

Prehistoric "Sea Monsters" of North Dakota

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Introduction

People have always been fascinated with the sea and the creatures that live in these mysterious ocean realms. Mythical sea monsters have been part of the lore of sea-going explorers and fisherman since before the days of wooden sailing ships. Sightings of sea monsters were plotted on many early maps of the oceans (fig. 1). During these ancient, superstitious times sea monsters appeared in many forms such as slimy or scaly sea serpents, dragons, and beasts with many arms. These early mythical creatures were often based on encounters with living animals such as whales, dolphins, turtles, and giant squids. For those of you who have spent time on the ocean in a small boat, particularly at night, you understand that the ocean can be an eerie place where sharks, sea turtles, dolphins, and squids can appear larger and more intimidating than they really are; they become "sea monsters." Eyewitness accounts and stories of sea monsters still persist in seafaring cultures, marine adventure novels, documentaries, and in the cinema.

It is likely that some of the sea monster lore is based on fossils of extinct creatures that lived in the ancient oceans. North Dakota was covered by marine waters at several times in the geologic past. Most recently,

from about 80 million to 60 million years ago seas covered all or parts of the state. Remains of animals that lived in those seas are entombed in the sediments, now turned to rock, that were deposited on the sea floors, particularly the shales of the Late Cretaceous, 80-million- to 70-million-year-old Pierre Formation. Fossils of these prehistoric "sea monsters" have been recovered from several sites in North Dakota (fig. 2). If they were living today, these animals would be viewed by many as sea monsters because of their extreme size and intimidating appearance. These prehistoric sea monsters included extremely large and predatory fish, reptiles, turtles, and squids. They were the apex predators in the Pierre Sea ecosystem.



Figure 1. Sea monster attacks a ship off the coast of Norway. *Magnus's carta marina*, 1572. National Library of Sweden.

