

Whales may be related to deer-like creature



Carl Buell

Source: December 20, 2007 The AP and Bellingham Herald

Whales may have come from deer-like animal

This undated handout artist rendering provided by Northeastern Ohio Universities Colleges of Medicine and Pharmacy (NEOUCOM) shows The 48 million year old ungulate *Indohyus* from India. *Indohyus* is a close relative of whales, and the structure of its bones and chemistry of its teeth indicate that it spent much time in water. In this reconstruction, it is seen diving in a stream, much like the modern African Mousedeer does when in danger.

By SETH BORENSTEIN / AP Science Writer [The following is adapted from the original article]

WASHINGTON -- The gigantic ocean-dwelling whale may have evolved from a land animal the size of a small raccoon, new research suggests. What might be the missing evolutionary link between whales and land animals is an odd animal that looks like a long-tailed deer without antlers or an overgrown long-legged rat, fossils indicate.

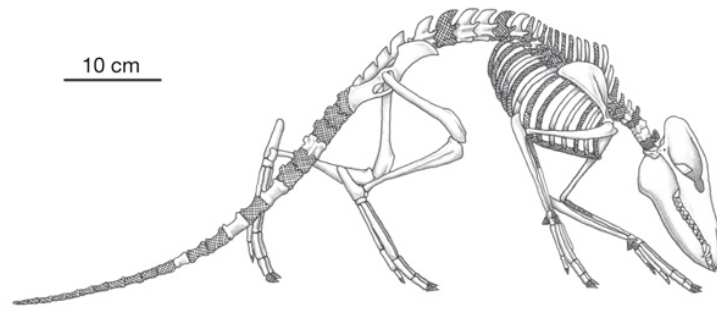
The creature is called *Indohyus*, and recently unearthed fossils reveal some crucial evolutionary similarities between it and water-dwelling cetaceans, such as whales, dolphins and porpoises.

For years, the hippo has been the leading candidate for the closest land relative because of its similar DNA and whale-like features. So some scientists were skeptical of the new hypothesis by an Ohio anatomy professor whose work was being published Thursday in the journal *Nature*.

Still, some researchers have been troubled that hippos seem to have lived in the wrong part of the world and popped up too recently to be a whale ancestor.

Newer fossils point to the deer-like *Indohyus*. The animal is a "missing link" to the sister species to ancient whales, said Hans Thewissen, an anatomy professor at Northeastern Ohio Universities College of Medicine.

1. According to what you have learned in this unit, should this really be called a "missing link"? What would be a more accurate term for this new species? Why is this so?



Source: December 20, 2007 www.nature.com/nature
Hatched elements are reconstructed on the basis of related taxa.



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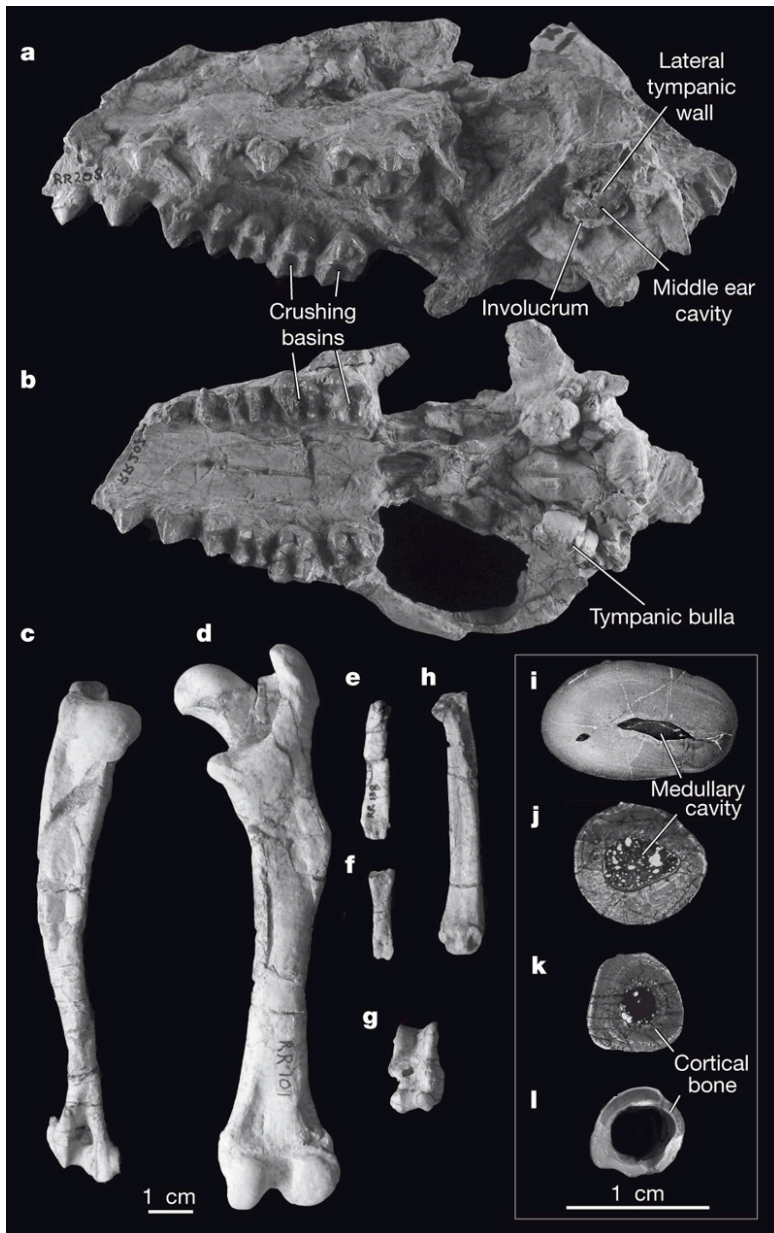
This **composite** drawing provided by the Northeastern Ohio Universities Colleges of Medicine and Pharmacy (NEOUCOM) shows the fossil skeleton of the even-toed artiodactyl *Indohyus*, which lived 48 million years ago in Kashmir, India. These fossils were found in a layer dense with bones where many skeletons of this species were washed together. *Indohyus* is a close relative of whales, and lived in water.

