Technical Session VI (Thursday, November 6, 2014, 10:15 AM)

NONRANDOM BUT UNPARSIMONIOUS PATTERNS OF MAMMALIAN DISPERSAL BETWEEN ASIA AND AFRICA DURING THE LATER PALEOGENE

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The fossil record reveals that multiple Asian mammal clades colonized Africa during the interval spanning from the middle Eocene–early Oligocene, approximately 8–15 Ma prior to the tectonic collision between Africa and Eurasia. These taxa include one or two rodent clades (Hystricognathi and possibly Anomaluroidea), anthropoid primates, miacoid carnivorans, and anthracotheriid artiodactyls. In all cases, vicariance fails to explain the distributional data, because none of the relevant clades is sufficiently ancient for hypotheses of vicariance to be reasonable, and because primitive sister taxa for each clade occur in Asia but are absent in Africa. Geophysical data require that each of these clades had to cross the marine barrier formed by the Tethys Sea in order to reach Africa. Examination of the Asian mammal taxa that succeeded in colonizing Africa reveals these colonists to have been biased in terms of body size, locomotor regime, and taxonomic composition (with small-bodied, arboreal members of Euarchontoglires being favored).

Assuming that chance dispersal across the marine Tethyan barrier was a rare event, the African radiations that were derived from these Asian colonists would be expected to be monophyletic. Phylogenetic analyses of two of the most successful clades to colonize Africa during the later Paleogene, hystricognathous rodents and anthropoid primates, shows that neither group conforms to the biogeographically parsimonious pattern of African monophyly. Instead, multiple Asian anthropoid and hystricognath clades appear to have colonized Africa more or less simultaneously. This nonrandom but unparsimonious pattern of intercontinental dispersal likely reflects one or more aspects of the paleobiology of early anthropoids and hystricognaths, which conferred upon them a predisposition to succeed in crossing marine barriers and establishing viable populations in the newly colonized terrain. The fact that these two taxa were subsequently able to colonize South America from Africa underscores the nonrandom nature of success at transoceanic dispersal among these early Cenozoic mammals. Funding provided by NSF BCS-1441585.

Poster Session IV (Saturday, November 8, 2014, 4:15 - 6:15 PM)

THE DEVELOPMENT OF THE ELGIN MUSEUM AS A PUBLIC AND SCIENTIFIC RESOURCE

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The Elgin Museum, the oldest independently run museum in Scotland, houses a 'Recognised' Collection of Devonian (Old Red Sandstone), Permian, and Triassic vertebrate fossils from the surrounding Moray area. This material was collected in the early–mid 19th Century attracting the interest of geologists and palaeontologists of the time who either personally visited the area or were sent material relating to their own studies. Subsequently, material has contributed to important discussions on tetrapod evolution, in a revision of the phylogeny of dicynodonts (Synapsida, Therapsida) and the affinities of *Saltopus* relative to the earliest dinosaurs, among other topics. Sadly, the majority, if not all, of the quarries sourcing these unique and diverse fossils have now closed or are inaccessible, meaning new examples are not likely to be recovered. In view of this, the entire geology collection at Elgin Museum, which includes the Recognised Collection, rocks and minerals from the local area, and a further range of non-Recognised fossils, is in the process of being re-organised to fully and better use the limited space available. The first step has been a thorough re-examination of the condition and potential use of specimens, for example, in displays, and school and public handling, leading to some unavoidable rationalisation of the rocks and minerals. The catalogue system has similarly been scrutinised to ensure all specimens are properly documented, particularly regarding their current location and the status of loans. Improvements to the building include the simple addition of new lighting in the West (geology) Store, to be followed eventually by strengthening of the floor in the larger North Store where rolling stacks will be installed to house more permanently the geology collection. The ultimate aim is to increase access to the geology collection for museum staff, volunteers, the interested public and academic community alike, and promote the collection as a valuable and versatile learning resource. Herein, the difficulties and successes of the developments are described so that other museums undergoing similar changes, now or in the future, can benefit from our experience.

Poster Session III (Friday, November 7, 2014, 4:15 - 6:15 PM)

FEEDING ECOLOGY OF DESMOSTYLIA AS INFERRED FROM SPECIALIZATIONS FOR INGESTION, DENTAL MORPHOLOGY, AND DENTAL WEAR

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Stable isotopic studies have helped us discern the geochemical basis of diet and water use in the Desmostylia, but are limited in identifying variables of how those resources were partitioned. Recent insights into the morphology of new specimens of desmostylians has shown a greater diversity within the group than previously recognized, many of which were sympatric. Amidst this diversity is a greater diversity in body size, but also feeding specializations.

Desmostylians lack the horny pad that sirenians develop on the remains of their symphysis and vestigial incisor/premolar alveoli, and instead tend to all have a narrow oral commissure with few teeth, similar to the suction feeding specializations seen in *Odobenus*. The notable exceptions are the paleoparadoxiids that have an array of wide flat incisors suited for cropping vegetation in a way similar to that seen in many terrestrial grazing mammals. Rostral orientation in the Sirenia typically reflects the location of preferred food items in the water column, and among the Desmostylia there seems to be little indication of any ventral deflection as seen in benthic feeding sirenians.

