



Nebraska History posts materials online for your personal use. Please remember that the contents of *Nebraska History* are copyrighted by the Nebraska State Historical Society (except for materials credited to other institutions). The NSHS retains its copyrights even to materials it posts on the web.

For permission to re-use materials or for photo ordering information, please see:

<http://www.nebraskahistory.org/magazine/permission.htm>

Nebraska State Historical Society members receive four issues of *Nebraska History* and four issues of *Nebraska History News* annually. For membership information, see:

<http://nebraskahistory.org/admin/members/index.htm>

Article Title: Mammoths and Muskoxen

Full Citation: Michael R Voorhies, "Mammoths and Muskoxen," *Nebraska History* 75 (1994): 66-73

URL of article: http://www.nebraskahistory.org/publish/publicat/history/full-text/NH1994Time3_Mammoths.pdf

Date: 5/23/2013

Article Summary: Beginning 1.8 million years ago Ice Age glaciers crushed fossils in Eastern Nebraska, limiting our knowledge of Plains wildlife during the Pleistocene Epoch. There is evidence of the origins and extinctions of fossil species in the West, however. Two widespread layers of volcanic ash from the Yellowstone cauldron sheltered significant quantities of fossils there.

Cataloging Information:

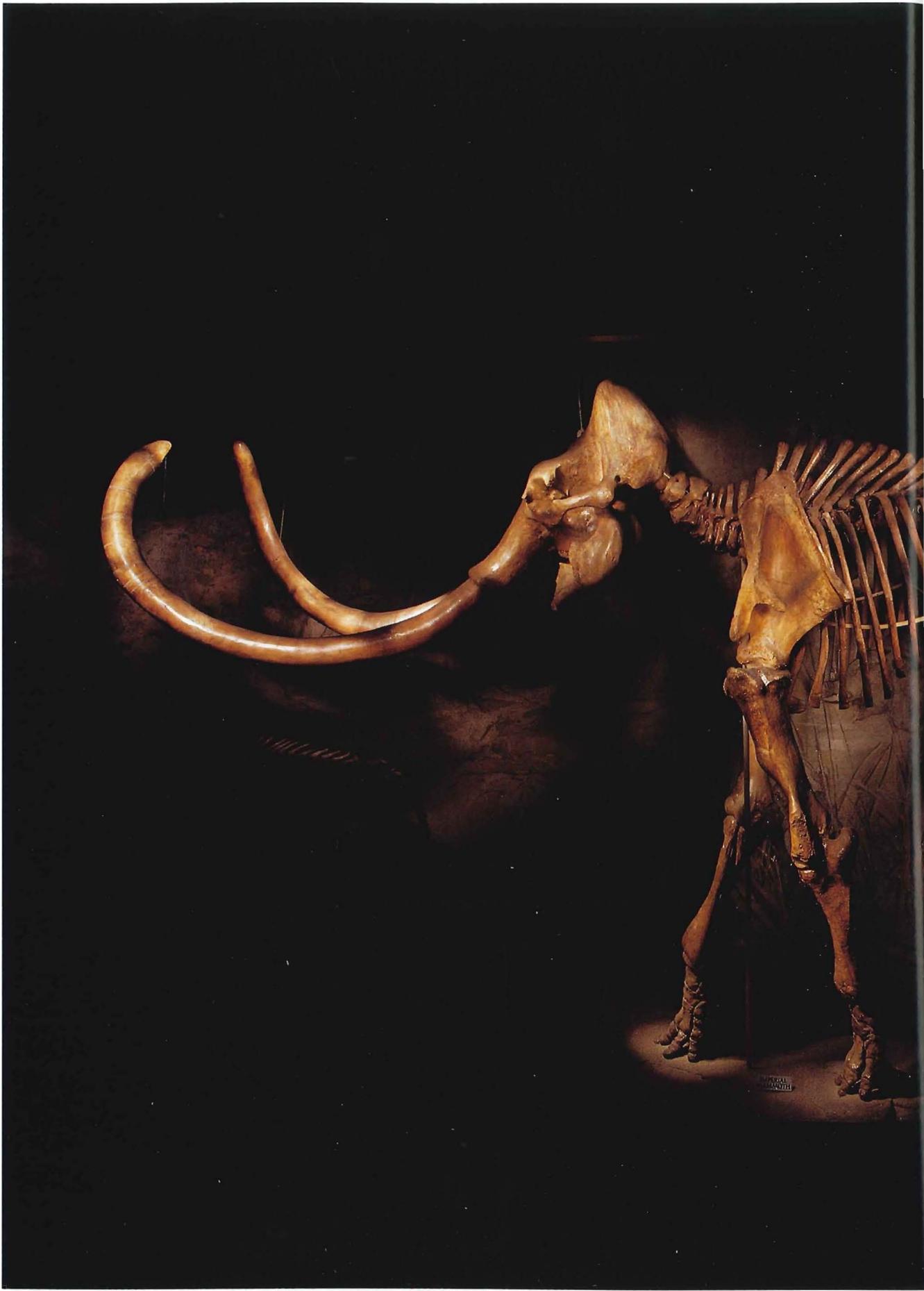
Names: E H Barbour, "Old Jules" Sandoz, Albert Ahrens

