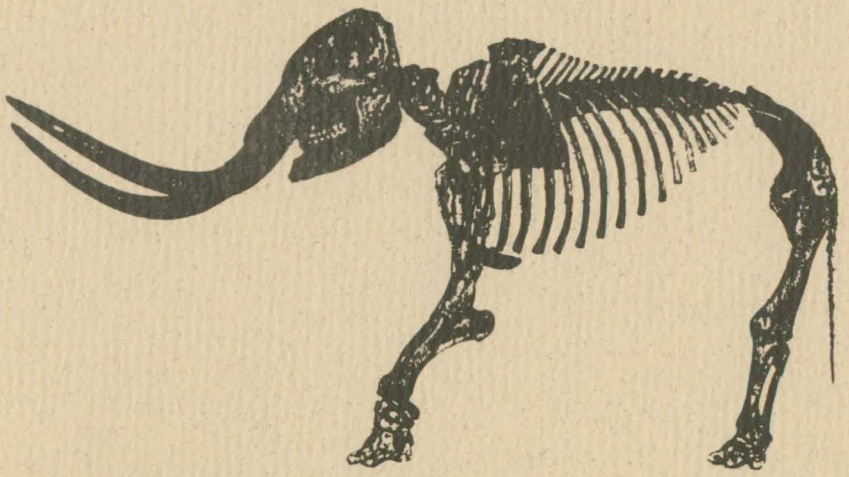
Educational Publication

A GUIDE TO THE GROLEAU-WHITE LAKE MASTODON

(Michigan's Second Mounted Mastodon)



Mammut americanum

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For information regarding this exhibit, contact OCC at (313) 363-7191. Ask for Dr. Brodbeck's office.

DEDICATION PAGE

The success of this project has been contingent upon a myriad of people. We would like to focus special appreciation on:

- the Groleau brothers for their recognition of the potential of this mastodon find and the generosity of their financial support
- the receptiveness of the staff of Oakland Community College for sponsoring this project
- the patient ombudsmanship of Professor Charles C. Nelson
- the drive, expertise and leadership of Mr. Jeheskel Shoshani, who spearheaded this unique experience
- Dr. Ned Brodbeck, the Provost of OCC Highland Lakes Campus for his time, effort and assistance in this project
- Professor and Mrs. Joseph Kelty for their advice and help from the inception to the completion of our task
- Mr. and Mrs. Burt Knox whose invaluable talents and knowledge promoted the project's success
- Mrs. Shirley Kammerer who continues to contribute untold time and effort on behalf of this project
- the families of all involved for their emotional and moral support
- the countless individuals who have made contributions of time, materials, ideas and talents.

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PROJECT HISTORY

Mounting a Mastodon (GSC - 240)
OCC Highland Lakes Campus
Instructor: Jeheskel (Hezy) Shoshani
Coordinator: Charles (Chuck) Nelson
Class began: September 3, 1981

Mastodons are prehistoric animals of elephant size. They roamed North America during the Pleisticene Epoch (during the last 1-2 million years). They became extinct about 8-10,000 years ago.

Over 250 skeletal remains of mastodons and mammoths have been discovered in Michigan. The bones of the present mastodon nicknamed "Elmer" (for the Elmer's glue initially used to hold broken bones together), were unearthed on March 11, 1968 on M-59 between Elizabeth Lake and Williams Lake Roads, just north of Suburban Knolls. The discovery was made by Groleau Bros., Inc., of Walled Lake. The bones were donated to OCC by Groleau, along with $500 for their preservation. Only one third of Elmer's bones were found. They were brought to New York City by Chuck Nelson and Mike Connell of the Science Department. The missing pieces were then cast by a team headed by natural historian Gary Sawyer in his Greenwich Village loft.

The reconstruction of Elmer began last fall under the supervision of Jeheskel (Hezy) Shoshani who has a deep interest in elephants, and whose interest merged with the establishment of the Elephant Interest Group, centered at Wayne State University, Department of Biosciences.

The lecture part of the course included the elephant's anatomy, natural history, evolution and possible migratory routes.

The lab part included mounting the skeleton in an erect position. A mural background was painted under the supervision of Sister Mary Van Gilder.

Upon completion, Elmer became the second such skeleton in Michigan (the other is at the University of Michigan in Ann Arbor).*

*Footnote: The Groleau-White Lake Mastodon was completed June 24, 1982. The formal dedication was held on June 28, 1982.

COMPOSITION OF CLASS

This class spanned three terms. About 50 students attended during the year while 15 students completed all three sessions. This group reflected a diverse composition. A variety of backgrounds, ages, talents, occupations and temperaments merged in a task orientated project. The mastodon was mounted through a combination of learning and labor that will serve as a unique educational tool for all who choose to employ it.