Postcanine dental morphology in *Behemotops*, *Cornwallius*, and paleoparadoxiids retain a similarity between first and last molars, yet in paleoparadoxiids the tooth sizes do not seem to scale with the increase in body size seen in paleoparadoxiids throughout the Miocene. In contrast, *Desmostylus* has a dramatic increase in molar size associated with their its body size, and this ontogenetic pattern mimics the sequential eruption of molars seen in elephantids. Postcanine enamel thickness is greater in *Cornwallius*, *Desmostylus*, and to a lesser degree in paleoparadoxiids, which may be an indicator of a longer wear life of the individual teeth, possibly due to a more abrasive diet. Shear length of postcanine teeth increased with the pattern of cusp duplication seen in *Cornwallius* and *Desmostylus*, a feature seen in terrestrial herbivores that transition from eating soft plat foods to those of greater fracture toughness such as grasses. Wear on the lingual sides of postcanine teeth of *Cornwallius, Desmostylus,* and some paleoparadoxiids are similar to patterns of lingual wear seen in benthic feeding *Odobenus*. Lastly, remains of ingesta found in the infundibulae of some desmostylian postcanine teeth appear to have crushed hard-shelled invertebrates and some have the carbonized remains of plants, suggesting that their diets may have consisted of both, like a ‘chef’s salad of the sea.‘

Technical Session I (Wednesday, November 5, 2014, 10:45 AM)

ANATOMY AND FUNCTION OF THE TAIL IN THE PROTOCETID ARCHAEOCETE *MAIACETUS INUUS* (MAMMALIA, CETACEA): INSIGHTS INTO THE EVOLUTION OF TAIL-POWERED SWIMMING IN EARLY CETACEANS

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One of the keys to understanding the evolution of cetaceans involves elucidating the details of how their derived swimming mode evolved from that of a four-legged, terrestrial ancestor. Most modern quadrupeds swim using a modified terrestrial gait, in which all four of their appendages are used to paddle through the water. Modern cetaceans, on the other hand, oscillate a specialized horizontal tail fluke through the water to generate forward propulsion. Despite being composed of mostly fibrous and ligamentous soft tissue, the presence of a well-defined fluke can be inferred by the size and shape of terminal caudal vertebrae. Based on caudal proportions, it appears that basilosaurid archaeocetes (e.g., *Dorudon atrox*) possessed tail flukes before the end of the Eocene. However, the origination of this feature in cetacean phylogeny has been difficult to assess given the paucity of archaeocete fossils preserving terminal caudal vertebrae. *Maiacetus inuus* is a protocetid archaeocete known from the Habib Rahi Formation of Pakistan (Lutetian, 47.5 Ma). One known specimen of *Maiacetus* preserves all 21 of its caudal vertebrae, making it an ideal candidate for assessing tail use in a representative protocetid. Comparative analyses of the caudal vertebrae with those of over 75 specimens of modern mammals suggests a significant amount of muscular control in the tail of *Maiacetus*. The large number of ventrally-projecting chevrons (14) in *Maiacetus* is a characteristic shared by mammals that have extensive tail control, including dolphins, porpoises, and prehensile-tailed mammals. Multivariate statistical analyses of caudal vertebrae demonstrate that the vertebrae of *Maiacetus* occupy a unique area of morphospace in the vicinity of some prehensile-tailed mammals and semiaquatic taxa (such as otters). The proportions of the terminal caudal vertebrae, however, do not indicate a well-defined tail fluke as they do in basilosaurids and modern cetaceans. Thus, the tail of *Maiacetus* appears truly intermediate in form and function between terrestrial and aquatic mammals. It appears to have had significant epaxial musculature for controlling its movement, and though a well-defined tail fluke may not have been a present, a tail with a poorly defined nascent fluke cannot be ruled out. *Maiacetus* represents an early archaeocete that likely used its muscular tail to supplement paddling of the hind limbs for generating propulsion during swimming.

Technical Session IV (Wednesday, November 5, 2014, 3:30 PM)

THE SKULL AND SKELETON OF A LARGE-BODIED DIPROTODONTIAN MARSUPIAL FROM THE LATE OLIGOCENE OF CENTRAL AUSTRALIA AND THE ORIGIN OF WOMBATS

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In the early 1970s, the late Dick Tedford and colleagues collected the partial skull and skeleton of a large diprotodontian marsupial from the late Oligocene (~24-26 Ma old) Namba Formation near Lake Frome in central Australia. This specimen represents one of the oldest marsupials known from associated cranial and postcranial remains anywhere in Australia, but it has never been adequately described or illustrated. The skull is crushed and lacks the lower jaw, but the upper postcanine dentition is well-preserved, and much of the appendicular skeleton is intact. Depending on the regression equation used, estimated body mass is at least 28 kg. Its craniodental morphology appears approximately intermediate between that of the extinct vombatiform wynyardiids and wombats (Vombatidae): three upper incisors were present, but the first was greatly enlarged; a canine was present; the P3 is bicuspid and lacks a 'hypocone'; the upper molars are clearly not open-rooted, but their roots are elongate and there is no clear distinction between the root and crown; the occlusal morphology of the molars shows striking similarities to unworn molars of the living wombats *Vombatus* and *Lasiorhinus*; although damaged, the ear region appears vombatid-like in that, if a zygomatic epitympanic sinus of the squamosal was present, then it was very shallow. The postcranial skeleton shows some evidence of probable burrowing adaptations, notably a distally wide humerus with an enlarged deltopectoral crest, and a quadratic discriminant analysis of skeletal measurements suggests that it was at least partially fossorial. Phylogenetic analysis of a novel 72 character craniodental dataset places the new taxon as sister to vombatids, with wynyardiids and diprotodontids successively more distantly related; in contrast to most previous analyses, marsupial lions (Thylacoleonidae) are recovered as the first vombatiform family to diverge. Ancestral state reconstructions on the phylogeny suggest a single origin of fossoriality in the lineage leading to vombatids,