

cetes *Basilosaurus isis* and *Dorudon atrox* dominate the early Priabonian interval that has yielded the most whales to date, but several additional species are present. We have mapped literally hundreds of well preserved specimens of *Basilosaurus* and *Dorudon*. Subadult specimens of *Dorudon atrox* are common, providing a basis for growth studies but obscuring achievement of recognizable differences in adult specimens. All *Basilosaurus isis* specimens found to date are adult, and these sort into subtly larger and smaller specimens. Discovery that the protocetid *Maiacetus inuus* is dimorphic raises the question of sexual dimorphism in *Basilosaurus* and other basilosaurids. In *Maiacetus* the male specimen averages about 12% larger in linear dimensions than the known female, and has a larger canine that corroborates interpretation as a male. A 12% difference in linear measurements corresponds to an expected mean difference of a little more than two standard deviation units between the sexes ( $2 \times 0.05 = 10\%$  or 0.10 on a natural log scale). Normally we expect to find 95% of specimens within two standard deviations of the mean, for an expected range of four standard deviation units. With two-standard-deviation dimorphism, we expect to find 95% of specimens, males and females, in a range of six standard deviation units. This also raises the possibility that dimorphism can be recognized by sample bimodality even in small samples. To test this idea we studied femur diaphysis length for femora representing seven different individuals of *Basilosaurus isis*. The resulting distribution spans seven standard deviation units, and is clearly bimodal, with modes even more separated than expected. Four specimens have shorter diaphyses and cluster together, and three specimens have longer diaphyses and cluster together. Each small sample spans about three standard deviation units, but the separation between modes is five standard deviation units. For comparison, two femora of later North American *Basilosaurus cetoides* differ by four standard deviation units. We interpret *Basilosaurus isis* and *B. cetoides* with smaller femora as females, and those with larger femora as males. By this criterion, the complete skeleton of *B. isis* under study at present, WH-74 collected in 1989 and 2005, is a female. The posterior half of the Smithsonian skeleton, USNM 12261, is a male.

Poster Session II, (Monday)

#### PLESIOSAURS FROM THE MAASTRICHTIAN OF BENTIABA, NAMIBE PROVINCE, ANGOLA

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Recent excavations at the Maastrichtian locality of Bentiaba, Namibe Province, in the southern part of Angola, have yielded high quality and partially articulated plesiosaur specimens that indicate at least three taxa were present. A new elasmosaurid is the most abundant and well-preserved plesiosaur taxon at Bentiaba. It is known from a complete articulated paddle and other elements of the skeleton, many of which remain to be collected. The most diagnostic elements so far recovered are the complete pelvic and pectoral girdles, which indicate that the Bentiaba elasmosaurid is probably a new genus because it bears an asymmetrical ventral process of the coracoids, a complete cordiform posterior coracoid vacuity, and pronounced excavation of the anterior border of the coracoids, among other characters. A polycotyloid is identified on the basis of confluent basioccipital tubers. *Tourangisaurus*, a genus initially named from the Late Cretaceous of New Zealand, is identified by short but massive propodials with no distal facets for epipodials and by the nearly symmetrical anterior and posterior borders of the ischium. The presence of *Tourangisaurus* in Angola extends the geographic range of this genus and suggests austral affinities for the Angolan plesiosaur fauna, as opposed to the early mosasaur and turtle records in Angola, which indicate northern affinity. Because the South Atlantic Ocean opened at its southern extent prior to the completion of the tropical Atlantic Gateway, plesiosaurs with southern affinities could have entered the coastal waters of Angola multiple times both prior to and after the evolution of mosasaurs, leading to the biogeographic pattern reflected in marine tetrapods from the Maastrichtian of Angola. Thus, the high quality specimens from Bentiaba are critical for a phylogenetic understanding of southern hemisphere plesiosaur biogeography specifically and Cretaceous marine tetrapod biogeography generally.

Technical Session I, Sunday 11:00

#### A CRETACEOUS ARMOURY: MULTIPLE ANKYLOSAURID TAXA IN THE LATE CRETACEOUS OF ALBERTA, CANADA AND MONTANA, USA

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Several taxa of ankylosaurid dinosaurs from the Late Cretaceous of North America have been reassigned to the genus *Euoplocephalus*. Unlike any other dinosaur known from numerous skeletons, *Euoplocephalus* is thought to be present in both the Dinosaur Park, Horseshoe Canyon, and Two Medicine Formations, and possibly the Oldman Formation. This suggests that further examination of specimens referred to *Euoplocephalus* is required in order to verify whether this genus transcends formational boundaries, or should be split into several taxa. *Euoplocephalus* has been considered highly morphologically variable, especially in terms of cranial morphology. However, examination of more than 60 specimens, including 13 skulls, shows that these variations are stratigraphically segregated. Ankylosaurids from the Horseshoe Canyon Formation are found to be distinct from *Euoplocephalus*, which is restricted to the Dinosaur Park Formation. *Anodontosaurus*, the holotype of which is from the Horseshoe Canyon Formation, is therefore distinct from *Euoplocephalus*, and is a valid taxon. *Euoplocephalus* specimens from Montana appear to be similar to those from the Dinosaur Park Formation. When compared with *Euoplocephalus*, *Anodontosaurus* possesses

