



Educator Guide: *Mammoths & Mastodons*

Grades K - 12

Duration

30-45 minutes

NGSS Alignment

DCIs

3-LS4-1

MS-LS4-1,2

HS-LS4-5

S+E Practices

1,3, 4

Crosscutting Concepts

1, 2, 7

CA EP&Cs

III.a

Materials for Museum Visit:

Paleontology Field Journal
(p.5-6)

Clipboards

Pencils

Introduction

Between 10,000 - 50,000 years ago giant mammoths, mastodons, and other Ice Age mammals roamed what is now Los Angeles. Many became trapped in the oozing asphalt at the Tar Pits, preserving their stories for us! For decades, the world-famous museum at La Brea Tar Pits has been excavating and displaying incredible Ice Age fossils, including those from Columbian mammoths and American mastodons, and now you can experience their world come to life.

This Educator guide uses highlighted objects throughout the museum to transport students to Ice Age LA. Students will experience the process of paleontology as scientists and researchers excavate fossils beneath the streets of LA and use fossil finds to build an understanding of Los Angeles' past. By uncovering how similar or different Los Angeles was in the past, students will discover more about our changing planet.

Explore how these titans of the Ice Age and their relatives evolved, adapted, and survived in a changing world.

Pre-Visit

- Review geologic time chart with your students, highlighting Pleistocene (p. 8).
- Print copies of the Paleontology Field Journal (p. 5-6) for your students to use during their visit.
- Introduce or review vocabulary students will see in the museum (p. 7—i.e. - Proboscidean, excavation, Pleistocene, etc.)

How to Use this Guide

This special exhibit has been integrated into the entirety of the museum. You will see something new around every corner!

Highlighted exhibit objects and suggested prompts are **bolded** in this guide. Our *Museum Tips* are italicized and can be used to provide opportunities for expansion on subjects, and to prepare yourself, your students, and your chaperones for what to expect in our busy galleries. ***MS/HS Extension questions are also italicized and bolded.***

Our appendix (p. 5-9) includes key terms and definitions relevant to the exhibition, and additional resources for you to utilize with your students during your exploration of *Mammoths and Mastodons*. Prior to your visit, print copies of the Paleontology Field Journal (p. 5-6) for students to record observations during their museum experience.

Mammoths & Mastodons was created by the Field Museum, Chicago. The Los Angeles presentation is made possible by Judy and Ron Perlstein.

Section 1 | Stomping Grounds: Mammoths and Mastodons

This section displays the articulated skeletons of the American Mastodon (*Mammot americanum*) and the Columbian Mammoth (*Mammuthus columbi*), both proboscideans that roamed the Los Angeles Basin during the last Ice Age.

Highlight Piece: American Mastodon Articulated Skeleton

Shorter and stockier than their mammoth cousins, mastodons also evolved differently shaped skulls, tusks, and teeth. At one time, mastodons ranged from Europe to North America. However, during the last Ice Age, only *Mammot americanum* still survived.

Highlight Piece: Columbian Mammoth Articulated Skeleton

Look at the skeleton of the Columbian mammoth. Though it is extinct, scientists can make educated inferences about its lifestyle based on its skeleton.



Activity: Next to the articulated skeleton of the Columbian Mammoth is a life-sized model with a mural depicting life in North America during the last Ice Age. Use this mural to discuss the biodiversity of Ice Age LA. Allow students time to observe the mural and then guide your students' observations with the following questions:

- What do you see in this environment?
- What is happening in this mural?
- Is there anything here that surprises you?
- Do you think anything is missing from this image?

This is a great time to utilize the Paleontology Field Journal for reflections or to draw/write their answers to any of the above questions.

MS/HS Extension: How does this mural demonstrate the biodiversity of Ice Age Los Angeles? Ask your students to look for other murals in the museum that also depict Ice Age biodiversity and have them compare these images.

Museum Tip: This gallery has a projection over the Columbian Mammoth skeleton. Encourage your students to observe closely and they might hear and see some of these Ice Age giants roaming!

Section 2 | Pushed to Their Limits: Mammoths in Miniature

This section details the harrowing tale of pygmy mammoths. Using life-sized models, and authentic lower jaws of a Columbian mammoth next to a pygmy mammoth mandible, students will be able to concretely see the dramatic adaptation of the pygmy mammoth.

Highlight Piece: Pygmy Mammoth (Model & Lower Jaw)



Not all mammoths were gigantic! The Pygmy Mammoth (*Mammuthus exilis*) of California's Channel Islands was only about the size of a large horse! The pygmy mammoth was a separate mammoth species specially adapted to island life.

Activity: Invite your students to examine the lower jaws of the Columbian mammoth and the pygmy mammoth on display. Using their Paleontology Field Journals, have students compare the similarities and differences or draw some of their reflections.

