

CRETACEOUS COASTAL FOREST AND PALEOCENE SWAMPLAND: NEW ADDITIONS TO THE NORTH DAKOTA HERITAGE CENTER CORRIDOR OF TIME EXHIBIT

By John W. Hoganson

Introduction

The first permanent fossil exhibit at the North Dakota Heritage Center in Bismarck was installed in 1992. That was the Highgate Mastodon skeleton, part of the First People exhibit. Since that time, a decision was made to interpret the history of life in North Dakota from the first fossil evidence of life in the state until the appearance of humans. The entrance area to the main gallery of the Heritage Center museum would house these exhibits and is called the Corridor of Time. The prehistoric life exhibits that depict life in North Dakota from different geologic time periods are based on North Dakota's fossil record. They are meant to provide an introduction to the remainder of the museum which interprets human history in North Dakota from the first appearance of people in the state about 11,000 years ago up to the present. Development of the prehistoric life exhibits is a collaborative effort between the North Dakota Geological Survey (NDGS) and the State Historical Society of North Dakota. Funding for the exhibits is from appropriations to these agencies and private donations. Fossils in the exhibits are from the North Dakota State Fossil Collection managed by the NDGS and housed at the Heritage Center, specimens donated by individuals for the exhibits, and loaned specimens. Almost all of the fossils were collected in North Dakota.



Highgate Mastodon skeleton, *Mammut americanum*. North Dakota Heritage Center exhibit.

Cretaceous Epicontinental Seas

The first Corridor of Time exhibit was completed in 2000 and interprets life in North Dakota during the Cretaceous from about 90 million to 70 million years ago when the state was covered by shallow, epicontinental seas. That exhibit features the restored skeleton of the 23-foot-long mosasaur (marine lizard), *Plioplatecarpus*. The skeleton was collected from the Pierre Formation near Cooperstown and was donated to the state by the Tranby and Olson families. Other fossils in this marine Cretaceous exhibit include remains of sharks and other fish; the seabird, *Hesperornis*; and several species of cephalopods, gastropods, bivalves, and crustaceans. The fossils are exhibited in front of a wall-sized mural painted by David Miller that illustrates how we think the 80-million-year-old marine community appeared.



Mosasaur skeleton, *Plioplatecarpus*. North Dakota Heritage Center exhibit.

Cretaceous Delta and Coastal Forest

By about 68 million years ago, the sea that covered North Dakota had retreated far enough that a huge delta, as large as the Mississippi delta today, developed over what is now western North Dakota. The eastern extent of the delta shore was in the vicinity of Bismarck. Sediments deposited in the delta are now called the Hell Creek Formation. Shallow marine estuarine and lagoonal habitats existed along the shore of this delta. The sediments deposited in those settings are called the Fox Hills Formation. Fossils recovered from the Hell Creek and Fox Hills Formations provide a glimpse of what life was like in western North Dakota and provide information about the climate and environment at that time. Many of these fossils are displayed in the new Cretaceous Coastal Forest display.

The Hell Creek Formation is the main dinosaur fossil-bearing formation in North Dakota and three species of dinosaurs are featured in the Cretaceous Coastal Forest exhibit. The diorama is a death scene where a partial skeleton of a *Triceratops*, buried in a sand bar, is being scavenged by two small theropod dinosaurs called dromaeosaurs. Dromaeosaurs were small, about six feet long, vicious meat-eating dinosaurs that roamed the Hell Creek Delta, possibly in packs. Other fossils displayed in the diorama include *Tyrannosaurus rex* and dromaeosaur teeth, a skull cast of the thick-headed dinosaur (pachycephalosaur), crocodile bones, a partial skeleton of the flightless seabird *Hesperornis*, and beautifully preserved turtle shells. Coprolites, fossil feces, provide detail to the diorama. Fossils from Fox Hills Formation shoreline deposits, including oysters, other bivalves, gastropods, shark, ray and ratfish teeth, and rare leaf fossils are also exhibited. The actual brow horn of a *Triceratops* is mounted on a side rail for visitors to touch. A cast of one of the first birds from the Jurassic, *Archaeopteryx*, is used to illustrate that most paleontologists now believe that modern birds are descendants of dinosaurs. A wall-sized mural, painted by Geoff Elson, behind the diorama shows what we think the Cretaceous Coastal Forest plant and animal community looked like. The skeleton (cast) of *Pteranodon*, a flying reptile with a wing span of 20 feet, hovers over the exhibit.