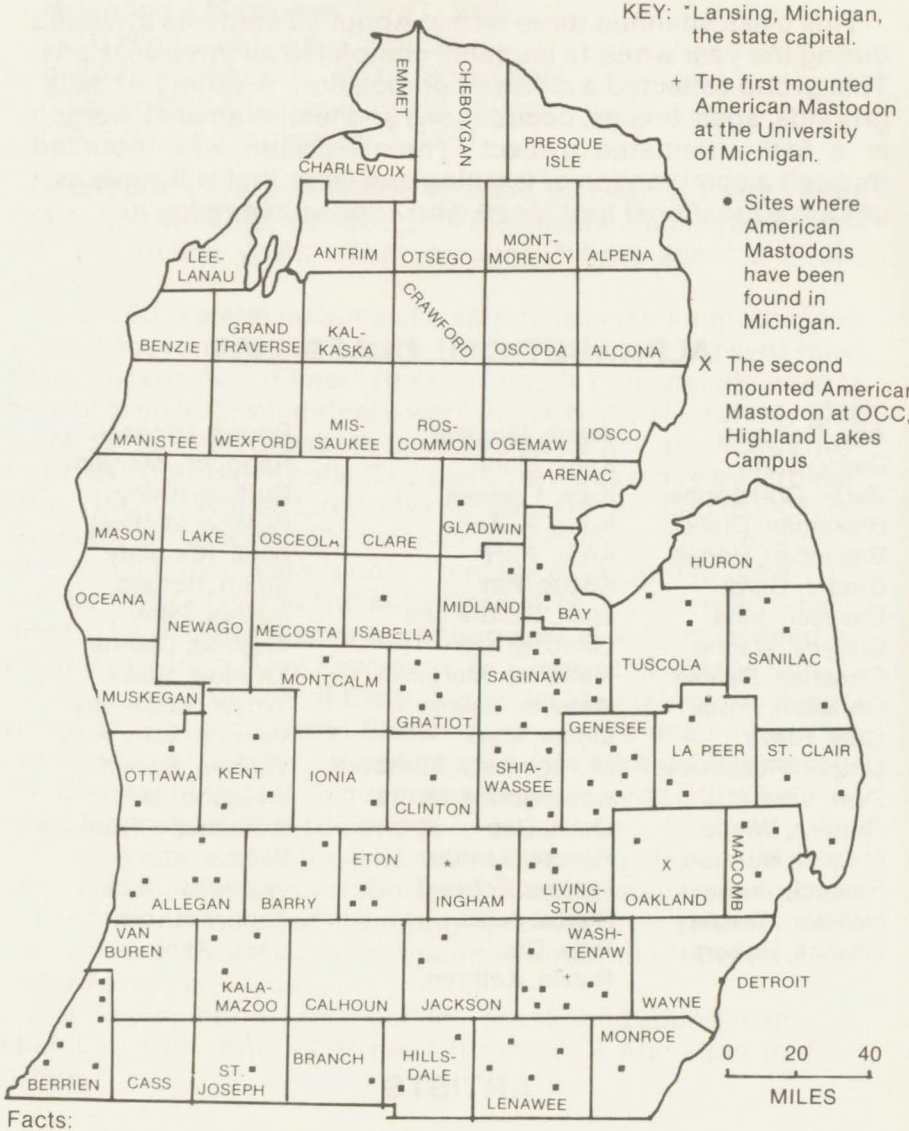
ALPHABETICAL CLASS LIST

Ady, Deborah
Barry, Cathy
Barry, Christopher
Blakeman, Diane
Blakeman, Renee
Brader, Carol
Cavalier, Jane
Cheyne, Wayne
Christian, Denise
Christian, Frank
Cool, Steve
Draper, Rosemary
Dorr, Vera
Gentles, Wilma
Goebel, Norman
Haslock, Jessica
Heilman, Bradley
Howick, Robert
Jakub, Michael
Kelty, Mary
Kern, Frances
Knox, R. Anne
Knox, Burt
Kozub, Pat
Lash, Sandra Lee
Lehto, Kristen
Mahaffey, Margaret
Metoyer, Louise
Moller, Mark
Montgomery, Elizabeth
Noordhoorn, Nedra
Oslin, Deb
Perkins, Linnea
Petteys, Edward
Pierce, Jules
Pitts, Gail
Potvin, Kathryn
Pound, Michael
Reppuhn, Marylin
Ruffino, Kathy
Ruffino, Michael
Shell, Kimberly
Smith, Ronald
Sujdak, Peter
Thomas, Dianne
Thurlow, Steve
Troyer, Rosemary
Vaerten, Mary Ann
Vaerten, Robert
Wiegand, Janet
Williamson, Gregory
Wilson, James
Woughter, Rick
Zoch, Francis
Zoch, Patricia

