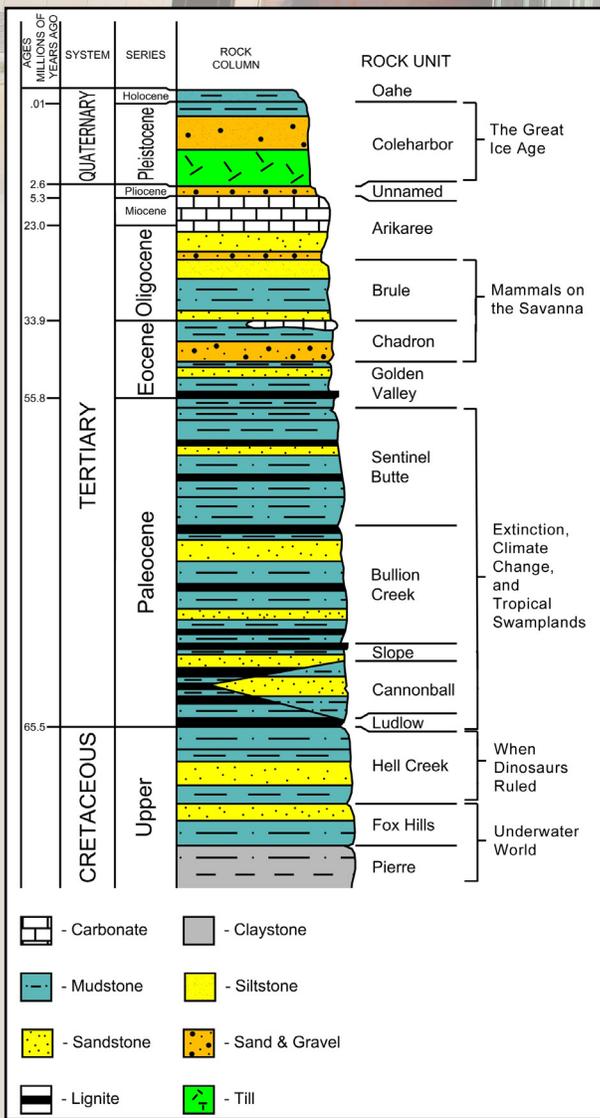


# The New Adaptation Gallery: Geologic Time at the North Dakota Heritage Center

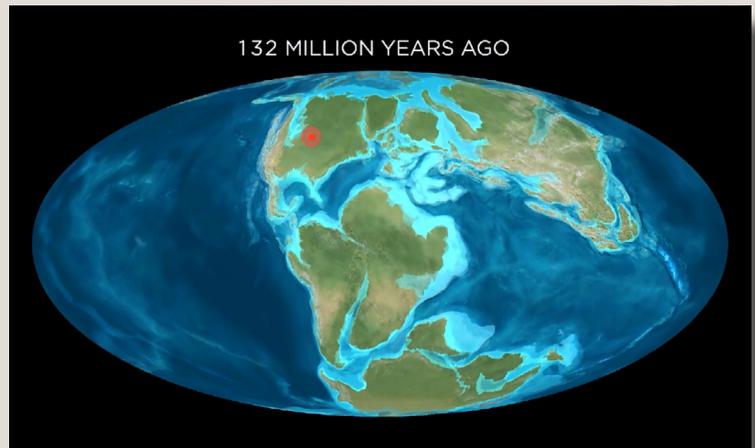
*John W. Hoganson, Jeff J. Person,  
and Becky Barnes*



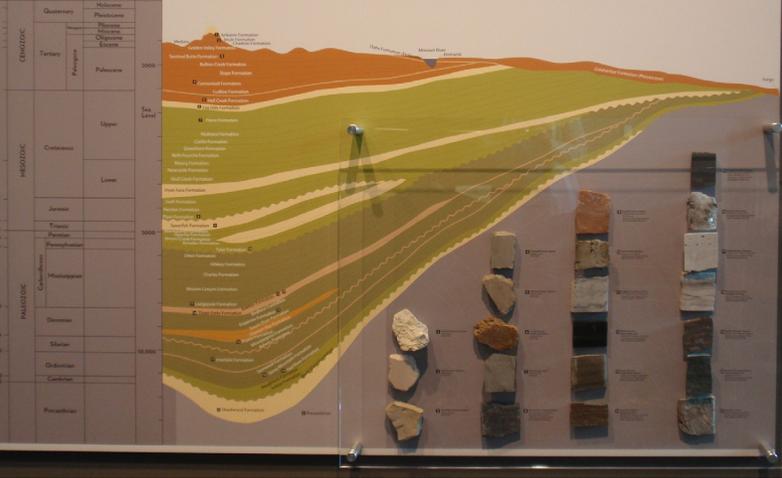
**Figure 1.** Partial Stratigraphic column of North Dakota showing the age of the Geologic Time Gallery displays.

