Poster Session A

THE FIRST TRITYLODONT FROM THE MESOZOIC IN MONGOLIA

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The first tritylodont specimen was found by the Hayashibara Museum of Natural Sciences - Mongolian Paleontological Center Joint Paleontological Expedition in 2002 from the Upper Jurassic or Lower Cretaceous continental red beds in Shar Teg (Gobi Altai Aimag) in western Mongolia. The specimen is a fragmented skull with lower jaw that was preserved in a concretion in a red mudstone layer of the Ulan Malgait Beds. The beds also yielded several crocodilian forms (small and large), turtles, a sauropod skeleton, and theropod bones.

The tritylodont specimen shows four upper postcanine teeth *in situ*, and four lower postcanines *in situ* in function. It has three upper incisors among which the second is largest. There is one lower incisor with large size and its root occupies large part of the symphysis. The snout portion is short and robust. The upper postcanine teeth exhibit porportionally large buccolingual width. The lateral, medial and internal (lingual) row on an upper tooth have respectively 2, 2, and 3 cusps. The size of the tooth (mesiodistal length: 7.42mm; buccolingual width: 10.12mm for example) is large among ever discovered tritylodonts in China and North America.

The dental and rostral morphology of the specimen differs from that observed in Chinese taxa such as *Bienotherium*, *Bienotheroides*, and *Yunnanodon*, and from North American forms such as *Kayentatherium* and *Oligokyphus*. The dental morphology (not in size) of the specimen is similar to that of *Xenocretosuchus* from Shestakovo, Kemerovo region of western Siberia, Russia (Lower Cretaceous). The geologic age of the red beds in Shar Teg is still controversial. However, the specimen gives new data on biogeographical and geochronological range of the Tritylodonta.

Wednesday, 11:45

SKELETAL PNEUMATICITY IN SAURISCHIAN DINOSAURS AND ITS IMPLICATIONS FOR MASS ESTIMATES

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The vertebrae of most sauropods and theropods have large foramina that lead to internal chambers. In life, these chambers housed pneumatic diverticula similar to those of birds. Many authors have commented on the weight-saving construction of saurischian vertebrae, but no one has quantified how much mass was saved by skeletal pneumatization. To determine the volume of air in pneumatic vertebrae of sauropods and theropods, I analyzed cross-sections from CT scans and photographs of cut specimens. I propose the Air Space Proportion (ASP) as a measure of the proportional volume of air in pneumatic bones. The ASPs of a large sample of sauropod and theropod vertebrae range from 0.32 to 0.89, with a mean of 0.60. This means that, on average, air occupied more than half of the volume of pneumatic saurischian vertebrae. Three other features of the ASP values are noteworthy. First, these values are very similar to the range and mean of ASPs for pneumatic long bones of extant birds. Second, the brachiosaurid sauropod *Sauroposeidon* has the highest ASP values, up to a remarkable 0.89. A high ASP is an autapomorphy of *Sauroposeidon*, and may have evolved to lighten its long neck. Finally, ASPs appear to be independent of the internal complexity of the vertebrae. The mean values for all taxa other than *Sauroposeidon* fall between 0.50 and 0.60, regardless of whether their vertebrae are camerate or camellate. This indicates that the evolution of complex internal structures from simple ones involved a redistribution rather than a reduction of bony tissue within the vertebrae.

ASP data may be used to account for skeletal pneumaticity in volumetric mass estimates. In *Diplodocus* and *Tyrannosaurus*, skeletal pneumatization is calculated to have lightened the animals by 7-10%—and that does not include the extraskeletal diverticula, pulmonary air sacs, lungs, or tracheae. If all of these air reservoirs are taken into account, the specific gravities of *Diplodocus* and *Tyrannosaurus* are 0.80 and 0.82, respectively. These values are higher than published values for birds, but lower than those for squamates and crocodilians.

Poster Session B

ATTACK BEHAVIOR OF TYRANNOSAURID DINOSAUR(S): CRETACEOUS CRIME SCENES, REALLY OLD EVIDENCE, & "SMOKING GUNS"

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Dinosaur paleopathology provides proxy evidence for various types of behaviors and species interactions in the fossil record. Bite marks suggest activity such as feeding, scavenging and predation. Healed bite marks provide direct evidence of predation and hunting behavior that would otherwise be unknown and in such cases provide evidence of failed predation.