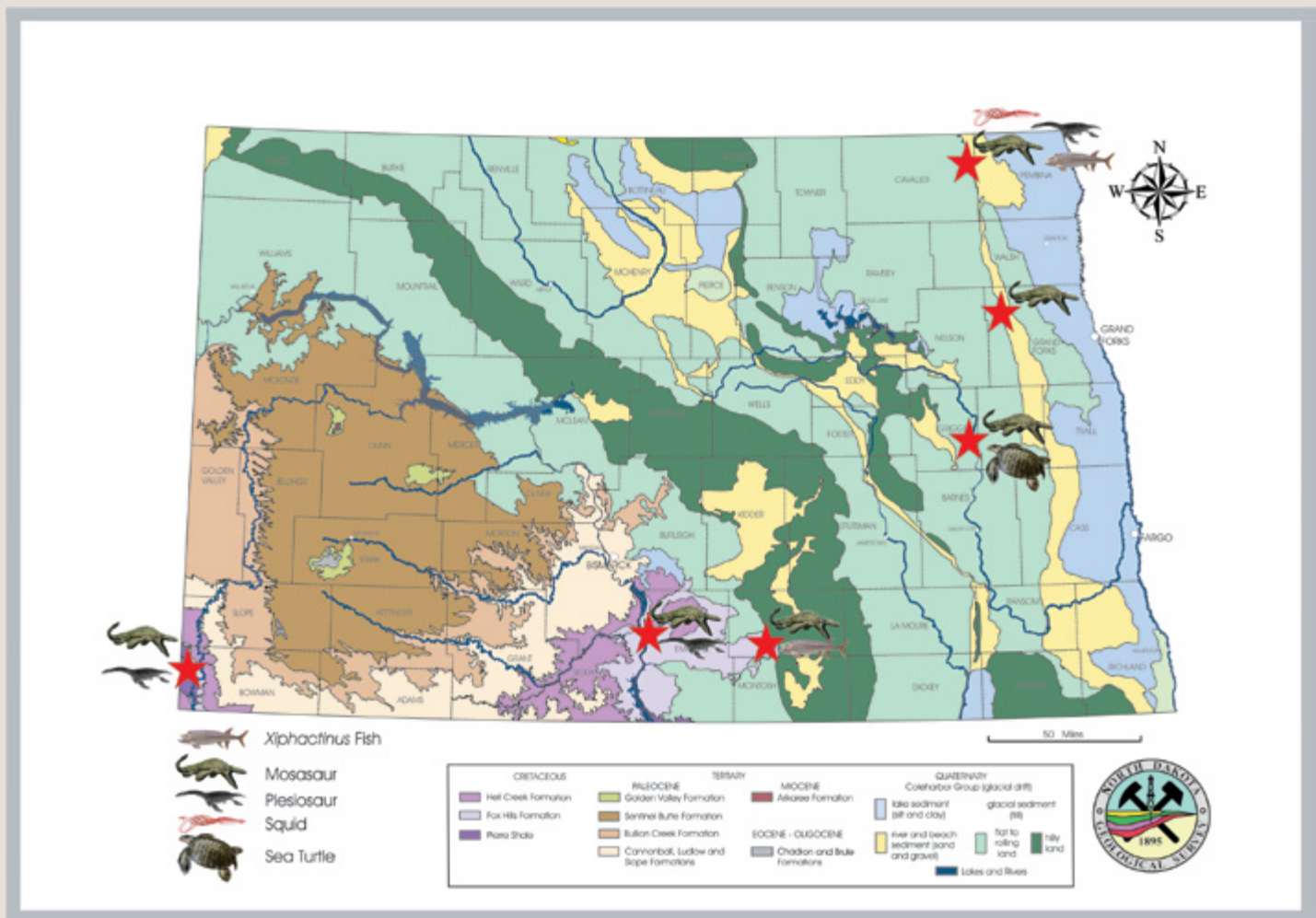


Figure 2. Simplified geologic map of North Dakota showing where prehistoric “sea monster” fossils have been found.



Figure 3. Seventeen-foot-long *Xiphactinus* skeleton cast displayed at the North Dakota Heritage Center in Bismarck.

Xiphactinus

Xiphactinus, from Latin and Greek for “sword ray,” was one of largest bony fish to live in the Pierre Sea, reaching lengths of 20 feet (figs. 3 and 4). It resembled a huge, fanged, bulldog tarpon but was not related to tarpons. It could swim at high speeds and was an efficient pursuit hunter that probably used its ghoulish fangs to strike prey during initial attack. This fish could swallow huge fish whole. A *Xiphactinus* skeleton found in the Niobrara Formation in Kansas has a perfectly preserved six-foot-long fish inside (trying to eat such a big meal likely killed the *Xiphactinus*, however). There is fossil evidence that *Xiphactinus* also preyed on mosasaurs (large marine reptiles). Even though *Xiphactinus* was an apex predator, we know that it was scavenged by sharks, particularly *Cretoxyrhina*, because remains of *Xiphactinus* have been found in a fossilized carcass of that shark. *Xiphactinus* was cosmopolitan and its fossils have been



Figure 4. Image of *Xiphactinus*. Mural at the North Dakota Heritage Center.

found in Late Cretaceous rocks in many parts of the United States, Canada, and Europe. In North Dakota, remains of *Xiphactinus* have been found in the Pierre Formation near Walhalla, Cavalier County and in the Fox Hills Formation in Logan County (fig. 2). Like so many of the large, Late Cretaceous “sea monsters,” *Xiphactinus* became extinct at the end of the Cretaceous.