## Introduction

In 1991, a group of Heritage Center staff began meeting informally after work to discuss a Heritage Center expansion. This "committee" was formalized in 1992 by Jim Sperry, Superintendent of the State Historical Society of North Dakota, and became known as the Space Planning About Center Expansion (SPACE) committee. The committee consisted of several Historical Society staff and John Hoganson representing the North Dakota Geological Survey. Ultimately, some of the SPACE committee ideas were rejected primarily because of anticipated high cost such as a planetarium, arboretum, and day care center but many of the ideas have become reality in the new Heritage Center expansion. In 2009, the state legislature appropriated \$40 million for a \$52 million Heritage Center expansion. The State Historical Society of North Dakota Foundation was given the task to raise the difference. On November 23, 2010 groundbreaking for the expansion took place. Planning for three new galleries began in earnest: the Governor's Gallery (for large, temporary, travelling exhibits), Innovation Gallery: Early Peoples, and Adaptation Gallery: Geologic Time. The



**Figure 2.** Plate tectonic video. North Dakota's position is indicated by the red symbol.



### Orientation

Featured in the Orientation area is an interactive touch table that provides a timeline of geological and evolutionary events in North Dakota from 600 million years ago to the present. Visitors activate the timeline by scrolling to learn how the geology, environment, climate, and life have changed in North Dakota through time. A 16-foot-wide screen above the touch table has a looping video showing how Earth is continually changing by continental movements caused by plate tectonics (fig. 2). The position of North Dakota during these continental movements is indicated on the screen. A wall-size North Dakota Williston Basin stratigraphic column graphic is located behind the touch table (fig. 3). Visitors will learn about the different rock formations found at the surface in North Dakota and those thousands of feet below the surface. Rock samples from several formations, including oil-bearing rocks

**Figure 3.** Williston Basin stratigraphic cross section and rocks from several formations.

such as the Bakken Formation, are attached to the stratigraphic column for visitors to see.

existing gallery became the Inspiration Gallery: Yesterday and Today. It is being totally renovated and will interpret the history of North Dakota from territorial days to the present. Great Plains Exhibit Development, an exhibit design firm, was hired to fabricate displays in the new galleries. Our task was to develop ideas, provide fossil specimens, and write interpretive information for displays in the Geologic Time Gallery. On April 28, 2014 the Geologic Time and Early Peoples exhibits where completed and unveiled to the public. The Inspiration and Governor's galleries will be completed by November in time for the dedication of the Heritage Center expansion on November 2 in conjunction with North Dakota's 125th anniversary of statehood.



**Figure 4.** Skeleton of the 24-foot long mosasaur, *Plioplatecarpus*.

The Geologic Time Gallery provides a perspective on geological, environmental, climatic, and biological changes in North Dakota through deep time from about 600 million years ago to the appearance of humans in the state about 13,000 years ago. This saga is told through a series of exhibits, dioramas, and interactive displays and features more than 600 fossil specimens. The gallery is divided into the following areas: **Orientation; Underwater World; When Dinosaurs Ruled; Extinction, Climate Change, and Tropical Swamplands; Mammals on the Savanna; the Great Ice Age; and Learning Lab** (fig. 1). The Geologic Time Gallery is meant to introduce visitors to North Dakota as it was at different times in the geologic past before the arrival of humans.

### Underwater World

From about 80 million to 70 million years ago, during the Cretaceous Period, North Dakota was covered by inland seas. The Underwater World diorama shows what those subtropical seas were like and the interesting, sometimes incredibly large, animals that lived in those seas. This exhibit is an immersion experience where visitors will be walking on the seafloor



**Figure 5.** Skeletons (casts) of the giant fish *Xiphactinus* and huge sea turtle *Archelon*.



Figure 6. Habitat reconstruction wall mural of North Dakota 80 million years ago.

