

Texas Memorial Museum

Hall of Geology and Paleontology

Educator Guide

Grades 6-8



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 6th grade - 6.1, 6.2, 6.6, 6.7, 6.8, 6.9, 6.10, 6.11, 6.13, 6.15, 6.18, 6.20, 6.22, 6.24 7th grade - 7.1, 7.2, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11, 7.13, 7.15, 7.18, 7.20, 7.22, 7.24 8th grade - 8.1, 8.2, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11, 8.13, 8.15, 8.18, 8.20, 8.22, 8.24

Science 6th grade - 6.3, 6.11, 6.12, 6.14 7th grade - 7.3, 7.10, 7.12, 7.14 8th grade - 8.3, 8.6, 8.11, 8.12, 8.13, 8.14

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.
- **composite** – A display skeleton made up of bones of more than one individual of the same species.
- **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.
- **geology** – The study of the Earth and its natural history, as revealed in its rocks, soil, and other features.

Words to Know (continued)

- **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. Think, Pair, Share

TEKS: Science - 6.12 (C), 7.12 (A), 8.6 (C)

Language Arts - 6.1, 6.2, 6.6, 6.9, 6.13, 6.15, 6.20, 7.1, 7.2, 7.6, 7.9, 7.13, 7.15, 7.20, 8.1, 8.2, 8.6, 8.9, 8.13, 8.15, 8.20

Working in pairs, students suggest possible definitions for vocabulary chosen by the teacher from the list of *Words to Know* and complete the graphic organizer below. Student pairs share their graphic organizers with the class. Graphic organizers can be compiled to create an individual or class dictionary of geological and biological terms.

Word	Definition	Student drawing
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Pre-visit Activities (continued)

2. My Trip to the Museum

TEKS: Language Arts - 6.1, 6.2, 6.6, 6.9, 6.13, 6.15, 6.20, 7.1, 7.2, 7.6, 7.9, 7.13, 7.15, 7.20, 8.1, 8.2, 8.6, 8.9, 8.13, 8.15, 8.20

Students visit the Texas Memorial Museum's *Hall of Geology and Paleontology* webpage (<http://tmm.utexas.edu/exhibits/hall-1/>) to view exhibits they will see during their visit. Students then write down three questions they have about the exhibits. Teachers should collect the questions and redistribute them while visiting the Museum so that students can answer them.

3. If I were a rock would I shake, rattle, or roll?

TEKS: Science - 6.14 (A), 8.12 (A) Language Arts - 6.10, 6.11, 6.13, 6.15, 6.18, 6.20, 6.22, 6.24, 7.10, 7.11, 7.13, 7.15, 7.18, 7.20, 7.22, 7.24, 8.10, 8.11, 8.13, 8.15, 8.18, 8.20, 8.22, 8.24

Students explore the three types of rocks, how they are formed, and the rock cycle at the following website:

Interactives, *The Rock Cycle*: <http://www.learner.org/interactives/rockcycle/index.html>

After viewing the website, students should draw and label a diagram of the rock cycle to include the processes rocks may undergo. They may revisit the interactive rock cycle diagram as necessary.

4. KWHL Chart Parts I

TEKS: Science - 6.12 (C), 7.12 (C), 8.11(A) Language Arts - 6.1, 6.11, 6.13, 6.15, 6.18, 6.20, 7.1, 7.11, 7.13, 7.15, 7.18, 7.20, 8.1, 8.11, 8.13, 8.15, 8.18, 8.20

Students should brainstorm what they know, what they want to know, and how they will find information to answer their questions regarding prehistoric life in Texas.

5. What does a paleontologist do?

TEKS: Science - 6.3 (D, E), 7.3 (D, E), 8.3 (D, E)
Language Arts - 6.7, 6.8, 6.10, 6.11, 6.13, 6.15, 6.18, 6.20, 6.22, 6.24, 7.7, 7.8, 7.10, 7.11, 7.13, 7.15, 7.18, 7.20, 7.22, 7.24, 8.7, 8.8, 8.10, 8.11, 8.13, 8.15, 8.18, 8.20, 8.22, 8.24

Students visit the following websites to explore the science of paleontology including information on how paleontologists find fossils in the field, prepare fossils for display or research, and exhibit fossils in a museum.

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

Pre-visit Activities (continued)

American Museum of Natural History: The Paleontology Portal – Fossil Preparation:

<http://preparation.paleo.amnh.org/1/home>

Students then develop and perform a skit, write a comic strip, create a PowerPoint presentation, or write a song or chant tracking a fossil from the point at which it was found by a paleontologist through being exhibited in a museum.

