increasing interest as we begin to explore the refilling of vertebrate ecomorphospace in the recovery period following the Hangenberg extinction.

Symposium: Vertebrate Paleontology in the Northern Neotropics: Cradle and Museum of Evolution across Geological Time (Wednesday, October 17, 11:45 am)

A SYNTHESIS OF CENOZOIC NEOTROPICAL MAMMAL EVOLUTION IN SOUTH AMERICA: BIOGEOGRAPHY AND INFLUENCES FROM HIGHER LATITUDES

CROFT, Darin A., Case Western Reserve University, Cleveland, OH, United States

Fossil assemblages from the Southern Cone have long been the basis for understanding patterns of Cenozoic mammal evolution in South America. More recent studies of assemblages from other parts of the continent have added a geographic dimension to this mainly temporal framework, revealing additional complexities. The present study synthesizes the past two decades of research on terrestrial Cenozoic mammals of tropical South America (the Neotropics). Within this region, spatial gaps in sampling and shared characteristics among faunas of each region permit the recognition of two subregions: low latitude (LL) faunas north of about 15° S and mid-latitude (ML) faunas south of 15° S.

The pre-Oligocene record of terrestrial mammals in tropical South America includes only two well characterized ML localities, Tiupampa, Bolivia and Itaboraí, Brazil. The lack of unambiguously correlative and well-sampled extratropical localities during the Paleocene and early Eocene hampers biogeographic conclusions based on these sites, but cingulate xenarthrans and microbiotherian marsupials may have originated in the tropics during this interval. New middle Eocene mammals from Contamana, Peru (LL) mostly remain undescribed but are noteworthy in including the oldest rodents in South America, suggesting a LL tropical origin for caviomorphs. Pyrotheres may also have originated in the LL tropics by the late Eocene.

The earliest interval for which detailed time-correlated comparisons of tropical and extra-tropical localities are possible is the late Oligocene. Such studies reveal few clear examples of supragenerically endemism in the Neotropics, but argyrolagid and caenolestoid marsupials and tolypeutine armadillos may have originated in the ML tropics by this time. By the early Miocene, distributions of some suprageneric clades, such as mesotheriid notoungulates and chinchillid rodents, clearly differ among LL and ML Neotropical localities and between tropical and extratropical regions. This pattern persists into the middle Miocene with these and other groups. Primates become restricted to tropical latitudes during the middle Miocene and groups such as pampatheres may have originated in LL areas by this time. Range contractions of older lineages into the tropics and extratropical expansions of newly originating clades continues into the late Miocene and Pliocene. Mammals such as astrapotheres are last recorded in LL localities during this interval. Neotropical evidence of the earliest stages of the Great American Biotic Interchange is surprisingly scarce, but a proboscidean and artiodactyls from the LL Madre de Dios Formation have been proposed to represent its first phase in South America.

Edwin H. and Margaret M. Colbert Prize Competition (posters displayed October 17 - 20, judging occurs Thursday, October 18)

MODELING FUNCTIONAL TRADE-OFFS OF TEETH FROM EXTINCT AND EXTANT HARD PREY CRUSHING TAXA

CROFTS, Stephanie B., University of Washington, Seattle, Seattle, WA, United States

The dense mineral composition of teeth, especially enamel and enameloid layers, means that they are commonly found in the fossil record. Because of the tight connection between tooth morphology and function, tooth shape is often used to infer the diet of organisms; and tooth morphologies are generally placed in one of three categories: cutting, piercing, and crushing. Experiments measuring the mechanics of cutting blades and puncturing devices, as well as experimental measurements of tooth performance in these two categories have found that notched blades reduce the energy needed to cut through animal flesh, and that the need to prevent tooth failure leads to a trade-off in the ability of canine teeth to puncture flesh. In this study I set out to test the relative ability of different tooth morphologies to crush prey items. I constructed four series of archetypal tooth models that graded from one morphological extreme to another, covering the range of morphologies used for durophagy. Using a tooth with a flat occlusal surface as 'tooth zero,' I varied the degree of convexity and concavity of the occlusal surface to generate two series of models. To generate the other two series, I added a conical stress concentrator to the center of the occlusal surface and changed its morphology. To vary the shape I changed two parameters: the height, or how far a force concentrator would extend above the occlusal surface of 'tooth zero,' and the radius, which determined how far the base of the force concentrator spread over the occlusal surface 'tooth zero.' By mounting these models in a materials testing system, I was able to measure the force needed by these shapes to crush morphologically and compositionally identical prey items. I compared these results to finite element models of these same tooth shapes to determine whether prey-breaking or prevention of tooth breakage plays a more important role in the evolution of crushing tooth shape. Based on these two data sets, it appears that there is a trade-off, similar to that seen in puncturing teeth, between tooth shape durability and tooth function.