ARTISTS

Kozub, Pat
Lang, De Lois
Moore, Gladys
Reibitz, Friedel
Ruffino, Kathy
Shinske, Dolores
Vander Velden, Shirley
Van Gilder, Sr. Mary

Map of Lower Michigan
With Mastodon Discovery Sites

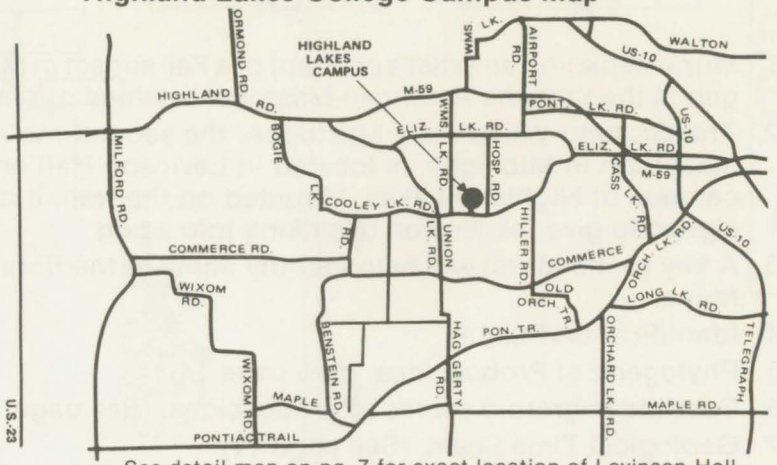


Facts:

1. State size - 56,818 square miles; 1,398 miles of inland water; and 38,575 miles of Great Lakes water.
2. Michigan was the 26th state admitted to the Union in 1837.
3. The highest point in Michigan - 1,980 feet.
4. The lowest point in Michigan - 572 feet below sea level.

Oakland Community College

Highland Lakes College Campus Map



See detail map on pg. 7 for exact location of Levinson Hall.

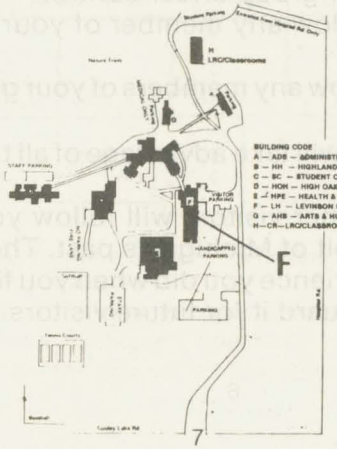
Code Of Conduct

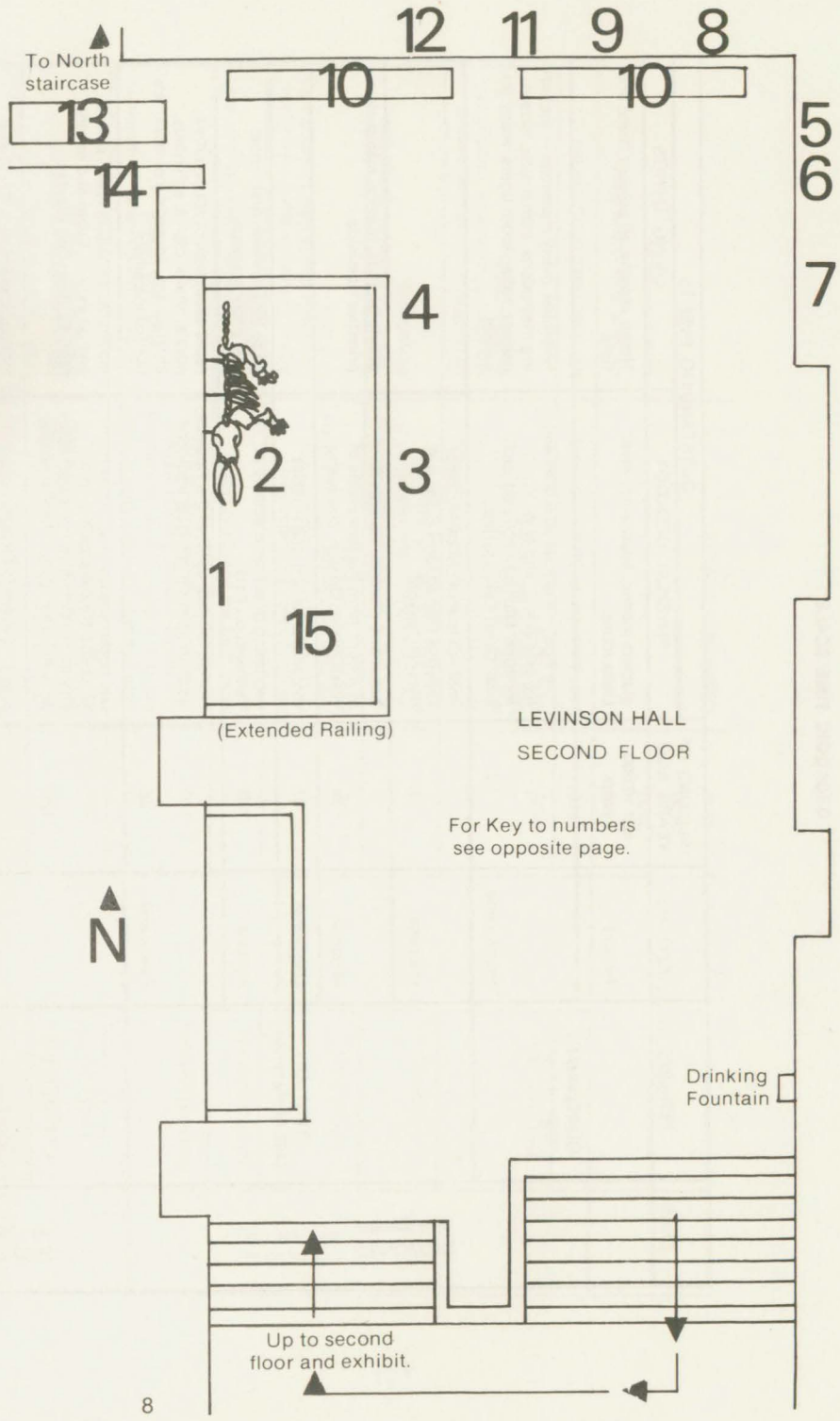
1. We are most pleased that you have taken this opportunity to visit our display.
2. We hope your visit will be enjoyable and educational.
3. In order that all visitors may benefit from this experience, we extend the following suggestions:
   a. Please remember that this is a functioning college and classes will most likely be in session. Therefore, please try to keep the noise level to a minimum.
   b. Please keep your group under control.
   c. Please do not allow any member of your group to lean over the railing.
   d. Please do not allow any members of your group to handle the exhibits.
4. We do hope that you will take advantage of all the materials in a positive manner.
5. Remember, many other visitors will follow you to visit this unique natural exhibit of Michigan's past. They will wish to enjoy the same experience you did when you first saw Elmer. Please help us safeguard it for future visitors.