For students that would like more information on paleontology as a career, visit:

Paleontological Research Institution, *I Want To Be A Paleontologist!*

https://www.priweb.org/outreach.php?page=Edu_Prog/publicEdprograms/be_a_paleontologist

6. How are fossils formed?

TEKS: Science - 4.10 (B), 5.11 (B)

Language Arts - 6.1, 6.2, 6.8, 6.10, 6.11, 6.13, 6.15, 6.18, 6.20, 6.22, 6.24, 7.1, 7.2, 7.8, 7.10, 7.11, 7.13, 7.15, 7.18, 7.20, 7.22, 7.24, 8.1, 8.2, 8.8, 8.10, 8.11, 8.13, 8.15, 8.18, 8.20, 8.22, 8.24

Students brainstorm the ways fossils are formed. Then view the video:

PBS, *Becoming a Fossil*

http://www.pbs.org/wgbh/evolution/library/04/3/1_043_01.html

Students create drawings or posters showing the sequential steps of fossilization from the video.

During-visit Activities

1. Audio Tour Scavenger Hunt

TEKS: Science - 6.11 (A), 7.12 (C), 7.14 (C), 8.11 (A), 8.13 (A)

Language Arts - 6.1, 6.2, 6.8, 6.10, 6.11, 6.13, 6.15, 6.22, 7.1, 7.2, 7.8, 7.10, 7.11, 7.13, 7.15, 7.22, 8.1, 8.2, 8.8, 8.10, 8.11, 8.13, 8.15, 8.22

Texas Memorial Museum has a free cell phone-based audio tour. It consists of a list of questions highlighting certain specimens in the exhibits. Questions, transcripts and podcasts can be downloaded from <http://tmm.utexas.edu/education/audio-tour/> before your visit. Divide students into teams and assign questions. Have students locate the specimen with the question, write down the name of the organism, time period in which that organism lived, and a possible answer. Students may use a cell phone to check their answers during the museum visit or back in the classroom.

During-visit Activities (continued)

2. Fossil Quest

This activity is designed for grades 5-7 and is available on TMM's Curriculum Resources page (<http://tmm.utexas.edu/education/resources/>) under Lessons and Activities.

Students will practice distinguishing between types of fossils and practice critical thinking skills in describing whether an object is a fossil or not.

3. Changes in Texas over Time

TEKS: Science - 6.12 (C), 7.10 (B), 7.12 (C), 8.11 (A), 8.14 (A)

Language Arts - 6.8, 6.10, 6.11, 6.13, 6.15, 6.20, 6.22, 6.24, 7.8, 7.10, 7.11, 7.13, 7.15,
7.20, 7.22, 7.24, 8.8, 8.10, 8.11, 8.13, 8.15, 8.20, 8.22, 8.24

Complete the *Changes in Texas over Time* worksheet (found on the following page) using the museum exhibits. Examples of Texas environments could include words such as terrestrial, marine, forest, swamp. Adaptations may include tooth shape, position of limb attachment, placement of eye and nose openings, scales, tusks, etc.

Changes in Texas over Time

Geologic Time Period (mya = million years ago)	Environments	Organisms	Adaptations
Permian (299-252 mya)			
Triassic (252-201 mya)			
Cretaceous (145-66 mya)			
Tertiary (66-2.6 mya)			
Ice Age (2.6 mya -12,000 years ago)			

Use your completed chart to answer the following questions.

1. Describe the environmental changes that have taken place over time in Texas.

2. What major adaptations seem to be best for each different environment?

3. Make a prediction about what may have happened to cause the changes in the types and numbers of plants and animals from one time period to the next. What evidence do the fossils on exhibit provide to support your prediction?

Post-visit Activities

1. Habitat Housing

TEKS: Science - 6.12 (C), 7.10 (B), 7.12 (C), 7.14 (A), 8.11 (A, B), 8.14 (A, B)
Language Arts - 6.10, 6.11, 6.13, 6.15, 6.18, 6.20, 6.24, 7.10, 7.11, 7.13, 7.15, 7.18, 7.20,
7.24, 8.10, 8.11, 8.13, 8.15, 8.18, 8.20, 8.24

Students become real estate agents and develop a sales pitch for a particular geological time period. Students create a brochure, commercial, or poster to advertise their property. These should include a description of the climate, animal and/or plant life, food and water sources, possible threats to existence (predators, weather, habitat loss) and any improvements that potential customers (other animals) may need to make to the property to ensure their survival.

2. KWHL Chart: Part II

TEKS: Science - 6.12 (C), 7.12 (C), 8.11(A) Language Arts - 6.1, 6.2, 6.11, 6.13, 7.1, 7.2, 7.11, 7.13, 8.1,
8.2, 8.11, 8.13

After your museum visit, return to the KWHL chart from the pre-visit activities and fill in the *What I learned* section.

3. Journal Writing

TEKS: Science - 6.12 (C), 7.12 (C), 8.11(A)
Language Arts - 6.10, 6.11, 6.13, 6.15, 6.18, 6.20, 6.24, 7.10, 7.11, 7.13, 7.15, 7.18, 7.20,
7.24, 8.10, 8.11, 8.13, 8.15, 8.18, 8.20, 8.24

Allow students time to write about their museum experience. They should be sure to include:

1. How fossils tell us about environments of the past
2. At least five adaptations that organisms from Texas' past possessed that improved their chances for survival and reproduction.

