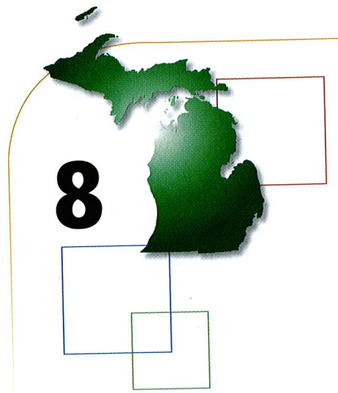

8 Pleistocene Fauna

J. Alan Holman and Danita Brandt

Introduction

Michigan's fossil record extends back to the Archean Eon (Chapter 3), and is especially rich during the Paleozoic Era (Chapter 4). That record was interrupted by the "Lost Interval" of missing Mesozoic Era strata (Chapter 5), and as a consequence, there is little prospect of finding dinosaur fossils in Michigan. There are also no significant post-Paleozoic fossil deposits until about 50,000 years ago, during the Pleistocene Epoch of the Cenozoic Period (Plate 4). The reason for the lack of fossils from the Late Pennsylvanian Period to the Early Pleistocene was the absence, during that interval, of suitable environments for burial and preservation of sediments and entombed organic material. During the Pleistocene, however, numerous bogs that formed after the retreat of the glaciers provided suitable conditions for trapping and preserving fossil remains, including aquatic invertebrates and aquatic and terrestrial vertebrates. Thus, we begin there.

Invertebrate Pleistocene fauna

The Pleistocene invertebrate fossil record in Michigan comprises members of only two major taxonomic groups (phyla): molluscs and arthropods. The fossils all belong to extant genera, i.e., alive today, and represent fresh water and terrestrial niches. Among the molluscs, fossil gastropods (snails) include the genera *Physa*, *Helix* and *Planorbis* (Fig. 8.1A). Pelecypods (clams) are quite abundant in Michigan Pleistocene deposits, and include the freshwater genera *Anodonta* and *Piscidium* (Fig. 8.1B). Among the aquatic arthropods, microscopic ostracodes are most abundant as fossils (Fig. 8.1C), and among terrestrial arthropods, insects, especially beetles, dominate the arthropod fossil record. Bits and pieces of insects are more common as fossils than entire organisms, and the hardened front wings (elytra) are the most commonly found beetle fossils (Fig. 8.1D).

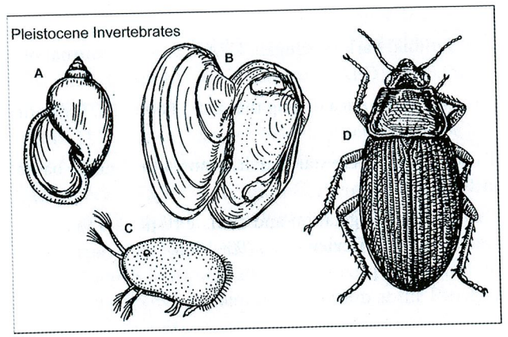

FIGURE 8.1 Some of Michigan's Pleistocene invertebrates. A. The gastropod *Physa*. B. The clam *Anodonta*. C. An Ostracod. D. A Pleistocene beetle.

Although undoubtedly an important component of Michigan's Pleistocene ecosystems and food-webs, invertebrates are not as well known as are Michigan's Pleistocene vertebrates, which include members of five classes: Osteichthyes (bony fish), Amphibia, Reptilia, Aves (birds) and Mammalia. These are discussed below.

Vertebrate Pleistocene fauna

Michigan's Pleistocene vertebrates are remarkably restricted in time and space. The most ancient ones consist of fishes and small mammals known from a single site that existed about 55,000 years ago. The next oldest vertebrates consist of a duck and a mammoth, each from separate sites and dated about 30,000 years ago. The remainder of the Michigan Pleistocene vertebrates are known from a plethora of sites that range from about 14,500 to11,000 years ago, the end of the Pleistocene. All of the verified Pleistocene vertebrates of Michigan (Holman 2001, Seymour 2004) have been found in the southern half of the Lower Peninsula, south of a boundary marked by the Mason-Quimby Line (Holman 1991, Fig. 8.2), a line originally drawn to indicate the distribution of American Mastodonts and most Paleo-Indian fluted spear points (Cleland et al. 1998).