Geologic Time: Pleistocene Epoch, Irvingtonian Age

Nebraska Paleontology Sites: Old Dutch Cleanser Mine (Orleans), Creighton, Hartington, McCook, Red Cloud, Wauneta, Plainview, Valentine, Hay Springs, Rushville, Gordon, Nuckolls County, Angus

Keywords: mammoth (elephant), *Microtus* (meadow vole), muskoxen, *Arctodus* (short-faced bear), *Castoroides* (giant beavers), prongbucks, shrews

Photographs / Images: Archie the Mammoth, now in Morrill Hall; mammoth, mastodon, and four-tusker teeth; Nebraska map showing mammoth finds in almost every Nebraska county; plaster cast of the foot bones of an Ice Age mammal; 12-million-year-old fossils found near Valentine when sediment from larger bones was screened; fossil fish bearing oxbow lake deposits made of diatom skeletons; image of an American mastodon, a distant relative of today's elephants



CHAPTER SIX

Mammoths and Muskoxen

The Depths of the Ice Age



Mammoth, mastodon and four-tusker teeth

**By Michael R. Voorhies
University of Nebraska State Museum**

GEOLOGISTS HAVE IDENTIFIED at least six separate layers of rocky debris carried into eastern Nebraska by Pleistocene glaciers. The towns of Cedar Bluffs, Nickerson and Santee have all lent their names to beds of gummy boulder clay left behind by retreating ice sheets. The estimate of six ice advances into the state is the best we can do since glaciers, like bulldozers and dictators, have a way of obliterating evidence of their predecessors. Climate researchers studying the less-disturbed record in the deep sea find strong evidence that glacial-interglacial cycles have occurred like clockwork every 100,000 years. We may therefore have discovered only about a third of our glacial deposits. Alternatively, some glaciers might not have reached all the way to our area. We need to study more outcrops to be sure.

For a paleontologist it would be fun to write — but probably boring for anyone else to read — the history of Plains wildlife as it responded to each new advance of ice. At present, only the barest outline of those epic encounters can be sketched, because Nebraska's best deposits of Pleistocene fossils are in the west, where there were no glaciers, while the glacial deposits themselves have produced only a few beat up bones and teeth. For the moment, therefore, we are forced to use a cruder time scale, based on origins and extinctions of fossil species and on two widespread layers of volcanic ash.

The great Yellowstone cauldron erupted twice more during the Pleistocene, first 1.2 million years ago and most recently 600,000 years ago, each time covering Nebraska with ash deposits that not only make excellent time markers but are so thick in places that they have been mined commercially.

Archie the Mammoth, now in Morrill Hall, was excavated by E.H. Barbour in 1922.

Probably the best known Nebraska mine is near Orleans, where for many years the Cudahy Company shoveled up white volcanic ash by the boxcar-load and shipped it to Omaha, where it was manufactured into Old Dutch Cleanser, a nationally advertised household scouring powder.