We describe a rib from an adult lambeosaurine hadrosaur from the This Side of Hell Quarry, in northern Wyoming. The rib, from the skeleton of a lambeosaur, nicknamed "Lucky," shows extensive exostosis around the impression of a large tooth. Lucky's rib was "shaved" as the tooth slid along it and the rib was permanently twisted from the torque and crushing force that was supplied to the living tissue during the attack bite. The tooth embedded itself in the bone during a clear attempt to rip the rib from the body of the lambeosaur. The attempt failed and the rib was ripped almost subparallel to its long axis. The rib healed around a hole that provides an outline of the tooth, leaving a permanent gape with an arching bridge. The tooth that most closely fits the outline most likely belonged to an adult tyrannosaurid dinosaur. This is being studied further using three-dimensional scanning methods and rapid prototyping. Adjacent ribs show signs of suppuration suggesting Lucky survived a massive infection that occurred after the failed attack. It may have taken up to 1-2 years for the complete healing of such a wound based on studies of modern animals, suggesting that the injury to the ribs happened a number of years before the dinosaur's final demise.

Poster Session A

THE TEIID LIZARD *PENETEIUS* DISCOVERED IN THE UPPER CRETACEOUS NAASHOIBITO MEMBER OF THE KIRTLAND FORMATION, SAN JUAN BASIN, NEW MEXICO

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Four teeth from the Naashoibito Member of the Kirtland Formation can be referred to the unusual teiid lizard *Peneteius*. Specimens NMMNH P-36544, P-41223, P-41224, and an as yet uncatalogued specimen were recovered by screenwashing from NMMNH locality L4005. The locality has also yielded mammal teeth, including the Lancian (Maastrichtian) index taxon *Essonodon browni*, dinosaurs, crocodilians, turtles, a salamander, and jaw fragments of other squamates.

P-41223 is an isolated lower tooth. It is antero-posteriorly compressed and has transversely oriented, bicuspid crowns. A transversely oriented, U-shaped ridge connects these cusps. P-36544 and P-41224 are upper teeth. Each of the upper teeth has a subpleurodont attachment to a fragment of maxilla. The maxillary fragment has a wide, shallow supradental gutter. The teeth each have six cusps arranged in three parallel, transversely oriented pairs. The central pair is the largest and is connected by a sharp, transversely oriented, V-shaped ridge and is flanked by the anterior and posterior pairs of cusps, each connected by smaller and lower U-shaped ridges. Isolated osteoderms (P-36543) from locality L4005 may belong to the same taxon.

The age of the Naashoibito has proven difficult to constrain by means other than vertebrate biostratigraphic correlation, as the unit is bounded by erosional surfaces and has yielded no diagnostic palynomorphs or datable volcanic ashes. While the *Peneteius* teeth from L4005 closely resemble the teeth of *P. aquilonius*, from the upper Maastrichtian Hell Creek Formation of Montana, *Peneteius* is also known from the Campanian of Utah and Texas. Thus, its presence in the Naashoibito is consistent with a Maastrichtian age but is not a narrow constraint.

Thursday, 10:30

THE SKULL OF *POSTOSUCHUS KIRKPATRICKI* AND ITS SIGNIFICANCE FOR A RELATIONSHIP WITH CROCODYLOMORPHS

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Postosuchus was an apex predator in North American terrestrial ecosystems during the Late Triassic Period, when rauisuchids like *Postosuchus* represent the largest predators, reaching lengths of 9-10 meters. Recent phylogenetic analyses of extinct suchian archosaurs have used *Postosuchus kirkpatricki* as the outgroup to crocodylomorphs. However, since these analyses have been based on characters from previous descriptions of *Postosuchus*, they are dubious because many details of the holotype skull of *Postosuchus*, TTUP-9000, had been obscured by plaster, wire mesh, and paint.

Subsequent preparation of the type material by the author has revealed an almost complete, well-preserved skull that differs significantly from previous descriptions. For this study, all other known *Postosuchus* skull material was examined as well. The bifurcated infratemporal fenestra is confirmed. New or undescribed details of the skull include: the sutural articulations of the maxilla, nasal, frontal, lacrimal, prefrontal, and jugal/quadratojugal are significantly different than previously recognized, the presence of sculpture on numerous dermal skull elements, a complex and enlarged olfactory system, and the shape of the mandibular fenestra. Other characters are shared between *Postosuchus* and crocodylomorphs, including; a highly reduced prefrontal with a descending process, a squamosal with a broad lateral expansion over the temporal region, the contact of the quadratojugal with the postorbital, and the jugal excluded from the posterior margin of the antorbital fenestra. These synapomorphies and other characters, strongly indicate a sistergroup relationship of *Postosuchus* and related rauisuchid archosaurs with crocodylomorphs.

Poster Session A

BITE FORCE ESTIMATES FOR NON-AVIAN THEROPODS

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A biomechanical approach is used to estimate bite force in non-avian theropods. Mandibles can be modeled as beams undergoing a bending load during food ingestion. Assuming similar bone properties and solid mandibles, the bite force applied at middentary (~mid-tooth row) should be proportional to the external dimensions of the mandibular corpus and inversely proportional to the distance from the articulation (Zx/L). Thus, comparison of Zx/L values with those of extant taxa (*Varanus komodoensis* and *Alligator mississippiensis*) can provide an idea of relative bite force if all mandibles are equally approximated by a solid beam model.