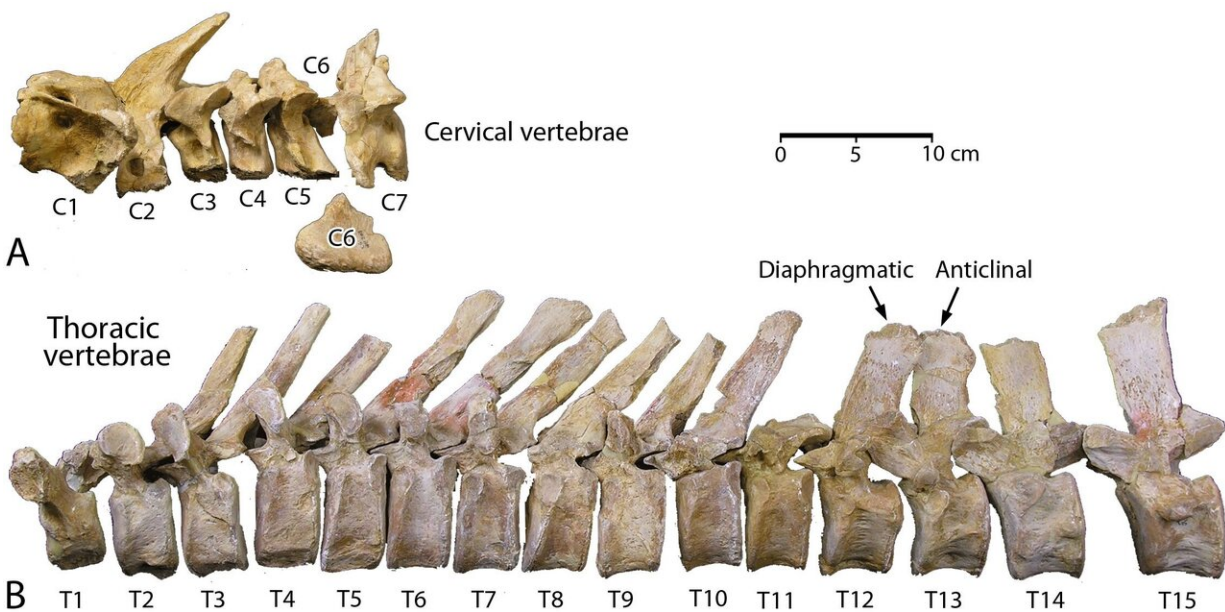


Newly described fossil whale represents intermediate stage between foot-powered and tail-powered swimming

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Cervical and thoracic vertebrae of *Aegicetus*. Compared with earlier whales, *Aegicetus* has a more elongated body and tail and smaller back legs, and it lacks a firm connection between the hind legs and the spinal column. These adaptations indicate an animal that was more fully aquatic and less of a foot-powered swimmer than its ancestors. Credit: Gingerich et al in *PLOS ONE*.

A newly described fossil whale represents a new species and an important step in the evolution of whale locomotion, according to a

University of Michigan paleontologist and his colleagues.

The fossilized remains of *Aegicetus gehennae* were recovered in the Egyptian desert in 2007 and were dated to around 35 million years ago. The creature appears to have been well-adapted for swimming through undulation of the mid-body and tail, somewhat as crocodiles swim today, according to U-M's Philip Gingerich.

The discovery is detailed in a paper scheduled for publication Dec. 11 in the journal *PLOS ONE*.

The fossil record of whale evolution tracks the transition from land-dwelling ancestors to ocean-dwelling cetaceans. Protocetids are a group of early, semi-aquatic [whales](#) known from the middle of the Eocene, a geological epoch that began 56 million years ago and ended 33.9 million years ago. Protocetid remains have been found in Africa, Asia and the Americas.

While modern whales are fully aquatic and use their tails to propel themselves through the water, most protocetids are thought to have been semi-aquatic and swam mainly with their limbs.

In their *PLOS ONE* paper, Gingerich and his colleagues describe a new genus and species, *Aegicetus gehennae*, the first late-Eocene protocetid. Its body shape is similar to that of other ancient whales of its time, such as the famous *Basilosaurus*.

The researchers suggest that an undulatory swimming style might represent a transitional stage between the foot-powered swimming of early whales and the tail-powered swimming of modern whales.

"Early protocetid whales living 47 to 41 million years ago were foot-powered swimmers. Later, starting about 37 million years ago, whales

became tail-powered swimmers," said Gingerich, a professor emeritus in the U-M Department of Earth and Environmental Sciences and curator emeritus at the U-M Museum of Paleontology.

"This newly discovered fossil whale, *Aegicetus*, was intermediate in time and form and was transitional functionally in having the larger and more powerful vertebral column of a tail-powered swimmer," said Gingerich, who is also a professor emeritus of ecology and evolutionary biology and of anthropology.

The fossilized bones were discovered in the Wadi Al Hitan World Heritage Site in the Western Desert of Egypt. *Aegicetus* is the youngest-known protocetid and is known from one exceptionally complete skeleton—roughly two-thirds of the individual's bones were recovered—and a partial second specimen, making it among the best-preserved ancient whales.

The mostly complete specimen is believed to have been a male. It would have weighed nearly 2,000 pounds in life and would have been about 12 feet long.

Compared with earlier whales, *Aegicetus* has a more elongated body and tail and smaller back legs, and it lacks a firm connection between the hind legs and the spinal column. These adaptations indicate an animal that was more fully aquatic and less of a foot-powered swimmer than its ancestors.

The original fossils have been held at the U-M Museum of Paleontology for study but will soon be returned to the Egyptian Geological Museum in Cairo. Molds and casts of nearly all of the specimens will remain in Ann Arbor.

Wadi Al Hitan, or "Valley of the Whales," is a UNESCO World

Heritage Site best known for yielding complete and nearly complete skeletons of prehistoric whales. In 2007, a partial skeleton of *Aegicetus* was found eroding from sediments in the eastern part of the World Heritage Site. Later that year, a much more complete skeleton was located.

In addition to Gingerich, the authors of the *PLOS ONE* paper are Mohammed Sameh M. Antar of the Egyptian Environmental Affairs Agency and Iyad S. Zalmout of the Saudi Geological Survey.

Research in Egypt was sponsored by the Egyptian Geological Museum, the Egyptian Environmental Affairs Agency, the Egyptian Mineral Resources Authority, the University of Michigan Museum of Paleontology, The U.S. National Science Foundation, and the National Geographic Society.

Specimens described in the paper were collected and studied following protocols outlined in a three-way memorandum of understanding between the Egyptian Geological Survey and Mining Authority, the Egyptian Environmental Affairs Agency, and the University of Michigan.

More information: Gingerich PD, Antar MSM, Zalmout IS (2019) *Aegicetus gehennae*, a new late Eocene protocetid (Cetacea, Archaeoceti) from Wadi Al Hitán, Egypt, and the transition to tail-powered swimming in whales. *PLoS ONE* 14(12): e0225391. doi.org/10.1371/journal.pone.0225391

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