Ask your students: How were pygmy mammoths better adapted to changing climate than larger mammoth species?

MS/HS Extension: Are there other examples of animals adapting to their environment by adapting their size? How would this help other animal species?

Museum Tip: There is a video interactive that details more about the pygmy mammoth and how it adapted to a new environment. Run time: 3 minutes

Section 3 | Using Ice Age Fossils to Inform the Future

In this next section, students will see a laboratory filled with scientific tools and, of course, fossils. The scientists they see working are volunteers, preparators, and students.

Highlight Piece: Fossil Lab

Most fossils—large and small—found at La Brea Tar Pits are brought to the Fossil Lab to be cleaned, repaired (if needed), and categorized before being put into storage. Take a look into the Fossil Lab at the diagram of all the bones we've found that belong to Zed, and then take a look at his tusks!

Ask your students: What kinds of tools do they see our scientists using? Do they recognize any of these tools?
MS/HS Extension: Why do microfossils provide a more comprehensive understanding of our ecosystem than the fossils of megafauna such as mammoths?



Museum Tip: The large screen at the far left of the lab is connected to a microscope so your students can view microfossils on a larger scale. Encourage your students to take a peek and see if they can identify any of the particles!



Highlight Piece: Zed's Tusk

Contrary to what your students might think, mammoths are relatively rare finds at La Brea. The most complete and largest Columbian Mammoth was found during excavations of Project 23, and we nicknamed him Zed. Your students will probably notice that there appears to only be one tusk on display. Zed's other tusk is also on display, but it has not been removed from its protective plaster jacket. Our scientists have decided to keep the other tusk protected for future scientists to examine with more advanced technology; perhaps your students will work with it in the future!

Ask your students: What is a tusk? Can your students compare the tusk of a mammoth (or mastodon) to their own bodies?

Museum Tip: Analysis of growth rings in Zed's tusk show that he was well-nourished and died in early summer, possibly sustaining serious soft-tissue injuries in a battle for a mate during musth (mating season). For more information about tusks and how scientists examine them, check out the video on tusk analysis in which Dr. Daniel C. Fisher, paleontologist, discusses what patterns in tusks can tell us about the lives of mammoths. Run time: 3 minutes

Section 4 | Trunks & Tusks: Meet the Proboscideans

This section details the evolutionary history of proboscideans. Elephants, mammoths, and mastodons belong to a group of mammals called proboscideans. The name comes from the Greek, proboscis, or trunk, a feature many of these animals share. As soft tissue, trunks don't often fossilize, so they are inferred from skull morphology. Fossils show that the earliest proboscideans lacked trunks. Elephants today use their trunks for eating and drinking, breathing and smelling, spraying water and dust, and more.

Museum Tip: Have your students try out the trunk interactive in this gallery space to test how well they can manipulate a trunk!

Highlight Piece: Proboscidean Family Tree

How do we read this tree? Phylogenetic trees show the evolutionary relationships between organisms - in this case, among proboscideans. To read this phylogenetic tree, start at the bottom and work your way up! The diagram places older events in time at the bottom and more recent events towards the top. Lines end when a genus (like *Amebelodon*) or a species (like *Mammut americanum*) became extinct.

Ask your students to use their finger to trace the relationship between two proboscideans of their choice, or print copies of the family tree for students to explore (p. 9). Are there any proboscideans still living today?

Highlight Piece: Lyuba

Lyuba is a woolly mammoth specimen found in 2007 in Siberia. Woolly Mammoths lived in cold, dry regions like Russia, not California. Lyuba is the most complete and well-preserved mammoth specimen ever found. She died in Siberia about 42,000 years ago, at the age of about one month old. Scientists are studying Lyuba's well-preserved DNA as well as her teeth, organs, and bones, to learn more about mammoth history in Siberia. A replica specimen of Lyuba is on display here, as the original specimen is too delicate for travel.

Ask your students, what similarities or differences do they notice between a woolly mammoth like Lyuba, and a Columbian Mammoth like Zed?

MS/HS Extension: Why is Lyuba so well preserved? [Three factors led to Lyuba's excellent state of preservation. 1: She was buried quickly after her death in fine sediment that sealed off oxygen. 2: She was "pickled" by acids formed by bacteria that entered her body soon after her death. 3: She remained frozen in Siberia's permafrost over many thousands of years.]

What new questions have arisen for your students as you've explored these Titans of the Ice Age?