Poster Session IV (Saturday, October 20, 4:15 - 6:15 pm)

***OGMOPHIS, CALAMAGRAS* AND THE 32 MILLION YEAR OLD AGGREGATION OF SNAKES FROM THE WHITE RIVER FORMATION: ARE THEY ERYCINES?**

CROGHAN, Jasmine A., University of Alberta, Edmonton, AB, Canada; CALDWELL, Michael W., University of Alberta, Edmonton, AB, Canada

Fossil taxa attributed to the Erycinae, like many other fossil snakes, are defined almost entirely by vertebral forms. The 'erycine' serpent aggregation from the Oligocene White River Formation consists of four largely complete and articulated individuals, including skulls. The observed vertebral variation, rostral to caudal, provides a unique opportunity to identify potential overlap of existing vertebral form taxa with the columnar variation present in these four individuals. More importantly, these complete skeletons, rich in critical anatomical details, provide key data for synonymizing numerous vertebral form taxa and for systematizing these animals using complete skeletal data. For example, the caudal vertebrae visible on the specimens do not display the additional complex processes definitive of Erycinae with the exceptions of *Lichanura* and *Albaneryx*. The mid trunk vertebrae of the Oligocene aggregation possess low neural spines and flattened neural arches (similar to modern Erycinae), yet vary throughout the vertebral columns of all four individuals. Vertebral descriptions at the subfamilial, generic, and importantly, the species level, are loosely defined in extant erycines. Therefore, the previous assignment of these snakes to *Ogmophis* sp. and *Calamagras* sp., or to any other genus of erycine, extant or extinct, is presently unsupported. External examination of the available skulls revealed the presence of one cranial character attributable to Erycinae: a lacrimal foramen not entirely surrounded by the prefrontal bone. Preliminary analysis of the individuals in this White River ophidian aggregation demonstrates the presence of three out of the six diagnostic features of the subfamily Erycinae, and strongly suggests that these specimens require recognition as new taxa, not as *Ogmophis* or *Calamagras*.

Poster Session IV (Saturday, October 20, 4:15 - 6:15 pm)

FUNCTIONAL MECHANICS OF ORNITHOMIMOSAUR CRANIA COMPARED TO OTHER THEROPODS

CUFF, Andrew R., University of Bristol, Bristol, United Kingdom; RAYFIELD, Emily J., University of Bristol, Bristol, United Kingdom

Ornithomimosaurs have long been referred to as ostrich mimicking dinosaurs due to their apparent cranial convergence with many of the extant palaeognaths. Both groups possess lightweight skulls with large orbits and derived ornithomimosaurs become edentulous and possess a keratinous rhamphotheca. Whether this convergence is superficial or functional is of importance to understanding the evolution of this group and theropods in general. The skulls of three ornithomimosaurs (*Garudimimus* and the ornithomimids *Struthiomimus* and *Ornithomimus*) were digitally reconstructed using CT scan data. Virtual muscles were recreated using osteological correlates, from which bite forces were calculated. Hypothetical beaks that cover the rostrum were created based on known fossils and modern birds to study their effects. Finite element models were run using the muscle loads. Geometric morphometric methods allowed us to compare the deformation undergone by the skull in addition to analysing strain patterns. These were then compared to an ostrich model that was validated by the author, and previous finite element studies of other theropods (*Allosaurus* and *Coelophysis*).

Results show that sutures play a role in reducing overall strain in skulls. As with the ostrich skull, using a homogeneous material property with a Youngs modulus less than that of cortical bone makes a good compromise when sutures are not easily segmented from CT scans. Beaks reduce strain in the skulls, with more extensive morphologies capable of much higher feeding loads. The derived ornithomimids have smaller muscle loads but strain similarly to the more primitive *Garudimimus*. When scaled to the same sizes and loaded equivalently the derived species deform differently suggesting that they might be exploiting different diets. Based on the results we suggest that derived ornithomimids experience more similar strain patterns to those of ostriches, but ostrich skulls experience higher strain magnitudes under equivalent loads.

When compared to typically carnivorous theropods (*Allosaurus* and *Coelophysis*) ornithomimosaurs have very different strain patterns due to their edentate nature which are exaggerated by the presence of a beak. This has implications for feeding method and may be linked to the hypothetical herbivorous diets of the ornithomimosaurs and the repeated evolution of beaks in theropod dinosaurs.

Technical Session I (Wednesday, October 17, 10:15 am)

MULTI-ELEMENT HISTOLOGICAL ANALYSIS OF AN ORNITHOMIMID (DINOSAURIA) BONE BED FROM THE HORSESHOE CANYON FORMATION, ALBERTA

CULLEN, Thomas M., Carleton University, Ottawa, ON, Canada; RYAN, Michael J., Cleveland Museum of Natural History, Cleveland, OH, United States; EVANS, David C., Royal Ontario Museum, Toronto, ON, Canada; CURRIE, Philip J., University of Alberta, Edmonton, AB, Canada; KOBAYASHI, Yoshitsugu, Hokkaido University Museum, Sapporo, Japan

Data from bone beds and osteological microstructure provide information from which hypotheses regarding ontogeny, metabolism, ecology, and behaviors of ancient vertebrates can be established. Multiple hind limb elements (femora, fibulae, tibiae, metatarsals, and pedal phalanges) from three individuals from the first North American bone bed of Late Cretaceous ornithomimids were examined histologically. Each specimen showed