Dromaeosaur, a small theropod dinosaur, feeding on a *Triceratops* bone in the Cretaceous coastal forest diorama with a mural in the background showing life in North Dakota 65 million years ago.

Adjacent to the diorama is a full-scale drawing of the skeleton of a 23-foot-long adult hadrosaur, *Edmontosaurus*. *Edmontosaurus* was one of the more common plant-eating dinosaurs that lived on the Hell Creek Delta, and was apparently a major prey of *Tyrannosaurus rex*. This skeleton drawing is the backdrop for *Edmontosaurus* fossils. A complete eight-foot-tall leg, including the foot with all toe bones, is mounted on the wall in the position of the leg on the drawing. Visitors will, in a dramatic way, be able to visualize the enormity of these animals through this display. Two lower *Edmontosaurus* jaws with their batteries of hundreds of teeth, and skin impressions of that species, are also exhibited. One of the Hell Creek rocks containing rare, well-preserved skin

impressions that show large tubercles, was 3D scanned to create a mold. A cast of the rock was then made to replicate the skin impressions. Visitors are allowed to touch the replica, to feel the texture of *Edmontosaurus* skin. All of the *Edmontosaurus* fossils were provided by Tyler Lyson of Marmarth and were collected by him from the Sonsalla family property near Marmarth, Slope County.



Edmontosaurus, a duck-billed dinosaur, display in the Corridor of Time exhibit

K-T Boundary Extinction Event

About 65 million years ago, one of Earth's greatest biological catastrophes occurred. It has been estimated that about three-quarters of all plant and animal species became extinct at that time, including those that are displayed in the new exhibit. Geologists call this the K-T (Cretaceous-Tertiary) Boundary extinction event. The cause of the mass extinction has been debated by scientists for decades. Although the debate continues, most scientists believe that this catastrophe was caused by a huge meteoroid (asteroid) striking the earth—the Asteroid Impact Theory. It is estimated that the asteroid would have been over six miles in diameter and was traveling at about 50,000 miles per hour at impact. A 100-mile-wide crater called Chicxulub, on Mexico's Yucatan peninsula is believed to be the impact site.



New Leipzig (background) and Richardton meteorites.

Meteorites from the Richardton and the New Leipzig areas are included in the extinction part of the exhibit to show what “asteroid” rocks look like. The Richardton meteorite, a stony meteorite, fell between Richardton and Mott in 1918 and is on loan to us from the Department of Geology and Geophysics at the University of Minnesota. In 1936, Daniel Buckwitz, Jr. found the New Leipzig meteorite on his farm. It is on loan to us from the Smithsonian, National Museum of Natural History.



New Leipzig and Richardton meteorites in Corridor of Time exhibit.

Paleocene Swamplands and Forests

The K-T boundary extinction event marks the end of the Age of Reptiles, when reptiles were the dominant life forms on Earth, but it also marks the beginning of the Age of Mammals, the age in which we live today where mammals are dominant. However, for the first few million years after the extinction, other reptiles, but not dinosaurs, mosasaurs, or pterosaurs, were still common and important members of early Tertiary (Paleocene) communities. Many were top-of-the-food-chain predators such as crocodiles, alligators, and champsosaurs (crocodile like animals).

The new Paleocene swamplands exhibit is a diorama showing life in western North Dakota about 60 million years ago. The exhibit includes a pond containing skeletons of a *Champsosaurus*, soft shelled turtle, and fish. It also contains several leaf fossil specimens and freshwater mollusks. Lilly pads dot the rippled, Plexiglas pond surface. A crocodile skeleton basking in the sun on an insect-bored log of petrified wood is found on the pond shoreline. Shells of snapping and soft-shelled turtles, the skull of the bear-like mammal *Titanoides*, freshwater snails and clams, and several leaf fossil specimens are also displayed on the shoreline sands. A huge, beautifully preserved petrified log with the skeleton (cast) of a lemur-like mammal, *Plesiadapis*, crawling on it and large terrestrial snail shells in the bark are also found on the shore. Crocodile coprolites (fossil feces) are scattered on the sand for detail. Several small fossils, including flowers and seeds of plants and bird and fish bones are exhibited in Plexiglas covered cases.