Mosasaur [Plioplatecarpus, Platecarpus, Tylosaurus, Mosasaurus]

Mosasaur were huge marine reptiles, some more than 50 feet in length. The name mosasaur means “Meuse Reptile” and refers to the initial discovery of fossils of these animals in the 1700s in a limestone quarry along the Meuse River near the town of Maastricht in the Netherlands. Fossils of these creatures were discovered about 50 years before dinosaurs. Mosasaur were not dinosaurs as suggested in some children’s’ books. They are related to monitor lizards such as the Komodo dragon that lives in Indonesia today. Unlike those of their terrestrial lizard relatives, mosasaur’s limbs were modified to form paddles or flippers (fig. 5). They had streamlined bodies and were powerful swimmers moving their broad, flattened tails from side to side for locomotion. Their paddles

were used primarily for steering rather than for propulsion. Mosasaur were ambush hunters and apex predators in the shallow, warm Cretaceous seas. It is assumed that their primary prey was fish. They had double-hinged jaws and flexible skulls (similar to snakes) which enabled them to capture large fish. Backwards directed teeth on the roof of their mouths would help force the prey into their gullets. They also ate birds, cephalopods (ammonites), and probably other mosasaur. Mosasaur were air-breathing animals and gave live birth in the water. They became extinct at the end of the Cretaceous during the Cretaceous/Paleogene (K/Pg) extinction event about 65 million years ago.

Like dinosaurs, there were many different kinds of mosasaur, probably about 40 genera and nearly 100 species that lived during the Cretaceous. They inhabited oceans worldwide. In North Dakota, mosasaur fossils have been recovered from the Late Cretaceous Pierre and Fox Hills Formations. The largest and most complete skeleton of a mosasaur found in North



Figure 5. Image of the 24-foot-long mosasaur, *Plioplatecarpus*. Painting by David Miller.

Dakota was excavated from the Pierre Formation along the Sheyenne River near Cooperstown, Griggs County (figs. 2 and 6). It was discovered by Mike Hanson and Dennis Halvorson, from Cooperstown, on the Tranby/Olson property (Hoganson et al., 1999). The 75% complete skeleton is from a 24-foot-long *Plioplatecarpus* and is displayed at the North Dakota Heritage Center in Bismarck. The largest mosasaur found in North Dakota, *Tylosaurus*, was at least 40 feet long and was found in the Pierre Formation near McCanna, Grand Forks County (fig. 2). Two other Pierre Formation sites in North Dakota have also yielded mosasaur remains, the Pembina Gorge site, near Walhalla, Cavalier County and the South Marmarth site, Bowman County (fig. 2). Fossils at these sites are tentatively identified as *Platecarpus*. Mosasaurs also lived in the coastal communities of the Fox Hills Sea during the Late Cretaceous in North Dakota. Fossil teeth of these animals, found in Emmons, Logan, and Bowman Counties, have been identified as *Mosasaurus* and possibly *Plioplatecarpus* (fig. 2) (Hoganson et al., 2007).

