

# Ice Age mammals of North Dakota:

Where have all the large mammals gone?

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## Introduction

Although ice ages have occurred on numerous occasions throughout Earth's history, general consensus is that the last Great Ice Age, the Pleistocene Epoch, began about 2.6 million years ago. Throughout this period, North Dakota suffered through numerous advances of continental glaciers from Canada during the cold intervals and glacial retreat during the warmer interludes. Then, about 12,000 years ago, glaciers left the state for good. The remnants of this glacial age are the masses of ice in Antarctica, Greenland, and the world's high mountain areas. This is in stark contrast to past times when Earth was essentially ice-free. Drainage patterns, landscape, and the kinds of animals and plants that lived here were altered during each of these glacial advances and retreats. The present landscape of North Dakota results from these glacial processes and about three-fourths of the surface of North Dakota is veneered by glacial drift (fig. 1).

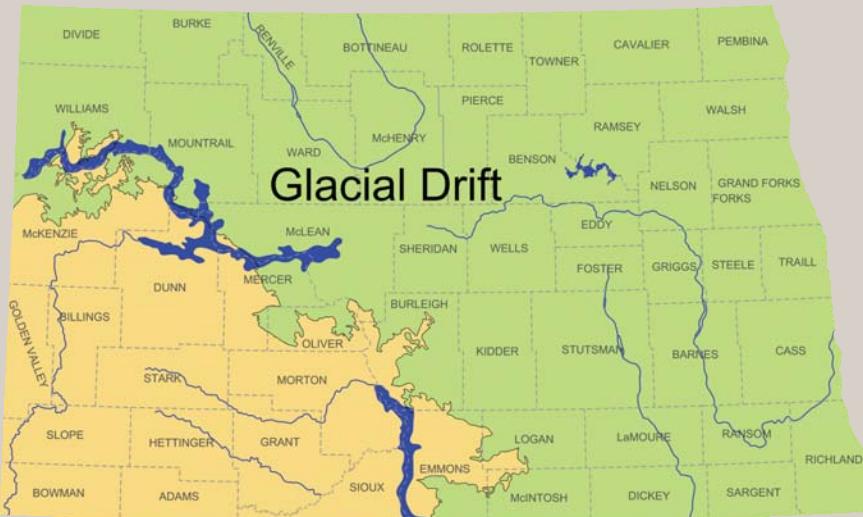


Figure 1. Simplified geologic map of North Dakota showing that three-fourths of the state is covered with glacial drift (green).

Little is known about life in North Dakota at the end of this Ice Age when the world was warming and the glacial ice was melting. This is ironic given the vast areas of glacial drift in North Dakota where fossils of the Ice Age animals and plants are entombed. The list of Pleistocene mammalian taxa from North Dakota is short and reflects the sparsity of studies of Pleistocene faunas in this state. Most fossils of mammals that have been reported in

North Dakota are from isolated finds often associated with glacial mapping or stratigraphic investigations. The age of most of these fossils has not been determined by radiometric dating, but all are probably Wisconsinan or Rancholabrean in age and likely all are from what is referred to as "near time" or the last 50,000 years. In 1987, Allen Kihm, in his review of Pleistocene and early Holocene mammals in North Dakota, lamented over the meager number of reports of Quaternary mammal fossil finds in North Dakota. Almost 20 years later, Hoganson (2006) noted that few studies of Ice Age fossils have been conducted in North Dakota since Kihm's report. In recent years, a few significant Ice Age mammal remains have been discovered in North Dakota including the massive bison *Bison latifrons* (Hoganson, 2003) and the ground sloth *Megalonyx jeffersonii* (Hoganson and McDonald, 2007). Several additional mammoth (*Mammuthus*) and horse (*Equus*) fossil specimens have also been discovered since Kihm's review (Hoganson, 2006).