Michigan's known Pleistocene vertebrate fauna is composed of at least 39 taxa, including seven fishes, three amphibians, two reptiles, two birds and 25 mammals. Of these, 33 were either identified positively or at least tentatively to the species level (Table 8.1). Mastodonts, giant browsing megaherbivores, have yielded by far the most abundant vertebrate remains in the Pleistocene of Michigan.

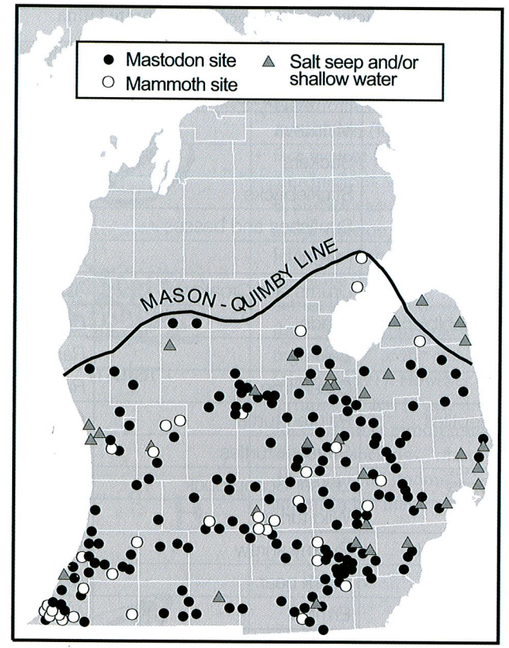

FIGURE 8.2 Locations of known Mastodon and Mammoth sites in Michigan, in relation to the Mason-Quimby Line. There is no undisputed evidence of Pleistocene vertebrates and very little evidence of Paleo-Indian activity north of this line in Michigan.

Michigan's fossil giants: mammoths and mastodonts

People are often confused by the terms mastodont and mammoth, thinking that both names refer to a single Ice Age mammal that looks like a long-haired elephant. Actually, these huge mammals have a long and separate evolutionary history and are as different from one another as horses are from rhinos! That is, they are members of different major groups; mastodonts belong to the Family Mammutidae, whereas mammoths are members of the Family Elephantidae (which also includes the modern elephants). Mastodonts and mammoths also differ in a number of skeletal characteristics, e.g., the shape of the skull and tusks, but are most easily distinguished based on the structure of their teeth. Mastodont teeth (Fig. 8.3A) have chewing surfaces composed of large knobs, the individual knobs usually with worn-down central portions. The knobs are arranged in two rows. The name mastodont comes from the structure of these teeth, which technically means "nipple tooth." Mammoths have teeth (Fig. 8.8B), with chewing surfaces that are composed of a single row of thin enamel plates. The jaw muscles and teeth of mastodonts and mammoths work differently to produce two kinds of chewing motions. In mastodonts, the lower jaw moves up and down against the upper jaw producing a crunching type of chewing motion. In mammoths, the lower jaw moves backward and forward, causing a grinding type of chewing.

The differences in jaws, muscles, and teeth are associated with the feeding habits of these two animals. Mastodonts ate and chewed *mast* and other types of *browse* between the upper and lower teeth, whereas mammoths ground up grass between the transverse enamel ridges of their teeth. In the Pleistocene, mastodonts were most abundant in eastern woodlands; mammoths were abundant in the prairie states. Thus, mastodont fossils are much more abundant in Michigan than those of mammoths.

