

Province in northeastern China and in Gansu Province and the Inner Mongolian Autonomous Region in northwestern China. Taxa described in the last ten years include the psittacosaurid *Hongshanosaurus* (You et al. 2003), and basal neoceratopsians *Archaeoceratops* (Dong and Azuma 1997), *Chaoyangsaurus* (Zhao et al. 1999), *Magnirostris* (You and Dong 2003), and *Auroraceratops* (You et al. 2005). *Auroraceratops* from the Mazongshan region of Gansu is short-faced and has very broad nasals and frontals, giving the skull a turtle-like appearance. Other autapomorphies include blunt, striated premaxillary teeth and a mushroom-cap expansion of the dorsal end of the lacrimal. *Auroraceratops* shares several apomorphies with more derived ceratopsians, including exclusion of the basioccipital from the foramen magnum and a broad, deep coronoid process. *Auroraceratops* occupies a derived position within basal Neoceratopsia, and is more derived than *Liaoceratops* and *Archaeoceratops* but is less derived than *Protoceratops* and other coronosaurs. Exquisite preservation and delicate preparation of the new specimens permits access to poorly described palatal structures, allowing important new details to be detected. Evolutionary trends in the palate and in dental features are elucidated.

Marine Reptiles Symposium, Wednesday 2:30

A PHYLOGENY OF PLESIOSAURIA (SAUROPTERYGIA), WITH EMPHASIS ON THE SYSTEMATIC STATUS OF *LEPTOCLEIDUS*, ANDREWS 1922

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Leptocleidus Andrews, 1922 is a poorly known plesiosaur genus from Lower Cretaceous successions of the UK, South Africa, and Australia. Historically, there has been little consensus regarding its phylogenetic position within Plesiosauria, largely due to its unusual combination of a relatively small skull and short neck. As a result, a diverse array of potential sister groups have been posited for *Leptocleidus*, including long-necked Cretaceous elasmosaurids, Early Jurassic "rhomaleosaurs", and Middle to Late Jurassic pliosaurids. A cladistic analysis including *Leptocleidus*, and a new, apparently morphologically similar specimen from Alberta, TMP 94.122.01, was undertaken to assess their phylogenetic position within Plesiosauria.

A character-taxon matrix was assembled afresh, consisting of 28 taxa sampled broadly among plesiosaurs, scored for 152 critically reanalyzed and redefined cranial and postcranial characters. The results indicate a basal dichotomous split into the traditionally recognized pliosauroid and plesiosauroid clades. Nested within Pliosauroida, a monophyletic Leptocleididae was recovered, consisting of *L. superstes*, *L. capensis*, and an unnamed Australian taxon AM F99374. In contrast to earlier suggestions, *Leptocleidus* neither clusters with *Rhomaleosaurus*, which was found to be paraphyletic, nor with large-skulled pliosaurid taxa, such as *Simolestes*. Rather, a sister group relationship between Cretaceous Polycotylidae and Leptocleididae was recovered. Although TMP 94.122.01 is superficially similar to *Leptocleidus*, several discrete characters of the skull indicate that this new taxon is nested within Polycotylidae.

Poster Session II

TYMPANIC PNEUMATICITY IN ARCHOSAURIA: RECOGNIZING PATTERNS OF ORGANIZATION AND HOMOLOGY

DUFEAU, David, WITMER, Lawrence, Ohio Univ., Athens, OH

The tympanic cavity of archosaurs gives rise to a variety of epithelial diverticula that pneumatize the bones of the braincase and suspensorium. Tympanic pneumaticity is not well understood with regard to its ontogeny, morphological variability, and phylogenetic distribution. Moreover, the relationship of true tympanic pneumaticity to other pharyngeal pneumatic systems in the braincase has been completely unexplored. We present here a preliminary survey of braincase pneumaticity in Archosauria and tests of homologies of the associated pneumatic recesses. Methods include computed X-ray tomography (CT), microCT, and 3D visualization of the CT scan data, which together provide a detailed characterization of the pneumatic recesses relative to the skeleton, otic labyrinth, and brain cavity. Additionally, CT scans of extant taxa, coupled with dissection, give insight into the soft-tissue associations of the diverticula. To shed light on the highly derived condition of adult crocodylians, ontogeny of pneumatic sinuses is being traced via microCT in a growth series of American alligator. Morphological similarities between examined fossils and extant taxa were examined in a phylogenetic context, allowing tests of hypotheses of homology. Of particular interest is the evolution of the modern condition in the two clades of extant archosaurs. Study of the avian condition is further advanced, and focal theropod taxa include the ceratosaur *Majungasaurus*, the allosauroids *Acrocanthosaurus* and *Allosaurus*, as well as nonavian coelurosaurs such as tyrannosaurids, oviraptorosaurs, ornithomimids, troodontids, and dromaeosaurids. Homologies of median pharyngeal sinuses in the basiscrania of archosaurs remain equivocal. The rostral tympanic recess, however, is the most widely distributed of the paratympanic sinuses whereas the dorsal tympanic recess may be restricted to coelurosaurian clades where it shows high levels of homoplasy.

