MAMMOTHS AND MASTODONS

TITANS OF THE ICE AGE

Educator Guide

Presented by The Field Museum Education Department

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The Field Museum

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Trunks and Tusks: Meet the Proboscideans

Elephants, mammoths, and mastodons belong to a group of mammals called **proboscideans** (pro-bo-SIH-dee-ans). The name comes from the proboscis or trunk, a feature many of these animals share. The first proboscideans appeared in Africa about 55 million years ago. Over many generations, they evolved into over 150 different species that ranged across the globe.

The proboscidean family tree traces the ancestry of mammoths, mastodons, elephants and their relatives back through 55 million years of evolutionary history. The first proboscideans originated in Africa. From there, they expanded into Asia, Europe, and eventually into the Americas. In Africa, scientists find nearly complete skeletons of one of the earliest proboscideans (Moeritherium), but complete skulls are rarely found. To understand what these animals looked like, scientists create composites or combinations of skull parts from different individuals.

This skeleton of an American mastodon shows the beast's tusks have a more pronounced curve than those of today's elephants.
Photo by John Weinstein © The Field Museum

Guiding Questions:

1. **Are mammoths the ancestors of elephants?**

   No. Neither animal is the ancestor of the other. Instead, mammoths and elephants are close relatives and belong to the same family, Elephantidae. In Africa, about six million years ago, a branch of Elephantidae split into three groups: Loxodonta, the ancestors of African elephants; Elephas, the ancestors of Asian elephants; and Mammuthus, the earliest mammoths.

2. **Where did the first proboscideans originate? From there, where did they disperse?**

   The first proboscideans originated in Africa. From there they migrated into Asia and Europe. The proboscideans that migrated into Asia then crossed over into North America on the Bering Land Bridge. Once in North America proboscideans spread throughout the continent and eventually into South America.

Growing up in the Herd: The Life of a Mammoth

This illustration shows four female woolly mammoths in their herd. Fossil records indicate that herds consisted of adult females and young calves. When male mammoths reached young adulthood, they left their herd.
Illustration by Velizar Simeonovski © The Field Museum

What was life like for young mammoths? How were they raised and nurtured? Who were their family members? Scientists try to answer these questions by studying evidence such as fossil bones, tissue remains, and DNA. They also observe elephants to better understand the likely behaviors and lifecycles of mammoths.

About three million years ago, mammoths extended their range beyond Africa by moving into Eurasia. Over time, these mammoth populations became isolated from one another, eventually evolving into new species as a result of adapting to different environments.

Sometimes, nearly intact mammoths are found in the permafrost of Siberia, providing scientists with a wealth of information about their lives. During much of the Pleistocene, or last great Ice Age, millions of woolly mammoths roamed the Earth. Because many of these animals lived and died in cold, dry regions, their remains are often well preserved, giving scientists much to study.

Lyuba is the most complete and well-preserved mammoth specimen ever found—and the most studied. This female woolly mammoth died in Siberia about 42,000 years ago. She was about one month old at the time of her death. By studying her DNA, bones, stomach contents, internal organs, teeth and tusks, as well as the area where she was found, Lyuba provides scientists with valuable information about a population of mammoths for which few samples exist.

An international team of scientists studied Lyuba after her discovery, performing an autopsy and DNA analysis. *© RIA Novosti*

Guiding Questions:

1. **What parts of Lyuba are scientists using to learn about her life history? What have they learned?**

   Scientists are studying Lyuba's well-preserved DNA to learn more about mammoth history in Siberia. Her teeth help scientists determine how long she spent in her mother's womb, when she was born, and her approximate age when she died. Lyuba's intestines show what kind of nourishment she received. X-rays and CT-scans combined with forensic examinations reveal Lyuba's distinctive mammoth features and her bone structure. Examination of Lyuba's trunk, mouth, esophagus and trachea help scientists suggest her cause of death.

2. **What was one adaptation that resulted from mammoths living in cold environments?**

   Mammoths eventually evolved thick fat layers beneath their skin. They also had a warm "undercoat" of fur and an "overcoat" of guard hairs—some up to three feet in length—to protect against the wind.

Stomping Grounds: Where Mammoths Roamed

As proboscideans spread beyond Africa, about 20 million years ago, they moved across Europe and Asia into the Americas. Over their six million year history, proboscideans were able to adapt to diverse environments: Asian elephants in tropical forests; woolly mammoths in cold, dry steppes; and mastodons in temperate woodlands. In the American West, Columbian mammoths shared the landscape with other animals and plants. Today, scientists use clues from the past, such as plant pollen and animal dung, to help re-create diverse mammoth habitats.

Visitors to *Mammoths and Mastodons: Titans of the Ice Age* will be able to see fossil skulls, as well as life-size replicas of these ancient beasts.
© http://www.paleoart.com

In the early 1800s, the first scientific expeditions to Siberia collected remains of mammoths. These early discoveries sparked the public's fascination with woolly mammoths and their wintry habitats. In places like Siberia and Alaska, cold permafrost helps preserve mammoth remains, and the abundance of woolly mammoth bones here often leads people to believe that mammoths only lived in snowy, cold climates. But in fact, during the last Ice Age, many of these areas were drier and less snowy than they are today. Mammoths also lived in warmer climates, but their remains are often less well preserved in these regions.