TABLE 8.1 Michigan's Pleistocene vertebrate fauna

Major Group	Common name	Scientific name	Reference
Fish	Northern pike	*Esox lucius*	Shoshani et al. (1989)
	Minnows	Cyprinidae	Seymour (2004)
	Suckers	Catostomidae	Seymour (2004)
	Sticklebacks	*Pungitius cf. P. pungitius*	Seymour (2004)
	Sunfishes and basses	*Pomoxis*	Holman (1979)
	Perch	*Perca flavescens*	Shoshani et al. (1989)
	Drums and Croakers	*Aplodinotus cf. A. grunniens*	Seymour (2004)
Amphibians	Toads	*Bufo americanus*	Holman (1988)
	Bullfrog	*Rana catesbeiana*	DeFauw and Shoshani (1991)
	Green frog	*Rana clamitans*	DeFauw and Shoshani (1991)
Reptiles	Painted turtle	*Chrysemys picta*	Holman and Fisher (1993)
	Softshell turtles	*Apalone spinifera*	Holman and Fisher (1993)
Birds	Lesser Scaup duck	*Aythya affinis*	Holman (1976)
	Wild turkey	*Meleagris gallopavo*	Shoshani et al. (1989)
Mammals	Pygmy shrew	*Sorex hoyi*	Seymour (2004)
	Black bear	*Ursus americanus*	Eshelman (1974)
	Ermine	*Mustela erminea*	Seymour (2004)
	Flat-headed peccary[1]	*Platygonus compressus*	Wilson (1967)
	Moose	*Alces alces*	Shoshani et al. (1989)
	Scotts moose[1]	*Cervalces scotti*	Garland and Cogswell (1985)
	Wapiti (elk)	*Cervus elaphus*	Hay (1923)
	White-tailed deer	*Odocoileus virginianus*	Holman et al. (1986)
	Caribou	*Rangifer tarandus*	Hibbard (1952)
	Woodland muskox[1]	*Bootherium bombifrons*	Holman (1990)
	American beaver	*Castor canadensis*	Shoshani et al. (1989)
	Giant beaver[1]	*Castoroides ohioensis*	Holman (1991)
	Deer mouse	*Peromyscus maniculatus*	Seymour (2004)
	Collared lemming	*Dicrostonyx groenlandicus*	Seymour (2004)
	Northern bog lemming	*Synaptomys borealis*	Seymour (2004)
	Brown lemming	*Lemmus cf. L. trimuronatus*	Seymour (2004)
	Southern Red-backed vole	*Clethrionomys cf. C. gapperi*	Seymour (2004)
	Meadow vole	*Microtus pennsylvanicus*	Holman (1979)
	Yellow-cheeked vole	*Microtus xanthognathus*	Seymour (2004)
	Muskrat	*Ondatra zibethicus*	Shoshani et al. (1989)
	Meadow jumping mouse	*Zapus cf. Z. hudsonius*	Seymour (2004)
	Rabbit	Unidentified	Seymour (2004)
	American Mastodont[1]	*Mammut americanum*	Garland and Cogswell (1985)
	Jefferson Mammoth[1]	*Mammuthus jeffersoni*	Abraczinskas (1993)
	Woolly Mammoth[1]	*Mammuthus primigenius*	Case et al. (1935)