3D Imaging Symposium, Friday 11:15

3D IMAGING AND BIOMECHANICS: BRINGING 3D FINITE ELEMENT MODELING TO COMPARATIVE BIOLOGY

DUMONT, Elizabeth, WERLE, Sean, GROSSE, Ian, UMass Amherst, Amherst, MA
The development of 3D imaging techniques has given comparative morphologists the ability to visualize and compare structures in exciting new ways. Work in our lab focuses on taking 3D data a step beyond imaging by transforming them into finite element models that serve as the basis of comparative biomechanical analyses. Finite element analysis (FEA) is

a physics-based numerical technique routinely used by engineers to predict and optimize the behavior of engineered products. FEA is relatively new to functional morphology but clearly can provide a truly novel qualitative, as well as quantitative, perspective on form-function relationships. In the engineering world, engineers use powerful computer aided design (CAD) tools to rapidly create a mathematically geometric model of the product that is required for FEA. However, in the biological world geometries of organic systems are highly irregular and not amenable to construction by CAD tools. Instead, the complex geometries of many biological structures must be digitally reconstructed from stacks of 2-D image scans. This digital reconstruction process from raw image data to 3-D mathematical geometric models is the most significant impediment to the widespread use of comparative FEA. Our lab has been working to simplify this process and thus make FEA more available to vertebrate morphologists. In this symposium, we present new, efficient methodologies which facilitate the development of finite element models of vertebrate structures. The development of these improved finite element modeling techniques are part of a larger research project to study the biomechanical links between cranial morphology, bite force and biting behavior in mammalian evolution.

Marine Reptiles Symposium, Wednesday 5:00

AIGIALOSAUR MORPHOLOGY: IMPLICATIONS FOR MOSASAUROID SYSTEMATICS

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Aigialosaurs are a group of Cenomanian and Turonian squamates found in marine rocks of Croatia, Slovenia, Italy, Israel, and Mexico. Aigialosaurs are typically diagnosed by a series of cranial synapomorphies, including an intramandibular hinge and sickle-shaped quadrate morphology, and a postcranial morphology very similar to that of extant varanids. While only half a dozen relatively complete specimens are known worldwide, the systematic relationships of aigialosaurs are important due to their hypothesized basal positions within Mosasauroida (aigialosaurs and mosasaurs).

In numerous systematic analyses of the mosasauroid lineage aigialosaurs have been found to represent a paraphyletic assemblage of sequential sister taxa to the family Mosasauridae. However, a recent study found that several aigialosaur taxa actually nested within the family Mosasauridae, suggesting that the paddle-like limb of mosasaurs evolved on several separate occasions.

Examination of the data matrix used in this most recent analysis showed a large amount of missing data amongst aigialosaur taxa, resulting in large amounts of homoplasy in the preferred trees. In an attempt to fill in as much of the missing data as possible, several of the key basal taxa were reexamined. *Aigialosaurus dalmaticus* and *Opetiosaurus buccichi*, the two most complete aigialosaur specimens, were redescribed and the resulting anatomical information was added to the existing data matrix. Ensuing trees that incorporated the new and modified data showed little support for multiple evolutionary origins of the paddle-like limb in mosasauroids. However, the relationships of aigialosaurs remain poorly resolved, indicating the need for new specimens and further examination of key taxa, the 'Trieste aigialosaur' in particular.

Poster Session III

FRESHWATER HYBODONT SHARKS FROM THE LOWER CRETACEOUS OF SAHARA

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The Elrhaz Formation (Aptian) of the Gadoufoua area in north-eastern Niger has yielded an abundant vertebrate fauna for around 40 years. Most of the taxa are terrestrial and they belong to turtles (*Platycheiloides*, *Teneremys*, *Taquetochelys*), crocodiles (*Anatosuchus*, *Sarcosuchus*, *Stolokrosuchus*), and dinosaurs (*Lurdusaurus*, *Ouranosaurus*, *Nigersaurus*, *Suchomimus*). Freshwater taxa have also been recorded (Unionids, *Mawsonia*, *Asiatoceratodus*, *Pliodetes*).

Recent fieldwork in the Elrhaz Fm has focused on the research of microsites. Tons of raw sediment have been sampled via dry screening, underwater screen washing and heavy liquid separated. Thousands of fossil remains have been found and numerous teeth of elasmobranchs have been sorted under binoculars. At least a hundred teeth of two taxa of hybodont sharks have been found. A first set of teeth have crowns with a principal low and rounded cusps with two or three pairs of lateral cusplets decreasing in size laterally. The roots have an anaulachorize stage. This tooth morphology suggests a strong relationship with the genus *Polyacrodus*. The second set of teeth is more numerous (around 200). The teeth are small (less than 2.5 mm), gracile, and narrow labiolingually. The crowns are unornamented with any cusp. The occlusal face shows a crushing surface. The roots are wider than the lowermost part of the crown as in the teeth of *Lonchidion*. The roots have small foramina placed irregularly but with a holaulachorize stage. If this kind of tooth belongs to a hybodont taxon, this last character is unusual among this clade and the relationships with previously described taxon is difficult. In front of these isolated teeth, some fin spines of hybodonts have been found *in situ*. They are striated. A complete one is 100 mm long.

Wednesday 2:30

THE HESPERORNITHIFORM BIRD *ASIAHESPERORNIS* FROM KUSHMURUN, NORTHERN KAZAKHSTAN

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