

of both methods more likely leading to robust results and more insightful interpretations of feeding ecology.

Technical Session V (Wednesday, October 17, 3:00 pm)

FIRST EVIDENCE OF REMINGTONOCETIDAE (MAMMALIA, CETACEA) OUTSIDE INDO-PAKISTAN: NEW GENUS FROM THE EARLY MIDDLE EOCENE OF EGYPT

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Remingtonocetids are semiaquatic archaic cetaceans known for their elongated narrow skulls, long necks, and robust pelvis and hind limbs. The family currently includes five genera (*Attockicetus*, *Remingtonocetus*, *Dalanistes*, *Andrewsiphius*, and *Kutchicetus*), which are known principally from the middle-to-late Lutetian Domanda Formation of Pakistan and the late Lutetian Harudi Formation of India. Some specimens have been recovered from other formations; however, all previous occurrences have been restricted to the Lutetian of Indo-Pakistan. A new genus of remingtonocetid cetacean has been recovered from the late Lutetian Midawara Formation of Egypt. The specimen includes a left innominate with a complete ilium, ischium, and acetabulum; a nearly complete left femur; a four-vertebra sacrum; and partial lumbar and anterior caudal vertebrae. The long, broad ilium and near closure of the acetabular notch compare closely with the innominates of other remingtonocetids, though the ischium is much broader and flatter. The femur is generally similar in size and shape to known specimens of *Remingtonocetus*, but has a more vertically-oriented head and neck and a shaft with a more circular cross-section that lacks a conspicuous lateral keel. The sacrum is composed of four vertebrae, three of which are at least partially fused together as in other remingtonocetids, with very large dorsal sacral foramina. A well-preserved lumbar vertebra has curved zygapophyses, reniform epiphyses, and short transverse processes with only a modest degree of anterior or ventral inclination, comparing closely with lumbar vertebrae of *Remingtonocetus*. However, partial neural arches suggest that lumbar neural spines were inclined posteriorly rather than anteriorly. The new specimen increases the known taxonomic diversity of Remingtonocetidae, illustrates additional variation in the morphology and locomotor repertoire of the group, and provides the first evidence of the family in Africa.

Technical Session X (Friday, October 19, 8:30 am)

MORPHOLOGIC INDICATORS OF FOSSORIALITY AND THE EVOLUTION OF BURROWING IN DICYNODONTS (AMNIOTA: SYNAPSIDA)

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Among the extinct ancestors of mammals, the Diconodontia is a clade easily recognized by characteristic turtle-like beaks, toothless except for a pair of large tusks. Diconodonts were an ecologically important group of herbivores with a distribution across the Permo-Triassic boundary. Evidence exists that some diconodonts were burrowers; for example *Diictodon* has been found fossilized in burrows. Two highly specialized genera, *Cistecephalus* and *Kawingasaurus*, have skeletal morphologies very similar to that of modern moles, in that they have shortened but very robust humeri, with enlarged epicondyles and deltopectoral crests; thus they have been presumed to be fossorial, possibly even entirely subterranean. Despite the description of diconodonts as generally fossorial by many workers, this assumption has yet to be rigorously tested. Here we test for the presence of morphological indicators of burrowing behavior in diconodonts by using quantitatively identified osteological correlates of fossoriality in extant mammals, whose behavior is known. Understanding burrowing behavior in diconodonts will give insight into the evolution of this unique group, as well as provide a model for examining the functional morphology of fossoriality in other vertebrate groups.

We collected linear measurements on the forelimb and hindlimb skeletons of 39 Permian to Triassic diconodonts and 157 extant mammals spanning 15 orders. Extant mammals were binned into three categories: fossorial, subterranean or non-digging. Reduced major axis regression analyses indicate that fossorial taxa have more disparate hind- and forelimbs than nonfossorial taxa, and confirm that the humeral epicondyles and olecranon processes of fossorial taxa are relatively larger than those of non-diggers. Discriminant function analyses clearly distinguish between the three functional groups, demonstrating a morphologic continuum from the least to the most fossorial among extant taxa. The addition of diconodonts to these analyses supports the prior notion that *Cistecephalus* and *Kawingasaurus* were at least fossorial, and *Cistecephalus* was likely subterranean. These analyses shed the most light on the behavior of the small to mid-sized diconodonts, as the large Triassic forms fall well to the non-fossorial extreme of the limb shape space. Mapping inferred fossoriality into a phylogenetic context indicates that there was a single clade of specialized burrowing diconodonts and that other burrowers, such as *Robertia*, were not closely related. Our results suggest that burrowing has evolved independently multiple times within diconodonts. Understanding the distribution of burrowing in diconodonts adds to our knowledge of the taxonomic and paleobiologic patterns of the critical end-Permian extinction.