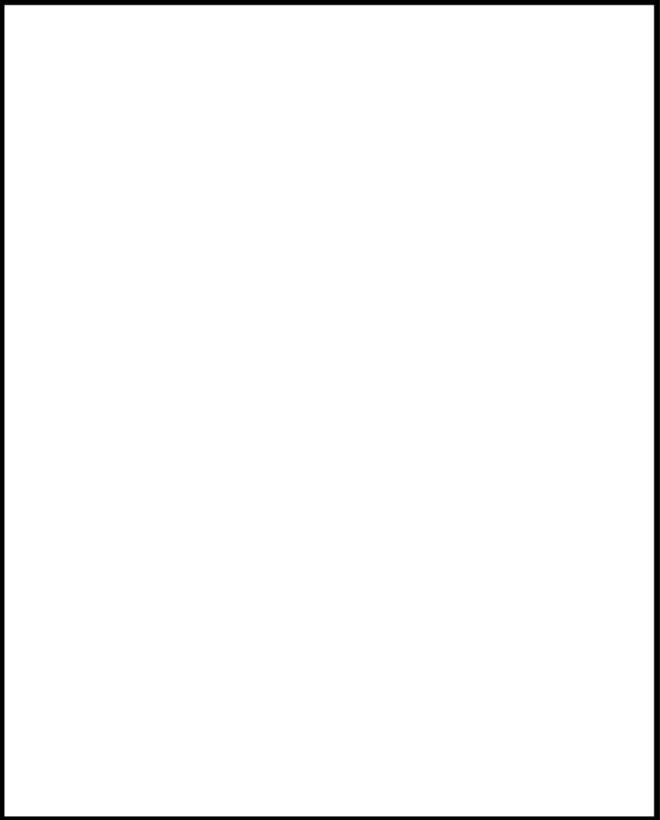


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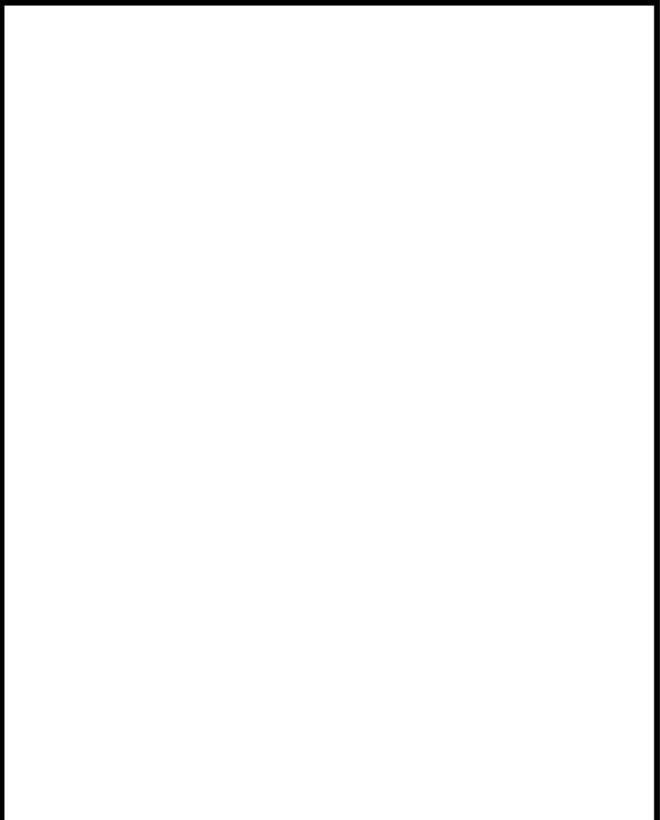
THESE OBSERVATIONS BELONG TO:



Draw/Describe the environment you observed



Draw/Describe the animal(s) you observed



Vocabulary

Biodiversity: the variety of life in the world or within a particular habitat or ecosystem.

Climate: Describes the weather conditions of a place over a long timespan; including patterns of temperature variation, humidity, wind, precipitation, etc.

Era: A division of geologic time; eras are subdivided into periods (just as one year is divided into multiple months).

Extant: organism that is still living

Extinct: organism that has no living members

Fossil: Any preserved evidence of ancient life. Can be everything from a skeleton, to a footprint, or even a leaf! Ancient is usually defined as older than 10,000 years.

Geology: The study of the processes that have shaped Earth; also known as "earth science" or "geoscience".

Mammoth: Proboscideans from genus Mammuthus, alive during the Pleistocene; most easily identified by the long curving tusks and, in northern species, a covering of long shaggy hair.

Mastodon: A genus of proboscideans largely defined by the shape of their teeth, having blunt and conical molars.

Matriarchal/Matriarchy: A form of social organization in which the leader or head of the group is female.

Musthe: Mating season; generally summer months

Paleontology: The science which studies the history of life on Earth by examining fossil evidence.

Period: A subdivision of geologic time; multiple periods are encompassed by an era (just as multiple months are contained in one year).

