macro- and microfossils presents a fuller environmental picture for the site as well as contributing to the development of a Carboniferous vertebrate biostratigraphic scheme, using especially xenacanthoid sharks, to aid marine/non-marine correlation.

NEW PROTOCETID ARCHAEOCETE (MAMMALIA, CETACEA) FROM THE LATE MIDDLE EOCENE COOK MOUNTAIN FORMATION OF LOUISIANA

UHEN, M. D. Museum of Paleontology, The University of Michigan, Ann Arbor, MI 48109-1079

A new archaeocete whale was recently found in the collections of the United States National Museum of Natural History. This specimen was collected in 1944 during a water survey in Natchitoches Parish, Louisiana. It was recovered from the Milams Member of the Cook Mountain Formation, which is early Bartonian (late middle Eocene) in age.

The specimen includes thirteen vertebrae: four anterior thoracics, five lumbars, one sacral, and three of questionable assignment. The thoracic vertebrae increase in size from anterior to posterior, and the centra have convex cranial surfaces and concave caudal surfaces. Centra of the lumbar vertebrae are larger in all dimensions and the neural spines are anteroposteriorly longer than those of the thoracic vertebrae. Lumbar vertebrae have large pre- and postzygapophyses that are oriented nearly vertically. Both the cranial and caudal ends of lumbar centra are concave. The sacral vertebra is represented by a centrum with both transverse processes. The centrum is much wider than it is tall or long. The transverse processes are large, with well-developed auricular surfaces on their distal ends. The auricular surfaces display a rough, spongy texture indicative of cartilaginous articulation with the innominata. The cranial and caudal ends of the centrum and transverse processes lack indications of fusion to adjacent vertebrae.

This new whale is much larger than *Protocetus* and *Rodhocetus*, and the vertebrae are unlike those that have been assigned to *Eocetus*. It is possible that the new whale represents either *Pappocetus* or *Babiacetus*, based on size alone, but neither species has had vertebrae assigned to them. This new species is similar in size to the Plant Vogtle protocetid, but the innominate recovered with that specimen lacks a surface for articulation with a sacrum, so these two specimens cannot represent the same species. The new specimen is similar to *Protocetus* in retaining a single sacral vertebra, in contrast with earlier protocetids with multiple sacral vertebrae, and later basilosaurids that lack sacral vertebrae altogether.

THE QUALITY OF THE AVIAN FOSSIL RECORD

UNWIN, D. M., Dept. of Geology, Univ. of Bristol, Queen's Road, Bristol, BS8 1RJ, U.K.

It is widely believed that birds have a poor fossil record, but the evidence is largely anecdotal. A quantitative analysis, based on the stratigraphic distribution of all avian families, resolved to the stage level, shows that birds have a much better record than previously thought. In terms of completeness, the avian fossil record compares well with other vertebrate groups: it is better than that for Amphibia and nearly as good as that for Testudines. The record is not uniformly complete, however. The Mesozoic record is relatively poor and highly uneven, while the Cenozoic record is generally good, though there are high degrees of incompleteness in the Palaeocene and early Eocene. Surprisingly, bearing in mind the likelihood of taphonomic bias, the record of terrestrial birds is almost always as good as that of marine birds, and often better. Other tests are not so encouraging. Historical analyses show that the rate of discovery of new taxa remains high, implying that much still remains unknown. This is supported by recent cladistic analyses and DNA hybridisation studies which also suggest that many families have a greater stratigraphic range than is currently revealed by fossils. Reassessment of avian diversity through time yields new insights into bird evolution. Diversity remained low throughout the Mesozoic. Following the extinction of most clades in the Late Cretaceous, there was a major neornithine radiation in the early Tertiary. It has been suggested that the K/T boundary event was the key determinant of this pattern, but recent fossil discoveries and the results of other studies indicate that the neornithine radiation was well under way by the end of the Mesozoic. Avian diversity patterns also fail to provide any evidence for mass extinctions which are supposed to have occurred in the upper Eocene, middle Miocene and Pliocene.

THE STRUCTURE, FUNCTION AND EVOLUTIONARY HISTORY OF THE PTEROSAUR FLIGHT APPARATUS

UNWIN, D. M. and BAKHURINA, N. N., Dept. of Geology, Univ. of Bristol, Bristol, BS8 1RJ, U.K., MARTILL, D. M., Dept. of Geology, Univ. of Portsmouth, Portsmouth, PO1 3QL, U.K. & FREY, E., Staatliches Museum für Naturkunde, D-76133 Karlsruhe, GERMANY.

Two general models have been proposed for the pterosaur flight apparatus: a 'narrow-winged' version involving only the forelimbs, and a 'broad-winged' version, involving fore and hind limbs. Evidence of soft tissues in a wide variety of taxa (Eudimorphodon, Sordes, Anurognathus, Rhamphorhynchus, Pterodactylus and Zhejiangopterus), indicate varying degrees of attachment of the main wing membrane to the legs, but there are no examples where the hind limbs are entirely free of this structure. In addition, in most of the taxa cited, there is evidence of a uropatagium, a flight membrane stretched between the hind limbs and supported and manipulated by the fifth toe. The strong correlation between skeletal morphology and development of the flight patagia means that restorations of wing-shape can be attempted for all reasonably well known pterosaurs, even where evidence for soft tissues is absent. Preliminary studies, based on these restorations, indicate that early, primitive pterosaurs such as Dimorphodon had short, broad wings with large uropatagia while later, more derived forms, such as Pteranodon, had long, narrow wings, and strongly reduced uropatagia. These morphological variations seem to be correlated with skeletal modifications, especially in the forelimb, and presumably reflect differing wing kinematics and flight styles. The mechanical linkage of fore and hind limbs probably acted as a strong constraint on morphological diversity, preventing pterosaurs from entering many niches now occupied by birds, and thus played an important role in shaping the evolutionary history of this group.