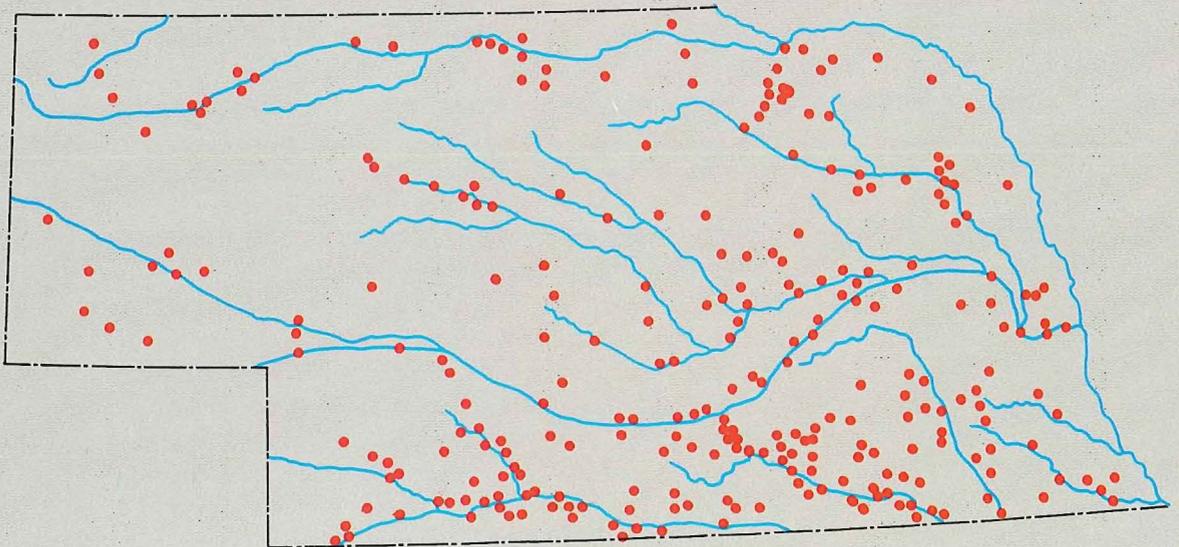
As early as 1909, giant camel bones were uncovered at the Old Dutch Cleanser Mine as teams of horses cleared sand and gravel from the top of the ash bed. E.H. Barbour collected a huge *Stegomastodon* wisdom tooth and other fossils when he visited the site in 1910. Later trips by University of Nebraska field parties yielded horse, prongbuck, mammoth and carnivore remains as well as abundant microvertebrate and invertebrate fossils.

Those collections gained special importance when the "Old Dutch Cleanser" ash (formally named the Sappa Ash after Sappa Creek) was dated at 1.2 million years by the fission track method. Other fossil beds judged to be about the same age have been found near Creighton, Hartington, McCook, Red Cloud and Wauneta. Just recently, a high school student, Mike Jones of Cambridge, discovered an important new site near his hometown. The deposits were formed in a variety of environments (glacial outwash at Hartington, a muskrat marsh at McCook) and are not all exactly the same age, but as a group they bring the early Pleistocene wildlife of Nebraska into focus.

There are holdovers from the Age of Zebras such as the long-legged giant browsing camel *Titanotylopus* and the last of the four-tusker family, *Stegomastodon*. But along with those old-timers are Asian immigrants that paleontologists recognize as marking the beginning of a new mammal age, the Irvingtonian, 1.8 million years ago. Foremost among the newcomers were an elephant (the mammoth) and a mouse (the meadow vole *Microtus*). Despite the enormous size difference between them, those animals share a trait common to

Mammoth remains in the collections of the University of Nebraska State Museum have come from almost every county in the state. The mammoth is the official state fossil of Nebraska.

MAMMOTH FINDS





Plaster cast of the foot bones of an Ice Age mammoth. Like other elephants, mammoths walked on tiptoe with a round pad of gristle supporting the back of the foot.

specialized grass-eaters: their tall-crowned teeth, which consisted of alternating plates of hard (enamel), soft (cementum) and intermediate (dentine) tissue. Both the 10-ton and the one-ounce mammals apparently were well equipped to deal with the changing vegetation of the Great Plains as wave upon wave of glaciation swept down from the north.

Mammoths came striding across the Bering land bridge on legs much longer and slimmer than those of the mastodons and stegomastodons they met when they reached North America. With their rangy build and ability to eat high-fiber grasses, mammoths seem far better adapted to open environments than their bulkier, dumpier relatives were. Stegomastodon, which probably competed with the newly arrived mammoths more directly than did their cousins the mastodons, soon declined to extinction after a short period of coexistence. True mastodons continued to survive in forested areas.

