Unveiling the tale of Tutcetus, the 'pharaoh' of whales who died young 41 million years ago

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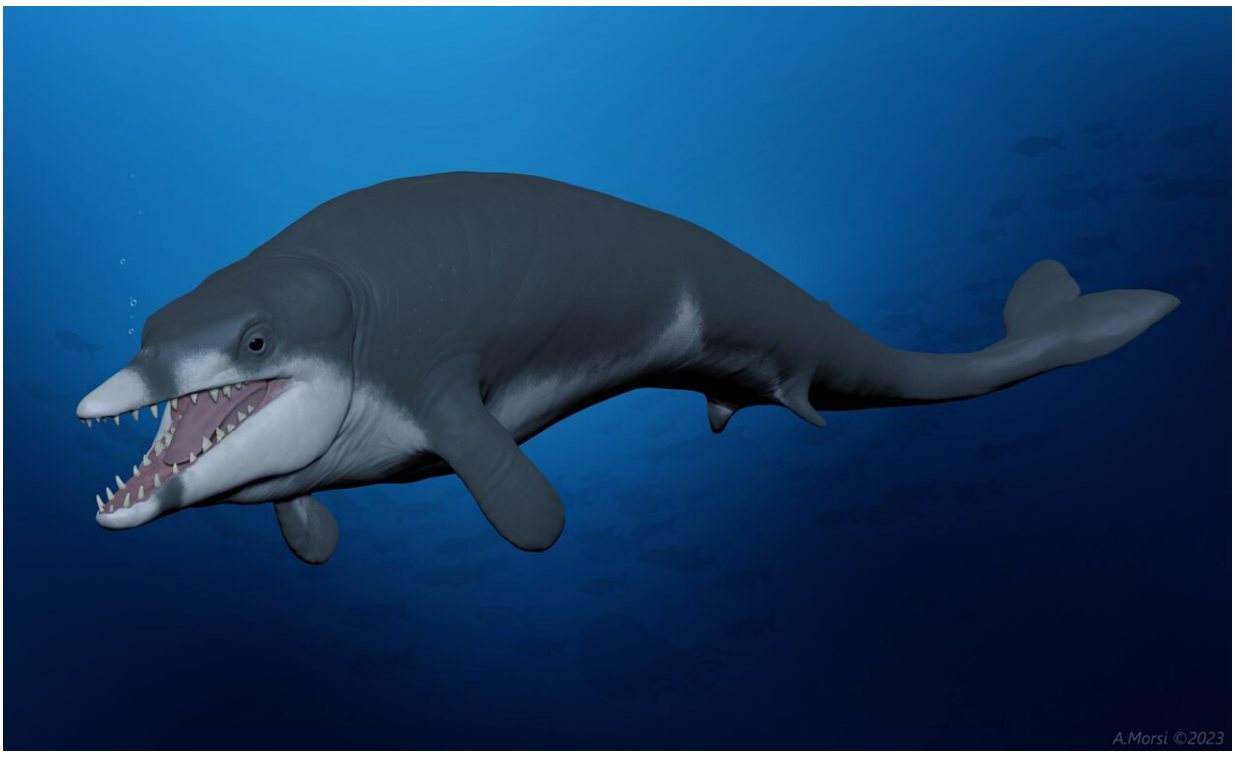


Life reconstruction of the extinct basilosaurid whale Tutcetus rayanensis swimming in the Tethys Ocean of present-day Egypt, 41 million years ago. Illustration by Ahmed Morsi. Credit: Hesham Sallam - Mansoura University Vertebrate Paleontology Center

An international team of scientists, led by Egyptian researchers, has made a groundbreaking discovery of a new species of extinct whale, Tutcetus rayanensis, that inhabited the ancient sea covering present-day Egypt around 41 million years ago. This new whale is the smallest basilosaurid whale known to date and one of the oldest records of that family from Africa. Despite its tiny size, Tutcetus has provided unprecedented insights into the life history, phylogeny, and paleobiogeography of early whales.

Basilosauridae, a group of extinct fully aquatic whales, represents a crucial stage in whale evolution, as they transitioned from land to sea. They developed fish-like characteristics, such as a streamlined body, a strong tail, flippers, and a tail fin, and had the last hind limbs visible enough to be recognized as "legs," which were not used for walking but possibly for mating.