“underwater.” The simulated underwater experience is enhanced with sound and lighting effects. Featured in this exhibit are suspended skeletons of some creatures that would have inhabited the seas including the 24-foot-long Cooperstown mosasaur (large, marine lizard-like predators) *Plioplatecarpus* (fig. 4), 16-foot-long tarpon-like fish *Xiphactinus* (cast), 12-foot-long giant sea turtle *Archelon* (cast) (fig. 5), and 5-foot-tall diving seabird *Hesperornis* (cast). Fossil specimens of these animals are displayed on the “sea floor.” A wall-sized mural behind the diorama shows how North Dakota appeared 80 million years ago (fig. 6). Fossils of some smaller fish including sharks and other animals are displayed with a magnifier for up close viewing. The fossils of many of the invertebrate animals that lived in these seas, including beautifully preserved ammonites, are also exhibited (fig. 7).



Figure 7. Cretaceous shoreline exhibit with large ammonites.

### When Dinosaurs Ruled

During the Late Cretaceous, about 68 million to 65 million years ago, oceans receded and western North Dakota was a huge delta. North Dakota’s climate was warm temperate to subtropical. Exotic animals lived on this delta, including dinosaurs. This display features full scale casts of the skeletons of *Tyrannosaurus rex* (about 35 feet long) and *Triceratops* (about 30 feet long) facing each other in a combative pose (fig. 8). Through computer animation and augmented reality technology, these animals are brought to life and do battle when visitors

activate iPad screens (fig. 9). Other fossils in this display include a duck-billed dinosaur leg bone that shows gnaw marks caused by *T. rex* teeth, a skull of *Triceratops* (fig. 10), a jaw of a duck-billed dinosaur *Edmontosaurus*, a skeleton of the flying reptile *Pteranodon* and its nest with babies (fig. 11), skeletons (casts) of small raptor-like dinosaurs, a mammal skeleton *Didelphodon* (cast), plants, and invertebrates that lived with the dinosaurs. Fossils of these plants and animals are displayed in cases. A wall-size mural showing how North Dakota appeared 65 million years ago is behind the dinosaur skeletons. An exhibit about the evolution of birds is also included. A real *Triceratops* brow horn is available for visitors to touch.

In the North Dakota Corridor of History hallway, as one enters the Geologic Time Gallery, the skeleton of Dakota, the mummified duck-billed dinosaur, is



Figure 8. *Triceratops* and *T. rex* skeletons (casts).



Figure 9. Augmented reality iPad interactive.



Figure 10. *Triceratops* skull.

displayed which provides a dramatic introduction to the Geologic Time Gallery.

### Extinction, Climate Change, and Tropical Swamplands

About 65 million years ago a devastating mass extinction occurred on Earth when the last of the dinosaurs and about three-fourths of all species died. An exhibit discusses the possible causes of the extinction. To help interpret this story a video is shown, a rock showing the K/Pg (K/T) boundary, and meteorites are displayed. By about 60 million years ago, during the Paleocene Epoch, western North Dakota was a subtropical to tropical forested swampland. A diorama, simulating a swampland, is presented to illustrate this time in North Dakota's geologic past. Featured in this diorama is a cast of a



Figure 11. Skeleton (cast) of the flying reptile *Pteranodon* plus a nest of babies.

12-foot-long crocodile *Borealosuchus* skeleton (fig. 12), a 3-foot-long salamander *Piceoerptean* skeleton, an 8-foot-long skeleton (cast) of *Champsosaurus* (crocodile-like animal), turtles, the skeleton (cast) of a lemur-like mammal *Plesiadapis*, the skull and skeleton (cast) of the bear-size mammal *Titanoides*, and fossils of invertebrates animals. Fossils of many plants from this time are displayed on a 20-foot-long wall (fig. 13). On this wall are also



Figure 12. Twelve-foot-long *Borealosuchus* skeleton (cast).



Figure 13. Twenty-foot-long wall containing Paleocene plant fossils.

examples of North Dakota's state fossil, *Teredo*-bored petrified wood (fig. 14). Fossils of animals that lived in the last sea to cover North Dakota, the Cannonball Sea, are displayed including teeth of sharks and other fish and many fossils of invertebrate animals. A wall-size mural showing how North Dakota appeared 60 million years ago is behind the diorama (fig. 15).

### Mammals on the Savanna

About 35 million to 30 million years ago, during the late Eocene and Oligocene Epochs, North Dakota was a low-lying featureless plain with a temperate, dry climate. This open plain was a scrubland and savanna consisting of shrubs, some grasses, and few trees with some ponds. Fossils of many exotic mammals have been found in these 30-million-year-old rocks, many of which are exhibited in this display. The exhibit includes the remains of the elephant-size brontothere *Megacerops*, giant pig-like *Archaeotherium* (fig. 16), rhinoceros *Subhyracodon*, early horse *Mesohippus* (fig. 17), weasel-like canine *Hesperocyon*, insectivore *Leptictis*, sheep-like *Merycoiodon*, rabbit *Palaeologus*, predatory cat-like mammals *Dinictis* and *Hoplophoneus*, and others. Shells of the huge tortoise *Styemys* and other turtles and a



Figure 14. *Teredo*-bored petrified wood display.

fish skeleton are also displayed. A wall-size mural recreating North Dakota's landscape 30 million years ago accompanies this display (fig. 18).