A primitive species of *Microtus* is the most common mammal collected at the Old Dutch Cleanser Mine and most other deposits of equivalent age. Those little animals with their ever-growing teeth seem to have replaced the more primitive voles with shorter-crowned, rooted teeth that flourished 1 million or 2 million years earlier during the Pliocene age.

Muskoxen, which also originated in Asia, arrived in Nebraska at about the same time as mammoths and *Microtus*, but their fossil record is much spottier. Only three muskox specimens more than 1 million years old have been found in the state — two from glacial gravels near Hartington and one just west of the glacial border near Plainview.

Horses became much more diverse in the early Pleistocene than they had been during the Pliocene. Rivalling the largest draft horses in size was *Equus giganteus*, a rare, zebra-like species, apparently the last and largest of its breed in North America. Much more common were average-size horses similar in build to the modern horse, *Equus caballus*, and probably ancestral to them. The oddest-looking of the native Ice Age horses was undoubtedly *Equus calobatus*, the “stilt-legged” horse named for its stretched-out looking lower leg and foot bones.

Sharing the open plains with horses and mammoths were herds of prongbucks about the size of today’s species but with more deeply forked horns. Prairie dogs, pocket gophers and pocket mice also were common. Muskrat evolution continued at a slow, steady pace, each generation averaging

SMALL CLUES, BIG PAYOFFS

By Michael R. Voorhies, University of Nebraska State Museum



Many of these 12-million-year-old fossils from a site near Valentine would have been missed if sediment from around the larger bones had not been screened.

In the 1950s paleontologists realized they had been wasting more than half their evidence — literally tossing it over their shoulders in the race to collect big, showy fossils for display. That was when Claude Hibbard, a lean, outspoken Kansan, demonstrated what could be done with a little simple technology. By sieving sediment through window screen, he was able to double or triple the number of species known from Great Plains fossil sites, including some deposits that previously had been considered well known. One of “Hibbie’s” favorite tricks was to screen the piles of dirt thrown out of fossil quarries by earlier field parties and then publish the results.

Responsible professionals today consider

it downright immoral to chop through a bone bed and save only the spectacular pieces. Workers at fossil sites today sift sediment (if it’s loose and dry enough to pass through the screens) or load it into gunny sacks for a trip to the nearest water where it can be soaked and wet-screened.

At many sites, more fossils are found by sifting than by getting down on hands and knees to probe for larger bones with a trowel. The screen yields not only the remains of little animals but small, interesting parts of big animals — things like ear bones of mastodons or the special hide-gripping teeth of bone-crushing dogs.

A hedgehog jaw or a coral snake vertebra certainly takes a lot less effort to collect than

an elephant bone and, in the final analysis, probably will give more accurate information about the ancient environment than the big bone ever could. Small creatures are often confined to particular environments and limited geographic areas while big ones, by virtue of their large size, tend to have broader ranges. Mole, snake and lemming fossils, therefore, tell us more about the habitats in which mammoths and sabercats lived than the fossils of the large animals do. So a paleontologist interested in big animals can’t afford to ignore the little ones.

In an era of tightened budgets, screening is also an inexpensive and quick way to collect big enough samples of single species that we can begin studying evolution on a fine scale.

somewhat larger and having more complex teeth than the one before. Subtle changes in the dental patterns of bog lemmings, always common in marsh deposits, also give us a useful stopwatch for keeping track of Pleistocene time.

As always, carnivores are rare in the early Pleistocene faunas of Nebraska, but enough fossils have been collected to show that there were modern-looking otters in the muskrat marshes and packs of small wolves patrolling the uplands. The wolves, *Canis edwardi*, are not much larger than the ancestral coyotes from which they probably arose during the Pliocene. A few scraps of big cat bone have been found, but not enough to identify.

Middle Pleistocene

Our fossil record is much better for the late Irvingtonian mammal age, or middle Pleistocene, 600,000 to 100,000 years ago. Reports of rich bonebeds of

that age near Hay Springs began to reach East Coast museums more than a century ago. Then in 1901, frontiersman “Old Jules” Sandoz sent Barbour the lower jaw of a gigantic beaver he found near Rushville, prompting exploration by University of Nebraska paleontologists. During the late 1930s and early 1940s, WPA workers excavated thousands of bones and teeth from the Hay Springs and Rushville quarries as well as from sites of similar age near Gordon, also in Sheridan County but farther down the Niobrara River.