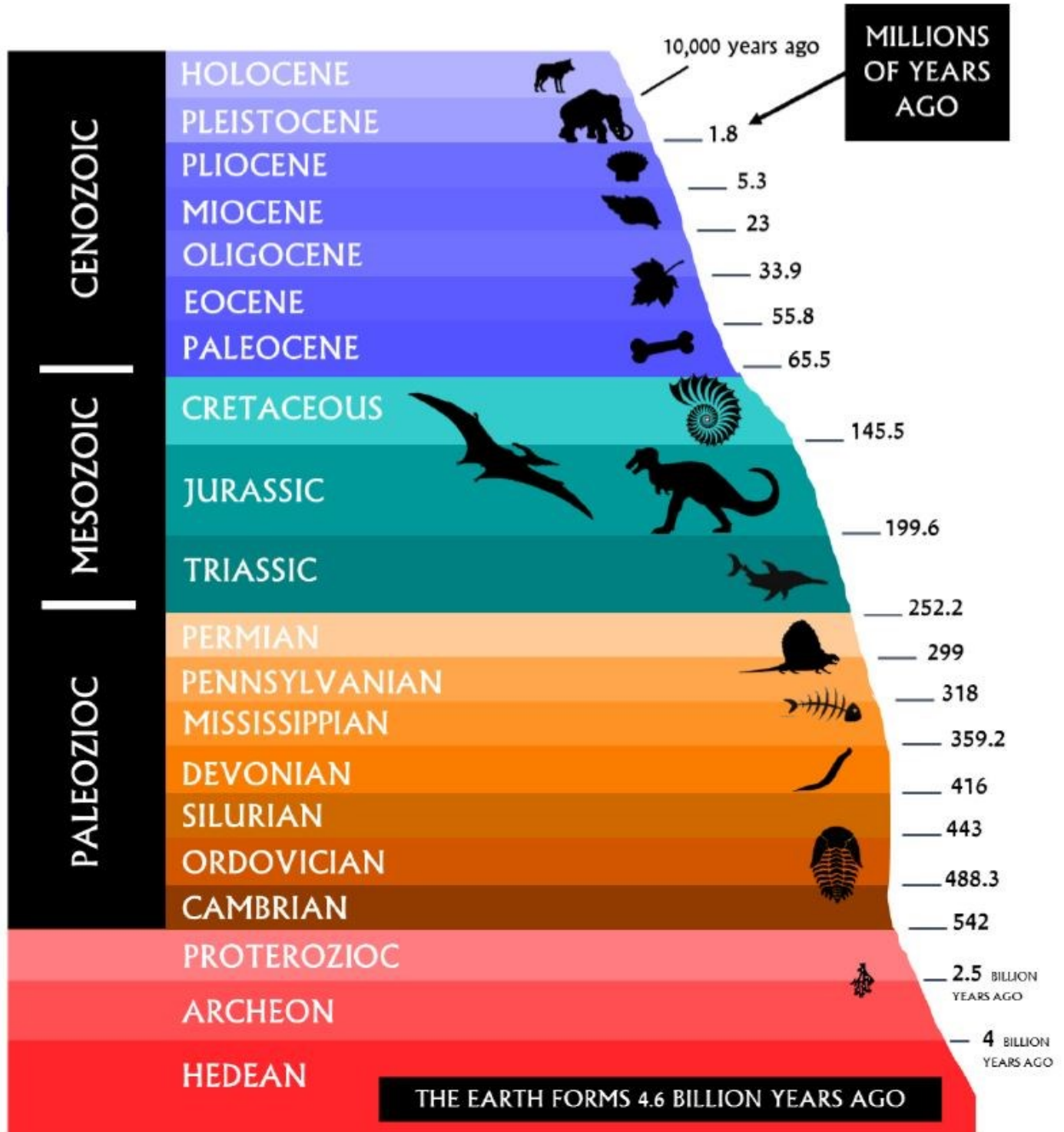
- **Pleistocene:** The Pleistocene Period lasted from about 2,588,000 to 11,700 years ago; the last Ice Age.

Phylogenetic: A branching diagram or "tree" showing the evolutionary relationships among various biological species or other entities

Proboscideans: Members of an order of mammals that includes the living elephants and their extinct relatives, such as mammoths and mastodons; defined especially by their trunk.

Proboscis: A long, flexible snout found on members of the order Proboscidea.

GEOLOGICAL TIME CHART



The Proboscidean Family Tree

This family tree traces the ancestry of mammoths, mastodons, elephants, and their relatives back through 55 million years of evolutionary history.

There are over 150 members of the Proboscidean Order. The earliest known member is *Eritritium azzouzorum* [er-rih-THER-ee-um ah-zoo-ZOR-um], a rabbit-sized mammal whose remains were recently uncovered in Morocco.