KEY AND DESCRIPTION OF EXHIBIT AREA

1. Mural depicting an artist's concept of a Fall sunset in Michigan at the time the American Mastodon roamed our land.
2. The Groleau-White Lake Mastodon, the second mounted mastodon in Michigan, is located in Levinson Hall on the campus of Highland Lakes. Mounted on the wall, it is designed to give the illusion of sinking into a bog.
3. A key to the Mural will help identify some of the flora and fauna.
4. Identification Plaque.
5. Phylogeny of Proboscidea. (See page 14)
6. Possible migratory routes of Proboscidea. (See page 14)
7. Geological Time Scale. (See page 11)
8. Geological Cross-section. (See page 13)
9. Project title: The Groleau-White Lake Mastodon.
10. Fossils and models in showcase.
11. Aerial Photo of Elmer's discovery site.
12. Name Plaque of Project Participants.
13. Newspaper clippings and specimens in showcases.
14. Photo Montage of Elmer's Reconstruction.
15. View of the Groleau-White Lake Mastodon from below.

Suggested Tour Route — Enter South door from the parking lot. Climb stairs to second floor. View second floor exhibits in numerical order. When finished, continue to stairs at North end of building and return to first floor passing under the exhibit and out South door to your waiting buses.





GEOLOGIC TIME SCALE

ERAS	PERIODS	EPOCHS	MILLIONS OF YEARS AGO	OUTSTANDING EVENTS	
				PHYSICAL GEOLOGY	LIVING THINGS
CENOZOIC (recent life)	QUATERNARY (age of man)	Recent	last 10,000 years	glaciers melted, Mississippi River Delta forms	**Homo sapiens,** all present fauna and flora
		Pleistocene	1.7	"Ice Age" - 4 glacial advances and retreats in N.E. and N.W. North America; Michigan covered each time; Great Lakes formed	hominids, many mammals — including mastodons, mammoths, horses, camels, saber-tooth tigers; many go extinct
	TERTIARY (age of mammals)	Pliocene	5	final uplift of the Rockies; major canyons start to form in the S.W. (Grand Canyon)	
		Miocene	24	Coast and Cascade Ranges form; eruptions form the lava plains of Washington, Oregon, and Idaho	prairie grasses; grazing mammals; primitive hominids
		Oligocene	37	volcanic activity in the Rockies	
		Eocene	53	beginning of volcanic activity at Yellowstone Park	large foraminifera; first horse; first proboscideans
		Paleocene	65	Florida formed; uplift of the Rockies, western minable minerals implaced	rapid expansion of foraminifera, corals, snails, clams, echinoids, crustaceans; spreading of mammals; hoofed mammals
MESOZOIC (middle life)	CRETACEOUS		140	last ocean separates E. states from W. states; Rockies start to form; Florida starts to form; volcanic activity in Nevada, Idaho, Utah, Montana	molluscs; dinosaurs reach climax and go extinct; flying and marine reptiles; flowering plants
	JURASSIC		195	seas and rivers in the west; beginning of the Sierra Nevada and Coast Range Mountains	molluscs; dinosaurs, flying and marine reptiles; first bird
	TRIASSIC		230	opening of Atlantic Ocean; continent is high; desert climate in the S.W.	molluscs; reptiles, small dinosaurs, marine reptiles (plesiosaurs and ichthyosaurs); petrified wood
PALEOZOIC (ancient life)	PERMIAN		280	climax of Appalachian mountain building; climatic extremes produce dry conditions, deserts, sand dunes, salt deposits; lots of reefs in seas	many invertebrates go extinct; reptiles increase in numbers; mammal-like reptiles
	PENNSYLVANIAN		310	third phase of Appalachian mountain building; extensive swamps; Ouchita Mountains formed; Eastern states are formed, Western states are not	fusilinids, giant insects, amphibians, reptiles, coal forests
	MISSISSIPPIAN		350	seas cover the interior of North America	Age of Crinoids, blastoids, fusilinids, bryozoans