distinctive skull and cervical half ring ornamentation. Although previously thought to represent variation within *Euoplocephalus*, differences in tail club morphology are also correlated with stratigraphy. *Anodontosaurus* tail clubs typically have a greater width:length ratio than *Euoplocephalus* and are characterized by pointed, triangular knob osteoderms in dorsal view. *Dyoplosaurus*, from the Dinosaur Park Formation, was recently suggested to be distinct from *Euoplocephalus* based on pelvic morphology. The taxonomic assignment of Natural History Museum specimen R5161 ("*Scolosaurus*") is still uncertain, but this specimen does not appear to be referable to *Euoplocephalus* based on cervical half ring morphology. Royal Ontario Museum specimen 813 includes armour not found in Natural History Museum specimen R5161 and represents a distinct but as yet indeterminate taxon. Ankylosaurid diversity in the Late Cretaceous of Alberta and Montana is greater than previously recognized.

Poster Session I, (Sunday)

#### THE UTILITY OF POSTCRANIAL ELEMENTS IN DIAGNOSING SOUTHERN AFRICAN MICROFAUNA

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Micromammals are informative environmental indicators due to their ecological specificity, sensitivity to environmental change, and small habitat ranges. As such, small mammal assemblages are often useful in paleoenvironmental reconstructions, particularly in cave localities which frequently preserve large samples. While species composition and relative abundance of these fossil assemblages are needed to reliably reconstruct paleoenvironments, lower-level taxonomic identification using mandibles, maxilla and teeth can be ambiguous due to overlapping morphologies. Data from postcranial elements is often overlooked as a source of apomorphies. In order to test the value of micromammal postcrania in identifying taxa from a Pleistocene fossil assemblage from northwestern Botswana, an examination of 13 known modern species trapped at the Koanaka Hills locality of Ngamiland Province was undertaken. Results from this analysis indicate that the femur displays genus-specific morphological features. Femoral characteristics that are most diagnostic include proximal to distal length, features of the neck (width, length, and angle), head size, greater trochanter size, lesser trochanter size, inter-trochanteric angle, and third trochanter size and position. While individual features tend to overlap between genera, the suite of these characteristics allowed confident diagnosis of the genera examined. Our analysis also proved useful in differentiating between two species of *Gerbilliscus* (*G. brantsii* and *G. leucogaster*). An examination of the fossil small mammal femora (early to middle Pleistocene in age) collected from the Koanaka South Bone Cave locality yielded distinctions consistent with the morphology of the modern taxa, indicating that the postcranial elements may allow for more confident micromammal identification. Many of the taxa studied in this analysis are widespread in southern Africa and are known to occur at many fossil localities in the region.

Poster Session IV, (Wednesday)

#### NOVEL CHARACTERS FOR HIGH LEVEL PHYLOGENY OF PLACENTAL MAMMALS

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The recently established phylogenetic framework for living placental mammals enables a sophisticated level of character analysis. Phenotypes previously thought to be without much significance for high-level nodes (e.g., vertebral variation, timing of dental eruption) may prove to be key apomorphies in distinguishing major clades within placental mammals. For example, vertebral variation has been shown to be relatively low due in part to stabilizing selection. Among humans, departures from a neck skeleton with seven ribless vertebrae has already been associated with high frequency of fetal and/or childhood pathology and infrequent survival to reproductive age. The extent to which other mammals also exhibit this pattern has not yet been adequately quantified. Here, we present data from the axial skeleton of embryonic, fetal, and near-term non-human mammals, focusing on afrotherians and xenarthrans, and quantify their vertebral counts and incidence of axial skeleton anomalies (e.g., asymmetries, non-thoracic ribs). Our data show that most mammals have at least some variability in the axial skeleton, but with a few exceptions this variability tends to be greater in afrotherians (e.g., hyracoids, tenrecids) and xenarthrans (e.g., pilosans) than in other mammals (e.g., carnivorans, rodents, talpids). Investigating this character complex in certain extinct groups is difficult, because sample sizes of enigmatic taxa such as the Malagasy "aardvark" or endemic South American ungulates are small. We seek to test the extent to which such extinct clades exhibit features differentially present in "northern" vs. "southern" placental mammals.

Technical Session X, Tuesday 9:00

#### AVIAN TAXONOMIC DIVERSITY AND ANATOMICAL DISPARITY IN THE LOWER CRETACEOUS XIAGOU FORMATION OF THE CHANGMA BASIN, GANSU PROVINCE, PEOPLE'S REPUBLIC OF CHINA

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**Program and Abstracts**

October 2010



**70th Anniversary Meeting  
Society of Vertebrate Paleontology**

David L. Lawrence Convention Center, East Lobby &  
Westin Convention Center Pittsburgh  
Pittsburgh, Pennsylvania USA  
October 10–13, 2010