Skulls, jaws and teeth of a primitive species of mammoth are well represented in the collections from the Sheridan County sites but no stegomastodon, which almost certainly was extinct by that time — about 300,000 years ago. Remains of horses are by far the most abundant fossils found, which accounts for the nickname “*Equus* beds” given to the deposits by old-time bone hunters. No giant horses have been discovered, but rare specimens of a burro-size species and a larger “stilt-legged” species are present. The most common specimens are from a normally proportioned horse called *Equus excelsus*.

Camel remains are next in abundance after horses in the Hay Springs, Rushville and Gordon quarries, but no sign of the giant camels is found in the middle Pleistocene. Instead, we find an animal called *Camelops*, which resembled modern camels in size and body shape but, judging from the foot bones, did not spread its toes as widely. Like most Nebraska fossil camels, *Camelops* does not appear to have been well adapted for trekking across dunes.

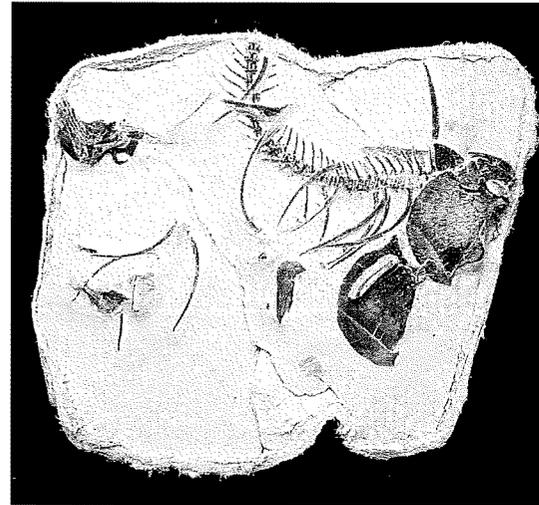
Muskoxen are present but rare, while bison are totally absent in the Sheridan County deposits. Prongbucks of two sizes have been found, the smaller of which, *Capromeryx* (“goat antelope”), stood little more than two feet tall and weighed less than 30 pounds. Deer similar to whitetails have been found but no elk, moose or caribou. Rounding out the roster of large vegetarians were two species of ground sloths, ox-size descendants of the Pliocene sloths found at Broadwater.

Nebraska’s earliest examples of the heavy-fanged sabertooth cat called *Smilodon* — and one charming little saber kitten — are found mingled with horse, camel and mammoth bones in the Rushville quarries. In addition to coyotes, two larger members of the dog family were present, one virtually identical to the timber wolf of today and the other a massive-jawed species called *Canis dirus* — the dreaded dire wolf. That short-legged, large-brained wolf may have played a hyaena-like role in Ice Age America.

Among the predators was the largest carnivorous mammal that ever walked the earth: the monstrous short-faced bear, *Arctodus*. Those extinct giants not only grew much larger than any living bears but probably were more predatory in their behavior than modern black bears or grizzlies, judging from their long legs and short muzzles that give them a distinctly cat-like appearance. Large males probably weighed more than a ton and had a standing reach of at least 13 feet. Large enough and fast enough to routinely bring down horses and camels, they may even have taken on small elephants when the opportunity arose.

Among the aquatic creatures, we note an unusual abundance of giant beavers, *Castoroides*, even larger than the ancestral species found at Broadwater. Muskrats almost as large as modern ones but with slightly less complex teeth also are abundant in the collections from Sheridan County, but remains of smaller creatures are scarce.

To get a really good look at the hidden world of the middle Ice Age we need to travel southeast about 250 miles to Nuckolls County where Albert Ahrens discovered the richest trove of Pleistocene fossils found in Nebraska in the past 20 years. Ahrens, a knowledgeable local historian, was exploring a ravine near his hometown of Angus when he spotted some elephant bones. Since he had occasionally found artifacts in plowed fields nearby, he notified the Nebraska



Fossil fish bearing oxbow lake deposits made of diatom skeletons are common in Nebraska’s Cenozoic rock record. This recently collected skeleton has not been carefully studied, but it resembles the modern buffalo fish.

State Historical Society, thinking the site might be important archaeologically.