	DEVONIAN		395	second phase of Appalachian mountain building; seas withdraw and then recover the interior; extensive reefs in Michigan	Age of Fishes, corals, brachiopods, small land plants form forests for the first time
	SILURIAN		435	seas still widespread; evaporation of sea covering Michigan results in thick salt and gypsum deposits	corals, brachiopods, graptolites, eurypterids
	ORDOVICIAN		500	more than 60% of North America covered by shifting seas including Michigan; volcanoes in the east; beginning of the Appalachian Mountains	all invertebrate phyla are present; abundant brachiopods, graptolites; primitive fishes
	CAMBRIAN		570	seas cover North America 3 times	trilobites make up 70% of life
	PRECAMBRIAN		3100		bacteria, blue-green algae
			3500		blue-green algae
			3800	oldest rocks	
			4600	beginning of the earth	

GEOLOGIC TIME SCALE

The large amount of time that has passed since the earth was formed, estimated by scientists to be 4.6 billion years, is called geologic time. The geologic time scale represents this amount of time in several different ways.

First, it represents different lengths of time based on: 1. units of rock deposited at approximately the same time, 2. evidence of fossils, and 3. geologic events.

Second, it is a set of names given to rocks within the same time frame. This helps to arrange and classify materials into an orderly form and allows geologists to communicate between themselves.

Third, it is a chart showing the distribution of geologic events in the earth's crust.

The geologic time scale is a combination of two scales, a relative scale and an absolute, or atomic, scale.

The Relative Time Scale

The relative time scale is not determined by time increments, but on relationships of fossils and geologic events to one another. Geologic history is based largely on the study of sedimentary rocks and the fossils they contain. As geologists studied these materials in the 1700's, they found that fossils occured in definite sequences in the rocks with the oldest fossils in the bottom of a sequence and the youngest on top. By comparing which fossil was the oldest, younger, or youngest in a given sequence, a relative method of determining time was developed. The principle was applied to the rocks and a geologic time scale showing the relationships of rocks was devised. It developed as the result of individual work by a number of people, in many places, to form a composite diagram, shown in a single, vertical column, of the succession of all known rocks. After this scale was set, approximate ages, in years, were assigned to the fossils and rocks.

The Absolute Time Scale

The absolute, or atomic, time scale is based on actual time increments. It was developed in the early 1900's after the discovery of radioactivity in 1896. Radioactive decay of certain elements in rocks occur at constant rates in specific increments of time known as half-lives. This allows the determination of the age of igneous and metamorphic rocks. Sedimentary rocks older than 50,000 years can not be dated this way, but are bracketed between the dated igneous and metamorphic rocks. The absolute dates then used to calibrate the relative time scale were fairly close. The scale is constantly being updated as more accurate dating techniques are developed.

The geologic time scale in the display is a combination of both the relative and absolute time scale.

Divisions of Geologic Time

Man records his existence on earth by using devices such as calendars and watches that break time down into smaller and smaller increments such as months, weeks, days, hours, minutes, and seconds. Just as the more familiar ways of measuring time are broken down into smaller and smaller units, so is geologic time. The divisions and their names are based on the occurence, or lack, of fossils and major life forms.