## Early Investigations of Ice Age mammals from North Dakota

Upaham (1895) was the first to mention the presence of Pleistocene mammalian fossils in North Dakota, when he recovered mammoth teeth and other bones from the base of the Herman beach ridge of Glacial Lake Agassiz near Absaraka, Cass County. Most subsequent reports have been of isolated finds discovered during mapping of glacial deposits as a result of the North Dakota Geological Survey's county geological mapping program. These reports include remains of horse, *Equus* (Clayton, 1962; Kume and Hansen, 1965); badger, *Taxidea taxus* (Baker, 1967); and Cervidae (deer?) (Baker, 1967; Bluemle, 1967). A muskrat, *Ondatra zibethicus*, skull and trace fossils (scat and gnawed wood) of the beaver, *Castor*, were found at the 9,750-year B.P. Seibold Site in Stutsman County (Cvancara et al., 1971). Ashworth and Cvancara (1983) recorded mammoth teeth from Pembina and Cass counties. The tooth from Emden, Cass County was identified as woolly mammoth, *Mammuthus primigenius* and was recovered from the Lake Agassiz Herman beach that formed about 11,500 years ago. This identification was reaffirmed by Harrington and Ashworth (1986) during their study of mammoth fossils from North Dakota. In that report, they

also listed *M. primigenius* remains from McKenzie, Stutsman, and Pembina counties and a tooth fragment of the steppe mammoth, *Mammuthus columbi*, from Williams County.

Since the creation of the North Dakota Geological Survey-administered State Fossil Collection by legislative action in 1989, housed at the North Dakota Heritage Center in Bismarck, several Pleistocene fossils and fossil sites have come to my attention. These finds are summarized below.

### The huge Ice Age bison, *Bison latifrons*

The scientific name, *Bison latifrons*, refers to this animal's broad cranium and large horns. They were massive animals, the largest of all North American bison, with horns that spanned over seven feet (2 m) – more than twice as wide as those of the living North American bison. Their bodies were about 25 % larger than their living relatives. Unlike the grassland-dwelling modern bison, *Bison latifrons* lived in small groups and inhabited wooded areas. McDonald (1981) was first to report the occurrence of *Bison latifrons* in North Dakota. Its presence was indicated by a horn-core fragment found in the early 1950s near Independence, Dunn



**Figure 2.** *Bison latifrons* skull from Mountrail County on exhibit at the North Dakota Heritage Center in Bismarck. Horn tip to horn tip is about 7 feet (2 m). NDGS 216.



**Figure 3.** *Megalonyx jeffersonii* claw from Emmons County on exhibit at the North Dakota Heritage Center in Bismarck. Width about 6.5 inches (165 mm). NDGS 217.

County, on the Fort Berthold Reservation before the site and town were inundated by the waters of Lake Sakakawea when Garrison Dam was built.

In 1998, Kent Pelton from Watford City discovered a well-preserved skull of *Bison latifrons* along the shore of Lake Sakakawea on US Army Corps of Engineers-administered land within the boundaries of the Fort Berthold Reservation, Mountrail County (Hoganson, 2003). This skull produced a date of >47,500 years B. P. and is now on exhibit at the North Dakota Heritage Center in Bismarck (fig. 2). It was recovered from an extensive fluvial deposit of uncertain age mapped by Clayton (1980) as Quaternary or Upper Tertiary Sediment, Undivided. A few years later, *B. latifrons* remains, associated with other fossils including *Mammuthus primigenius*, *Equus* sp., and *Cervidae*, were discovered in the same fluvial deposit, but from another site on the Fort Berthold Reservation in McKenzie County. This is called the Hoffman Site and is the first fossil site in North Dakota of Pleistocene age that is yielding a diverse assemblage of mammalian fossils.