1. Extinct
The abbreviation "cf." Indicates that the genus or species is tentatively identified.

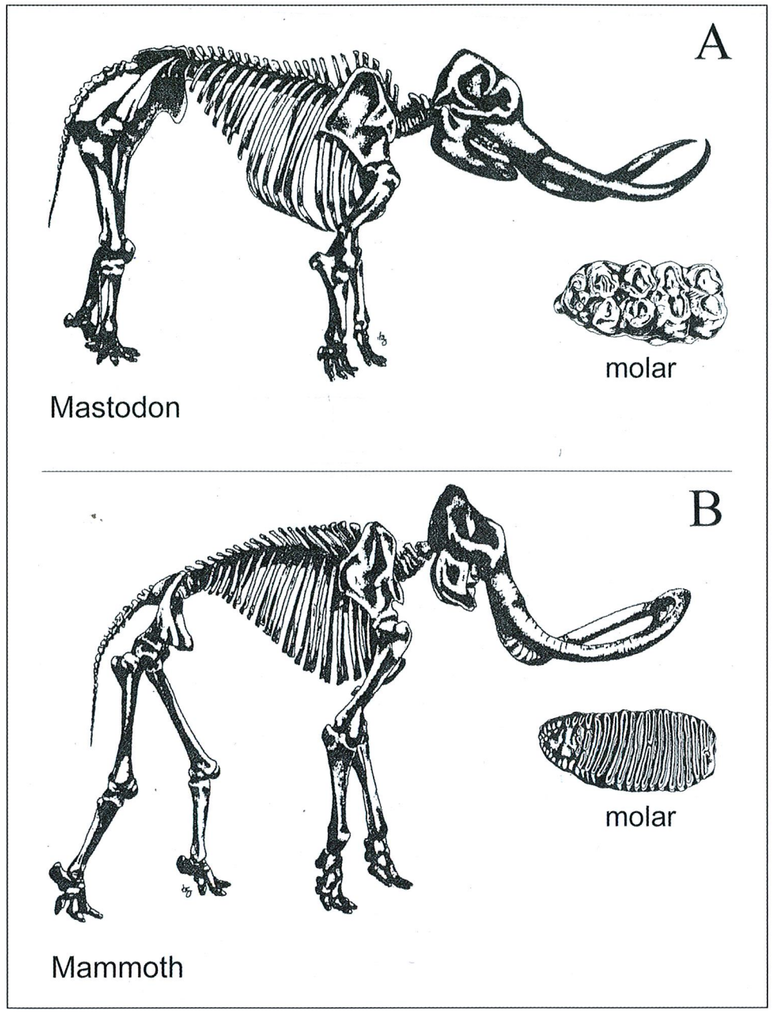

FIGURE 8.3 A comparison of mastodonts and mammoths from the Pleistocene of Michigan. A. Skeleton (left) and surface view of tooth (right) of an American Mastodont. B. Surface view of tooth (left) and a skeleton (right) of a Jefferson Mammoth. Note: the name "mastodont" comes from a Greek word that, translated to English, requires a "t" at the end (Haynes 1991). However, the terminal "t" has largely disappeared in common usage, and both spellings, "mastodont" and "mastodon," appear in the literature.

In Michigan, mastodonts are thought to have preferred open spruce woodlands, as well as open pine and spruce forests. Food remains found inside the rib cages of mastodonts showed the presence of twigs, conifer cones, leaves, tough grasses and marsh and swamp plants. Only one species of mastodont actually occurred in the Pleistocene in Michigan. It ranged from about 2.5 to 3 m high at the shoulders and weighed from about four to six tons. There are at least 61 mastodont sites in Ontario, 211 in Michigan, 136 in Ohio, 23 in Indiana, 40 in Illinois and 20 in Wisconsin, all associated with the last glaciation.

At least 27 mammoth sites are known in Ontario, 49 in Michigan, 57 in Ohio, 13 in Indiana, 11 in Illinois and 28 in Wisconsin. Each site may contain either one or two different species of mammoth. Two species of mammoths are recognized in Michigan, the Jefferson Mammoth and the Woolly Mammoth (Table 8.1); the latter species is very rare in the state. The Jefferson Mammoth is usually identified on the basis of being larger and having less complicated teeth than the Woolly Mammoth. The Jefferson Mammoth is thought to have become extinct almost 13,000 years ago in the Great Lakes region. It preferred grasslands (in Michigan) and was only about one-fourth as abundant as Mastodonts in the state.

Because of cave paintings and engravings in Eurasia, as well as thousands of bones and even frozen carcasses in Siberia, we know that the Woolly Mammoth had the general appearance of a relatively small, shaggy elephant with small ears and a short trunk. It entered the Great Lakes region from time to time, and besides Michigan, has been reported from Ontario and Ohio. A complete skull has even been found in southeastern Ohio.

Post-Pleistocene faunal changes

Of the 33 vertebrates identified to species in Table 8.1, seven became extinct by the end of the Pleistocene, and others occupy a much-reduced geographic range today in Michigan than they did then. Still other groups have vanished entirely from Michigan since the Pleistocene. At least some of this faunal change can be attributed to changes in climate and subsequent shifts in habitats. For example, the distribution of fossil lemmings indicates that they were more widely dispersed during the Pleistocene, ranging as far south as Virginia, Tennessee and Arkansas. The three Pleistocene species found as fossils in Michigan do not live here today, but are found only much farther north, in the tundra of Alaska, Canada and Greenland. This shift in their range may correspond with the waning of the Pleistocene ice sheets and northern shift of the cooler habitats in which they lived.

