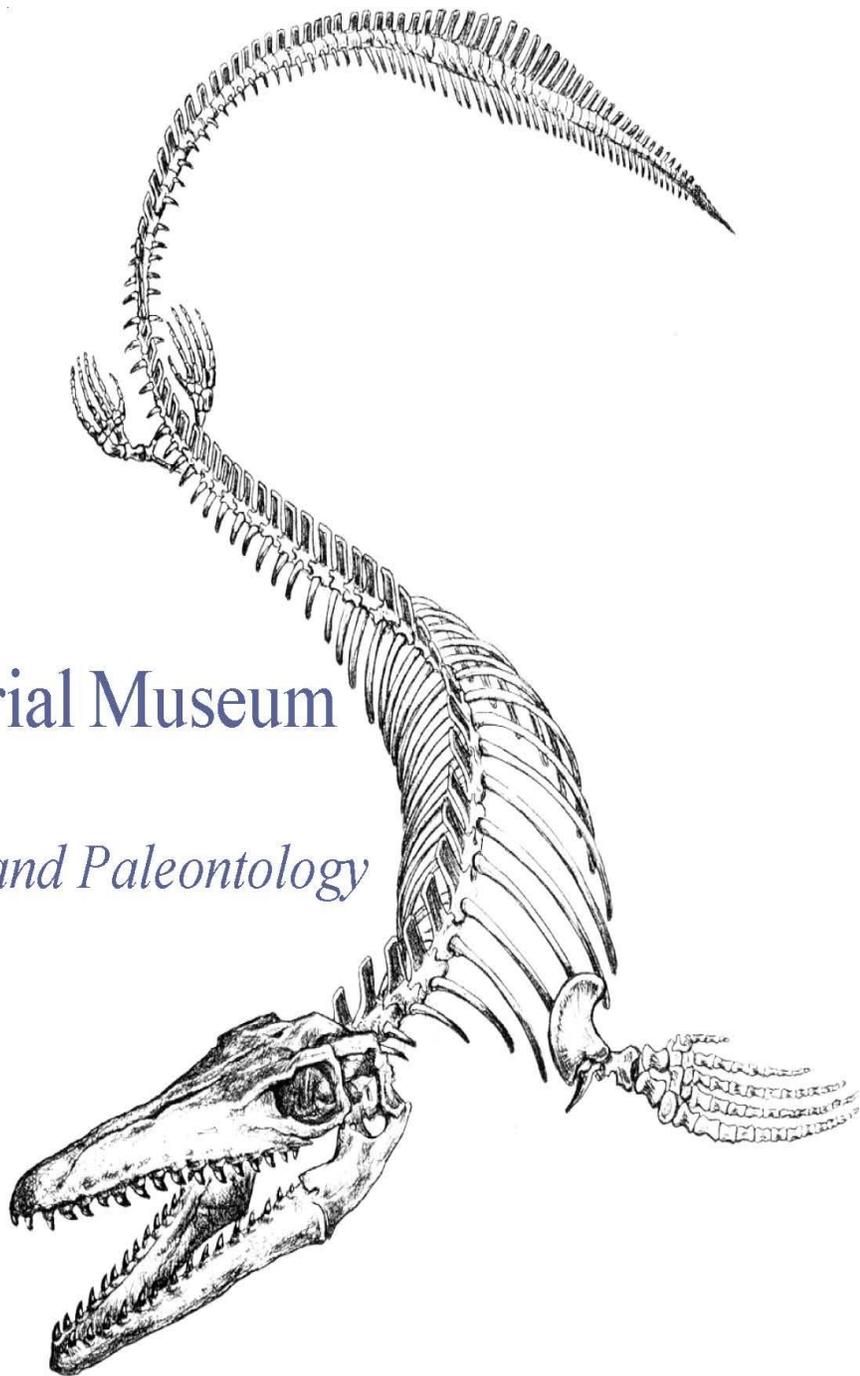


Texas Memorial Museum

Hall of Geology and Paleontology
Educator Guide
Grades 3-5



Hall of Geology and Paleontology Overview

Over its long history Texas has been pocked by meteorites and covered by oceans. Mountains have come and gone, and new ones have appeared. Forests have sprouted and disappeared, and the climate has changed dramatically. Texas has been home to some of the world's strangest and most spectacular creatures. Its dynamic geological history has left today's Texas with a great wealth of natural resources. So walk with us back through the Ice Ages, beyond the Age of Dinosaurs, into the most remote depths of Texas' natural history. By studying environments and life forms of Texas' past, we have learned much about our natural world today. As you walk through the *Hall of Geology and Paleontology*, consider this: what will the Texas environment be like in the future?

Texas Essential Knowledge and Skills Correlations

English Language Arts and Reading 3rd grade - 3.1, 3.3, 3.4, 3.6, 3.7, 3.8, 3.9, 3.14, 3.15, 3.18, 3.20
4th grade - 4.1, 4.3, 4.5, 4.7, 4.8, 4.9, 4.10, 4.15, 4.16, 4.18, 4.19, 4.21, 4.25 5th grade - 5.1, 5.3, 5.7, 5.8, 5.9, 5.10, 5.15, 5.16, 5.18, 5.19, 5.21, 5.25

Science 3rd grade - 3.9 (A-C), 3.10 (A) 4th grade - 4.9 (A,B), 4.10 (A) 5th grade - 5.7(D), 5.9 (A-C), 5.10(A)

Social Studies 3rd grade - 3.16 (E) 4th grade - 4.6 (A), 4.22 (C) 5th grade - 5.6 (A), 5.25 (C)

Words to Know

- **adaptation** – Features or behaviors that can improve a plant or animal's chance for survival and of producing more surviving young.
- **amphibian** – An animal that typically lives in an aquatic habitat breathing by gills as juveniles, and primarily in a terrestrial habitat using lungs and moist glandular skin to breathe as an adult.
- **carnivore** – An organism that eats other animals.
- **cast replica** – An exact copy of a fossil usually made out of plastic or fiberglass.
- **dinosaur** – A specific type of reptile that first appeared in the Mesozoic Era and walked upright (did not sprawl) and did not spend its whole life in aquatic habitats.
- **environment** – The surroundings and conditions in which an organism lives.
- **erosion** – The breakdown and transport of rock or soil.
- **evolution** – Changes in plants and animals over many generations.
- **extinction** – The dying out of a species of any living thing, forever.
- **field jacket** – The name given to a package of rock containing fossils that have been wrapped in plaster bandages or plaster and burlap. A field jacket protects a fossil so that it can be safely transported back to the museum.