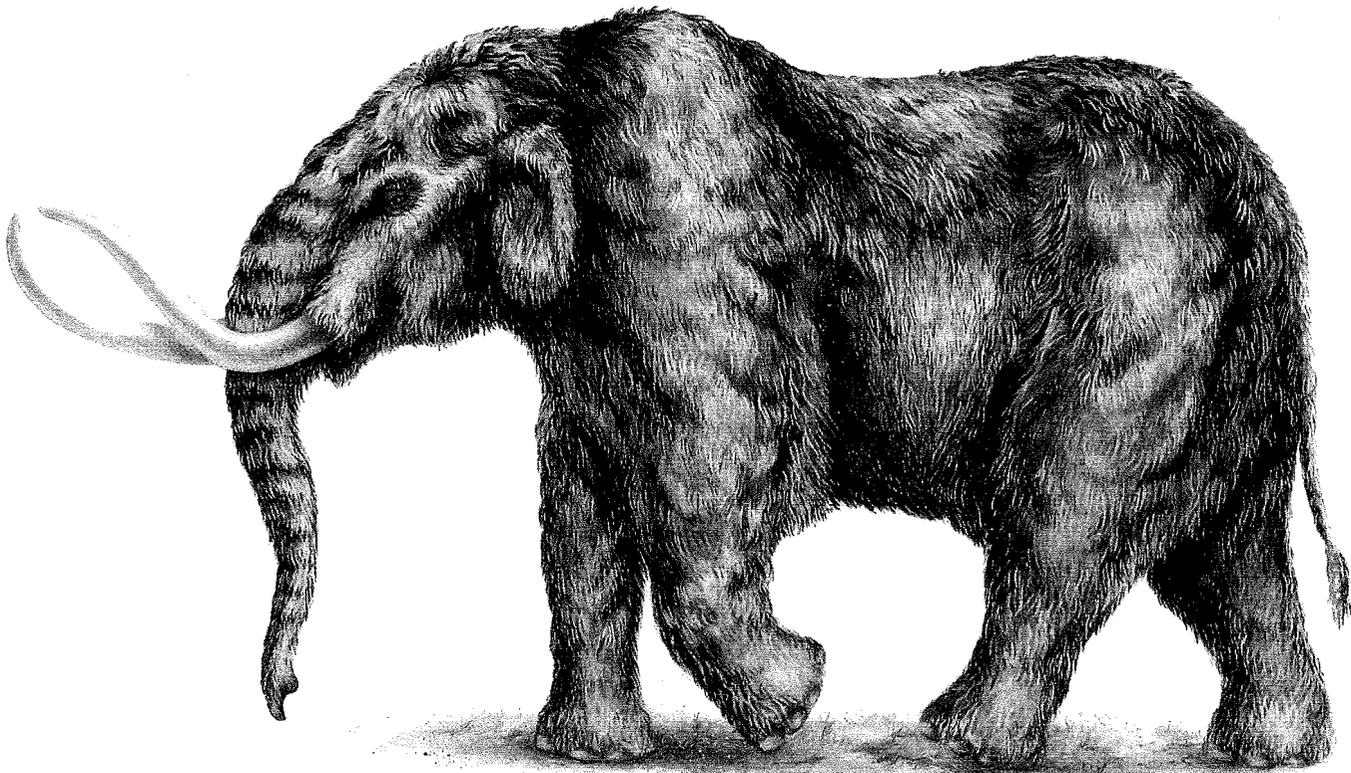
The society's Gayle Carlson found no evidence of human activity at the site but thought it might be interesting to paleontologists so he gave George Corner of the University State Museum a call. Corner, then the museum's highway salvage paleontologist, accompanied Ahrens to the site and came away shaking his head in amazement. "You're not going to believe this place, Mike," he said when he got back to Lincoln. "It's wall-to-wall fossils."

Indeed it was. I'll never forget my first trip to Ahrens' bone gulch on a wet November day in 1986. Stepping up to the edge of the deep ravine, the first thing I noticed was a horizontal layer of greenish-white silt sandwiched between two thick beds of reddish-brown Ice Age windblown dust. Up close I found that the light color was due to enormous numbers of clam and snail shells and at still closer range I began to pick out the dozens of pink-colored bones and teeth that stud each square foot of the shell bed.

George and I traced the fossil bed more than a hundred yards that first exciting afternoon and finally hauled eight gunny sacks of "snail dirt" back to the pickup. When we sieved the samples at the museum, the silt readily rinsed away, leaving a thick layer of almost nothing but fossils on the screens. In just those few shovelfuls of sediment we found beautifully preserved jaws, teeth and bones of more than 40 species of vertebrates, nearly as many as the museum had collected at another rich site near Angus during several seasons of work in the 1950s and 1960s.