Likewise during the Pleistocene, caribou ranged across Michigan and as far south as Virginia and Tennessee. Today the nearest caribou to Michigan are found along the north shore of Lake Superior. This shift in range mirrors the climate/habitat changes associated with the final retreat of the ice.

Some Pleistocene vertebrates may have succumbed to other ecologic pressures in combination with climate change. The Giant Beaver (*Castoroides ohioensi*; Fig. 8.4) is a spectacular, extinct rodent that was as large as a medium-sized Black Bear. Fossils of this animal have been found in at least 10 sites in Michigan. The incisor teeth (Fig. 8.4B) of the Giant Beaver appear to be a combination of a gouge and a chisel that could cut wood and strip bark as well as allowing the animals to root for aquatic plants. Its molars, however, were adapted for eating succulent aquatic plants.

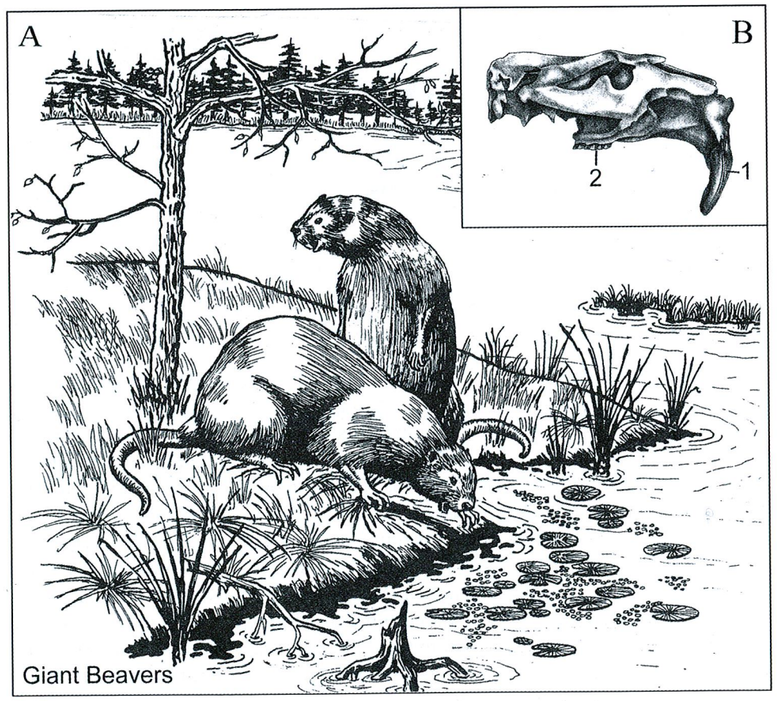

FIGURE 8.4 Drawings of the extinct Giant Beaver. A. Giant Beavers near a pond. B. A Giant Beaver skull (in side view); 1= incisor teeth, 2= molar teeth.