- **fossil** – Evidence of past life (body parts, burrow, footprint, etc.) that is at least several thousand years old.
- **geologic(al) time** – The period of time covering the formation and development of the Earth, from about 4.6 billion years ago to today.
- **geologic(al) time scale** – A chart or arrangement of geological events in time order from oldest to youngest.
- **geologist** – A scientist who studies the origin, history, and structure of the Earth.

Words to Know (continued)

- **geology** – The study of the Earth and its natural history, as revealed in its rocks, soil, and other features.
- **herbivore** – An animal that eats plants.
- **igneous rock** – Rock that is formed when magma cools and hardens.
- **invertebrate** – An animal without a spinal column (backbone).
- **mammal** – Animals that have hair and nourish their young with milk from mammary glands.
- **marine** – Living in a saltwater environment (oceans, seas, lagoons, etc.).
- **mass extinction** – The dying out of numerous species over a geographically wide area.
- **metamorphic rock** – Rocks that have changed in response to increases in temperature and pressure, or the presence of hot, watery fluid.
- **meteorite** – A piece of rock from space that lands on Earth.
- **omnivore** – An animal that eats both plants and animals.
- **paleontologist** – A scientist who studies fossils to understand life of the past.
- **paleontology** – The study of extinct organisms and their environments.
- **plate tectonics** – The theory that Earth’s crust and upper mantle are broken up into crustal “plates” that move along the surface of the Earth. Movement is driven by heat from the Earth’s mantle.
- **predator** – An animal that preys on other animals.
- **prey** – An animal that is killed by another animal for food.
- **reptile** – A type of vertebrate that has dry scaly skin, breathes air, and usually lays eggs on land.
- **rock cycle** – Model or diagram that describes how rocks form and change from one type to another over time.
- **sediment** – Solid fragments of earth materials that are produced by the weathering and erosion of rock.
- **sedimentary rock** – Rock that is formed by the compaction and cementation of sediment (pieces of pre-existing rock) or by chemical precipitation (minerals crystallize out of water and are deposited).
- **species** – A population of organisms that can freely breed with one another, producing fertile young.
- **terrestrial** – Living on or in the ground.
- **vertebrate** – Animals with a spinal column (backbone).
- **weathering** – The physical and chemical breaking apart of rock and other solid material.

