Also, Paleo-Indians occasionally hunted mastodons from the Pacific Coast to the Great Lakes. In 1977, a bone projectile point was found embedded in a mastodon rib near Sequim, Washington. Evidently people living in a shrub-tundra landscape had killed and butchered the animal near a pond about 12,000 years ago. Mastodons were also butchered in southwestern Michigan about the same period. And stone tools characteristic of the Clovis culture were found directly associated with mastodon bones at Kimmswick, Missouri. Although people may have contributed to mastodon extinction, which occurred about 9000 years ago, rapidly changing climate seems to have been a more significant factor. Perhaps the resulting severe changes in plant community structure and composition changes unprecedented in earlier parts of the ice age were mainly responsible for the extinction of the American mastodon.

C.R. Harington
March, 1996

American Mastodon. Reproduced courtesy of the Canadian Museum of Nature, Ottawa

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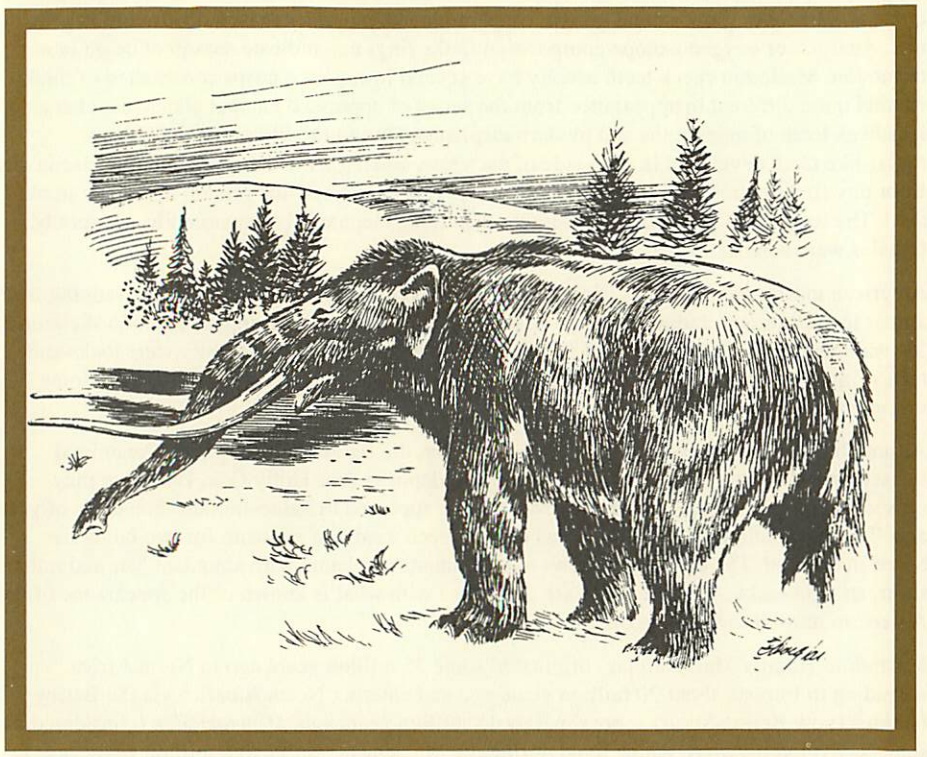

Ink sketch by Charles Douglas.

American Mastodon

American mastodons *(Mammut americanum)* are of interest because they were among the largest land animals living during the ice age (Quaternary the last 2 million years), were so widely distributed in North America, and are commonly represented by fossils. Further, they have interesting historical connections. In 1739 an expedition from Montréal under the leadership of Charles Le Moyne, Baron de Longueuil, found bones and teeth on a journey down the Ohio River toward the Mississippi. But it was not until 1799 that the great French anatomist, Georges, Baron Cuvier, first recognized that they belonged to an elephant-like animal he called *mastodon* ("nipple tooth"). However, the Scottish naturalist Robert Kerr in 1792 first provided a scientific name *"Elephas americanus"* for the American mastodon based

on its unique cheek teeth "covered uniformly with enamel and furnished with a double row of high conic processes." Thomas Jefferson made it a duty of the explorers Lewis and Clark to learn of the existence of mastodons in the "West".

Compared to living elephants and mammoths, American mastodons tended to have straighter tusks and squatter (between 2 and 3 m in shoulder height) and longer bodies (about 4.5 m). Generally, females were smaller. The upper tusks (enlarged second upper incisor teeth) extended 2 m or more beyond the sockets: some mastodons had vestigial tusks in their lower jaw, but often they were lost by maturity. Male tusks are larger and heavier than those of females. The tusks show annual growth rings produced in part by seasonal variation in growth rate. Analysis of oxygen isotope composition in the rings can indicate season of death in a mastodon. Mastodon cheek teeth usually have several low, paired cusps constructed of thick enamel quite different in appearance from the series of appressed enamel plates that characterize cheek teeth of mammoths and modern elephants. During the life of the animal, six molar-like teeth developed in each side of each jaw, making 24 in all. The teeth increase in size from tiny first premolars to massive third molars (the only teeth that remain in the jaw in old age). The teeth grew forward into position as in living elephants and mammoths. Generally, females were smaller.

American mastodons had coats of fine underwool overlain by coarser guard hairs ranging from amber to dark brown. Judge Miller, in describing the discovery and appearance of a skeleton at Shawangunk, New York stated that "... around and in the immediate vicinity were locks and tufts of hair of dun brown, of an inch and a half to two inches and a half long and, in some instances, from four to seven inches in length."