Since that first memorable afternoon, George and I have joined Albert and his hospitable family for two highly enjoyable and productive months excavating the new site, which has proved to be the filling of an ancient marsh. The bonebed, covering at least an acre, originated after, but probably not long after, the last thick bed of volcanic ash was deposited over the region 600,000 years ago. More than a quarter of a million fossils representing more than 100 species of Ice Age vertebrates have been identified from the site so far.

American mastodon, a distant relative of today's elephants, as it might have looked in life. Stomach contents of some specimens show that these heavy-bodied, long-headed animals were browsers. They ranged Ice Age forests in eastern North America, but their remains are scarce in the arid West. Mammoths outnumber them by 20 to 1 in Nebraska.



Large mammals from the Albert Ahrens site include such typical Plains dwellers as mammoth, horse, camel and prongbuck reminiscent of those from the Sheridan County sites, but also such woodland creatures as mastodons (a good portion of the skeleton of a young male) and a giant member of the deer family called *Cervalces* — the “stag moose.” The stag moose remains from the Nuckolls County site, which may be the oldest in North America, come from animals roughly the size of a modern moose, much smaller than the common late Ice Age species *Cervalces scotti*, which had the largest rack of any American deer. Muskoxen also are relatively more common at the Ahrens site than in any other known deposits of comparable age.

Studies of fossil pollen from the sinus cavities of Ahrens site mammoth and mastodon skulls reveal what vegetation surrounded the ancient marsh. Trees such as larch, spruce, fir, birch and hemlock gave the landscape a “north woods” flavor, but some species still growing near the site, such as elm, oak and hackberry, were also present in the Ice Age flora. Mosses and various aquatic marsh plants were abundant along with diverse grasses, herbs and forbs that probably lived in more open, better drained upland areas.

Fossil animals from the site harmonize well with the environment indicated by the pollen samples: a marsh surrounded by cool, moist forest with patches of drier grassland. Mollusk expert Hal Pierce has identified more than 45 species of clams and snails from the site, most of which live north and east of Nebraska today. Fossil fish recognized include northern pike, bullheads, suckers and a number of species of minnows and chubs. Tens of thousands of frog bones have been collected along with modest numbers of toad and salamander parts, thousands of snake vertebrae and a few lizard jaws. Turtles are very rare in the deposit, and all collected so far have been aquatic species, such as snappers, which are the only turtles adapted for climates as cold as southern Canada. The list of fossil birds from the site continues to grow, but already includes such interesting forms as a stork, passenger pigeon and turkey as well as dozens of species of waterfowl, raptors and perching birds. Like many Nebraska marshes today, the ancient one in Nuckolls County must have been prime habitat for ducks, geese and shorebirds. We know at least some of them nested there because fossil eggshell is fairly common at the site.

My personal favorites among all the fossil mammals from the Ahrens site are the shrews. Seven different types of those bloodthirsty, hyperactive little animals, including one new giant species, are represented by perfectly preserved jaws. Three species, the masked, short-tailed and least shrews, still inhabit Nebraska, but the arctic, pygmy and water shrews live only where the summers are much cooler than ours. The same can be said for a number of rodents at the Ahrens site, such as redback voles, spruce voles and northern bog lemmings, which are much more at home today in the cool evergreen forests of Canada than on the dusty plains of Nebraska. Northern pocket gophers, Richardson’s ground squirrels and white-tailed prairie dogs are three other high latitude or high altitude rodents that no longer live in Nuckolls County but which are represented by thousands of fossils at the site. Other rodents in the fauna, such as meadow voles, prairie voles, porcupines, grasshopper mice, woodchucks, pocket mice, kangaroo rats, jumping mice and a host of others have descendants still living in Nebraska.

An area in northwestern Minnesota and southwestern Manitoba is where most of the small mammals found as fossils at the Ahrens site are living today. The environment in that area, open grasslands bordering on mixed coniferous-hardwood forest interspersed with bogs, may be the best modern analogue for the environment of south-central Nebraska during a glacial advance. We suspect that an ice sheet covered what is now the Missouri River Valley while the Ahrens marsh was filling up with moose, mastodon and muskrat parts.