Pre-visit Activities

1. KWL chart: Part I

TEKS: Science -3.9 (A-C), 3.10 (A,B), 4.9 (A,B), 4.10 (A), 5.7 (D) 5.9 (A-C), 5.10 (A) Language Arts - 3.14, 3.15, 3.17, 3.18, 3.20, 4.15, 4.16, 4.18, 4.19, 5.15, 5.16, 5.18, 5.19, 5.21

Students make a KWL chart listing what they know, what they want to know, and what they learned (after visiting the Museum) about prehistoric life in Texas.

Pre-visit Activities (continued)

2. What do animals need to survive?

TEKS: Science -3.8 (A-C), 3.10 (A), 4.9 (A,B), 4.10 (A), 5.7 (D), 5.9 (A,B), 5.10 (A) Language
Arts - 3.1, 3.3, 3.4, 3.20, 4.1, 4.5, 5.1, 5.5, 5.25

All animals share common needs such as food, water, and a place to live. Have groups of students research a prehistoric animal and create a poster illustrating the animal in its natural habitat. Students should include all of the things the animal needs to survive. Groups may present their posters to the class. As a class, brainstorm the impact of different environmental changes (such as temperature changes, drought, introduction of a competing species in the same niche, etc.) on the animal's ability to survive.

Giraffes have long necks to help them reach leaves high in the trees of the African savannah.
Camels have humps on their backs to store fat as an energy source for use during times when food is hard to find. (Contrary to popular belief, they do not store water in their humps).
Armadillos have flexible armor that protects their head, neck and body from predators.
Walking sticks look like branches to camouflage themselves from predators.
Male peacocks have large, brightly-colored feathers to help them attract mates.

3. How do adaptations help animals survive and reproduce?

TEKS: Science - 3.9 (A), 3.10 (A,B), 4.10 (A,B), 5.10 (A,B)
Language Arts - 3.1, 3.3, 3.4, 4.1, 4.5, 5.1, 5.5

Adaptations are characteristics that help an animal survive and reproduce in its environment. Just like animals today, animals that lived in Texas' past had adaptations to help them obtain food, attract mates, and protect themselves. To get students thinking about adaptations, show pictures of animals that are familiar to them and discuss the adaptations they have that help them survive and reproduce. Use the following examples or compile a list of your own:

The long necks of giraffes help the giraffes reach leaves high in the trees of the African savannah.

A camel's hump stores fat as an energy source for use during times when food is hard to find.

Armadillos have flexible bony armor that protects their body from predators.

The body shape of a walking stick helps camouflage the insect from predators.

Male peacocks have long, brightly-colored feathers that are attractive to females.

Pre-visit Activities (continued)

4. Create-a-saurus

TEKS: Science -3.9 (A), 3.10 (A), 4.10 (A), 5.10 (A) Language Arts - 3.14, 3.15, 3.17, 3.18, 3.20, 4.15, 4.16, 4.18, 4.19, 5.15, 5.16, 5.18, 5.19, 5.25

If you could design your own dinosaur, what would it look like? Have students pretend they are a paleontologist who discovered a new dinosaur and write a news article describing the animal's characteristics and specific adaptations that allow it to thrive in its environment. Students should give their dinosaur a scientific name, describe what the dinosaur's environment was like, and draw a picture of the dinosaur in its environment.

