Technical Session II, Wednesday 11:15

FEEDING MECHANISM OF LARGE MESOZOIC FOSSIL CHIMAEROIDS (CHONDRICHTHYES, HOLOCEPHALI): HOW LARGE A SHELL COULD THEY CRUSH?

SHIN, Ji-Yeon, University of California, Davis, Davis, CA, USA; MOTANI, Ryosuke, University of California, Davis, Davis, CA, USA

Holocephalans are well adapted to durophagy, feeding upon hard prey, with their massive toothplates equipped with hypermineralized pads providing a molariform-crushing surface called tritors. Some fossil chimaeroids possessed the largest toothplates (up to 20cm long) known in holocephalans, suggesting they could have consumed larger and stronger prey than their living relatives. *Edaphodon* commonly co-occurs in the Cretaceous with inoceramids, which could reach more than 1m in length and up to 1cm in shell thickness. So it is important to test if the genus could crush some of these large bivalves. I estimated the maximum theoretical bite force in two fossil chimaeroid genera, *Ischyodus* and *Edaphodon*, to determine their feeding performance. Bite force was calculated using lever mechanics and estimated cross-sectional areas of adductor mandibulae muscles. A preliminary theoretical bite force analysis suggested a range of 210-866N from anteriorly to posteriorly in the jaw of *Edaphodon* (estimated total length of 305cm) and 232-939N for *Ischyodus* (333cm). Published data on the extant chimaeroid, *Hydrolagus colliei* (body size range of 21-44cm) show that bite force ranges from 11-191N including both anterior and posterior values. I also measured shell strength of the extant bivalve *Tapes philippinarum* and the gastropod *Tegula funebralis* to compare the values with the calculated theoretical bite forces. During the shell strength analysis, metal casts of *Edaphodon* toothplates were attached to a stress analyzer to investigate the crushing performance of the tritors. The crushing test showed that tritors not only provided crushing surface but also held and stabilized the prey effectively. The measured shell strength ranged from 52-253N for bivalves with shell lengths 3.2-5.3cm and 107-908N for gastropods with shell lengths 1.1-2.7cm. Bite force estimates and extrapolations from the shell strength measurements suggest that *Ischyodus* and *Edaphodon* were capable of generating sufficient bite force to consume bivalves within gape size limitations while crushing rigid gastropod shells were mechanically challenging.

Technical Session XVI, Saturday 9:15

PHYLOGENETIC ANALYSIS OF RELATONSHIPS AMONG TRADITIONAL FAMILIES OF NOTUNGULATA USING POSTCRANIAL CHARACTERS

SHOCKEY, Bruce, Manhattan College and AMNH, New York, NY, USA; FLYNN, John, American Museum of Natural History, New York, NY, USA; CROFT, Darin , Case Western Reserve University, Cleveland, OH, USA; WYSS, André , University of California, Santa Barbara, Santa Barbara, CA, USA; NEINAST, Alexandra, New York University, New York, NY, USA

Proposed hypotheses for intraordinal relationships of Notoungulata consistently have shown two post-Eocene clades, Typotheria and Toxodontia, as well as some early Cenozoic basal groups (e.g., Henricosborniidae, Notostylopidae). Although recent phylogenetic analyses have rigorously examined within-family relationships, little has been published on inter-familial relationships. Most have concentrated on cranio-dental morphology, leaving the postcranial skeleton largely unexplored. The present phylogenetic work, a component of a larger multi-system investigation of notoungulate phylogeny, thus focuses on the postcranial skeleton. This analysis fails to provide support for the traditional Typotheria-Toxodontia dichotomy. The "advanced Toxodontia" (including leontiniids, notohippids, and toxodontids) can be recognized by postcranial synapomorphies, including neckless astragalus, down-curved olecranon process, and lack of a medial epicondylar foramen of the humerus. The "advanced Toxodontia" further share an enlarged, subquadrate fibular facet of the calcaneum and a nearly vertical ectal articulation between the calcaneum and astragalus with *Eurygenium pacegnum* (previously considered a notohippid) and interatheriine interatheriids, a group traditionally placed in the Typotheria (postcranial skeleton of basal interatheriids remains unknown). In conflict with previous hypotheses, no postcranial characters unite the Isotemnidae with other taxa typically placed in the Toxodontia. Typotheria, as generally recognized, appear to be paraphyletic relative to "advanced toxodonts". Of the typothere taxa for which postcranial material are known, the Mesotheriidae possess a robust form of an otherwise plesiomorphic notoungulate skeleton: pentadactyl hands and feet, short, uncompacted metapodia, upwardly curved olecranon process, astragalus with elongated neck and with separation of tibial trochlea from the digital flexor groove. Mesotheriine mesotheres, however, are characterized by a distinctive pelvis having extra fused sacral vertebrae (up to 9) and ischium-sacrum fusion. Hegetotheres show fusion of the tibia and fibula, which is extensive (rabbit-like) in the pachyrukhines.