**Figure 4.** Painting of the Ice Age ground sloth *Megalonyx jeffersonii* by Dan Varner.

### The Ice Age ground sloth, *Megalonyx jeffersonii*

Linda and Doug Vanurden, while strolling along the shoreline of Lake Oahe in Emmons County in 1999, discovered a massive claw from the back foot of the Ice Age ground sloth *Megalonyx jeffersonii* completely weathered out and resting on the shore (fig. 3). They reported the find, and the US Army Corps of Engineers allowed us to study the specimen (Hoganson and McDonald, 2007). The name *Megalonyx jeffersonii* refers to the large claw on the third digit of each of the animal's back feet. It was bear-size and grew to lengths of 6 feet (1.8 m) or more (fig. 4). Thomas Jefferson, a paleontologist amongst other things, gave the name *Megalonyx* to this sloth in a 1799 presentation to the American Philosophical Society based on fossils found in Virginia. It was later given even the name *Megalonyx jeffersonii* in his honor. It is ironic that remains of *M. jeffersonii* would be found near one of the Lewis and Clark campsites in North Dakota almost 200 years after Jefferson commissioned the Lewis and Clark Expedition.

The North Dakota claw was not found in stratigraphic context, but yielded a date of about 12,000 years B. P. This ground sloth lived in wooded areas along the Missouri River at the end of the Ice Age.

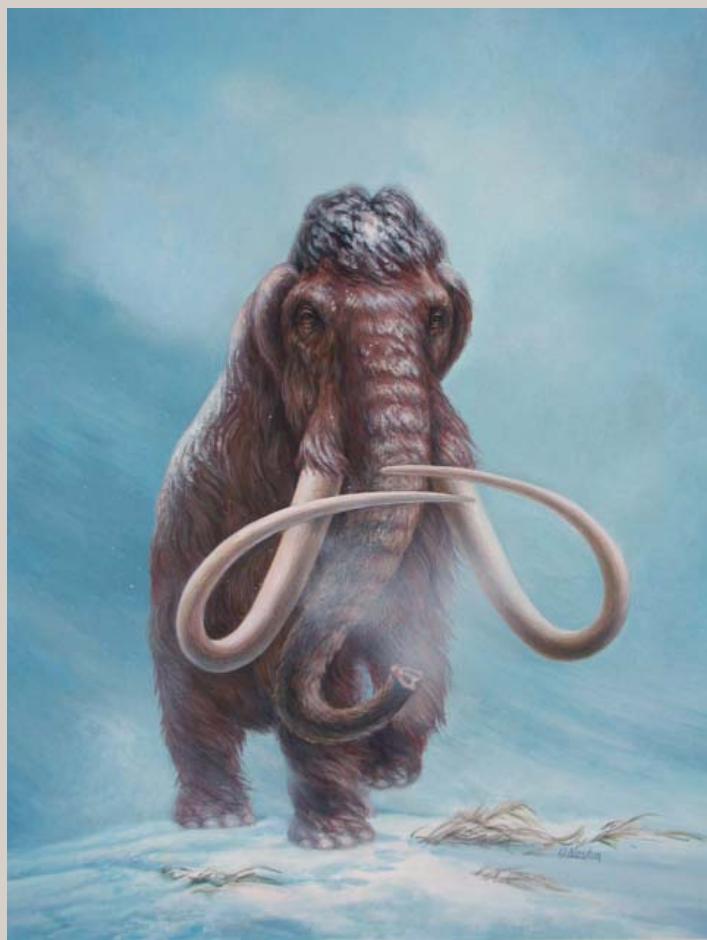


**Figure 5.** Woolly mammoth, *Mammuthus primigenius*, tooth from Oliver County on exhibit at the North Dakota Heritage Center in Bismarck. Width about 13 inches (330 mm). SHSND 1991.00158.

It is the only fossil of *Megalonyx jeffersonii* found in North Dakota and is now displayed at the North Dakota Heritage Center.

#### The Ice Age elephants, *Mammuthus* and *Mammut*

Several mammoth teeth, bones, and tusk fragments from North Dakota have come to my attention since Harrington and Ashworth's (1986) report on North Dakota mammoths was published.