During the Pleistocene, or last great Ice Age, mammoths lived alongside many other mammals—many now extinct. They shared their North American habitat with other herbivores like rabbits, antelopes, camels, horses and giant ground sloths—the largest herbivores after mammoths and mastodons. Powerful carnivores also populated these regions: dire wolves, short-faced bears, and American scimitar-toothed cats—the most successful predators of mammoths.

Guiding Questions:

1. **Why do some people think woolly mammoths only lived in snowy, cold climates?**

   Some people think this because these are often the environments where ancient animals' remains preserve well. Mammoth remains do not preserve as well as in warmer climates; thus, fewer remains are uncovered in warmer climates.

2. **How do scientists better understand what the mammoth diet was in a particular region?**

   Scientists analyze mammoth dung to determine what mammoths ate. For example, preserved mammoth dung from a cave in Utah named "Bechan" contains fragments of vegetation suggesting a diet rich in grasses, sedges, and other plants. These plants suggest that Utah, during the time of the mammoths, was fairly dry with pockets of wetlands.

A Prehistoric Drama: Sharing the Stage with Humans

For tens of thousands of years, humans lived alongside mammoths and mastodons. Early peoples painted images of mammoths inside the caves of southwest Europe. And in North America, people hunted both mammoths and mastodons with spears (and bravery!). Some scientists hypothesize that humans directly caused the extinction of mammoths and mastodons. Others suggest that climate change was to blame. Whatever the cause, by 12,000 years ago, nearly all mammoths and mastodons had disappeared from mainland Eurasia and North America.

Thomas Jefferson, America's third President, was a naturalist. He commissioned William Clark (of "Lewis and Clark") to go west after Clark had returned from his exploration of the Louisiana Purchase to collect mastodon bones for Jefferson's private collection. During his 1807 expedition to Big Bone Lick, Kentucky, William Clark uncovered spear points along with the bones of mastodons. Clark's find was the first to suggest that early peoples once hunted mastodons in North America.

In addition, depictions of mammoths from Paleolithic times have been found in Eurasia, but no prehistoric images of mammoths are known to exist in North America. In 2007, however, underwater archaeologists found what appears to be a rock carving of a mastodon in Lake Michigan's Grand Traverse Bay. And in 2009, an amateur fossil hunter in Vero Beach, Florida, found what appears to be an engraving of a mastodon (or mammoth) on ancient bone. Scientists are trying to authenticate both objects.

Humans were clearly influenced by these great beasts. This depiction of a mammoth, painted on the walls of Rouffignac cave in France, dates back 15,000 to 20,000 years ago. *© Jean Plassard, Grotte de Rouffignac*

Guiding Questions:

1. **What was the first evidence in North America that people once hunted mastodons?**

   Spear points found alongside mastodon bones in Kentucky. William Clark found these remains during an 1807 expedition requested by then president Thomas Jefferson.

2. **What is one physical difference between mammoths and mastodons?**

   Mastodons are shorter and stockier than mammoths and evolved differently shaped skulls, tusks and teeth. Mastodons evolved cone-shaped cusps on their molars adapted to pulverizing leaves, twigs, and bark while mammoths have more flat ridges which are better suited to a diet rich in grasses.

Pushed to Their Limits: Mammoths in Miniature

As the last mammoths became isolated in the far corners of the Northern Hemisphere, an interesting thing happened, they actually shrank in size. Over time, mammoths evolved smaller bodies as their range diminished. Rising sea levels, due to melting ice sheets, trapped some mammoths on islands. Other mammoths swam to and colonized islands, such as California's Channel Islands. Here, smaller mammoths were adapted to island life better than their larger, mainland cousins.

The pygmy mammoth of California's Channel Islands was only about the size of a large horse and was a separate species from the woolly mammoth or larger Columbian mammoths of the mainland. This mammoth species was specially adapted to island life where smaller mammoths had the advantage; they ate less food and were more agile, navigating hillier terrain more easily than their massive mainland cousins.

Some groups of woolly mammoths survived on small islands well past the end of the Pleistocene. Woolly mammoths lived until 5,700 years ago on St. Paul Island, Alaska; and some roamed on Wrangel Island, Siberia, until about 3,700 years ago.

Guiding Questions:

1. **How were pygmy mammoths better adapted to changing climate than larger mammoth species?**

   Pygmy mammoths were better able to adapt to life on an island because they ate less food and were more agile, and thus better able to navigate the hilly terrain. This smaller body size was advantageous on the smaller islands.

2. **How did some mammoths end up living on islands?**

   Rising sea levels from melting ice sheets trapped some mammoths on islands. Other mammoths swam to islands, like California's Channel Islands.

