Technical Session XV (Saturday, November 2, 2013, 9:45 AM)

THE SIRENIAN GENUS *METAXYTHERIUM*: WHAT'S UP WITH THOSE ANIMALS??

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Metaxytherium (Mammalia, Dugongidae) is one of the most widespread, long-lived, species-rich, commonly fossilized – and taxonomically troublesome – genera of Sirenia. Its morphologically conservative nature had, until recently, made it difficult to properly define this genus. In recent years, however, much has been done to clarify its contents, relationships, and eventful evolutionary history. Originally known only from the Miocene and Pliocene, its presence in the New World late Oligocene is now established, along with that of a new, early Oligocene genus likely ancestral to it. An apparently anagenetic lineage of West Atlantic-East Pacific species persisted into the late Miocene. A parallel European-Mediterranean lineage may also have begun in the late Oligocene, and ended only in the mid-Pliocene. Both showed a tendency towards increasing body size. However, the zoogeographic connections between these lineages are unclear, and the early to late Miocene members of both lineages exhibit near-stasis in morphology – something not seen elsewhere in the Sirenia. The latest Miocene and Pliocene Mediterranean species, in contrast, display relatively rapid evolution, along with ecophenotypic dwarfing during the Messinian Salinity Crisis. A long-standing puzzle, the mid-Miocene (Badenian) "*M. petersi*" from the Vienna Basin, seems to be at most a peripheral variant of the western European type species *M. medium*. At the opposite, East Pacific end of the genus' range, *M. arctodites* is the sister group and structural ancestor of the Hydrodamalinae (*Dusisiren* + *Hydrodamalis*), rendering the halitheriine genus *Metaxytherium* paraphyletic.

For the most part, these tropical marine herbivores may have owed their success to being ecological generalists that fed on seagrass leaves and the rhizomes of the smaller seagrass species. For most of their history, they coexisted with more diverse and morphologically flamboyant but more specialized and shorter-lived species of Dugonginae, which evidently ate larger and tougher rhizomes. Notably conservative in retaining small tusks through most of the Miocene, *Metaxytherium* then diversified surprisingly, in opposite directions: losing tusks altogether as they evolved into hydrodamalines in the Pacific, but growing much larger, dugongine-like tusks in the Mediterranean species *M. serresii* and *M. subapenninum*. Clearly, past evolutionary performance is no guarantee of future results!

Technical Session II (Wednesday, October 30, 2013, 8:15 AM)

WAS THE GIANT SHORT-FACED BEAR *ARCTODUS SIMUS* A HYPER-SCAVENGER? A NEW APPROACH TO THE DIETARY STUDY OF URSIDS USING DENTAL MICROWEAR TEXTURES

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The Pleistocene short-faced bear, *Arctodus simus* was the largest member of the order Carnivora to traverse North America, yet whether this giant was primarily an active predator, opportunistic omnivore, or bone crushing hyper-scavenger remains unknown. Dental microwear has the potential to offer new insight into this debate. Here, we investigate the application of dental microwear texture analysis to bears through compiling a baseline that correlates microwear attributes of lower first and second molars (m1 and m2, respectively) to known feeding behavior in modern bears. Resulting baseline data is then used to evaluate the hypothesis that *Ar. simus* was a bone consuming hyper-scavenger at Rancho La Brea, California. Results of texture analysis evince significant variation along the tooth row, with the crushing/grinding functionality of the m2 serving as a better dietary recorder than the slicing/shearing m1 carnassial. Texture analysis of the m2 shows significant variation among extant species that correlates with physical properties of known diets. Microwear complexity (*Asfc*) is significantly higher, and more variable for carnivorous and omnivorous ursids (*Ursus maritimus*, mean *Asfc* = 8.49; *U. americanus*, mean *Asfc* = 7.85) in comparison to more herbivorous bears (*Ailuropoda melanoleuca*, mean *Asfc* = 1.996; *Tremarctos ornatus*, mean *Asfc* = 4.172; *U. malayanus*, mean *Asfc* = 3.96). High anisotropy (*epLsar*) further differentiates *A. melanoleuca* (*epLsar* = 0.0039) from *U. maritimus* (*epLsar* = 0.0022) and *U. americanus* (*epLsar* = 0.0022). *Arctodus simus* exhibits wear attributes most similar to its closest living relative (*T. ornatus*), with significant differences ($p<0.05$) in at least one microwear attribute differentiating it from other extant bears. Our results indicate that *Ar. simus* was not consuming hard objects (e.g., bone) at Rancho La Brea, and are thus inconsistent with the hypothesis that short-faced bears were bone crunching hyper-scavengers across their range. Collectively, our work demonstrates the potential of dental microwear texture analysis to reveal the dietary ecology of extant and extinct bears across diverse geographic regions and through deep time.