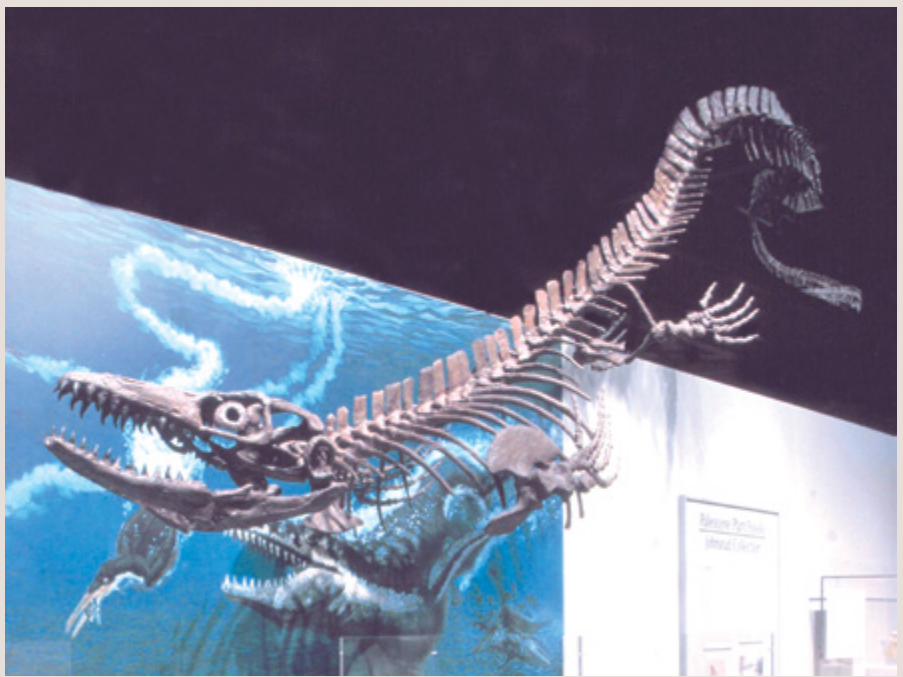


Figure 6. Skeleton of the 24-foot-long skeleton of the mosasaur *Plioplatecarpus* on exhibit at the North Dakota Heritage Center in Bismarck. Photo by Brian Austin.

Plesiosaurs

Fossils of another group of huge (some were 55 feet long), lizard-like reptiles, called plesiosaurs, have also been found in North Dakota. Like mosasaurs they were marine reptiles that lived in the Late Cretaceous seas that covered North Dakota. Plesiosaurs

had broad, compressed bodies, relatively short tails, and four long limbs in the form of flippers or paddles (fig. 7). Strong shoulder and pelvis muscles provided strength to the paddles for a “flying” movement that propelled the animal through the water. Plesiosaurs exhibited two primary morphological types, those with long necks and small heads and those with short necks and



Figure 7. Image of a 50-foot-long, long-necked plesiosaur with sharks in the foreground. Mural in the North Dakota Heritage Center.

large heads. They were air-breathing, bore live young, and were among the many larger predators that lived in the Cretaceous seas. They had a worldwide distribution. They were also a very long-lived group that first appeared in the Triassic, were common in the Jurassic, and became extinct at the end of the Cretaceous during the K/Pg extinction event about 65 million years ago. Some have suggested that plesiosaurs still exist today at places such as Loch Ness in the Scottish Highlands. Existence of the Loch Ness monster, referred to as Nessie, is questioned and is believed by scientists to be local mythical lore.

Plesiosaur skeleton parts were the first fossils of marine reptiles found during the early 1600s in Great Britain, but plesiosaurs were not formally recognized as a distinct group of animals until the early 1800s. In 1804, Lewis and Clark discovered the partial skeleton of a plesiosaur just south of the North Dakota border along the Missouri River in the Pierre Formation (Hoganson and Murphy, 2003). They described the fossil as a large fish, as most plesiosaur fossils in those days were thought to be.

Plesiosaur remains are sparse in North Dakota. No complete skeletons of these animals have been found in the state. Isolated bones, particularly the robust vertebrae and teeth, have been recovered from the Pierre Formation at sites near Walthalla in Cavalier County and in the southwestern corner of the state in Bowman County and from the Fox Hills Formation in Emmons County (fig. 2).

Archelon

Fossils of another of the Late Cretaceous huge marine reptiles have also been found in North Dakota, the giant sea turtle, *Archelon* (fig. 8). *Archelon* is derived from Greek meaning, “ruler turtle,” and so it was. It was one of that largest turtles to ever live. The largest *Archelon* fossil skeleton found was collected from the Pierre Formation in South Dakota. It was 13 feet in length, 16 feet from flipper to flipper, and estimated to have weighed about 5,000 pounds in life. It was the size of a Volkswagen beetle. Even though *Archelon* was massive, Hollywood exaggerated the size of *Archelon* (36 feet long), that terrorized the shell people on the beach in the 1966 film, “One Million Years B.C.”

