Fossil saved from mule track revolutionizes understanding of ancient dolphin-like marine reptile

May 14 2013

This is *Malawania*, the Jurassic-style Cretaceous ichthyosaur from Iraq. Credit: Illustrations by Robert Nicholls, paleocreations.com; coloring by C. M. Kosemen, cmkosemen.com

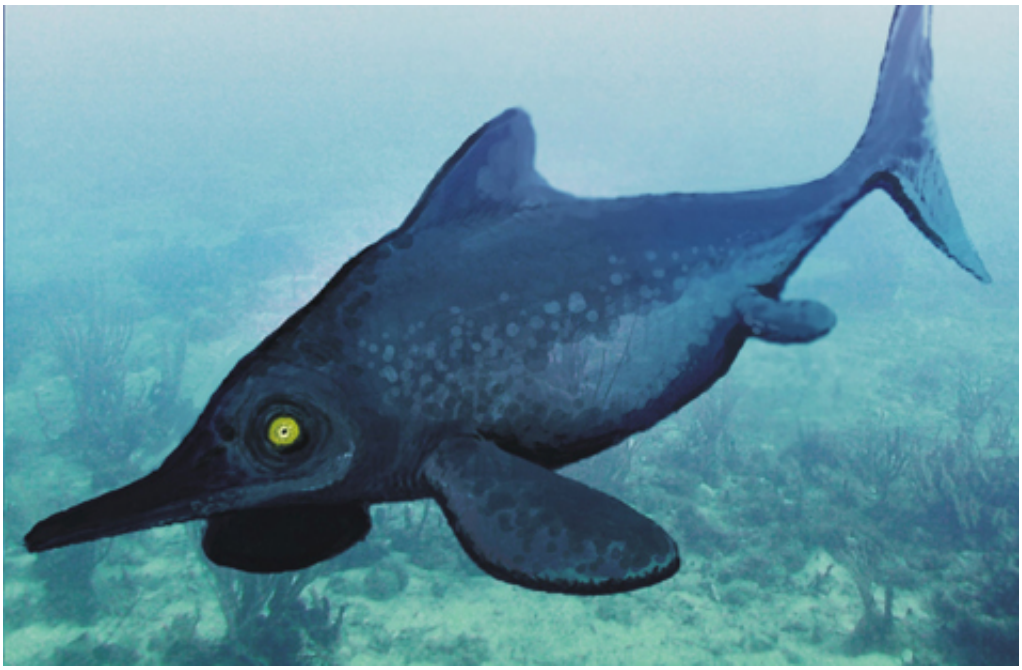
An international team of scientists have revealed a new species of ichthyosaur (a dolphin-like marine reptile from the age of dinosaurs) from Iraq, which revolutionises our understanding of the evolution and

extinction of these ancient marine reptiles.

The results, produced by a collaboration of researchers from universities and museums in Belgium and the UK and published today (May 15) in *Biology Letters*, contradict previous theories that suggest the ichthyosaurs of the Cretaceous period (the span of time between 145 and 66 million years ago) were the last survivors of a group on the decline.

Ichthyosaurs are marine reptiles known from hundreds of fossils from the time of the dinosaurs. "They ranged in size from less than one to over 20 metres in length. All gave birth to live young at sea, and some were fast-swimming, deep-diving animals with enormous eyeballs and a so-called warm-blooded physiology," says lead author Dr Valentin Fischer of the University of Liege in Belgium.

Until recently, it was thought that ichthyosaurs declined gradually in diversity through multiple extinction events during the Jurassic period. These successive events were thought to have killed off all ichthyosaurs except those strongly adapted for fast-swimming life in the open ocean. Due to this pattern, it has been assumed that ichthyosaurs were constantly and rapidly evolving to be ever-faster open-water swimmers; seemingly, there was no 'stasis' in their long evolutionary history.



This is a fellow Jurassic extinction survivor *Acamptonectes*. Credit: Illustrations by Robert Nicholls, paleocreations.com; coloring by C. M. Kosemen, cmkosemen.com

However, an entirely new ichthyosaur from the Kurdistan region of Iraq substantially alters this view of the group. The specimen concerned was found during the 1950s by British petroleum geologists. "The fossil – a well-preserved partial skeleton that consists of much of the front half of the animal – wasn't exactly being treated with the respect it deserves. Preserved within a large, flat slab of rock, it was being used as a stepping stone on a mule track," says co-author Darren Naish of the University of Southampton. "Luckily, the geologists realized its potential importance and took it back to the UK, where it remains today," adds Dr Naish, who is based at the National Oceanography Centre, Southampton.

Study of the specimen began during the 1970s with ichthyosaur expert Robert Appleby, then of University College, Cardiff. "Robert Appleby recognised that the specimen was significant, but unfortunately died

before resolving the precise age of the fossil, which he realised was critical," says Jeff Liston of National Museums Scotland and manager of the research project. "So continuation of the study fell to a new generation of researchers."

This is the partial skeleton of *Malawania*, a new ichthyosaur from Iraq. Credit: University of Southampton

In the new study (which properly includes Appleby as an author), researchers name it *Malawania anachronus*, which means 'out of time swimmer'. Despite being Cretaceous in age, *Malawania* represents the

last-known member of a kind of ichthyosaur long believed to have gone extinct during the Early Jurassic, more than 66 million years earlier. Remarkably, this kind of archaic ichthyosaur appears characterised by an evolutionary stasis: they seem not to have changed much between the Early Jurassic and the Cretaceous, a very rare feat in the evolution of marine reptiles.

"*Malawania*'s discovery is similar to that of the coelacanth in the 1930s: it represents an animal that seems 'out of time' for its age. This 'living fossil' of its time demonstrates the existence of a lineage that we had never even imagined. Maybe the existence of such Jurassic-style ichthyosaurs in the Cretaceous has been missed because they always lived in the Middle-East, a region that has previously yielded only a single, very fragmentary ichthyosaur fossil," adds Dr Fischer.

Thanks to both their study of microscopic spores and pollen preserved on the same slab as *Malawania*, and to their several analyses of the ichthyosaur family tree, Fischer and his colleagues retraced the evolutionary history of Cretaceous ichthyosaurs. In fact, the team was able to show that numerous ichthyosaur groups that appeared during the Triassic and Jurassic ichthyosaur survived into the Cretaceous. It means that the supposed end of Jurassic extinction event did not ever occur for ichthyosaurs, a fact that makes their fossil record quite different from that of other marine reptile groups.

When viewed together with the discovery of another ichthyosaur by the same team in 2012 and named *Acamptonectes densus*, the discovery of *Malawania* constitutes a 'revolution' in how we imagine ichthyosaur evolution and extinction. It now seems that ichthyosaurs were still important and diverse during the early part of the Cretaceous. The final extinction of the ichthyosaurs – an event that occurred about 95 million years ago (long before the major meteorite-driven extinction event that ended the Cretaceous) – is now even more confusing than previously

assumed.

More information: Fischer V, Appleby RM, Naish D, Liston J, Riding JB, Brindley S and Godefroit P. 2013. A basal thunnosaurian from Iraq reveals disparate phylogenetic origins for Cretaceous ichthyosaurs. *Biology Letters*, 9: 20130021. dx.doi.org/10.1098/rsbl.2013.0021

Provided by University of Southampton