The Paleocene, about 60 million years ago, was much different than today. The climate was like the southeast part of the United States today, hot and humid. Not only were there huge swampy areas in western North Dakota, but there were also vast forests growing here that contained many species of exotic trees, including magnolia, bald cypress, *Ginkgo*, dawn redwood, sycamore, horse chestnut, and even palms. These plants are represented in the exhibit by leaf fossils, most of which were donated by Clarence Johnsrud. A large, wall-sized mural, painted by Geoff Elson, that is a backdrop for the diorama dramatically illustrates what life was like during this time.

Part of this exhibit also provides information about how North Dakota’s vast lignite coal reserves formed through the accumulation of thick mats of vegetation in the swamps. It took millions of years for heat and pressure to convert the vegetation to lignite.



Paleocene swampland diorama with a mural in the background showing life in the swamp 60 million years ago in western North Dakota.



Pond diorama in the Paleocene swampland part of the Corridor of Time exhibit with champsosaur, turtle, fish, snails, and leaf fossils.

Exhibit Grand Opening

The public grand opening for the new Corridor of Time exhibit was on December 9, 2006. Activities at the day-long opening included games, crafts, and face painting for children. The Dakota Zoo brought living reptiles for people to view. Visitors were also encouraged to bring rocks and fossils for identification. I gave two presentations about the prehistoric life of North Dakota. Refreshments were provided for the 250 that attended. Brett Woodward answered questions about North Dakota rocks and fossils

Two special events were held prior to the grand opening. A private viewing of the new exhibit was held on the evening of December 4. Legislators, donors of fossil specimens and funds, and members of the Paleontology Advisory Group gathered to inaugurate the exhibit. Brief presentations were given by Lt. Governor Jack Dalrymple, Marion Houn (representing Senator Dorgan), Lynn Helms, and Merl Paaverud. I had the privilege of thanking the many donors, staff, volunteers, and members of the Paleontology Advisory group for making the exhibit possible. Lt. Governor Dalrymple, Marion Houn, Secretary of State Al Jaeger, Merl Paaverud, Lynn Helms, Chet Nelson, Dianne Larson, and I participated in the ribbon cutting ceremony. Jeff Clark and staff from the North Dakota State University Archeology Technologies Laboratory provided a demonstration on the application of 3D technologies for museum exhibits. The technique of generating life-like casts of fossils from digital molds was shown by Craig Nelson, Prairie Fire 3D, of Bismarck. Geoff Elson, muralist with Split Rock Studios, was present to discuss his impressive habitat reconstruction paintings.

Reception and ribbon cutting ceremony for the Corridor of Time exhibit opening.



Lt. Governor Jack Dalrymple giving the keynote address at the opening of the Corridor of Time exhibit.



Ribbon cutting ceremony for the Corridor of Time exhibit opening: l. to. r. John Hoganson, Merl Paaverud, Chet Nelson, Lynn Helms, Marion Houn, Lt. Governor Jack Dalrymple, Dianne Larson, and Secretary of State Al Jaeger.



On December 8, a special ribbon-cutting ceremony and showing of the exhibit was provided to second-graders from the Bismarck-Mandan area. Over 300 second-graders, accompanied by about 50 adults spent the day at the Heritage Center doing North Dakota prehistoric life activities based on the new exhibit. The Dakota Zoo brought live reptiles, the State Library exhibited books about prehistoric life, the North Dakota Forest Service did demonstrations about the North Dakota trees, and many crafts and games were provided by the State Historical Society of North Dakota. Children were allowed to examine many fossils up close and Brett Woodward, of our staff, talked to them about the fossils. Of course, refreshments were provided. I provided presentations about North Dakota's prehistoric life. Students from Underwood, Washburn, Wilton, Center, Streeter, Linton, Turtle Lake, and Bismarck attended.



Second grade students examining the Cretaceous coastal forest diorama in the Corridor of Time exhibit.



Special ribbon cutting ceremony for second grade students.



Special second grade opening and program for Corridor of Time exhibit. John Hoganson giving a presentation about the prehistoric life of North Dakota.

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