

MESONYCHIDS

One of the most amazing stories in evolutionary biology is the origin of whales from land mammals. Archaic fossil whales first appeared in the Middle Eocene (approximately 50 million years ago) with a fully whalelike body, including a horizontal tail fluke, forelimbs modified into flippers, and no hind limbs. However, their distinctive triangular teeth provide a clue as to their origins: a group of hoofed mammals known as the mesonychids.

Mesonychids were the first group of mammals to become specialized meat-eaters, appearing in the middle Paleocene (approximately 62 million years ago), before more specialized carnivorous mammals (the creodonts and eventually the true carnivores) occupied that niche. Most mesonychids were the size and shape of large wolves or bears, although some were as small as foxes. Members of this group had a heavy robust skull armed with sharp canine teeth and huge round-cusped molar teeth, suitable not only for eating meat but also for crushing bone. The body was also very wolflike, with a long tail and limbs (Figure 1). Like many modern carnivores, mesonychids walked on the tips of their long toes, rather than flat-footed. Despite all these carnivorous adaptations, however, mesonychids were derived from hoofed mammals. The proof is in their toes, which had hooves rather than claws.

By the Early Eocene (approximately 55 million years ago), mesonychids had reached their peak of diversity, with wolf-sized beasts such as *Mesonyx* and *Harpagolestes* reigning as the largest carnivorous mammals of their time. However, they had to share their world with two other groups of carnivorous mammals: the creodonts (which soon surpassed them in size and diversity) and the true carnivores (which were still weasel-sized and which did not become large dog-sized or cat-sized predators until the Oli-

gocene (approximately 30 million years ago). By the Middle Eocene (approximately 50 to 47 million years ago), the mesonychids had declined rapidly in North America and Eurasia, where once they had dominated. The reasons for this decline are unclear. This period was a time of major climatic change, with global cooling and drying that destroyed the dense forests where mesonychids once had ruled. With the coming of open habitats, prey species became faster and more agile. Large, clumsy predators like mesonychids might have had difficulty finding cover to ambush their prey. In addition, some paleontologists speculate that mesonychids were less efficient at eating meat than creodonts or carnivorans, since the blunt, rounded cusps of mesonychid molars never developed the specialized, scissorlike shearing edges found in more specialized carnivorous mammals. For whatever reasons, in the late Middle Eocene the mesonychids were very rare. They disappeared from North America at the end of the Middle Eocene (approximately 37 million years ago) and from Asia in the Late Eocene (about 34 million years ago).

The last of the Asian mesonychids, however, was a truly spectacular beast known as *Andrewsarchus* (Figure 2). Only one specimen of this animal is known, but it is a skull almost a meter long, more than twice the size of any bear that has ever lived. If the rest of the animal were also bearlike, it would have been about four meters long, two meters high at the shoulder, and weighed almost four times as much as the largest known bear. It is possible that, since mesonychids were closely related to whales, the huge skull might just as easily have come from a whalelike body. However, the fossil was found in terrestrial deposits, so this seems less likely.

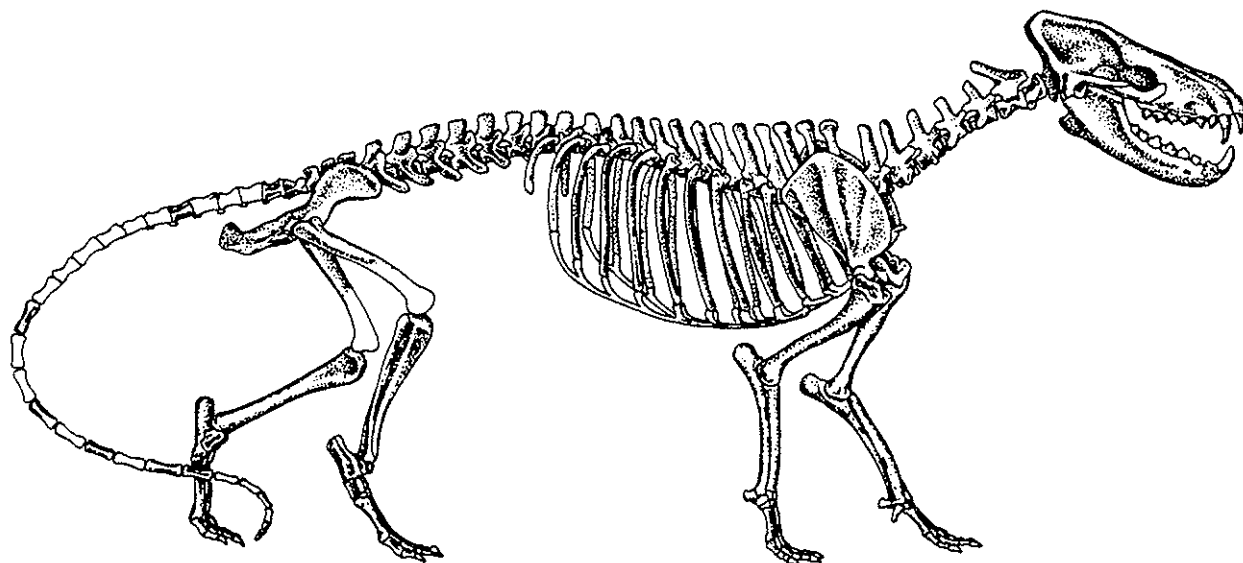


Figure 1. Skeleton of *Mesonyx*, a bear-sized mesonychid from the early Eocene of North America. From Scott (1888).