5. How are fossils formed?

TEKS: Science -5.7 (D)
Language Arts - 3.1, 3.14, 3.15, 3.18, 3.20, 4.1, 4.10, 4.15, 4.16, 4.18, 4.19, 5.1, 5.15, 5.16, 5.18, 5.19

Show the short (2 minutes, 34 seconds) video PBS, *Becoming a Fossil*
http://www.pbs.org/wgbh/evolution/library/04/3/1_043_01.html

Discuss the fossilization processes demonstrated in the video. To assess student understanding, have students create a comic strip depicting the fossilization of an organism of their choosing.

6. *How to Take your Grandmother to the Museum: Part I*

TEKS: Science - 3.9 (A, C), 3.10 (A), 4.10 (A), 5.7 (A, D), 5.9 (A,C), 5.10 (A) Language Arts - 3.1, 3.6, 3.7, 3.8, 3.9, 4.1, 4.3, 4.7, 4.8, 4.9, 4.10, 5.1, 5.3, 5.7, 5.8, 5.9, 5.10

Read *How to Take Your Grandmother to the Museum* by Lois Wyse and Molly Rose Goldman aloud to your students or assign the book for independent reading. Students then visit the exhibits page of Texas Memorial Museum's website (<http://tmm.utexas.edu/exhibits/hall-1/>) to familiarize themselves with the exhibits they will see in the *Hall of Geology and Paleontology* during their visit to the Museum.

During-visit Activities

1. Life in Austin during the Cretaceous

TEKS: Science -3.9 (A), 3.10 (A), 4.10 (A), 5.7 (D), 5.9 (A), 5.10 (A), 5.9 (B) Language Arts - 3.14, 3.15, 3.17, 3.18, 3.20, 4.15, 4.16, 4.18, 4.19, 5.15, 5.16, 5.18, 5.19

Find the mosasaur in the Cretaceous Period exhibit. This specimen was found in Onion Creek, right here in Austin! Based on the organisms present in the case, have students describe what they think Austin looked like when the mosasaur lived here. Students should be sure to explain the adaptations the mosasaur and other animals in the case have that support their answer.

2. Comparing and contrasting animal adaptations

TEKS: Science -3.9 (A), 3.10 (A), 4.10 (A), 5.7 (D), 5.9 (A), 5.10 (A) Language Arts - 3.14, 3.15, 3.17, 3.18, 3.20, 4.15, 4.16, 4.18, 4.19, 5.15, 5.16, 5.18, 5.19

Over its long history Texas has changed dramatically. Significant environmental changes that caused many organisms to either thrive or become extinct have occurred over time. Have students use a graphic organizer (such as T-chart or Venn diagram) to compare and contrast an animal living in Texas during two different geological time periods. Students should be sure to note the type of environment each animal lived in and describe the adaptations each animal had that allowed them to thrive in its environment.

3. Where in Texas?

TEKS: Social Studies -3.16 (E), 4.6 (A), 4.22 (C), 5.6 (A) 5.25 (C)
Language Arts - 3.14, 3.15, 4.15, 4.16, 5.15, 5.16

The majority of the fossils in the *Hall of Geology and Paleontology* were found in Texas. Give each student a copy of the *Texas Counties* map (pdf available here:

https://tpwd.texas.gov/publications/pwdpubs/media/pwd_mp_e0100_1070b_08.pdf). While exploring the exhibits, students choose ten fossils found in different counties in Texas and shade each county on the map where the fossil was found. Students should be sure to list the names of the fossils on their map and draw arrows to the county in which they were found. Encourage students to try to find one fossil from the county in which they live.

After-visit Activities

1. KWL Chart: Part II

TEKS: Science -3.9 (A-C), 3.10 (A, B), 4.9 (A,B), 4.10 (A), 5.7 (D), 5.9 (A-C), 5.10 (A) Language Arts - 3.14, 3.15, 3.17, 3.18, 3.20, 4.15, 4.16, 4.18, 4.19, 5.15, 5.16, 5.18, 5.19

Following your visit, return to the KWL chart started in the pre-activities and fill in the *What I learned* section.