AMPHICYONID EXTINCTION IN EUROPE

VIRANTA, Suvi, Dept. of Geology, PO Box 11, 00014 Univ. of Helsinki, FINLAND

The family Amphicyonidae (Mammalia: Carnivora) became globally extinct around 7-8 million years ago. This family was diverse in the Early and Middle Miocene of Europe. It went through a turnover in the Early Miocene, and all the Miocene forms were closely related, sharing the synapomorphic loss of the hypoconulid on m1.

Western Europe experienced enhanced turnover in the mammalian fauna during the so-called mid-Vallesian crisis (about 10.6 Ma) indicating substantial environmental change. At the same time amphicyonids experienced a significant decrease in diversity, leading to their eventual extinction.

Amphicyonid extinction in the Middle and Late Miocene of western Europe is studied in relation to environmental changes and changes in both the potential prey and carnivore community. The diversity of amphicyonids correlates with the occurrence of small pecoran (body mass 10-30 kg) species. The diversity of omnivorous carnivores parallels the diversity of amphicyonids, which were mainly bone-crushing mesocarnivores. All the omnivorous carnivores disappeared along with amphicyonids in the mid-Vallesian crisis in western Europe. The hypercarnivores which were only small body sized (less than 100 kg) species in the Middle Miocene were replaced by large forms (over 100 kg). Only a few Late Miocene (thus post crisis) localities known from Central Europe record amphicyonids. They seem to have preserved environments similar to the Middle Miocene of western Europe.

EOCENE TERRESTRIAL ENVIRONMENTS AND BIOTA OF THE NORTHERN ANTARCTIC PENINSULA

VIZCAINO, S.F., REGUERO, M.A., Departamento Científico Paleontología Vertebrados, Museo de La Plata; MARENSSI, S.A., SANTILLANA, S.N., Instituto Antarctico Argentino, ARGENTINA

The evidence for Early Tertiary terrestrial environments and biotas from Antarctica comes from the Eocene La Meseta Formation, Seymour Island (64°13'S, 56°39'W). Sediments of marine and paralic environments were deposited as infill in a tectonically controlled incised valley. The provenance of the sediments was a highland or mountainous area located to the northwest. The flora is composed of one gymnosperm and several angiosperm families. Vertebrates are represented by fishes, birds, and mammals. Among the birds are two ground-dwellers (?phorusrhacoid and ratites) and a falconid. Among the mammals are marsupials, sloths, and ungulates, all clearly adapted to forest habitats. The marsupials are arboreal and frugivorous to insectivorous. The sloths are semiarboreal folivores. The ungulates are browsing herbivores. A growing body of evidence indicates that during the Eocene, the northern part of the Antarctic Peninsula was a forested area with a seasonal, humid, cool climate that sustained a well-developed terrestrial vertebrate community.

AN UNSUCCESSFUL ATTACK ON AMEBELODON BY ?NIMRAVIDES

VOORHIES, M. R., and BAILEY, Bruce E., University of Nebraska State Museum, Lincoln, NE 68588-0514

It has long been surmised that extinct carnivorans with elongate, laterally-compressed upper canines preyed upon large, thick-skinned mammals but direct evidence for such predator/prey relationships is rare, especially in the pre-Pleistocene fossil record.

The right frontal bone of an almost perfectly preserved skull of Amebelodon cf. A. fricki (Proboscidea: Gomphotheridae) bears a deep puncture, lenticular in cross section, which we interpret as the bite mark of a sabertoothed felid. The skull and associated mandible were found in 1995 by Mike and Josh Spaeth on the Spaeth ranch in Deuel Co., western Nebraska, in weakly consolidated sand and gravel assigned to the Ogallala Group (undifferentiated). A sparse associated mammalian fauna indicates a mid-Hemphillian (ca. 7-8 Ma) age, approximately equal to that of the Cambridge and Oshkosh local faunas.

Extensive callus formation around the bite, likely a high-impact stab, shows that the wound was not fatal. The gomphothere, an aged female to judge from its dentition, survived until its third molars wore out. We suggest that the attacker was probably Nimravides cf. N. catocopis, a large machairodontine felid whose upper canines (measuring 30mm Ap x 15mm Tr and having strong carinae both fore and aft) are consistent with the size and morphology of the partly healed bite. The sabers of Barbourofelis (Nimravidae), the only other large mid-Hemphillian feliform, were probably too slender and fragile to have penetrated deeply into bones of adult proboscideans.

PRIMITIVE MORPHOLOGY OF THE MIDDLE EAR IN SOME RODENTS.

WAHLERT, John H., Natural Sciences, Baruch College, CUNY, 17 Lexington Ave., New York, NY 10010; OAKS, Emily C., Department of Biology, SUNY Oswego, Oswego, NY 13126.

The late early Eocene *Paramys copei* preserves the most ancient auditory morphology known in rodents; it is similar to the primitive morphology in therian mammals: exposed transpromontorial internal carotid artery with laterally diverging stapedial trunk, facial nerve entering chamber via secondary facial foramen and exiting from primitive stylomastoid foramen, tensor tympani and stapedius muscles probably large, epitympanic recess negligible. Probable derived rodent characters: breadth of petrosal anterolateral to promontorium suggesting