The newly discovered Tutcetus rayanensis was found in the middle Eocene rocks, and unambiguously, it helps to illuminate the picture of early whale evolution in Africa. The new whale's name draws inspiration from both Egyptian history and the location where the specimen was found. The genus name, Tutcetus, combines "Tut"—referring to the famous Egyptian Pharaoh Tutankhamun—and "cetus," Greek for whale, highlighting the specimen's small size and subadult status. The name also commemorates the discovery of the king's tomb a century ago and coincides with the impending opening of the Grand Egyptian Museum in Giza. The species name, rayanensis, refers to the Wadi El-Rayan Protected Area in Fayum where the holotype was found.

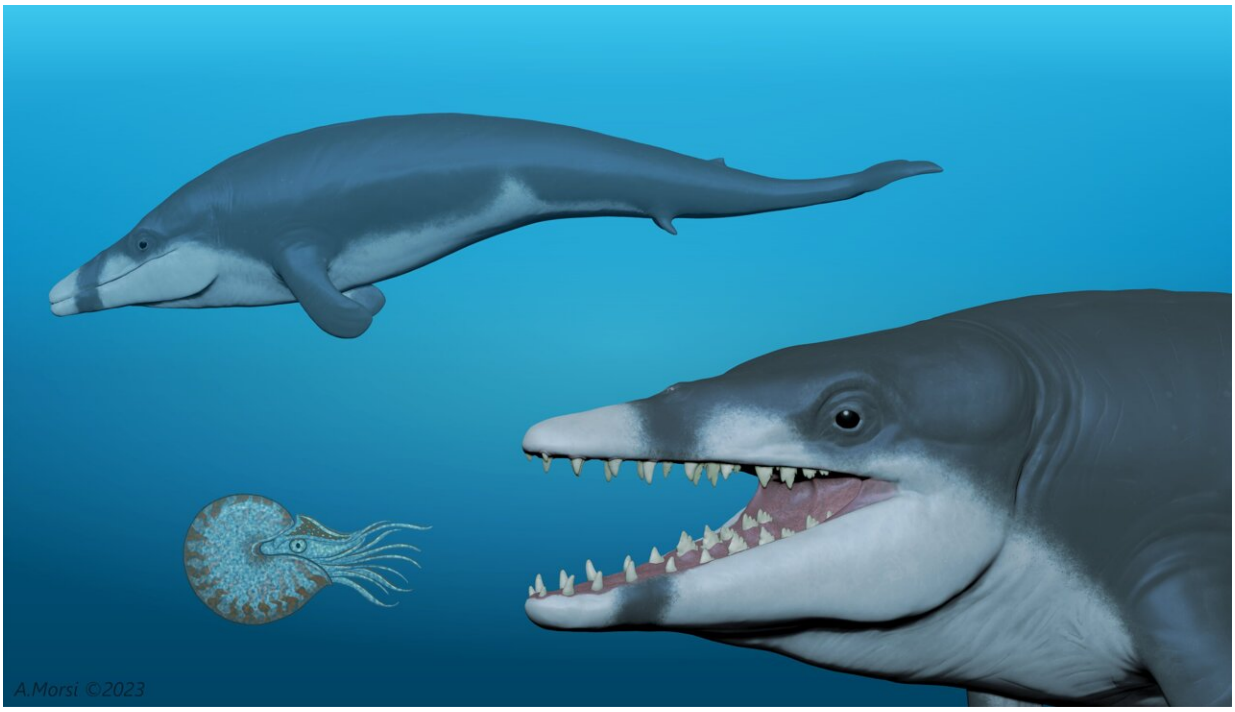
The Egyptian paleontologists Abdullah Gohar, Mohamed Sameh, and Hesham Sallam (from left) next to the holotype fossils of the newly identified basilosaurid whale, Tutcetus rayanensis, at Mansoura University Vertebrate Paleontology Center. Credit: Hesham Sallam - Mansoura University Vertebrate Paleontology Center

Hesham Sallam, a Professor of Vertebrate Paleontology at the American University in Cairo, founder of Mansoura University Vertebrate Paleontology Center, and the leader of the project, commented, "Whales' evolution from land-dwelling animals to beautiful marine creatures embodies the marvelous adventurous journey of life. Tutcetus is a remarkable discovery that documents one of the first phases of the

transition to a fully aquatic lifestyle that took place in that journey."