2. A Letter from the Past

TEKS: Science -3.9 (A,B), 3.10 (A), 4.9 (A,B), 4.10 (A), 5.7 (D), 5.9(A,B), 5.10(A) Language Arts - 3.14, 3.15, 3.17, 3.18, 3.20, 4.15, 4.16, 4.18, 4.19, 5.15, 5.16, 5.18, 5.19, 5.21

Have students recall an extinct animal they saw at the Museum and write a letter to modern-day people, describing what its life was like. Students should describe when and where the animal lived, what it ate, what it ate it, and specific adaptations that made it successful in its environment.

3. How to Take your Grandmother to the Museum: Part II

TEKS: Science -3.9 (A, C), 3.10 (A), 4.10 (A), 5.7 (A, D), 5.9 (A,C), 5.10 (A)
Language Arts/ Reading - 3.1, 3.14, 3.15, 3.17, 3.18, 3.20, 4.15, 4.16, 4.18, 4.19, 5.15, 5.16, 5.18, 5.19

Create your own *How to Visit the Texas Memorial Museum* book (based on *How to Take Your Grandmother to the Museum* by Lois Wyse and Molly Rose Goldman). Have each student or group of students create one page for the book in which they draw and describe an exhibit they saw at the Museum. Students should include the name(s) of the fossil, when and where it lived, the part of the body the fossil is from (if the specimen is not from a complete skeleton), and any other interesting facts. Combine all the student pages, and make a copy of the book for each student.

4. Travel Back in Time

TEKS: Science - 3.9 (A), 4.10 (A), 5.7 (D), 5.9 (A), 5.10 (A) Language Arts - 3.14, 3.15, 3.17, 3.18, 3.20, 4.15, 4.16, 4.18, 4.19, 4.21, 4.25, 5.15, 5.16, 5.18, 5.19, 5.25

Students create a travel brochure enticing others to visit Texas during a given time period represented at the Museum. Students should be sure to include information about what visitors to the time period might see and do, climate conditions so visitors know what to wear, plants and animals visitors may encounter, and a list of items to bring to make their visit more enjoyable.

Books for Educators

Hansen, T. & Slesnick, I. (2006). *Adventures in paleontology: 36 classroom fossil activities*. Arlington, VA: NSTA Press.

Lawson, K. (2003). *Darwin and evolution for kids: His life and ideas with 21 activities*. Chicago, IL: Chicago Review.

Lawrence Hall of Science. *Stories in Stone (GEMS)*. Berkeley, California: University of California at Berkeley.

Books for Educators (continued)

Silver, D.M. & Wynne, P.J. (1997). *The amazing earth model book*. New York: Scholastic Inc.

VanCleave, J. (1994). *Janice VanCleave's dinosaurs for every kid: Easy activities that make learning science fun*. New York, New York: John Wiley & Sons, Inc.

Books for Students

Arnold, C. (2004). *Pterosaurs: Rulers of the skies in the dinosaur age*. New York: Clarion Books.

Arnold, C. (2007). *Giant sea reptiles of the dinosaur age*. New York: Clarion Books.

Atkins, J. (2000). *Girls who looked under rocks: The lives of six pioneering naturalists*. California: Dawn Publications.

Chorlton, W. (2001). *Woolly mammoth: Life, death, and rediscovery*. New York: Scholastic, Inc. DK Publishing. (2007). *Map: Satellite*. New York: DK Publishing.

Eldredge, N., Eldredge, G. & Eldredge, D. (1989). *The fossil factory: A kid's guide to digging up dinosaurs, exploring evolution, and finding fossils*. Reading, MA: Addison-Wesley Publishing Co., Inc.

Holtz Jr., T. R. (2007). *Dinosaurs: The most complete, up-to-date encyclopedia for dinosaur lovers of all ages*. New York: Random House Children's Books.