This atlatl (spear thrower) is a carved reindeer antler in the shape of a mammoth. *© The Trustees of The British Museum / Art Resource*

Unlike dinosaurs, mammoths and mastodons lived side-by-side with humans. This piece of mammoth ivory, carved in the shape of a horse, is one way humans utilized mammoths—as a vehicle for art. *© Reunion des Musees Nationaux / Art Resource*

Conserving a Legacy: The Surviving Cousins

The cousins of mammoths and mastodons—elephants—are with us today. But for how long? As human populations expand into once-wild places, elephant populations in Africa and Asia are declining. Scientists are investigating the extinction of mammoths and mastodons to gain insight into the conservation of elephants today. Zoologists, park rangers, and everyday people are working around the world to save the last of the great proboscideans.

The savanna elephant is one of two surviving species of elephant in Africa today. The other is the forest elephant. Savanna elephants travel in matriarchal herds—family groups led by older females. Male elephants leave the herd as teenagers and live mainly solitary lives. In the late 1800s, an estimated five million savanna elephants roamed Africa. Today there are less than half a million, due largely to poaching and diminishing habitat caused by climate change and competition with humans. Savanna elephants are at home in the grasslands of Africa, and wild populations currently survive in southern Africa, eastern Africa, and parts of western Africa. African forest elephants, however, are at home in the tropical and subtropical forests of Africa. Currently, wild populations of forest elephants live in West and Central Africa.

The Asian elephant is the most endangered species of elephant in the world today. Current estimates suggest that only about 30,000 Asian elephants survive worldwide. They are at home in tropical and subtropical forests of southeast Asia, and current wild populations survive in India, Nepal, Bhutan, Bangladesh, Sri Lanka, Myanmar, Thailand, Loas, Cambodia, Vietnam, China, Malaysia and Indonesia.

Guiding Questions:

1. **What is the most endangered species of elephant today? Approximately how many of these elephants still survive? Where are these elephants found?**

   The Asian elephant is the most endangered elephant species today; only about 30,000 survive worldwide. Wild populations are found in India, Nepal, Bhutan, Bangladesh, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, China, Malaysia, and Indonesia.

2. **What is a matriarchal elephant herd?**

   An elephant family led by older female elephants. African savanna elephants travel in matriarchal herds. Male elephants leave the herd as teenagers to live predominantly solitary lives.

On-line Resources

The Field Museum's ***Mammoths and Mastodons*** Web site: fieldmuseum.org/mammoths

The Encyclopedia of Life: education.eol.org/educators/mammoths_mastodons

The Encyclopedia of Life (EOL) ***Mammoths and Mastodons*** species pages will feature new fossil photographs from The Field Museum Collections accompanied by reliable and comprehensive species descriptions. These and related pages can be used as a way for your students to learn and share their knowledge about the animals and plants of the Pleistocene Epoch. Visit EOL to find activities that engage your students in learning about Pleistocene biodiversity and ecosystems. There are a wide range of activities for students of different ages and abilities that can be used for quick reinforcement or as a long-term project. Activities include: adding information about Pleistocene species from the ***Mammoths and Mastodons*** exhibition to the EOL, uploading original artwork of Mammoths and Mastodons based on the featured fossil photographs, and uploading photos from a biodiversity scavenger hunt that links the ***Mammoth and Mastodons*** exhibit to permanent Field Museum exhibits such as ***Evolving Planet***. Your students will not only enjoy learning about Mammoths and Mastodons, but also help build the Encyclopedia of Life!

National Geographic *Waking the Baby Mammoth* Web site:

channel.nationalgeographic.com/episode/waking-the-baby-mammoth-3630

The Field Museum's *Evolving Planet*: fieldmuseum.org/evolvingplanet

The Field Museum's *The Ancient Americas*: fieldmuseum.org/ancientamericas

University of Michigan – Museum of Paleontology: paleontology.lsa.umich.edu/

Books

Agenbroad, Larry D., and Lisa Nelson (2002). Mammoths: Ice Age Giants. Minneapolis: Lerner Publications Co.

Arnold, Carolina and Laurie Caple (2002). When Mammoths Walked the Earth. New York: Houghton Mifflin Company.

Auel, Jean M (1985). The Mammoth Hunters. New York: Crown Publishing Group.

Bardoe, Cheryl (2009). Mammoths and Mastodons: Titans of the Ice Age. New York: Harry N. Abrams Co.

Lister, Adrian, and Paul Bahn (2007). Mammoths: Giants of the Ice Age. London: Frances Lincoln Limited Publisher.

O'Brien, Patrick (2002). Mammoth. New York: Henry Holt and Company.

Wheeler, Lisa (2006). Mammoths on the Move. Orlando, Florida: Harcourt, Inc.

Wilson, Ron (1984). Woolly Mammoths. Vero Beach, Florida: Rourke Enterprises, Inc.

Key Terms

*The following terms are found within the **Mammoths and Mastodons** exhibition:*

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.

Pleistocene: A period of time from about 1.7 million to 11,000 years ago, which includes the world's most recent period of glaciation, or Ice Age.

Herbivore: An organism that feeds primarily on grasses and other plant materials.

Carnivore: An organism that feeds primarily on other organisms.

Permafrost: Permanently frozen ground, generally occurs when temperatures remain below 0°C for several years.

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

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.