

Paleontologists assemble giant turtle bone from fossil discoveries made centuries apart

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The two partial limb fossils from the ancient sea turtle *Atlantochelys mortoni* fit together perfectly, leaving little room for doubt that they are from the same bone. This discovery surprised paleontologists because the two halves were discovered at least 163 years apart, defying conventional wisdom that most fossils break down after weeks or months of surface exposure. The distal half (shown on the left) was discovered in 2012; the proximal half (at right) has been in the collections of the Academy of Natural Sciences of Drexel University for more than a century and is shown with its original labels. It was first described in 1849. Credit: Drexel University

A broken fossil turtle bone discovered by an amateur paleontologist in 2012 turned out to be the missing half of a bone first described in 1849.

The surprising puzzle discovery has led paleontologists from the Academy of Natural Sciences of Drexel University and the New Jersey State Museum to revise conventional wisdom of how long fossils can survive exposed to surface conditions. It also provides insight into one of the largest turtle species ever known.

"As soon as those two halves came together, like puzzle pieces, you knew it," said Ted Daeschler, PhD, associate curator of vertebrate zoology and vice president for collections at the Academy of Natural Sciences of Drexel University.

That surprising puzzle assembly occurred in the fall of 2012, when Jason Schein, assistant curator of natural history at the New Jersey State Museum, visited the Academy's research collections to better identify and describe a recently-unearthed fossil. The discovery linked scientists from both museums to their predecessors from the 19th century, while setting the stage to advance science today.

The partial fossil [bone](#) that Schein had brought to the Academy was a recent discovery by amateur paleontologist Gregory Harpel. Harpel thought the bone seemed strange and out of place when he noticed it on a grassy embankment, a bit upstream from his usual fossil-hunting haunt at a brook in Monmouth County, N.J. Visiting the brook to search for fossil shark teeth is a weekend hobby for Harpel, an analytical chemist from Oreland, Pa. "I picked it up and thought it was a rock at first – it was heavy," Harpel said.

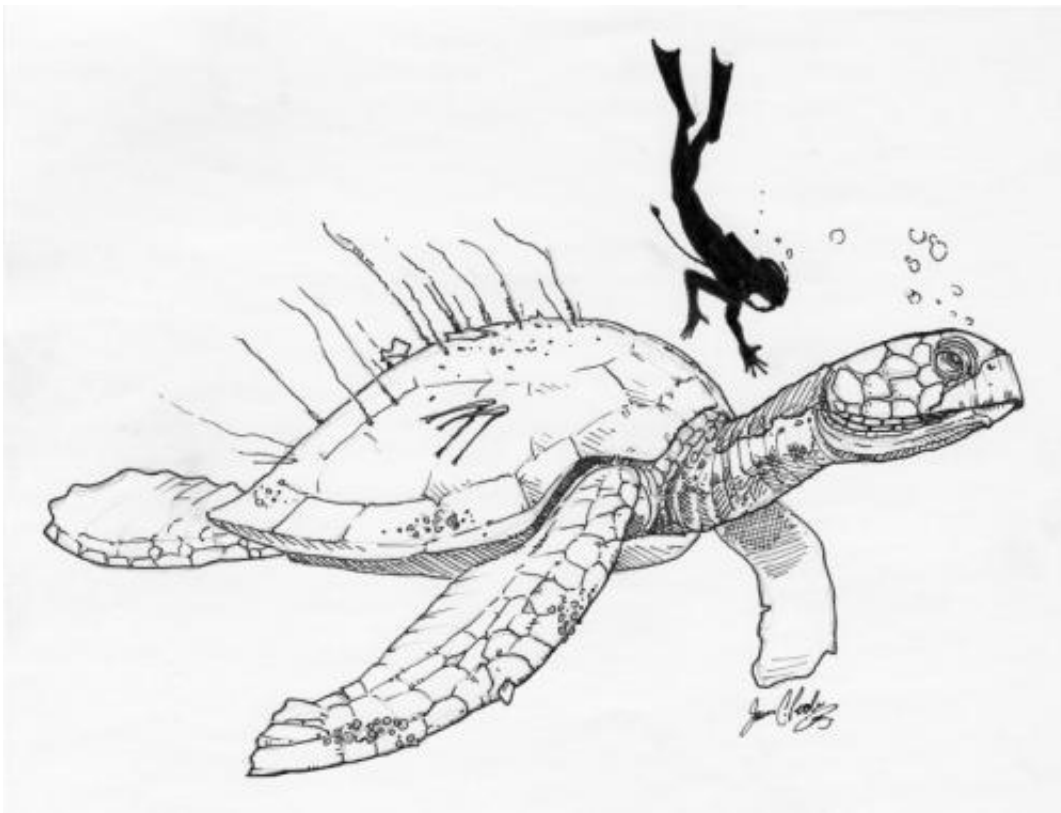
When he realized it was indeed a fossil, certainly much larger and possibly a lot more scientifically significant than shark teeth, he took it to the experts at the New Jersey State Museum, to which he ultimately donated his find.