New Perspectives on the Early Evolutionary History of the Synapsida, Saturday 11:45

NEW INFORMATION ABOUT CYNODONTS FROM THE MIDDLE TRIASSIC MANDA BEDS (RUHUHU BASIN) OF TANZANIA

SIDOR, Christian, University of Washington, Seattle, WA, USA; KENNETH, Angielczyk, The Field Museum, Chicago, IL, USA; HOPSON, James, University of Chicago, Chicago, IL, USA; KAMMERER, Christian, University of Chicago, Chicago, IL, USA; SMITH, Roger, South African Museum, Cape Town, South Africa

The Ruhuhu Basin of southern Tanzania is one of several rift basins in East Africa containing nonmarine rocks broadly contemporaneous with those of the South African Karoo. Expeditions to the Ruhuhu in the 1930s and 1960s recognized the presence of several fossiliferous horizons containing Permian and Triassic tetrapods. In 2007 and 2008, our team returned to the Ruhuhu to make the first paleontological collections in over 40 years. The most abundant therapsid fossils collected in the Lifua Member of the Manda Beds were the remains of cynodonts, including *Aleodon*, *Cricodon*, *Scalenodon angustifrons*, and '*Scalenodon*' *hirschsoni*. Historical collections of these taxa are typically limited to a few, mostly fragmentary, specimens. Our fieldwork has produced extensive well-preserved cranial and postcranial materials, many representing the first known postcranial elements for their respective taxa. The probainognathian *Aleodon brachyrhamphus* numerically dominates the new collection, with partial skulls, isolated jaws, and postcranial elements. The new collection also includes multiple complete skulls of the traversodontid *Scalenodon angustifrons* and cranial and postcranial materials of the trirachodontid *Cricodon metabolus*. In addition to the completeness and fine preservation of the new fossils, this collection is remarkable for including growth series for *S. angustifrons* and *Aleodon*. The Manda cynodont fauna is comparable to the Anisian faunas of the *Cynognathus* C Zone in South Africa, the upper Omingonde Formation in Namibia, and upper N'tawere Formation in Zambia. However, the Tanzanian fauna is more diverse taxonomically, with seven nominal species (those noted above plus *Luangwa*, '*Scalenodon*' *attridgei*, and '*S.*' *charigi*). Moreover, none of the other African cynodont faunas co-occur with abundant archosauriforms, suggesting that the Manda preserves a distinct habitat. Ongoing preparation and analysis of the new cynodont material will shed light on character polarities within Eucynodontia and Traversodontidae, as well as on the phylogenetic position of taxa such as *Aleodon*.

Romer Prize Session, Thursday 9:45

THE FIRST COMPLETE SKELETAL DESCRIPTION OF THE PUTATIVE STEM LISSAMPHIBIAN *DOLESERPETON* (TEMNOSPONDYLI: DISSOROPHOIDEA) SHEDS NEW LIGHT ON THE ORIGIN OF MODERN AMPHIBIANS

SIGURDSEN, Trond, McGill University, Montreal, QB, Canada

The Permian amphibamid *Doleserpeton* has often been suggested as a close relative of modern amphibians (Lissamphibia), but the skeletal morphology of this important form has never been described in full. An overview of its anatomy reveals numerous features that shed light on the origin of lissamphibians. As in other amphibamids, the interpterygoid vacuities of *Doleserpeton* are bordered by the pterygoid, parasphenoid, vomer, and palatine elements, but the palate lacks the ectopterygoid bone. These traits are shared with anurans, caudates (although the palatine is absent in salamanders), and the primitive Jurassic caecilian *Eocaecilia*. These taxa also share the presence of a transverse tooth row on the vomer with *Doleserpeton*. Such features are usually absent in lepospondyls and primitive tetrapods. The otic region and hearing system resemble those of anurans, as has been pointed out by several authors. The postcranial skeleton of *Doleserpeton* is in some regards typical for temnospondyls. However, it has a combination of primitive and derived traits that are consistent with lissamphibian affinities. Since it was first noted that *Doleserpeton* had pedicellate bicuspid teeth, a number of other fossil forms have been described as having tooth morphologies similar to those of modern amphibians. A review of these descriptions reveals that *Doleserpeton* remains the Paleozoic taxon with the most lissamphibian-like tooth morphology, including an elongated cylindrical base (pedicel) easily separated from a bicuspid crown. Phylogenetic analyses of amphibamids using both Bayesian inference and maximum parsimony reveal problems with previous phylogenies. The amphibamid morphology is closer to the primitive temnospondyl condition than previously published character matrices indicate, and the interrelationships of individual amphibamid taxa are still poorly resolved. However, the derived features seen in such dissorophoid taxa as *Apateon*, *Gerobatrachus*, and *Dolseserpeton* support the theory of lissamphibian origins within a paraphyletic Dissorophoidea.

Technical Session XIII, Friday 4:15

NEW INFORMATION ON THE MORPHOLOGY OF EMBRYONIC PROTOCERATOPSIAN AND HATCHLING ANKYLOSAUR DINOSAURS FROM BAYAN MANDAHU (INNER MONGOLIA, CHINA), USING MICRO-CT.

SISSONS, Robin, University of Alberta, Edmonton, AB, Canada

Excellent embryonic and hatchling dinosaur specimens were collected in 1988 and 1990 during the Sino-Canadian dinosaur expeditions in the Campanian redbeds of the Bayan Mandahu Formation (Inner Mongolian, China). Cranial and post-cranial material of two protoceratopsians and one ankylosaur, studied with the help of micro-CT data, represent the most complete neonate specimens described from the Gate and North Canyon areas of Bayan Mandahu. An embryonic protoceratopsian, cf. *Bagaceratops* (IVPP V16281), includes most of the skull and mandibles. A second embryonic specimen of cf. *Bagaceratops* (IVPP V16282) preserves a pair of mandibles and much of the postcranium. A partial cranium and postcranial skeleton of a hatchling ankylosaurian, cf. *Pinacosaurus*, was also collected. The protoceratopsian skull is truncated posteriorly, with several elements partially disarticulated and taphonomically shifted. Two structures on the tip of the rostral may have had a function similar to that of an egg tooth, the first such report in ornithischian dinosaurs. Despite being comparable to *Bagaceratops*, the nasals do not have a distinct horn core, although it is a very small structure in other juveniles of this taxon, and may not yet have been present in such a small individual. The predentary, even in an embryonic individual, is fully fused as one midline element, with no evidence of a bilateral origin as suggested by some researchers. Of