The holotype specimen consists of a skull, jaws, hyoid bone, and the atlas vertebra of a small-sized subadult basilosaurid whale that is embedded in an intensively compacted limestone block. With an estimated length of 2.5 meters and a body mass of approximately 187 kilograms, Tutcetus is the smallest known basilosaurid to date.

The team's findings have been published in *Communications Biology*, and the lead author, Mohammed Antar, from the Mansoura University Vertebrate Paleontology Center and the National Focal Point for Natural Heritage, stated, "Tutcetus significantly broadens the size range of basilosaurid whales and reveals considerable disparity among whales during the middle Eocene period. The investigation of the older layers in Fayum layers may reveal the existence of an older assemblage of early whale fossils, potentially influencing our current knowledge of the emergence and dispersal of whales."



Life reconstruction of two individuals of the extinct basilosaurid whale Tutcetus rayanensis, with the foreground individual preying on a nautilid cephalopod and another swimming in the background. Illustration by Ahmed Morsi. Credit: Hesham Sallam - Mansoura University Vertebrate Paleontology Center

Sanaa El-Sayed, a Ph.D. student at University of Michigan, member of Sallam Lab, and a co-author of the study, stated, "The relatively small size of Tutcetus (188 kg) is either primitive retention or could be linked to the global warming event known as the 'Late Lutetian Thermal Maximum (LLTM).' This groundbreaking discovery sheds light on the early evolution of whales and their transition to aquatic life."

Through detailed analyses of Tutcetus's teeth and bones, using CT scanning, the team was able to reconstruct the growth and development pattern of this species, providing an unparalleled understanding of the life history of early whales. The rapid dental development and small size of Tutcetus suggest a precocial lifestyle with a fast pace of life history for early whales. Additionally, the discovery of Tutcetus contributes to the understanding of the basilosaurids' early success in the aquatic environment, their capacity to outcompete amphibious stem whales, and their ability to opportunistically adapt to new niches after severing their ties to the land. The team's findings suggest that this transition likely occurred in the (sub)tropics.

Abdullah Gohar, a Ph.D. student at Mansoura University and a member of Sallam Lab and a co-author of the study, stated, "Modern whales migrate to warmer, shallow waters for breeding and reproduction, mirroring the conditions found in Egypt 41 million years ago. This supports the idea that what is known as now Fayum was a crucial breeding area for ancient whales, possibly attracting them from various

locations and, in turn, drawing in larger predatory whales like Basilosaurus".

Egyptian researchers don the regalia of King Tutankhamun as they proudly present the holotype fossils of the newly discovered whale species, Tutcetus rayanensis, at Mansoura University Vertebrate Paleontology Center. From left: Abdullah Gohar holds the symbolic crook and flail of King Tutankhamun, Mohamed Sameh wears the iconic King Tutankhamun Scarab Necklace, and Hesham Sallam sports Tutankhamun's Scarab Bracelet. Credit: Hesham Sallam - Mansoura University Vertebrate Paleontology Center

The team's findings have significant paleobiogeographic implications, demonstrating that basilosaurids likely achieved a rapid spread over the Southern Hemisphere, reaching high latitudes by the middle Eocene.

Erik Seiffert, who is the Chair and Professor of Integrative Anatomical Sciences at the University of Southern California and a co-author of the study, remarked, "The Eocene fossil sites of Egypt's Western Desert have long been the world's most important for understanding the early evolution of whales and their transition to a fully aquatic existence. The discovery of Tutcetus demonstrates that this region still has so much more to tell us about the fascinating story of whale evolution."

More information: Hesham Sallam, A diminutive new basilosaurid whale reveals the trajectory of the cetacean life histories during the Eocene, *Communications Biology* (2023). DOI: 10.1038/s42003-023-04986-w.
www.nature.com/articles/s42003-023-04986-w

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