

#### FUNCTIONAL MORPHOLOGY AND LOCOMOTION IN AN EOCENE PROTOCETID WHALE FROM GEORGIA

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An associated skeleton of a protocetid whale from Georgia includes 22 vertebrae (3 cervical, 7 thoracic, 7 lumbar, 4 sacral, and 1 caudal), 14 ribs, and a complete pelvic girdle. Analysis of the morphology of the hindlimb and pelvic musculature by comparative dissection of Recent terrestrial and semi-aquatic mammals (*Felis catus*, *Lutra concoloris*) suggests that the protocetid had less development of pelvic and hindlimb muscles than mammals that use the hindlimbs in terrestrial or aquatic locomotion. Comparative analysis of the neural canal cross-sectional area and centrum length indicate that the whale may have used primarily its forelimbs in aquatic locomotion. The hindlimbs were possibly used in terrestrial locomotion in a manner similar to that exhibited by walrus, and may also have acted as rudders in swimming.

#### PRELIMINARY RESULTS OF A STUDY OF AN EGGSHELL SITE IN THE MORRISON FORMATION OF COLORADO

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A new dinosaur eggshell locality has been discovered in the Upper Jurassic Morrison Formation of the Garden Park area of Colorado. A grid system is being used to map the eggshells on the surface in order to determine if there are patterns in the distribution of eggshell type and morphology.

Preliminary results indicate that at least two morphotypes are present. One type, which represents the majority of eggshell collected, has recently been named by Karl Hirsch and may belong to the ornithomimid *Dromaeosaurus*. A second type is very thin and occurs infrequently at this site. Preliminarily, also, it appears that eggshells do not occur on the bottom of rills but on their upper sides and across the hillslopes between the rills. Additionally, eggshell fragments are larger and more concentrated near the source areas. It is predicted that micro-analysis of the eggshell material will demonstrate there to be a non-random distribution of eggshells showing varying degrees of erosion effects and diagenetic changes.

#### CONTINUOUS TRACK ANALYSIS AND THE PHYLOGENETICS OF OLD AND NEW WORLD HIPPARIONINI (MAMMALIA, EQUIDAE)

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Continuous Track Analysis allows identification of reticulate evolution and avoids hypothesizing unknown ancestors. It redefines the goal of phylogenetics as maximizing the continuity of character distributions instead of minimizing character state transitions. The reticulations may represent convergence, hybridization, or (in biogeography) dispersal. A data set of over 50 Holarctic hipparionine species is analyzed with CTA. Sister grouping of the New World endemics *Pseudhipparion* and *Neohipparion* is rejected; their loss of the facial fossa is convergent. The Old World hipparionines did not originate independently from *Cromohipparion* and North American "*Hipparion*." No true skulls of "*H. forci*" exist; "*H. sinclairi*" resembles *Hipparion* s.s. only superficially; and "*H. ichonense*" is a dead-end lineage. *Hipparion* s.s. is probably restricted to the Old World, and *Cromohipparion* alone is responsible for the Miocene "*Hipparion* Datum Plane." A supposed primitive *Nannipus* that resembles *Cromohipparion* is actually "*H. ichonense*." True *Nannipus* probably derives from either *Hipparion* s.s. or a second Old World endemic, *Cromohipparion*. Migrations from the Old World to the New have not previously been entertained. The hipparionine phylogeny does not include reticulate links, which justifies the belief that hybridization is rare in mammals. There is little support for the existence of multiple unknown ancestors, which is reasonable in light of the excellent hipparionine fossil record. In paleontological studies like this one, the tendency of CTA to emphasize ancestor-descendant relationships will make it more appropriate than standard Wagner parsimony methods.

#### A PALEOBIOGEOGRAPHIC STUDY OF MORPHOLOGICAL CHANGE IN THE SOUTH AMERICAN ROBBENT *ACAREMYS*

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Over two hundred specimens of *Acaremys*, an Octodontid rodent, were collected from the Pinturas Formation of the Santa Cruz Province, Argentina, South America. The Pinturas Formation is Early Miocene Age (16 mya) and hypothesized to be slightly older than the Santa Cruz Formation. The first lower molar of each specimen was analyzed quantitatively and qualitatively to detect any change in morphology in time. Possible paleobiogeographic connections between the Santa Cruz and Pinturas Formations were also considered.