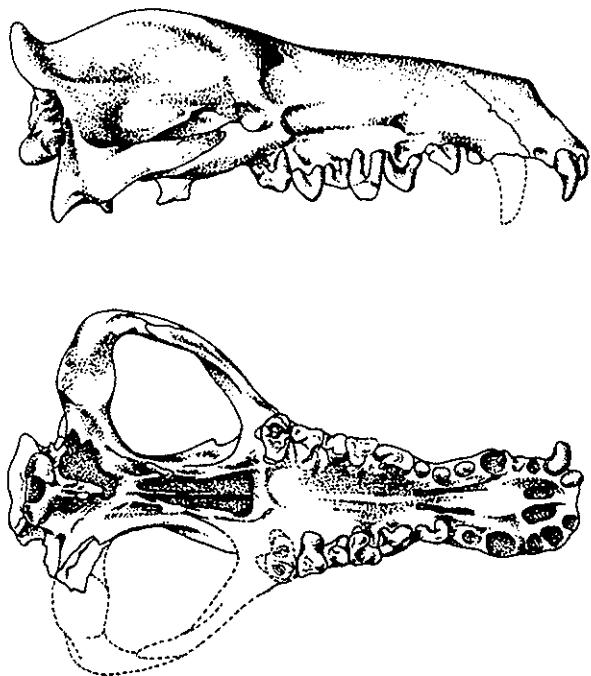


Figure 2. Meter-long skull of *Andrewsarchus*, the largest mesonychid ever found, from the late Eocene of Mongolia. From Osborn (1924).

As the last of the mesonychids died out in the Late Eocene (approximately 34 million years ago), their close relatives, the whales, were already established in the oceans of the world. The connection between mesonychids and whales first was suggested by William Diller Matthew in 1937 and revived by Leigh Van Valen in 1968 and by Fred Szalay in 1969. The earliest whales have many features of the braincase and skull, and especially their distinctive, triangular-bladed teeth, that are very similar to the condition found in mesonychids. For years the oldest known whales of the early Middle Eocene (approximately 50 million years ago) were fully aquatic animals that lacked hind limbs and were very different from mesonychids. In the past few years, however, numerous transitional forms between whales and mesonychids have been found, dating from the Early Eocene of Africa and Asia. The most impressive of these is *Ambulocetus* from the early Eocene of Pakistan. Although it still has a mesonychid skull and teeth, its front and hind feet are both adapted for swimming. It does not yet have a tail fluke. Other fossil whales have even more specialized front flippers and have their hind limbs reduced to tiny vestiges and have a tail with a horizontal fluke. The transformation from a carnivorous hoofed mammal to a fully aquatic whale is now one of the best documented major evolutionary transitions in the fossil record.

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See also Whales

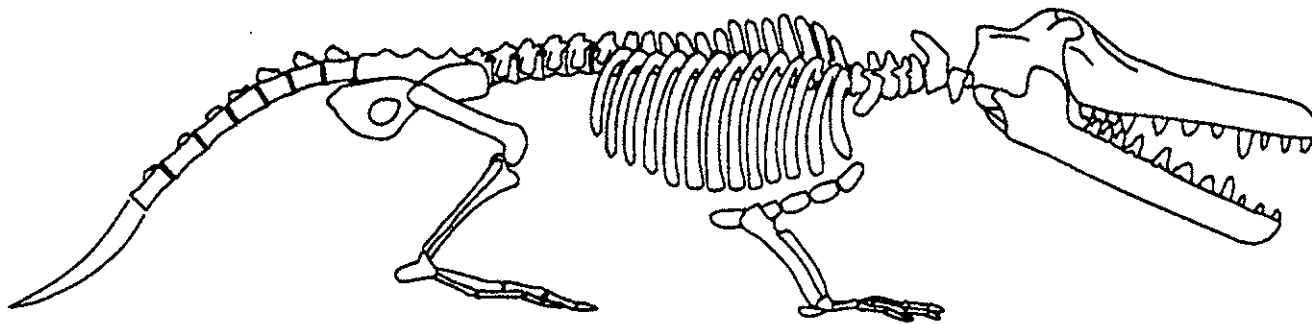


Figure 3. Reconstruction of *Ambulocetus natans*, approximately 50 million years old, found in the Kala Chitta Hills of northern Pakistan. From Thewissen et al. (1996).

Further Reading

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