Technical Session X (Friday, October 19, 12:00 pm)

A COMPREHENSIVE GENUS-LEVEL PHYLOGENY OF LIVING AND EXTINCT MARSUPIALS BASED ON CRANIODENTAL AND MOLECULAR DATA

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Comprising approximately 6% of extant mammalian species, and with a rich fossil record, Marsupialia represents a diverse and successful mammalian clade. However, macroevolutionary studies of Marsupialia have been hampered by the absence of a well-resolved higher-level phylogeny that incorporates a wide sampling of living and fossil taxa. Here we present results of a comprehensive phylogenetic study of Marsupialia, based on a novel dataset comprising 180 craniodental characters (many of which are entirely new) and ~2kb of sequence data from two nuclear genes (IRBP and GHR). Our study includes representatives of every currently recognised Recent marsupial genus and also a broad sampling of fossil taxa, focusing on well-preserved plesiomorphic forms that are likely to be useful in resolving interordinal and deep intraordinal relationships by breaking up long branches, and using the stem-metatherians *Herpetotherium*, *Pucadelphys* and *Mayulestes* as outgroups. Collectively, this represents a >300% increase in taxon sampling over previous total evidence analyses of marsupial phylogeny. This project has led us to propose novel or revised interpretations of many aspects of marsupial craniodental morphology: for example, we conclude that the enlarged 'gliriform' lower incisor is plausibly homologous between paucituberculatans and diprotodontians, and that the labial cusps of the upper molars of most diprotodontians are stylar in origin. Maximum parsimony analysis of the morphological partition alone recovers monophyly of the currently recognised marsupial orders, but supraordinal relationships are weakly supported and some accepted clades (e.g. Australidelphia) are not recovered. However, analysis of the total evidence matrix results in a phylogeny that is highly congruent with recent molecular phylogenies at both the supraordinal and intraordinal levels, supporting monophyly of (*inter alia*) Australidelphia, Phalangerida, Australoplagiuloidea and Petauroidea. Novel results include placement of the fossil didelphimorphian *Sparassocynus* as a crown-group didelphid, placement of the fossil dasyuromorphian *Barinya* as a stem-thylacinid rather than stem-dasyurid, non-monophyly of Wynyardiidae, and support for *Ekaltadeta* as the 'basalmost' branch of Macropodoidea. However, the relationships of some marsupial taxa, such as the marsupial mole *Notoryctes* and the enigmatic fossil *Yalkaparidon*, remain uncertain. The position of microbiotherians within Australidelphia, which is crucial for understanding the biogeographical relationship between South American and Australian marsupials, and the location of the root were also not clearly resolved. Nevertheless, our study should provide a solid phylogenetic foundation for future macroevolutionary analyses of Marsupialia.

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

TWO NEONATE MOSASAURS (SQUAMATA) FROM THE NIOBRARA FORMATION

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The Niobrara Formation of western Kansas represents one of the most famous mosasaur-bearing localities in the world. The relative abundance of mature mosasaur compared to juveniles in the Niobrara Formation once led to the hypothesis that mosasaur birthing areas were located elsewhere. Although the discovery of numerous juvenile mosasaurs in the Niobrara Formation in the last several decades led to a revision of this hypothesis, neonate mosasaurs are still extremely rare. Here, we report the fragmentary cranial remains of two neonate mosasaurs from the Niobrara Formation, heretofore erroneously cataloged as avian fossils in the collections of the Yale Peabody Museum. One specimen is represented by an isolated partial left dentary, while the other consists of a partial left dentary, partial right palatine, and other cranial elements. Comparison with other neonate mosasaurs reveals that these specimens are amongst the smallest individuals ever found, and shed new light on western Kansas as a possible mosasaur birthing area.

Technical Session XIX (Saturday, October 20, 3:30 pm)

THE IMPACT OF MASS MORTALITY ON THE LAND SURFACE BONE ASSEMBLAGE OF AMBOSELI PARK, KENYA

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The partial collapse of the mammalian herbivore community in Amboseli National Park, Kenya, in 2009 provided an opportunity to compare catastrophic mortality with the attritional skeletal record previously documented in this ecosystem. Mass mortality occurred during a severe drought, when over 11,000 individuals (primarily grazers) died in a period of 8 months. Amboseli has large permanent springs and swamps, and herbivores died from starvation rather than thirst. Taphonomic surveys documented skeletal remains on 20 established transects. The number of drought deaths far exceeded the initial recycling capacity of local scavengers, mainly spotted hyena. In 2010, skeletons were relatively complete and scavenger impact was low, with characteristic patterns of damage to particular