



Texas Memorial Museum

Hall of Geology and Paleontology
Educator Guide
Grades 6-8

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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 leaving more young.
- **amphibian** – An animal that typically lives in an aquatic habitat breathing by gills as young, 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** – An exact replica of a fossil usually made out of plastic or fiberglass.
- **composite** - Made up of bones of more than one individual.
- **dinosaur** – An extinct reptile from the Mesozoic Era that did not swim or fly.
- **erosion** – The wearing away 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, part of body, burrow, footprint, etc.) that is at least several thousand years old.
- **geologic time** - The period of time covering the formation and development of the Earth, from about 4.6 billion years ago to today.
- **geological 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.
- **herbivore** – An animal that eats plants.

Words to Know (continued)

- **igneous rock** - Rock that is formed when magma cools and hardens.
- **invertebrate** - An animal without a spinal column (backbone).
- **mammal** – Animals that have body hair, nourish their young with milk from mammary glands, and typically give birth to live young.
- **marine/aquatic** - Living in or near the water.
- **mass extinction** – The dying out of multiple species usually as a result of a cataclysmic event.
- **metamorphic rock** - Rocks that have changed due to changes 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 uses fossils to study ancient life.
- **paleontology** – The study of extinct plants and animals by looking at their fossils and other ancient remains.
- **plate tectonics** - The theory that Earth’s crust and upper mantle float as plates on a plasticlike layer of the mantle.
- **reptile** – A group of animals that have scales, breathe air, and usually lay eggs on land.
- **rock cycle** - Model that describes how rocks slowly change from one form to another over time.
- **sediment** - Solid fragments of material that come from the weathering of rock and are carried and deposited by wind, water, or ice.
- **sedimentary rock** – Rock that is formed as thousands or millions of years’ worth of sediment piles up and hardens.
- **species** – A group of organisms that can freely breed with one another, producing fertile young.
- **terrestrial** – Living on or in the ground.
- **vetebrate** - Animals with a spinal column (backbone).
- **weathering** - The breaking apart of rock and other solid material by wind and/or water.

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 (www.utexas.edu/tmm/exhibits/geology.html) 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.

Note: Encourage your students to visit the Paleo Lab while they are in the Museum to learn more about paleontology and ask questions about the exhibits.

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*

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.

Note: Encourage your students to visit the Paleo Lab while they are in the Museum to learn more about paleontology and ask questions about the exhibits.

Pre-visit Activities (continued)

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 Natural Science, *Follow a Fossil*
www.dmns.org/main/minisites/fossil/index.html

Children's Museum of Indianapolis, *Dinosphere*
www.childrensmuseum.org/themuseum/dinosphere/resources/bone_prep/index.htm

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*
www.priweb.org/ed/lol/careers.html

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*
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. Cell Phone 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. A copy of the questions can be downloaded and printed from www.utexas.edu/tmm/education/gbc/pdf/. 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.

2. 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, underwater, swamp. Adaptations may include sails, position of limb attachment, placement of eye and nose openings, scales, tusks, etc.

Changes in Texas over Time

Geologic Time	Environments	Organisms	Adaptations
Permian (290-250 mya)			
Triassic (250-205 mya)			
Cretaceous (145-65 mya)			
Tertiary (65-2 mya)			
Ice Age (2mya - 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 a real estate agent 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 had to improve 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 the 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.

Books for Educators (continued)

- McComas, W. F. (Ed.). (2008). *Investigating evolutionary biology in the laboratory*. Albuquerque, NM: National Association of Biology Teachers.
- Sandro, L., Constible, J. M., & Lee, R. E., Jr. (2007, July 1). *Extreme arthropods: exploring evolutionary adaptations to polar and temperate deserts*. *Science Scope*. Retrieved from http://www.nsat.org/_details.aspx?id=10.2505//ss07_030_09_24
- 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 (CA).
- 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 (CA).
- 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 (CA).
- Myers, T. (2007). *If you give a T-rex a bone*. A 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*
www.k5geosource.org

American Museum of Natural History, *Resources for Learning*
www.amnh.org/education/resources/index.php

ARKive Education, *Resources*
www.arkiveeducation.org/resource_list_sci11-14.html

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

Earth2class, *Earth History*
earth2class.org/curr_units/history%20labs.php

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

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

Illinois State Museum Geology Online, *Lesson Plans*
geologyonline.museum.state.il.us/tools/lessons

My Science Box, *Geology*
www.mysciencebox.org/geology

National Geographic, *Sea Monsters*
nationalgeographic.com/seamonsters/index.html

New York Science Teacher, *Earth Science*
www.newyorkscienceteacher.com/sci/

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

Science-class.net, *Geology*
science-class.net

Science Net Links, *Lessons*
www.sciencenetlinks.com/lessons.cfm?Grade9-12&BenchmarkID=10&DocID=44

Teachers' Domain, *Deep Time/History of Life*
www.teachersdomain.org/sci/life/evo/deeptime/index.htm

Websites for Educators (continued)

Texas Natural Science Center, *Non-vertebrate Paleontology Laboratory*
www.utexas.edu/tmm/npl/index.html

Texas Natural Science Center, *Vertebrate Paleontology Laboratory*
www.utexas.edu/tmm/vpl/

Tropical Ecosystems: Coral Reefs, Rainforests, & A Potpourri of Weather, Earth Science & Other Good Things, *Geologic Time Scale Analogy*
jrscience.wcp.muohio.edu/lab/GeoTime.html

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

University of California Museum of Paleontology, Paleontological Society, Society of Vertebrate Paleontology, and United States Geological Survey, *The Paleontology Portal*
www.paleoportal.org/index.php

University of Texas at Austin - Jackson School of Geosciences, *Institute of Geophysics-Plates Project*
www.ig.utexas.edu/research/projects/plates/

Websites for Students

American Museum of Natural History, *Ology*
www.amnh.org/ology

Denver Museum of Nature & Science, *Follow A Fossil*
www.dmns.org/main/minisites/fossil/index.html

Dinosphere: Now You're in Their World, *Dino Fossil Preparation*
www.childrensmuseum.org/themuseum/dinosphere/resources/bone_prep/index.htm

Museum Victoria, *Dinosaurs and Fossils*
museumvictoria.com.au/dinosaurs/

National Geographic, *About the Prehistoric World*
science.nationalgeographic.com/science/prehistoric-world

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

USGS, *Education*
geology.er.usgs.gov/paleo/glossary.shtml