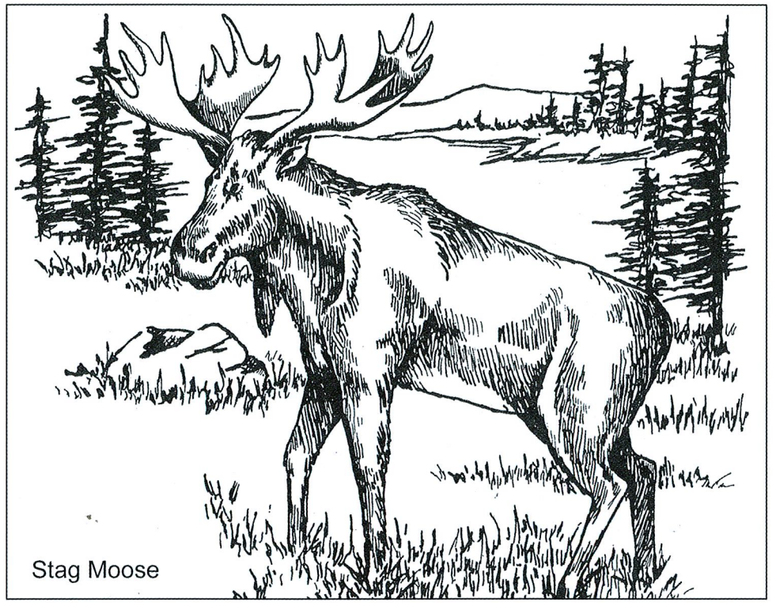

FIGURE 8.5 A drawing of a Scott's Moose (Stag Moose) in an open coniferous forest.

It is thought that the Giant Beaver became extinct because of its competition with the more resourceful modern beaver and because of the reduction of typical Giant Beaver habitat at the end of the Pleistocene.

The extinct Scotts (Stag) Moose (*Cervalces scotti*; Fig. 8.5) differs from the true Moose (*Alces alces*) in having narrower antlers with a more complicated branching pattern, and a different enamel pattern on the teeth. Despite these differences, it is thought that both may have occupied similar habitats. Therefore, competition for food under fluctuating climate conditions may have contributed to the extinction of Scott's Moose.

Explaining the reduction in numbers of individuals of other Michigan Pleistocene vertebrates is complicated by the appearance during the Pleistocene of a new group of predatory mammals—*Homo sapiens*. Humans must have impacted the Pleistocene fauna in the same way we impact ecosystems today—through hunting and habitat destruction. The effect of human hunting on several large game animals, including wild turkey, black bear and moose, is documented over historic timescales in Michigan. Today moose occur only in Michigan's Upper Peninsula and are the subject of intensive wildlife-management efforts. Wapiti (elk) were extirpated from Michigan by 1880, but have since been reintroduced in the central part of northern Lower Michigan. Wild turkey hybrids have been re-introduced successfully in many parts of the Lower Peninsula.

Extinction of the megaherbivores

All of Michigan's extinct Pleistocene vertebrates were large mammals, including the peccary (Fig. 8.6), Scott's Moose (Fig. 8.5), Woodland Muskox (Fig. 8.7), Giant Beaver and the three elephant-like giant herbivores (megaherbivores), the American Mastodont, Jefferson Mammoth and Wooly Mammoth. Michigan's mastodonts and mammoths were the dominant vertebrates in the Pleistocene ecosystems of Michigan, and in many other Pleistocene ecosystems in the New World. Like the present elephants and rhinos of Africa, they kept the vertebrate community in equilibrium by means of their feeding and other activities (Owen-Smith 1987). No such megaherbivores (giant herbivores) now exist in the New World, and, obviously, when the mastodonts and mammoths suddenly became extinct at the end of the Pleistocene, most of the ecosystems in this half of the globe changed forever. It has been documented in Africa that when the megaherbivores become extinct, other large mammals also become extinct—almost a domino effect. This certainly must have happened in North America (Holman 2001).