**Figure 6.** Painting of the woolly mammoth, *Mammuthus primigenius* by Dorothy S. Norton.

Mammoth remains, mostly teeth, have been found in thirteen North Dakota counties (Hoganson, 2006). Most of these fossils are in either the State Fossil Collection or the State Historical Society of North Dakota Collection housed at the North Dakota Heritage Center in Bismarck. Many of these teeth are not well preserved and can only be assigned to *Mammuthus* sp. Several of these teeth are not accompanied by temporal or stratigraphic information. Two well-preserved teeth, one from Oliver County (fig. 5) and one from McKenzie County, and bones from the Hoffman Site are identified as *M. primigenius*.

Woolly mammoths (*Mammuthus primigenius*) grew to heights of about ten feet (3 m) and are in the same family as living elephants (fig. 6). As with today's elephants, their upper incisors were greatly elongated to form tusks. These recurved tusks were used for brushing away snow, digging up roots, debarking trees, and fighting. Finger-like projections on the end of their trunks were used for grasping. They were herbivores, and their huge, flattened teeth were adapted for grinding vegetation. They had a thick coat of shaggy, black-to-brown hair for insulation against the Ice Age climate as well as an undercoat of fine hair and a layer of fat to help stay warm. Much is known about the anatomy of woolly mammoths because frozen carcasses of these animals have been found in Siberia. Early people hunted them for food and clothing; in Siberia dwellings were constructed from their bones and painted and etched images of them are found on cave walls in France and Spain.



**Figure 7.** Skeleton of the Highgate Mastodon (*Mammut americanum*) on display at the North Dakota Heritage Center in Bismarck. SHSND 88.240

A tooth identified as mastodon, *Mammut*, is in the museum collection at Bonanzaville, West Fargo. It is assumed that the specimen was found in Cass County, but it is not accompanied by provenience information. The American mastodon, *Mammut americanum*, was one of the common proboscideans that lived in North America at the end of the Pleistocene, but few fossils of these animals have been found in North Dakota. Mastodons were elephant-like and elephant-size – about as large as the Indian elephant that lives today – but they were neither true elephants nor very closely related to mammoths (fig. 7). Adults

were about 10 feet (3 m) tall at the shoulder. The heads of these animals were large with long, curved tusks. They probably used their tusks to break branches and bark from trees. Like the woolly mammoth that lived in North Dakota at the same time, mastodons were covered with long, shaggy hair for insulation against the Ice Age cold. Mummified specimens indicate that they had coarse, brownish outer hair, with a fine woolly undercoat similar to that of semi-aquatic animals such as moose. They were browsers and lived in boggy spruce woodlands. Stomach contents found with mummified mastodon skeletons indicate that they ate a variety of plants, including parts of conifer trees, leaves of various kinds, grasses, bog plants, and mosses. As with mammoths, Paleo-Indians hunted these animals.

#### The Ice Age horse (*Equus*), camel (*Camelus*), and deer (*Cervidae*)

The Ice Age horse, *Equus* sp., is represented by isolated teeth from several localities in North Dakota. At the Hoffman Site in McKenzie County other skeletal elements, including toe bones, have been found, none of which are sufficient for species



**Figure 8.** *Equus* sp. toe bones from the Hoffman Site, McKenzie County. Length about 4 inches (102 mm). NDGS 967.

identification (fig. 8). No Pleistocene horse skeletons or skulls have been found in North Dakota. The jaw found by Clayton (1962) has been provisionally assigned to *Equus niobrarensis?* although several species of horse probably lived on the Great Plains at the end of the Ice Age (fig. 9). Contrary to what many people believe, horses lived in North America long before they were brought to this continent by the Spaniards. In fact, horses first evolved in North America. Horses were wide-ranging in North America during the Pleistocene and became extinct on this continent about 13,000 years ago. They were reintroduced into the New World by Spanish conquistadors in the 1500s.

The only fossil found of the Ice Age camel, *Camelus* in North Dakota is a metatarsus from Williams County. Cervid (deer family) remains are equally sparse consisting of only a tooth, antler fragment, and metatarsal from three different sites.