The era is the largest time scale division and is based on fossil life. There are three eras and their names are derived from Latin terminology describing the dominant life form of the time. The oldest is the Paleozoic Era, the age of "ancient life." The dominant life forms of this time were originally thought to be invertebrates (animals without backbones), but eventually also came to include fishes, amphibians, and primitive plants. The Paleozoic lasted for 340 million years. The next era, the Mesozoic lasted for approximately 165 million years. The most recent era is the Cenozoic, the age of "recent life." Mammals and flowering plants and grasses are the dominant fauna and flora. Today's life forms are direct decendants of earlier Cenozoic forms. We are presently in the Cenozoic Era.

The beginning of the Paleozoic Era was determined by sudden abundance of fossils in the rocks. Geologic time before this era is commonly referred to as the Precambrian, or before life, although today evidence of simple life forms are found in the Precambrian. Some scientists have broken the Precambrian down into eras or smaller units based on igneous and metamorphic rocks. The Precambrian encompasses 7/8's of all geologic time lasting for 4,030 million years.

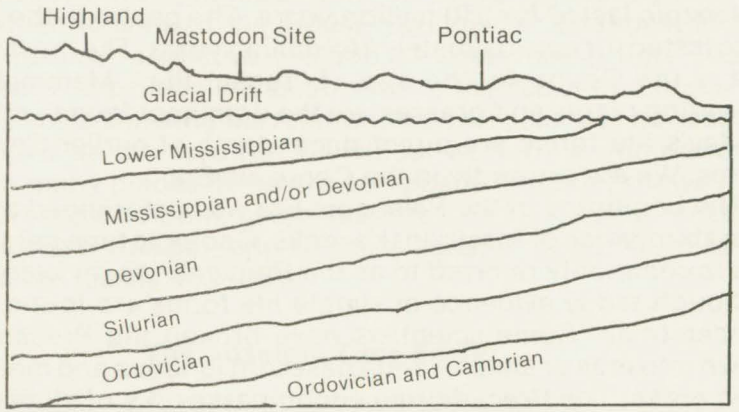
Each era is divided into smaller units of time called periods. These are determined by units of deposition of sediments or an abundant life form. Their names are derived from the geographic location where the rocks for that time increment were first described. For example the first period of the Paleozoic Era, the Cambrian, comes from the ancient Roman name for Wales (Cambria). (Precambrian is derived from this.) The Devonian period is named for Devonshire, England and is known as the "Age of Fishes."

All of the periods are broken down into smaller-scale subdivisions called epochs which in turn are broken down into ages. Generally the epochs of the Cenozoic Era periods are shown on a time scale, but those of the Paleozoic and Mesozoic Eras are deleted, as well as the ages, because they are too numerous.

The enclosed time scale follows this practice. It also shows the millions of years ago each division of time began, the important physical geological events of North America, and the dominant life forms. The display time scale colors are standard colors for each period.

GEOLOGIC CROSS-SECTION

A geologic cross-section is a sideways view of a slice of the earth showing the layers of rock below the surface. The geologic cross-sections in the display are taken along a north-south line and an east-west line running through the mastodon site. The rock types and thicknesses are taken from well-drilling records. The well locations are indicated in the small inset map of Oakland County. The colors are standardized for the time periods.



Source: Michigan Geological Survey

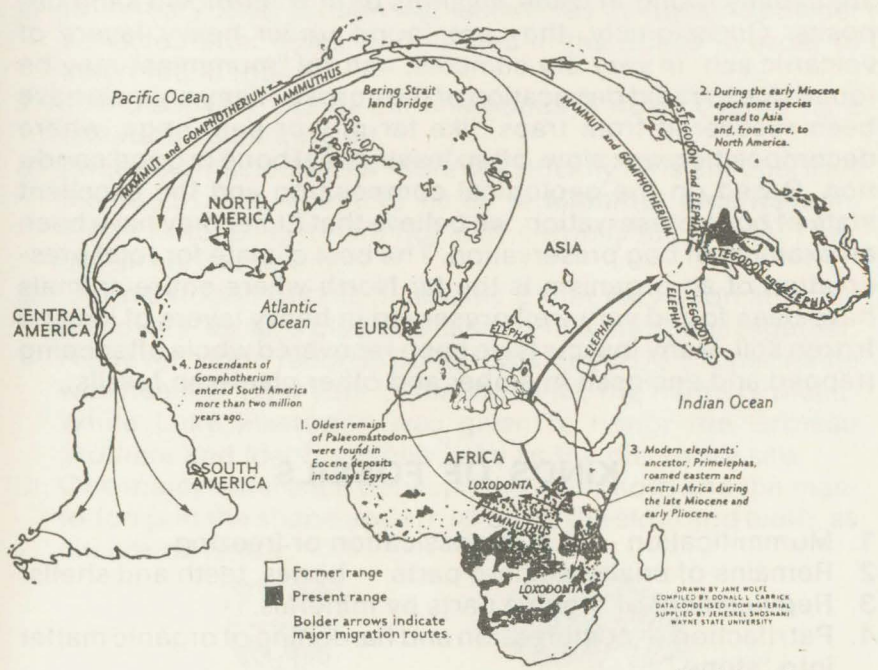
East-West Geologic Cross-Section of Oakland County Through the Mastodon Site

Phylogeny of the Proboscidea

The phylogeny represents the family tree of the elephant-like animals (order Proboscidea) depicting representatives from the oldest, **Palaeomastodon,** to the living elephants. Note the increase in size and increased length of tusks and trunks. See figure on inside of back cover.