Archelon did not have a solid shell as most turtles do. The carapace (top part of the shell) consisted of a framework of “struts” covered

with a leathery skin (fig. 9). This kind of shell would be lighter than a solid shell and would enhance mobility of the animal in the aquatic habitat. It is estimated that *Archelon* could live to be over 100 years old. They were carnivorous animals with a narrow skull and powerful jaws, probably feeding mostly on ammonites and squid.

The only *Archelon* fossil found in North Dakota was discovered by Peter Mack at the Cooperstown site in the Late Cretaceous Pierre Formation on the Tranby/Olson property (fig. 2). A partial mandible, vertebrae, and skull, shell, and limb bone fragments were recovered. These fossils are on display at the North Dakota Heritage Center with a skeleton cast of *Archelon*.

Tusoteuthis

The remains of another huge sea creature, the squid *Tusoteuthis*, have also been recovered from the Pierre Formation in North Dakota (Hoganson, 2009) (fig. 10). This animal, even though an invertebrate, could also be categorized as a sea monster because of its enormous size with a length of about 35 feet. Squids have a hard support structure in their mantle (the area of the body behind the head that contains muscles and organs) called a



Figure 8. The giant sea turtle *Archelon* being pursued by *T. rex*. Painting by Mark Hallett.



Figure 9. Skeleton cast of the 12-foot-long sea turtle *Archelon* on display at the North Dakota Heritage Center in Bismarck.

gladius (Latin for sword) or pen that can become fossilized. The gladius is in many ways similar to a backbone providing structural support for the animal and a place for muscle attachment. But unlike a backbone, the gladius consists of chitinous material, not bone. The gladius in squids is similar to the cuttlebone in the related cuttlefish that is sold in pet stores for use in birdcages for birds to sharpen their beaks, and as a calcium supplement. Squids are in the Class Cephalopoda (Greek for “head foot” – referring to the animals’ arms that appear to emerge from the head region of the animal). Other members of the Class Cephalopoda include octopuses, cuttlefish, chambered nautilus, and ammonites. Squids have eight arms and two tentacles. Several hundred species of squids live in the world’s oceans today.

Tusoteuthis is believed to have been similar to the living giant squid *Architeuthis dux* that can grow to lengths of 45 feet!