Although there is controversy about its authenticity, the figure of an elephant-like animal incised on the surface of a whelk shell from peat deposits near Holly Oak, Delaware may provide a glimpse of the American mastodon as it appeared to Paleo-Indians thousands of years ago. The shell, collected in 1864, seems to have been used as a pendant, for two holes are bored in one end. The engraving shows a long, squat "elephant" with abundant hair and rather short, straight tusks. All its features are consistent with what is known of the appearance of the American mastodon based on other evidence.

Mastodons (family Mammutidae) originated some 35 million years ago in North Africa, spreading to Eurasia about 20 million years ago and entering North America via the Bering Isthmus (now Bering Strait) approximately 15 million years ago. *Miomastodon* (considered by some as *Zyglolophodon*), which lived during the Miocene (some 22 to 6 million years ago) in Eurasia and North America, gave rise to both the American mastodon (*Mammut americanum*) and its closest known relative, Borson's mastodon (*Mammut borsoni*), which lived in Europe about 3 million years ago. The earliest records of the American mastodon are from Washington and Idaho, and extend back about 3.7 million years. Between about 1.8 and 0.4 million years ago the species occurred in Nebraska, Maryland and Pennsylvania, as well as Washington, Idaho and Florida.

Toward the close of the last glaciation (10,000 years ago)[1], American mastodons ranged from Alaska and the Yukon to central Mexico, and from Pacific to Atlantic coasts. Indeed, teeth have been dredged up by fishermen off the Atlantic Coast. Specimens have been found as far as 300 km from the present shoreline. Presumably mastodons lived in areas of conifer forest and marsh on the Continental Shelf during a period of glacially-lowered sea levels about 20,000 years ago.

[1] The ice age included four major glaciations separated by warmer interglacials in which the climate was similar to that of today.

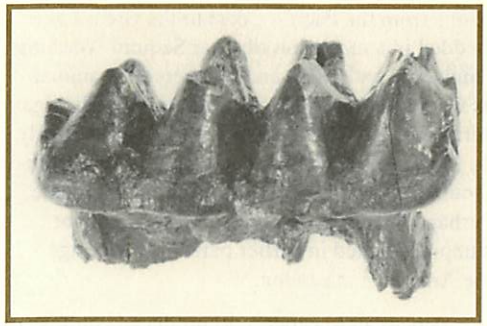

Figure 2: Side view of lower third molar tooth of American mastodon (Mammut Americanum) *from Old Crow basin, Yukon.*

Environmental changes evidently affected mastodons. Members of the species associated with pine parkland in the Ozarks during the middle of the last glaciation were small with rugged teeth, whereas those associated with later full-glacial spruce woodlands or forests in the same region were large and had smooth teeth indicative of optimum conditions.

In Canada, most mastodon remains (more than 60 specimens) have been found in deposits that postdate the last glaciation in southern Ontario. Fossils are known from every province and territory except Newfoundland and Prince Edward Island. One of the most remarkable specimens is the Hillsborough Mastodon, which was found in 1936 by workers repairing a dam on the property of Captain Conrad Osman at Hillsborough, New Brunswick. The animal had become mired in a local swamp during a relatively warm interval of the last (Sangamonian) interglacial about 100,000 years ago. Despite the massive size of the bones, a study of tooth-wear suggests that the animal was a young adult perhaps 15 to 18 years old at death. It is estimated to have weighed about 8.3 tonnes. Further, associated "dung balls" contain cut wood fragments and much clay. A cast of the skeleton is displayed at the New Brunswick Museum in Saint John. Mastodon remains of similar age are known from sink holes at Miller Creek and East Milford, Nova Scotia. At the latter site, remains of an adult skeleton, and a 7 year old were found with frog and turtle remains.

What did American mastodons eat? Of nine well-preserved specimens, two had food in the mouth (twigs of larch, and resins and tars with a high percentage of spruce pollen and some of pine, grass and composites). The remainder had stomach contents consisting of hemlock and cedar wood, conifer twigs, swamp plants and mosses. Nearly 250 litres of plant material were in the stomach of a mastodon found at Hackettstown, New Jersey. Perhaps mastodons used their tusks to pry off and break branches into bite-size pieces. When both tusks are preserved, one is usually shorter indicating preferential use (the way people are right-or left-handed).

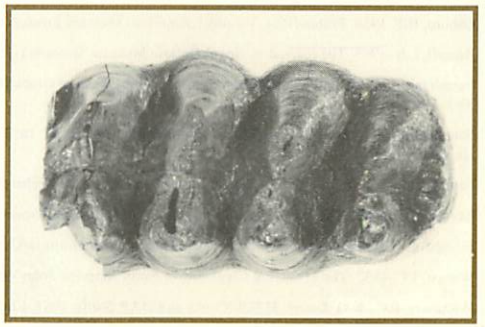

Figure 3: Top view of Figure 2 showing wear surface of M_3.

In the Great Lakes region, mastodons are usually associated with other browsing animals adapted to forests, such as beavers (*Castor),* giant beavers *(Castoroides)* and giant moose *(Cervalces).* Elsewhere, they are often associated with grazers of more open country, such as mammoths *(Mammuthus),* horses *(Equus)* and bison *(Bison).* There is good evidence from Friesenhahn Cave in Texas that American scimitar cats *(Homotherium serum)* preyed on young mastodons.