4. Diary – A Day in the Life of a...

TEKS: Science - 6.12 (C), 7.12 (C), 8.11(A)
Language Arts - 6.10, 6.11, 6.13, 6.15, 6.18, 6.20, 6.24, 7.10, 7.11, 7.13, 7.15, 7.18, 7.20,
7.24, 8.10, 8.11, 8.13, 8.15, 8.18, 8.20, 8.24

Students choose an extinct animal on exhibit at the Museum and write a diary page of one day's activities. They should portray themselves as the organism and describe which adaptations for survival they possess. Students should include how they obtain their food, any defense mechanisms, ways they avoid being eaten that day, climate in which they live, means of locomotion (swim, fly, walk on hind limbs, etc.) and any interesting interactions or events they experienced that day.

Post-visit Activities (continued)

5. I Know I Can(t) Sing

TEKS: Science - 6.12 (C), 7.12 (C), 7.10 (B), 8.11 (A, B) Language Arts - 6.10, 6.11, 6.13, 6.15, 6.24, 7.10, 7.11, 7.13, 7.15, 7.24, 8.10, 8.11, 8.13, 8.15, 8.24

Students create a song, rap, or chant about an extinct animal from the Museum. It should include the time period in which the animal lived, environmental conditions, and any adaptations the animal may have used to ensure its survival prior to its extinction.

6. Cell Phone Audio Tour Part II

TEKS: Science - 6.11 (A), 7.12 (C), 7.14 (C), 8.11 (A), 8.13 (A) Language Arts - 6.1, 6.2, 6.10, 6.11, 6.13, 6.15, 6.18, 7.1, 7.2, 7.10, 7.11, 7.13, 7.15, 7.18, 8.1, 8.2, 8.10, 8.11, 8.13, 8.15, 8.18

Discuss student answers to the audio tour as a class or in small groups. Have students revisit what surprised them the most, what they found most interesting, and what they still want to know. Using information from the audio tour guide, students develop an exam for their peers. As an extension, students can exchange tests and record answers on a separate sheet of paper. Students can also use answers to their assigned questions to create a game of *Jeopardy*.

Books for Educators

Beals, K., Parizeau, N., & MacPherson, R. (2003). *Life through time: Evolutionary activities for grades 5-8*. Arlington, VA: NSTA Press.

Benz, R. (2000). *Ecology and evolution: Islands of change*. Arlington, VA: NSTA Press.

Bybee, R. W. (2004). *Evolution in perspective: The science teacher's compendium*. Arlington, VA: NSTA Press .

Ford, B. A. (2001). *Project earth science: Geology*. Project Earth Science Series. Arlington, VA: NSTA Press.

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: Chicago Review.

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

McComas, W. F. (Ed.). (2008). *Investigating evolutionary biology in the laboratory*. Albuquerque, NM: National Association of Biology Teachers.

Books for Educators (continued)

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

Stebbins, R., Ipsen, D., Gillfillan, G. L., Diamond, J., & Scotchmoor, J. (2008). *Animal Coloration: Activities on the Evolution of Concealment*. Arlington: NSTA Press.

Books for Students

Adamson, H. (2007). *Charles Darwin and the theory of evolution*. Graphic Library Inventions and Discovery Series. Mankato, MN: Coughlan Publishing.

Brande, R. (2007). *Evolution, me and other freaks of nature*. New York: Random House Children's Books.

Gamlin, L. (2000). *Eyewitness: Evolution*. Eyewitness Books Series. New York: DK Publishing, Inc.

Lawson, K., & Lawson, K. (2003). *Darwin and evolution for kids: His life and ideas with 21 activities*. For Kids Series. Chicago: Chicago Review Press, Incorporated.

Morgan, J., & Anderson (Illus.), D. L. (2002). *Born with a bang*. Sharing Nature with Children Series. CA: Dawn Publications.

Morgan, J., & Anderson (Illus.), D. L. (2002). *From lava to life: The universe tells our earth story, Vol. 2*. Sharing Nature with Children Series. CA: Dawn Publications.

Morgan, J., & Anderson (Illus.), D. L. (2002). *Mammals who morph: The universe tells our evolution story: Book 3*. Sharing Nature with Children Series. CA: Dawn Publications.

Myers, T. (2007). *If you give a T-rex a bone*. Sharing Nature with Children Series. Nevada City, CA: Dawn Publications.

Parker, S., & Flegg, J. (2002). *100 things you should know about dinosaurs*. Broomall, PA: Mason Crest Publishers.

Walker, R., & Jones, S. (2007). *Genes and DNA (Kingfisher Knowledge Series)*. Kingfisher Knowledge Series. London: Kingfisher.

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>