Schein and David Parris, the museum's curator of natural history,

immediately recognized the fossil as a humerus – the large upper arm bone – from a turtle, but its shaft was broken so that only the distal end, or end nearest to the elbow, remained.

Parris also thought the fossil looked extremely familiar. He joked with Schein that perhaps it was the missing half of a different large, partial turtle limb housed in the collections at the Academy of Natural Sciences of Drexel University. That bone also had a broken shaft, but only its proximal end, nearest to the shoulder, remained. The coincidence was striking.

"I didn't think there was any chance in the world they would actually fit," Schein said.



Now that paleontologists have assembled a complete humerus bone from the sea turtle *Atlantochelys mortoni*, they have more information about the species and

its overall size. Prior to the discovery of the bone's missing half, the partial limb in the collections of the Academy of Natural Sciences of Drexel University was the only known fossil specimen of its genus and species. Based on the complete limb, they calculated the animal's overall size to be about 10 feet from tip to tail, making it one of the largest sea turtles ever known. It may have resembled modern loggerhead turtles. In this illustration, it is depicted with the outline of a human diver to indicate scale. The turtle lived 70 to 75 million years ago. Credit: Jason Poole, Academy of Natural Sciences of Drexel University

That's because the Academy's piece of the puzzle was much too old, according to the conventional wisdom of paleontology. Paleontologists expect that fossils found in exposed strata of rock will break down from exposure to the elements if they aren't collected and preserved, at least within a few years—decades at the most. There was no reason to think a lost half of the same old bone would survive, intact and exposed, in a New Jersey streambed from at least the time of the old bone's first scientific description in 1849, until Harpel found it in 2012.

The Academy's older bone was also without a match of any kind, making a perfect match seem even more farfetched: It was originally named and described by famed 19th-century naturalist Louis Agassiz as the first, or type specimen, of its genus and species, *Atlantochelys mortoni*. In the intervening years, it remained the only known fossil specimen from that genus and species.

It remained so until that fateful day when Schein carried the "new" New Jersey [fossil](#) to the Academy in Philadelphia, connecting the two halves. The perfect fit between the fossils left little space for doubt. Stunned by the implications, Schein and Academy paleontology staffers Jason Poole and Ned Gilmore, who had assembled the puzzle together, called Daeschler into the room.

"Sure enough, you have two halves of the same bone, the same individual of this giant sea turtle," said Daeschler. "One half was collected at least 162 years before the other half."

Now, the scientists are revising their conventional wisdom to say that, sometimes, exposed fossils can survive longer than previously thought. They report their remarkable discovery in the forthcoming 2014 issue of the *Proceedings of the Academy of Natural Sciences of Philadelphia*. The find is also featured in the April 2014 issue of National Geographic magazine, on newsstands now.

"The astounding confluence of events that had to have happened for this to be true is just unbelievable, and probably completely unprecedented in paleontology," said Schein.

The fully assembled *A. mortoni* humerus now gives the scientists more information about the massive sea turtle it came from as well. With a complete limb, they have calculated the animal's overall size – about 10 feet from tip to tail, making it one of the largest [sea turtles](#) ever known. The species may have resembled modern loggerhead turtles, but was much larger than any sea turtle species alive today.

The scientists believe that the entire unbroken bone was originally embedded in sediment during the Cretaceous Period, 70 to 75 million years ago, when the turtle lived and died. Then those sediments eroded and the bone fractured millions of years later during the Pleistocene or Holocene, before the bone pieces became embedded in sediments and protected from further deterioration for perhaps a few thousand more years until their discovery.

Provided by Drexel University

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