"As a zoo animal, it looks nothing like a whale," Thewissen said. But, he added, when it comes to anatomical features, the *Indohyus* "is quite strikingly like one." For example, the fossil hosts a thick covering of bone over the middle-ear space (called the involucrum). Before this, the involucrum had only ever been seen in cetaceans.

In addition, the levels of different carbon and oxygen isotopes in the tooth enamel of land-dwelling animals differ from those in aquatic animals because of the different isotope compositions in the food and water that they ingest. *Indohyus*'s teeth have higher levels of the carbon-13 isotope than is typical for water-foraging whales from the Eocene, suggesting that it fed on land-based plants instead. "We'd like to know in more detail what it ate," says Thewissen. "Isotopes found in the teeth indicate that it was not submerged vegetation. We'll be studying that in the future."

Thewissen, who earlier published papers on fossils of what he called the first amphibious whale and the skeleton of the oldest known whale, studied hundreds of *Indohyus* bones unearthed from mudstone in the Kashmir region of India. From that cache of bones he created a **composite skeleton** of a 48 million-year-old creature.

2. Thewissen has been criticized for using a composite skeleton. Why might using bones from lots of different animals be a problem?



Source: Source: December 20, 2007

www.nature.com/nature

The key finding connecting *Indohyus* to the whale is its thickened ear bone, something only seen in cetaceans. An examination of its teeth showed that the land-dwelling creature spent lots of time in the water and may have fed there, like hippos and whales. Also, the specific positioning and shape of certain molars connects *Indohyus* to the earliest whales, which are about 50 million years old, Thewissen said.

3. How do the key findings with this potential relative compare with other information you have learned about the ancestors of whales?

"The earliest whales didn't look like whales at all," Thewissen said. "It looked like a cross between a pig and a dog." They lost their legs and ability to walk on land about 40 million years ago, he said.

And the *Indohyus*? "A tiny little deer maybe the size of a raccoon and no antlers," Thewissen said. He said it most resembles the current African mousedeer, which has a rat-like nose and "when danger approaches, it jumps in the water and hides."

India and Pakistan were the general region where early whales lived. That matches with the *Indohyus* but not the early African hippos, Thewissen said. While modern-day cetaceans are known to be smart, early whales and *Indohyus* had small brains, the researcher said.

Other scientists were intrigued, but far from convinced, especially since the case for hippos has looked good, they said.

"While this new hypothesis for the origin of whales is compelling, it will require further testing, especially since other recent studies have suggested both hippos and Raoellids were involved in whale ancestry," San Diego State University biology professor Annalisa Berta said in an e-mail. Raoellids are the larger grouping of species that include the *Indohyus*.

Kenneth Rose, a professor of functional anatomy and evolution at Johns Hopkins University, said Thewissen didn't provide enough evidence to merit his conclusions. He also questioned the use of the composite skeleton. The ear bone thickness, the key trait that Thewissen used, was difficult to judge and seemed based on a single specimen, Rose said. Much of the work is based on teeth, and overall the remains preserved from this family of species are poorly preserved, he said.

Thewissen said there are problems with not enough well preserved fossils, but he said what's left makes a strong case for *Indohyus* as the closest land ancestor - with hippos as the closest living land relative.

4. Are other scientists convinced that they should put *Indohyus* as the probable ancestor of modern whales instead of Mesonychids? What do they have to say about their certainty and what it would take to convince them?

5. Is the disagreement among scientists a weakness of science? Why?

6. Does Thewissen claim that his study is perfect? Why is his acknowledgement that more information would be helpful actually making science stronger?

Further evidence:

Another clue as to how *Indohyus* lived can be found in its limb bones, which were thickened and heavy in the same way that a hippo's are. This suggests the animal was a wader, with heavy bones to help stop it from floating.

Safety in the water

Based on this evidence, Thewissen suggests that the ancestors of whales took to the water as a predator-avoidance mechanism, and didn't develop specific aquatic feeding behaviour until much later.

Palaeontologist Jonathan Geisler, from Georgia Southern University in Statesboro, had previously identified a link between raoellids and whales, but his evidence was based only on small fragments of teeth. This new work solidifies the link, he says.

"What is really important about these fossils is that they seem to confirm the hypothesis that the ancestor of cetaceans became semi-aquatic before evolving teeth specialized for eating fish," says Geisler.

[These last four paragraphs were taken from *Nature* Published online 19 December 2007 | *Nature* | doi:10.1038/news.2007.388]

7. Nothing was said about the types of toes in this new species. Based on what you've learned about other early cetaceans, and their likely close kinship to artiodactyls (even-toed ungulates) in general, and hippos in particular, what two features about the toes of this new fossil would you expect to see?

a.

b.

[Thanks to teacher Jennifer Wright for adapting this news information to an interactive assignment.]