Possible Migratory Routes

The projection of a world map with arrows indicates possible major migratory routes of the Proboscidea from Africa to Eurasia to North America and South America. Mastodon like animals may have arrived in North America through the Bering Strait land bridge about 10,000,000 years ago.



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REQUIREMENTS FOR FOSSILIZATION

Possession of hard parts — Bones, teeth, shells, chiton and the woody tissues of plants are more likely to be fossilized than soft tissues like muscle and skin. However, under the most favorable conditions even the most delicate of organisms may be preserved as carbon residues, impressions, or petrifactions.

Escape from immediate destruction — Atmospheric processes like erosion, mechanical action such as waves and crushing, and biological agents like predators, scavengers and bacteria all with destroy an organism's chance to become fossilized over time.

Rapid burial in a medium capable of retarding decomposition — The remains of marine organisms are more likely to be fossilized due to rapid sedimentation in shallow seas; the finer the sediment, the more likely fossilization will occur. Terrestrial forms are usually found in lakes, swamps or in wind-blown sand deposits. Occasionally, they are found under heavy layers of volcanic ash. In very dry climates, natural "mummies" may be found due to rapid dessication of the corpse. Many animals have been recovered from traps, like tar pits or peat bogs, where decomposition was slow, often leaving real bone in good condition. Based on the geological composition and the excellent state of bone preservation, we believe that Elmer may have been an example of bog preservation. The best climate for total preservation of an organism is the far North where entire animals have been found very well preserved in heavy layers of ice and frozen soil. Many insects have been recovered whole after being trapped and enclosed in amber and other plant-sap fossils.

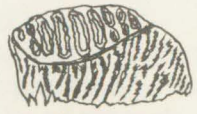
KINDS OF FOSSILS

1. Mummification — due to dessication or freezing.
2. Remains of unaltered hard parts — bones, teeth and shells.
3. Replacement of organic parts by minerals.
4. Petrifaction — compression and hardening of organic matter into "stone."
5. Carbonization — only a black carbon print is left.
6. Impressions — footprints, burrows and molds of body parts.

KITCHI MICHI

1. Mastodons, mammoths and elephants are either right or left tusked. This is evidenced by the uneven wearing of one tusk or the other.
2. The first known mastodon hair was found in Madison, Wisconsin, September 1980, by Kurt Hallin. The complete information is unpublished as yet.
3. Elmer's feet were cast from forms made of the famous Warren Mastodon's feet at the American Museum of Natural History, New York.
4. The number of maximum bones in an elephant vary slightly. As far as can be established, there are about 344 bones in an elephant and no clavicle.
5. The bones and casts of the Groleau-White Lake Mastodon weigh 750 pounds, which represents the entire skeleton except for the right foreleg, scapula, right hind leg, pelvis and right ribs (20).
6. In January 1982, protein was isolated by using bone powder collected after holes were drilled in the bones in order to insert metal rods.
7. The discovery site of Elmer's bones is now covered by a restaurant's parking lot.
8. Elmer is a mastodon. Or more specifically he is an American Mastodon. His scientific name is **Mammut americanum.** Elmer is not an elephant nor is he a woolly mammoth. They are all very different.
9. Our mastodon got his nickname Elmer very soon after his discovery. Elmer's glue was used to hold his bones together. However, once reconstruction was begun, a proper name was needed. By a vote of the students, the name Groleau-White Lake Mastodon was given to honor the Groleau brothers and identify White Lake as the discovery site.
10. One major difference between the mammoth and the mastodon is in the shape and structure of the skull and teeth, as illustrated below.

MASTODON



MAMMOTH

11. The mammoth's shoulder and head are situated higher than the hind quarters; those of mastodons are of about equal height.

SUGGESTED SOURCES FOR FURTHER INFORMATION

Elementary

1. Andrew, Roy Chapman. 1956. All about strange beasts of the past. Random House, New York, 146 pp.
2. Holden, Raymond. 1966. Famous fossil finds. Dodd, Mead & Co., New York, 100 pp.

Intermediate

3. Gray, Ralph. (ed.) 1983. Giants from the past. Books for World Explorers Series, National Geographic Society, Washington, D.C.
4. Lauber, Patricia. 1959. All about the ice age. Random House, New York, 151 pp.
5. Silverberg, Robert. 1970. Mammoths, mastodons and man. McGraw-Hill Book Co., New York, 223 pp.