Montpelier, VT: Invisible Cities Press. Matejovsky, C. (2007). *Stones and bones*. Santa Rosa, CA: Polebridge Press. Sheldon, D. (2006). *Barnum Brown: Dinosaur hunter*. New York: Walker Books for Young

Readers. Silverstein, A., Silverstein, V. & Nunn, L.S. (2007). *Adaptation*. Minneapolis, MN: Twenty-First Century Books.

Stille, D. R. (2005). *Erosion: How land forms, how it changes*. Mankato, MN: Compass Point Books.

Sloan, C. (2005). *How dinosaurs took flight: Fossils, science, what we think we know, and mysteries yet unsolved*. Washington, D.C.: National Geographic Children's Books.

Wenzel, G. (2004). *Feathered dinosaurs of China*. Watertown, MA: Charlesbridge Publishing.

Wyse, L. & Goldman, M.R. (1989). *How to take your grandmother to the museum*. New York: Workman Publishing Company, Inc.

Websites for Educators

American Geological Institute, K-5 *Geosource*: <http://www.k5geosource.org/>

American Museum of Natural History, *Resources for Learning*: <http://www.amnh.org/learn-teach/educators>

ARKive Education, <http://www.arkive.org/>

Denver Museum of Nature & Science, *Follow a Fossil*
<http://www.dmns.org/main/minisites/fossil/index.html>

Earth Science Explorer, *Earth Floor/Geologic Time*
http://www.cotf.edu/ete/modules/msese/earthsysflr/geo_activity.html

Evolution and the Nature of Science Institute, *Evolution Lessons*
<http://www.indiana.edu/~ensiweb/evol.fs.html>

Geologic Time Scale Analogy, <http://jrscience.wcp.muohio.edu/lab/GeoTime.html>

Illinois State Museum, *Geology Online Lesson Plans*
http://www.museum.state.il.us/ed_opp/lessonplans.html?topic=8

Jackson School of Geosciences, *Institute of Geophysics-Plates Project*
<http://www.ig.utexas.edu/research/projects/plates/>

Jackson School of Geosciences, *Non-vertebrate Paleontology Laboratory* <http://www.jsg.utexas.edu/npl/>

Jackson School of Geosciences, *Vertebrate Paleontology Laboratory* <http://www.jsg.utexas.edu/vpl/>

My Science Box, *Geology* <http://www.mysciencebox.org/geology>

National Geographic, *Sea Monsters* <http://www.nationalgeographic.com/seamonsters/index.html>

National Park Service, National Fossil Day: <https://nature.nps.gov/geology/nationalfossilday/>

New York Science Teacher, *Earth Science* <http://newyorkscienceteacher.com/sci/>

PBS, *Deep Time* http://www.pbs.org/wgbh/evolution/change/deeptime/low_bandwidth.html

Science-class.net, *Geology* <http://science-class.net/>

Science Net Links, *Lessons* <http://sciencenetlinks.com/lessons/fossils-and-geologic-time/>

The Paleontology Portal <http://paleoportal.org/index.php>

Websites for Educators (continued)

University of California Museum of Paleontology, *Teachers Resources*
<http://www.ucmp.berkeley.edu/education/teachers.php>

USGS Education: <http://education.usgs.gov/>

Websites Specifically for Students

American Museum of Natural History Ology: <http://www.amnh.org/explore/ology/paleontology>

Denver Museum of Nature & Science, *Follow a Fossil*
<http://www.dmns.org/main/minisites/fossil/index.html>

Children's Museum of Indianapolis, *Just for Kids – Dinosaurs*: <https://www.childrensmuseum.org/just-for-kids/dinosaurs>

National Geographic, *Prehistoric World*: <http://science.nationalgeographic.com/science/prehistoric-world>

Paleontological Research Institution, *I Want To Be A Paleontologist!*:
http://www.priweb.org/outreach.php?page=Edu_Prog/publicEdprograms/be_a_paleontologist

University of California Museum of Paleontology, *Student Resources in Paleontology*
<http://www.ucmp.berkeley.edu/education/students.php>