#### Where have all the large Ice Age mammals gone?

More than 30 genera and 40 species of large North American terrestrial mammals (those weighing more than 100 pounds [45 kilograms]), including those that lived in North Dakota, became extinct near the close of the Pleistocene Epoch, most about 13,000 years ago (Martin, 2005). Prior to this, species richness of large mammals on the Great Plains of North America was greater than areas of Africa such as the Serengeti today. Not only did giant herbivores like woolly mammoths and mastodons become extinct, but also large predators including short-faced bears, dire wolves, and saber-toothed cats died out; yet small mammals and plants that lived with them still exist today. The large mammals that survived, such as bison, grizzly bears, mountain lions, deer, elk, moose, and pronghorns, are remnants of a much more diverse Pleistocene community.



**Figure 9.** Painting of the Ice Age western horse, *Equus occidentalis* by Dorothy S. Norton.

Most species of mammals that ever lived on Earth are now extinct. Of the 5,158 mammalian genera that have existed since the later part of the Mesozoic Era, 4,075 or 80% of them have become extinct (McKenna and Bell, 1997). However, the loss of the diverse fauna of large mammals in North America at the end of the Pleistocene is unprecedented. For decades there has been an aggressive debate about the cause or causes that triggered this biological catastrophe. Climate change and over-hunting by people are the two primary hypotheses that have been proposed to explain this extinction. Recently, hyperdisease and comet impact have been advocated by some scientists to explain the extinction.

Perhaps the most controversial and highly debated of these hypotheses is called “overkill,” with Paul Martin being its leading proponent. Martin (2005) advocated that the earliest humans, who migrated to America from Asia about 13,000 years ago, were big-game hunters and drove the large mammals to extinction. These First Americans are called Clovis because of their distinctively shaped spear-points first found near the town of Clovis, New Mexico. Martin (2005) observed that two-thirds of the North American large animals north of Mexico, including woolly mammoths, rapidly disappeared with the appearance of these people. Earlier, Klein (1999) had referred to this as the “ecological shock of human arrival.” Martin (2005) pointed out that extinctions in other parts of the world also corresponded to human arrival, and there is little doubt that human activities have caused the demise of the at least 200 species of mammals that have become extinct world-wide in historic times. The “overkill” hypothesis has been criticized on several fronts including the scarcity of direct archeological/paleontological evidence of large mammal hunting by Clovis people. Also, there is growing evidence of the appearance of pre-Clovis human populations in the New World earlier, perhaps much earlier than 13,000 years ago.

The end of the Pleistocene was a time of climate flux. Because of this, many scientists believe large mammal extinctions at that time can be accounted for by environmental changes resulting in ecosystem disruptions rather than overkill (for example, Grayson and Meltzer, 2003; Barnosky, 1986; Webb, 1984). Two recent proposals have added to the debate about extinctions at the end of the Ice Age. Ross MacPhee of the American Museum of Natural History and Preston Marx of the Aaron Diamond AIDS Research Center have suggested that highly infectious diseases or hyperdiseases killed the large mammals. They propose that human populations that expanded into North America at the end of the Pleistocene brought with them diseases that were new to the New World. These disease agents would have then been transferred to susceptible large mammals. James Kennett of the University of California, Santa Barbara and his colleagues have advocated that a sudden climate change about 12,900 years ago was caused by comet impact and that this not only wiped out large mammals but also caused the demise of the Clovis culture.

Eventually we may determine the cause or causes of the megafauna extinction at the end of the Pleistocene with additional fossil finds and technological research advances. Until then, it is interesting to fantasize about what North Dakota and the rest of the North American Great Plains would have been like if the extinction of

these large beasts had not occurred. I visualize a North Dakota Serengeti with huge herds of elephants, camels, horses, and bison roaming the recently deglaciated plains and dire wolves, saber-toothed cats and humans culling these herds.