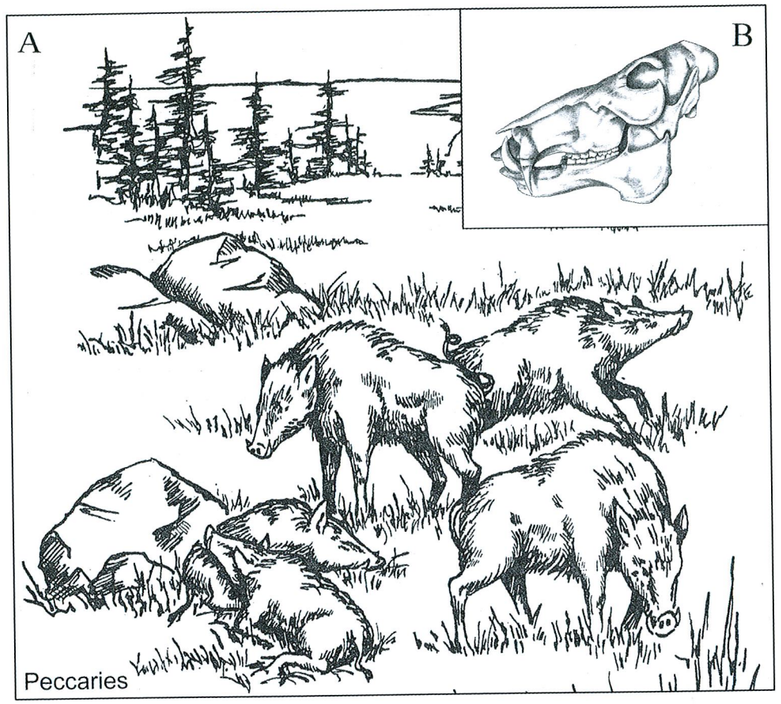

FIGURE 8.6 Pleistocene Peccaries. A. A group of Flat-headed Peccaries in an open situation. B. A Flat-headed Peccary skull (in side view).

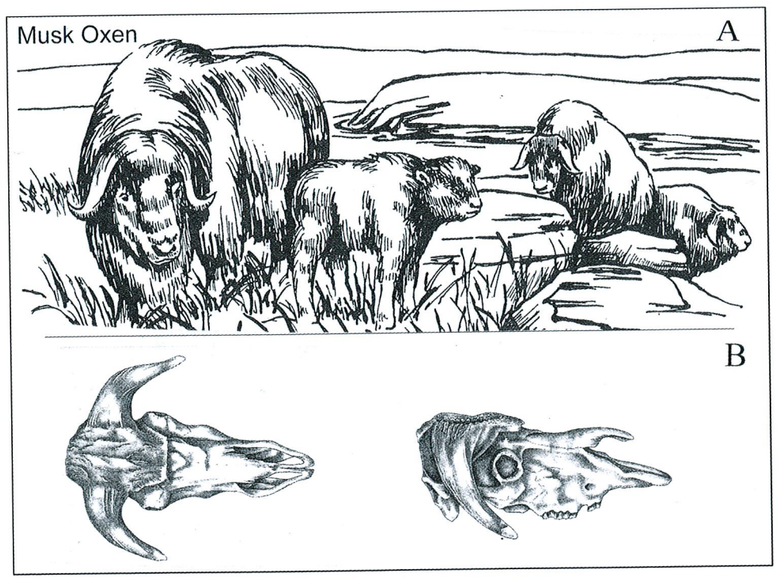

FIGURE 8.7 Woodland Muskoxen. A. A group of Woodland (Helmeted) Muskoxen in sparse cover. B. A skull (in top view) of a Woodland Muskox (upper). Same skull in side view (lower).

The possible role of Paleo-Indians as hunters of mammoths and mastodonts is a topic of current research, e.g., Fisher (1984a, b). Another topic of interest regarding these megaherbivores, independent of possible human intervention, is the suggestion that mastodonts and mammoths were dependant on the sodium that was found in the surficial salt deposits in Michigan (Fig. 8.2), in the same way that elephants are dependant on a salt supply today in Africa (Owen-Smith 1987, Holman et al. 1998). The abundance of mastodonts and mammoths in Michigan, relative to surrounding states, may be the result of yearly treks to Michigan to procure this essential element of their diet.

Epilogue

Small bands of Late Pleistocene hunters occasionally came upon mastodonts drinking from small, glacially derived ponds. Some may have tried to kill these megaherbivores with spears armed with fluted points. Others gathered turtles and smaller prey.

After the Pleistocene, humans became agriculturalists, then industrialists and finally technologists. Fields of grain replaced the natural grasslands and woodlands of the Pleistocene and domestic herbivores (cows, sheep, and goats) replaced the extinct Pleistocene ones. The intrepid turtles persisted through these myriad climate, habitat, and cultural changes to survive to the present day, whereas their megaherbivore brethren did not (Holman and Fisher 1993). Certainly there is more to learn about the underlying explanations for the distribution and evolutionary history of Michigan's Pleistocene fauna.

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