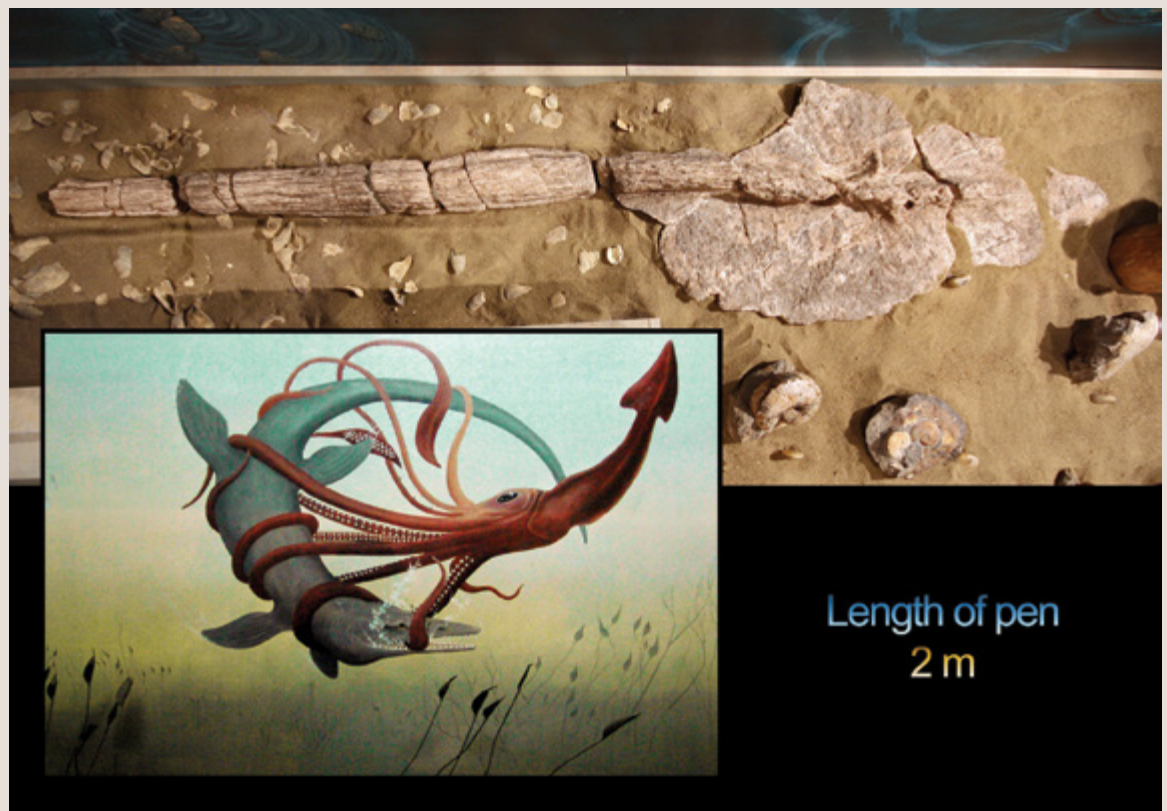


Figure 10. Gladius of the giant squid *Tusoteuthis* exhibited at the North Dakota Heritage Center in Bismarck. *Tusoteuthis* interacting with a mosasaur (image from the University of Kansas).

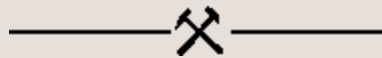
In 2002, during one of the North Dakota Geological Survey's public fossil digs an unusual fossil was discovered in the Pierre Formation at the Pembina Gorge site near Walhalla in Cavalier County (fig. 2). At first, I did not know what the fossil was. It appeared to be a fossilized branch from a tree with concentric layering in cross section. Further excavation revealed that this fossil was a canoe-paddle-shaped object that was about 6 feet long. It was determined to be a huge gladius of *Tusoteuthis*, the only one ever found in North Dakota. Calculations indicate that the squid that possessed this large gladius was about 35 feet long. This fossil is on exhibit at the North Dakota Heritage Center.

Conclusion

Seas worldwide during the Late Cretaceous, including those that covered North Dakota, were teeming with monstrous predatory animals. Most of these large animals, such as *Xiphactinus*, *Archelon*, and the many species of mosasaurs and plesiosaurs would have been considered sea monsters if seafaring cultures had existed at the time. But most of these massive animals did not survive the Cretaceous/Paleogene (K/Pg) extinction event when most of the large marine predators, the mosasaurs and plesiosaurs, were removed from the marine ecosystems. Today sharks, other fish, whales, turtles, and giant squids fill those niches. Some of these are today's "sea monsters."

References

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North Dakota Geological Survey to Offer Public Fossil Digs in 2014

The North Dakota Geological Survey began a public fossil dig program in 2000. The program is meant to provide opportunities for those interested in paleontology the experience of participating in scientific fossil excavations and other paleontological field work administered by North Dakota Geological Survey paleontologists. Several opportunities will be provided this year. These will include excavation of fossils from the Pembina Gorge Site near Walhalla, Cavalier County. At this site, in previous years, fossils of animals that lived in an ocean that covered North Dakota 80 million years ago have been excavated, including huge mosasaurs (large

marine lizards), fish, seabirds, and squids. We will also be doing paleontological field work in southwestern North Dakota near Marmarth where fossils of 65 million year old dinosaurs, turtles, mammals, and other animals will be found and collected. During another dig, people will work at a fossil quarry site in 60-million-year-old rocks near Medora where crocodile, turtle, and mammal fossils have been recovered in the past. Detailed information about this program can be found on the North Dakota Geological Survey website (<https://www.dmr.nd.gov/ndgs>).