High School and Adult

6. Dorr, John and Eschman, Donald. 1977. Geology of Michigan. University of Michigan, Ann Arbor, 476 pp.
7. Kurten, Bjorn and Anderson, Elaine. 1980. Pleistocene mammals of North America. Columbia University Press, New York, 442 pp.
8. National Geographic Magazine, Vol. 158, No. 5, November 1980, pp. 568-603.

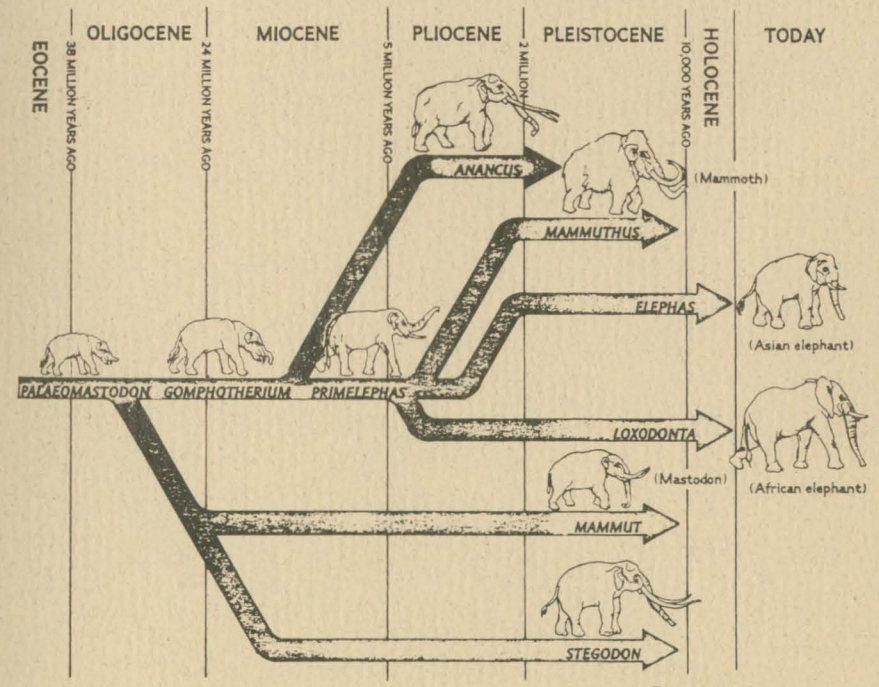
GLOSSARY

anatomy – the structure of an animal.
bog – soft, wet spongy ground; marsh; swamp.
carpals – wrist bones.
cast – to produce by pouring plaster in a mold.
caudal vertabrae – bones of the tail.
cervical vertabrae – bones of the neck.
cranium – the top part of the skull.
decomposition – decay; rot.
epoch – division of a geologic period.
era – one of the five divisions of geological history.
evolution – a gradual development from simpler to complex.
fauna – the animals of a given region or time.
femur – the thigh bone.
fibula – the thinner of two bones in lower hind leg.
flora – the plants of a given region or time.
fossil – the hardened remains of a plant or animal.
humerus – the bones of the upper foreleg or arm.
kettlehole – a depression left in land when ice melts.
kitchi michi – necessary trivia.
lumbar vertabrae – bones of the lower back.
mandible – lower jaw.
mastodon – "nipple tooth," an extinct, elephant-like animal.
metacarpals – hand bones.
metatarsals – foot bones.
migratory routes – routes taken by animals from region to region.
moraine – a hill of unconsolidated material left by a glacier.
mural – a picture of extensive size, painted or placed on a wall.
natural history – the study of animals or other things in nature.
patella – knee cap.
pelvis – the hip area and bones of the hip area.
period – interval of time characterized in some way.
phalanges – bones of the finger and toes.
phylogeny – the origin and development of a kind of animal.
proboscidean – having to do with elephants and their ancestors.
protein – a necessary part of the cells of animals and plants.
radius – the smaller of two bones in the forearm or leg.
sacrum – the vertabrae at the back of the pelvis.

scapula - shoulder blade.
sesamoid bone - a bone which is not connected to the skeleton.
sternum - breast bones.
tarsals - ankle bones.
thoracic vertebrae - vertabrae that the ribs are attached to.
tibia - the larger of the two bones in the lower leg.
tusk - elongated incisor teeth.
ulna - the larger of the two bones in the forearm or lower leg.

CLASSIFICATION OF THE AMERICAN MASTODON

Category	Taxon
Kingdom:	Animalia
Phylum:	Chordata
Subphylum:	Vertebrata
Class:	Mammalia
Order:	Proboscidea
Family:	Mammutidae or Palaeomastodontidae
Genus and Species:	**Mammut americanum**



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