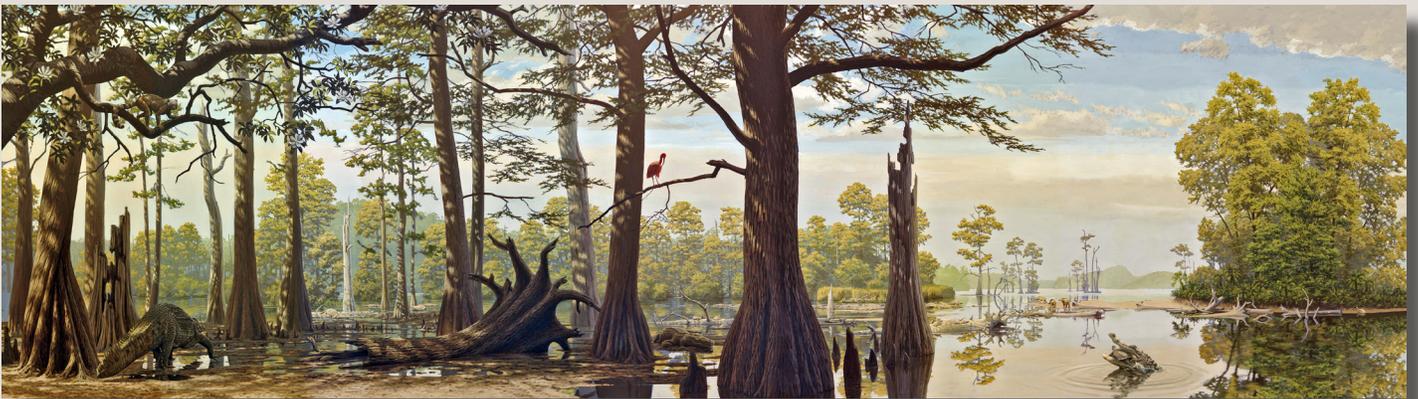


Figure 15. Wall mural showing western North Dakota about 60 million years ago.



Figure 16. Skeleton (center) of the giant pig-like animal *Archaeotherium* and others.



Figure 17. Skeleton of the 3-toed horse *Mesohippus*.



snails, clams, and plants. A wall mural shows what the landscape and life were like in North Dakota near the end of the Ice Age (fig. 21).

The Highgate Mastodon, *Mammuth americanum*, skeleton is displayed in the North Dakota Corridor of History as one exits the Geologic Time Gallery which continues the story of life during the Ice Age and provides a transition to the Early Peoples Gallery (fig. 22).

**Figure 18.** Wall mural recreating a North Dakota landscape 30 million years ago.

### The Great Ice Age

The last great Ice Age began about 2.6 million years ago and ended about 12,000 years ago. Continental glaciers advanced into North



**Figure 19.** *Bison latifrons* and *Smilodon* skeleton (casts).

Dakota from Canada on several occasions during that time, and with each advance, the landscape and life in the state were dramatically affected by the climatic and geological events associated with glaciation. The Ice Age display shows, through interactive video animations, how these glacial advances affected North Dakota's landscape. Images and locations of landforms and other geological features that were created by glacial activity are shown on a wall map. A hands-on exhibit allows visitors to see up close some of the boulders (glacial erratics) that were transported from Canada by glaciers and deposited in North Dakota. Fossils of animals and plants that existed in North Dakota near the end of the Ice Age are exhibited including the skull of the giant bison *Bison latifrons*, a skeleton (cast) of *Bison latifrons* being attacked by two saber-toothed cats *Smilodon*, and a skeleton (cast) of the huge, 8-foot-tall, ground sloth *Megalonyx* (figs. 19, 20). Other fossils of Ice Age animals displayed include remains of a woolly mammoth, frog, muskrat, insects,

### Learning Lab

The Geologic Time Gallery experience is enhanced by displays and activities in the Learning Lab. A video on a smart board shows our excavation of a 60-million-year-old crocodile skull and preparation of the fossil in our paleontology laboratory to give visitors, particularly children, an insight on how fossils are collected and prepared. The crocodile skull is displayed in the Learning Lab next to the video. Educational information provided in the Learning Lab



**Figure 20.** Skeleton (cast) of the giant ground sloth, *Megalonyx jeffersonii*. These sloths lived in North Dakota at the end of the last ice age.