Over time the populations revealed a significant decrease in molar size followed by a slight increase in size and then a period of stasis. Crown pattern did not change significantly. Change in molar size followed by a period of stasis suggests a significant change in environmental conditions followed by more stable environmental conditions.

*Acaremys* was the most abundant small rodent at the Pinturas Formation, but was found infrequently at the Santa Cruz Formation, where *Spassiomya* (also an Octodontid) was the most abundant. These results support the hypothesis that the Pinturas Formation and Santa Cruz Formation are of different ages with the former being the older formation based on geographic location.

#### SIZE STRUCTURE AND TROPHIC STRUCTURE OF MAMMALIAN FAUNAS

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In terrestrial communities, the distributions of heterotrophic species by size (size structure) and by feeding habits (trophic structure) reflect the three-dimensional complexity of habitat, the seasonal availability of plant food resources, and the amount of primary productivity. These aspects of habitat change along global climatic gradients. A survey of modern communities containing about half of the extant species of mammals reveals correlated patterns in the size structure and trophic structure of mammalian faunas.

The inverse relationship between body size and metabolic rate constrains the size range of mammalian species with particular feeding specializations. For example, granivorous and invertivorous mammals generally weigh less than 1 kg. Omnivorous mammals generally weigh less than 10 kg. Herbivorous species exhibit the broadest range of sizes, with the larger species using fermentative digestion to process forage of lower quality. Aspects of size structure are correlated with climatic variables that determine the amount and seasonal availability of food resources. Covariations of size structure and trophic structure in relation to climatic conditions are presented for modern faunas and for selected Cenozoic mammalian assemblages.

#### EARLY CRETACEOUS PTEROSAURS FROM WESTERN MONGOLIA AND THE EVOLUTIONARY HISTORY OF THE DSUNGARIPTEROIDEA

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In the early 1980's extensive remains of a medium sized pterodactylid pterosaur, *Phobosaurus* Bakhurina, 1986, were collected from early Lower Cretaceous sediments of Tatal in western Mongolia. The remains, usually disarticulated but often well preserved and uncrushed, were found in fluvial/lacustrine sediments and associated with fragmentary remains of dinosaurs (*Psittacosaurus*, a sauropod and a large theropod) and a dorsetisaurid lizard. Material includes skulls with elongate mid-line crests, and most of the postcranial skeleton with the exception of parts of the pelvis, manus digits i-ii and the pes.

The toothless jaw tips are followed by about 14 teeth, the posteriormost relatively stout and apparently designed for crushing heavy scaled fish and molluscs. Construction of the shoulder joint allowed the forelimb an extensive range of movement including adduction close to the body. This, and the proportionately long hindlimbs, suggest a relatively efficient quadrupedal gait when grounded.

This pterosaur neatly fills the morphological and temporal gap between *Germanodactylus* (relatively primitive) from the Upper Jurassic of Europe and *Dsungaripterus* (relatively derived) from the mid-Lower Cretaceous of China. These three taxa are the best known members of the Dsungaripteroidea, an important clade characterised by a suite of cranial and postcranial characters. Records from the Upper Jurassic of Europe, East Africa and ?North America and the Lower Cretaceous of Romania, Mongolia, China, and South America show that dsungaripterooids were widespread, persistent and possibly better adapted to terrestrial environments than other pterodactylid pterosaurs.

#### A MULTIVARIATE COMPARISON OF VARIATION IN FOSSIL AND LIVING RHINOCEROS SKULLS

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The evolutionary diversity of the superfamily Rhinoceroidea is represented by relatively many fossils and a few surviving taxa. Morphological variation in the skull was assessed for 15 extinct genera and four extant genera (living analogues). The latter provide a gauge of intragenetic and intraspecific variation for the fossils.

Separate multivariate analyses were performed on adult crania (19 measurements on 83 living and 103 fossil specimens) and adult mandibles (11 measurements on 80 living and 84 fossil specimens). These data included regression estimates of missing values for some specimens. Procedures programmed in SAS IML, including principal components, were used to observe multivariate within-group dispersors.

The black rhino sample (living genus *Diceros*) was the best group in terms of sample size ( $n=48$ ) and homogeneity (monospecific, geographically circumscribed, and no apparent subgroups) and, among the living forms, showed the greatest variation. Variation in fossil genera ranged from greater to less than that of the black rhino. Morphological, geographical, and temporal criteria were used to dissect the fossil genera into subgroups. Morphological variation