Poster Session IV (Saturday, November 2, 2013, 4:15 - 6:15 PM)

DESCRIPTION OF A NEW MIOCENE HEGETOTHERIID NOTOUNGULATE FROM CERDAS, BOLIVIA

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Notoungulates are extinct, endemic South America herbivores that ranged throughout South America during most of the Cenozoic. This study focuses on the typothere family Hegetotheriidae, a group of rodent or rabbit-like notoungulates that lived in South America from the early Oligocene through early Pleistocene. In particular, we describe hegetotheriid remains from the ~16 million-year-old site of Cerdas, Bolivia, which is situated on the eastern Bolivian Altiplano (21° 52' S, 66° 19' W), several kilometers southeast of the village of Cerdas (approx. 60 km southeast of Uyuni). Eight specimens were studied including several partial mandibles preserving posterior premolars and molars, a partial maxilla with P3-P4, two fragmentary dentaries preserving alveoli of the anterior dentition, several isolated cheek teeth, an upper incisor, and two calcanei. The specimens are referred to the Hegetotheriinae based on the absence of a strongly trilobed m3 talonid, lack of conspicuous diastemata among i2-p2 alveoli, and a relatively small I1. A Hegetotheriine affinity is supported by the two Cerdas calcanei, which are more similar to *Hegetotherium* than *Pachyrukhos* in having a circular sustentacular facet, a large navicular facet, and an only moderately rugose tuber. The Cerdas species differs from *Prohegetotherium* in lacking a labial groove near the anterior margin of the upper cheek teeth. The p3 of the Cerdas species differs from that of *Sallatherium* in having the trigonid shorter than the talonid; the opposite is true in *Sallatherium*. It differs from *Hemihegetotherium* in having upper and lower cheek teeth with flat rather than convex lingual faces and in having a more rounded molar trigonid. The Cerdas species is conservatively referred to the genus *Hegetotherium* based on its generally rectangular upper cheek teeth and semi-elliptical talonids. However, the lack of a shallow buccal groove on the m3 talonid suggests it may pertain to a distinct genus. A phylogenetic analysis testing this proposition is in progress. Linear measurements of the Cerdas specimens are 20–30% smaller than those of other hegetotheriines and fall outside the range of variation of 120 *Hegetotherium mirabile* specimens from Santa Cruz, Argentina. Thus, it clearly represents a distinct species. The absence of pachyrukhines from early and middle Miocene faunas of northern Chile and Bolivia suggests that small hegetotheriines such as the new Cerdas species may have occupied a pachyrukhine-like ecological niche in the middle latitudes of South America during this interval.

Romer Prize Session (Thursday, October 31, 2013, 8:45 AM)

QUANTIFYING PERIODS OF DIFFUSION IN MARINE AND TERRESTRIAL MAMMALIAN VERTEBRATE FOSSILS USING RARE EARTH ELEMENTS

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Rare earth (REE), trace elements (TE) and isotopes in vertebrate fossils have been used to study taphonomy/reworking, stratigraphic correlation, paleoenvironment reconstruction and fossilization processes. REE/TE/isotopes diffuse into bone during fossilization. The period of diffusion limits the temporal resolution of paleoenvironmental interpretations made from REE/TE/isotopes. Periods of incorporation have been calculated in only a few studies and additional measurements will better refine temporal resolution of geochemically based paleoenvironmental reconstructions. Five Late Eocene brontothere bones from the White River Group and four Miocene marine mammals from the Atlantic Coastal Plain were analyzed for REE/TE concentrations using Laser Ablation Inductively Coupled Plasma Mass Spectrometry. Of the five brontothere bones, four were from the same bonebed. An outer circumferential layer (OCL) was preserved on the margin in two brontothere bones and had lower concentrations than underlying bone, suggesting a lack of REE/TE incorporation into the OCL or subsequent leaching. Elevated concentrations were noted surrounding some osteon channels, indicating that Haversian systems may act as fluid conduits, bringing unreacted fluid into bone. REE depth fractionation tends to be less pronounced in marine bones (when compared to terrestrial bones) which may result from a greater influence of secondary diffusion pathways (Haversian systems). Diffusion periods for six REE were internally consistent and ranged from 0.9+/-0.2 to 2.8+/-0.6 ka in marine bones and 2.2+/-0.5 to 54.8+/-1.5 ka for terrestrial bones. Faster diffusion periods within marine bones suggest that fossilization occurs over a shorter timespan in saturated environments. Diffusion periods differed in brontothere bones from a single bonebed, which has implications for the fidelity of bulk sample analyses regarding temporal resolution of REE/TE/isotopes in paleoenvironmental reconstructions. Previous studies have reported soft tissue preservation within fossil bone and concluded that the rate of diffusion must have outpaced the rate of decay in order to preserve soft tissue. Rates of REE/TE diffusion suggest that biomolecule preservation in deep time would be favored in saturated environments (marine, lacustrine, channel).

Symposium 4 (Saturday, November 2, 2013, 10:30 AM)

EVIDENCE FOR A DISTINCT EARLY MAASTRICHTIAN POLAR DINOSAUR FAUNA FROM THE PRINCE CREEK FORMATION OF NORTHERN ALASKA

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Dinosaur biogeography in Laramidia, a Late Cretaceous landmass with an area approximately 20% that of present North America, remains controversial. While some recent studies of Campanian-aged faunas posit the existence of multiple distinct, latitudinally arrayed provinces and/or areas of regional endemism, others argue that Maastrichtian dinosaur faunas as a whole were largely homogenous. A major limitation of these studies has been that a robust data set on faunal composition from Arctic paleolatitudes of Laramidia has been lacking. A second problem has stemmed from the lack of temporal resolution between fossiliferous formations used in biogeographic analyses. We address the question of dinosaur endemism in the Western Interior through latitudinal comparisons of a polar fauna, the early Maastrichtian Prince Creek Formation (PCF) of northern Alaska, with a contemporaneous lower latitude fauna from the upper Horseshoe Canyon Formation of southern Alberta, Canada. The PCF was deposited on a low gradient, Arctic coastal plain environment at approximately 80°N – as far north as land existed at that time – while the Horseshoe Canyon Formation was deposited at approximately 58°N. Faunal composition data for the PCF is based on a taxonomic