**Figure 21.** Wall mural showing the landscape and life at the end of the Ice Age. Painting by Karen Carr.



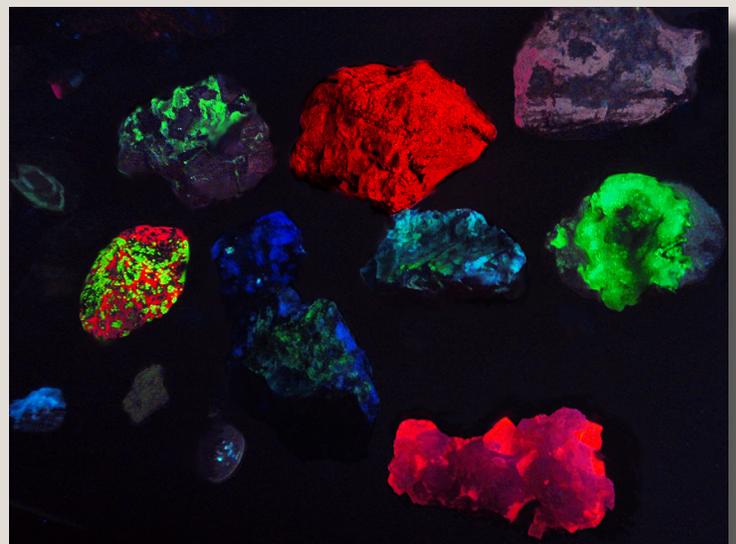
**Figure 22.** Skeleton of the huge elephant-like *Highgate Mastodon*.

includes what is a mineral, what is a rock, how coal is formed, how oil and gas are formed, what is a fossil, how does a plant or animal become fossilized, and other geological information. Rocks, minerals, and fossils for the Science Olympiad program are exhibited in the Learning Lab for students to study. Other displays include oil well cores and crude oil from several North Dakota rock formations, specimens of different grades of coal including lignite from North Dakota, Heritage Center building stones, an example of fossil preservation, and pseudofossils. A fluorescent mineral black light “closet” is also in the Learning Lab (fig. 23). This fluorescent mineral display compliments the gem and mineral exhibit in the North Dakota Corridor of History outside the doors of the Geologic Time Gallery.

The Learning Lab will be a dynamic place where paleontologists, educators, and docents can give demonstrations and provide hands-on experiences for students. It will be a place where teachers can bring their classes to learn about North Dakota geology and paleontology in an intimate environment.

### Acknowledgements

The Geological Time Gallery was completed through a collaborative effort between the State Historical Society of North Dakota museum staff and the North Dakota Geological Survey. Fund raising was spearheaded by the State Historical Society of North Dakota Foundation. Major donors for displays in the Geological Time Gallery are the North Dakota Petroleum Council, Whiting Petroleum Corporation, Murex Petroleum Corporation, and Neset Consulting Service. The following people donated fossils and rocks for the Geologic Time Gallery and hallway exhibits associated with the gallery: Jacob and Catherine Schlosser, Melvin Anderson, Fred Wertz, Blossomae Campbell family, Tyler Lyson, Olson/Tranby family, Tim Soma family, Tom Gould, Johnathan Campbell, Peter Mack, Bill Buresh, John Stumpf, Fred Nagel, Ray and Russ Oliger, Freedom Mine (North American Coal), J. Mark Erickson, Theodore Roosevelt Medora Foundation, National Park Service-Theodore Roosevelt National Park, Amber Kraft, Vern Hanson, Clarence Johnsrud, LaVonne Hunze, Jim McCulloch, Dave Jensen, Albert Privratsky family, Ron and Bob Obritsch, Bob Fitterer family, Don Burk, Linda and Doug Vannurden, Vernon and Carol Seibold, UND Geology Department, and Kent Pelton. Landowners that allowed us to collect fossils for display in the Geologic Time Gallery are: Olson/Tranby family, Tim Soma, John Stumpf, Fred Nagel, State of North Dakota, USFS Forest Service-Dakota Prairie Grasslands, Bureau of Land Management, and US Army Corps of Engineers. We thank all of these people and organizations for their overwhelming support to bring the story of the geological history and history of life in North Dakota to the public.



**Figure 23.** Rock and minerals in the fluorescent display.