## References

- Ashworth, A. C., and A. M. Cvancara. 1983. Paleoecology of the southern part of the Lake Agassiz Basin; pp. 133-156 in J. T. Teller and C. Clayton (eds.), Glacial Lake Agassiz. Geological Association of Canada Special Paper 26.
- Baker, C. H., Jr. 1967. Geology and groundwater resources of Richland County, Part 1. Geology. North Dakota Geological Survey Bulletin 46, 45 p.
- Barnosky, A. D. 1986. Big game extinction caused by late Pleistocene climatic change: Irish elk (*Megaloceras giganteus*) in Ireland. Quaternary Research 25:128-135.
- Bluemle, J. P. 1967. Geology and groundwater resources of Traill County. Part 1. Geology. North Dakota Geological Survey Bulletin 49, 34 p.
- Clayton, C. 1962. Glacial geology of Logan and McIntosh Counties, North Dakota. North Dakota Geological Survey Bulletin 37, 84 p.
- Clayton, C. 1980. Geologic map of North Dakota. United States Geological Survey, 1:500,000 scale.
- Cvancara, A. M., L. Clayton, W. B. Bickley, Jr., J. F. Jacob, A. C. Ashworth, J. A. Brophy, C. T. Shay, L. D. Delorme, and G. E. Lamers. 1971. Paleolimnology of Late Quaternary deposits: Seibold Site, North Dakota. Science 171:172-174.
- Grayson, D. K., and D. J. Meltzer. 2003. A requiem for North American overkill. Journal of Archaeological Science 30:585-593.
- Harington, C. R., and A. C. Ashworth. 1986. A mammoth (*Mammuthus primigenius*) tooth from late Wisconsin deposits near Embden, North Dakota, and comments on the distribution of woolly mammoths south of the Wisconsin ice sheets. Canadian Journal of Earth Sciences 23:909-918.
- Hoganson, J. W. 2003. Occurrence of the giant Ice Age bison, *Bison latifrons*, in North Dakota. North Dakota Geological Survey Newsletter 29(2):10-12.
- Hoganson, J. W. 2006. Late Pleistocene (Rancholabrean) mammals of North Dakota; pp. 79-83 in L. A. Manz (ed.), Quaternary geology of the Missouri River Valley and adjacent areas in northwest-central North Dakota. North Dakota Geological Survey Geological Investigations 24.
- Hoganson, J. W., and H. G. McDonald. 2007. First report of Jefferson's Ground Sloth (*Megalononyx jeffersonii*) in North Dakota: Its paleobiogeographical and paleoecological significance. Journal of Mammalogy 88:73-80.
- Jefferson, T. 1799. A memoir on the discovery of certain bones of a quadruped of the clawed kind in the western parts of Virginia. Transactions of the American Philosophical Society 4:246-250.
- Kihm, A. J. 1987. Pleistocene and early Holocene fossil mammals of North Dakota; pp. 86-92 in J. P. Bluemle (ed.), Glacial geology of central North Dakota, 1987 field trip of the North Dakota Geological Society.
- Klein, R. G. 1999. The human career: Human biological and cultural origins. 2nd ed. Chicago, Illinois, University of Chicago Press.
- Kume, J., and D. E. Hansen. 1965. Geology and groundwater resources of Burleigh County, North Dakota. Part 1. Geology. North Dakota Geological Survey Bulletin 42, 111 p.
- Martin, P. S. 2005. Twilight of the mammoths: Ice age extinctions and the rewilding of America. Berkeley, California: University of California Press, 250 p.
- McDonald, J. N. 1981. North American Bison: Their classification and evolution. Berkeley, California: University of California Press, 316 p.
- McKenna, M. C., and S. K. Bell. 1997. Classification of mammals above the species level. New York, New York: Columbia University Press.
- Upham, W. 1895. The Glacial Lake Agassiz. United States Geological Survey Monograph 25, 658 p.
- Webb, S. D. 1984. Ten million years of mammalian extinctions in North America; pp. 189-210 in P. S. Martin and R. G. Klein (eds.), Quaternary extinctions: A prehistoric revolution. Tucson, Arizona: University of Arizona Press.