity of vascular canals and the disorganization of collagen fibers increase with the rate of bone deposition, and osteocyte density is positively correlated with metabolic rate. Although these relationships are quantifiable, paleohistological studies generally use a tissue-level approach to compare bone growth among dinosaurs, except when reconstructing growth curves. I identified and refined several methods to improve the quantification of growth-related patterns in dinosaurian bone tissue, focusing on specific microstructural characters known to correlate with growth and metabolic rates in living tetrapods. The most critical histological indicator of growth, the rate of bone deposition, is rarely reported for dinosaurs. Occasionally, it has been estimated using values associated with specific vascular patterns in extant birds, a relationship that is not constant across tetrapods. Zonal area and average zonal width directly measure annual deposition, and can be used to bracket daily deposition rates. Estimating bone tissue growth based on vascularization pattern ("Amprino's Rule") actually confounds three separate vascular signals: density, connectivity, and patterning. As part of a larger study of archosaur growth, I measured canal density and the percentage of non-anastomosing canals in addition to describing vascular patterns, and reconstructed their ancestral states. Canal density shows an independent evolutionary trajectory from connectivity and patterning, and correlates more strongly with deposition rates. Collagen fiber orientation, which can signal seasonal shifts in deposition rate, is sometimes obscured in fossils by diagenetic alteration. Patterns of osteocyte organization and orientation, more than cell shape, are highly associated with fiber orientation and may be more appropriate proxies. Osteocyte and canal density, not typically reported for dinosaurs, are easily measured using digital boxplots along radial transects through the cortex. These measures suggest the possibility of more useful quantification of osteohistological indicators as proxies for growth and metabolic rates in extinct and extant vertebrates.

Technical Session IV (Wednesday, October 30, 2013, 2:15 PM)

A QUANTITATIVE MODEL FOR MORPHOLOGICAL EVOLUTION IN THE INTERATHERIIDAE (TYPOTHERIA, NOTOUNGULATA, MAMMALIA) AS A RESPONSE TO CLIMATIC AND TECTONIC CHANGES

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*An expanded phylogeny of the Interatheriidae (Typotheria, Notoungulata, Mammalia), including two new taxa represented by four newly described specimens from the Eocene-aged Los Queates Fauna of Chile, is presented. This phylogeny is used to quantify the relationship between climatic and tectonic events during the early Cenozoic and the rapid appearance of hypsodont dentitions, a morphological change observed in interatheriids as well as in many other families of South American ungulates at around this time. The rise of hypsodonty during the late Eocene in South America is likely related to cooling and aridification that occurred in South America at the Eocene-Oligocene Transition; it has also been attributed to the presence of volcanic ash on plant surfaces in varying amounts throughout the Cenozoic. Ancestral states for a continuously varying hypsodonty metric were reconstructed using both a likelihood model and phylogenetic independent contrasts, and show that hypsodonty appeared just once, in the common ancestor of Interatherium and Santiagorothia chiliensis, coinciding with the sudden radiation of the Interatheriinae. This implies that hypsodonty may have been important in the radiation of this subfamily. An oxygen isotope record of sea-surface temperature was used as a proxy for paleotemperature, and a model of rates of interplate convergence along the Chilean Andes was used as a proxy for volcanic activity. Rates of change in hypsodonty along the time-calibrated phylogeny were reconstructed, and the relationships between these rates of morphological evolution and the two proxies were quantified using a novel statistical method based on time series analysis. The results show no significant interaction between either of the two proxies and rates of change in hypsodonty, suggesting that neither of these aspects of paleoenvironment drove the evolution of hypsodonty, or that one or both were part of a more complex system that has not been captured here.

Poster Session I (Wednesday, October 30, 2013, 4:15 - 6:15 PM)

QUANTITATIVE APPROACH TO RIB IDENTIFICATION AT AN ALASKAN PLEISTOCENE SITE

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Despite the occurrence of remains of *Mammuthus primigenius* (woolly mammoth) in Alaskan Pleistocene archaeological sites, it is difficult to specify the nature of human-mammoth interaction implied. Is it possible that molars, tusks, or bones recovered at such sites were transported for utilitarian purposes, unrelated to hunting or consumption of mammoths? Several small mammalian ribs were recovered from a central Alaskan, Pleistocene archaeological site known as Swan Point and were initially treated as taxonomically indeterminate. However, we noticed a resemblance between one of these ribs and the morphology emerging from an unrelated x-ray computed tomographic study of the internal anatomy of two well-preserved neonate mammoth carcasses from Siberia. This comparison suggested that the Swan Point rib was a juvenile mammoth's left second rib, an identification that was later supported by microCT analysis of the Alaskan specimen. Additional ribs found subsequently at Swan Point also resemble those of a neonate mammoth. To evaluate our identifications quantitatively, we experimented with ways of comparing these relatively landmark-poor elements of mammalian osteology. Ribs are often under-represented in specimen descriptions as they usually offer few useful morphological characters. The ribs of mammoths and some other mammals are flattened mediolaterally creating anterior and posterior edges that extend proximodistally; changes in the curvature of these edges may be one of their more informative features. The 3-dimensional configurations of these edges and the dearth of landmarks elsewhere on ribs discourage use of traditional 2-dimensional morphometric analyses. Instead, we plotted 3-dimensional coordinates of semi-landmarks along these edges and fit an equation to those points; this information was supplemented by elliptical Fourier analysis of regularly-spaced cross-sections. By comparing coefficients generated in this manner from the Swan Point ribs, known mammoth ribs, and ribs of other appropriately sized mammals, we provide a strong argument that the Swan Point ribs are derived from a juvenile mammoth. This identification is important because these ribs are too fragile to have served any utilitarian purpose; human procurement of a mammoth calf for