

- Place the following fossil types in order according to the quality of information that they can provide to scientists: petrified remains, molds, casts, preserved remains, imprints. Justify your answers.
- Ask students to explain why the fossil record is incomplete. (It is estimated that 99% of extinct dinosaur and bird species left no fossil evidence behind.) Discuss how accurate our information is about the history of the Earth and its organisms.

Follow-up Activities

- Simulate a fossil dig by layering soil, sand, gravel and rocks in a large box. Place shells, hard seeds and bones in some of the sediment layers. Have the students set up a grid, photograph the site, measure and draw each excavated specimen and record the information in field books as if they were conducting a real dig. Ask them to use relative dating techniques when possible to estimate the hypothetical age of the specimens.
- Students can conduct research on the types of fossils that organisms create. Provide students with different types of soil (i.e., wet and dry mud and clay) and several shallow aluminum pans. Obtain several small pets and insects (hamsters, guinea pigs, lizards, beetles, spiders, slugs or snails). Place the soil in the pan and smooth it over with a ruler. Allow various types of organisms to move across the soil. Have students compare the imprints left behind by each type of organism, and the imprints left behind by the same organism in different types of soil. What do these imprints tell us about the animal that made them? What is the best type of soil for making a clear imprint?

Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at www.libraryvideo.com

- pubs.usgs.gov/gip/fossils/
"Fossils, Rocks and Time" is a Web page sponsored by the United States Geological Survey that provides information about fossils and dating techniques. Many helpful tables and graphics are presented on this site.
- www.emporia.edu/earthsci/amber/amber.htm
"The World of Amber" Web site offers everything you ever wanted to know about amber and more! Features on this site include descriptions of the physical properties of amber, where amber can be found, and how amber is recovered and used. Check out the "Life in Amber" link to see pictures of organisms that have been preserved in amber.
- www.idbsu.edu/bsuradio/misc/mammoth
Take a visit to Tolo Lake, Idaho, where numerous woolly mammoth fossils have been found. This site provides information about this discovery and the excavation process that unearthed these fossils.

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- www.english.cornell.edu/pri/
Fascinating facts about fossils await young geologists on the Paleontological Research Institution Web site, which includes virtual tours of fossil collections. This site also explains how scientists use fossils to provide information about the Earth and its inhabitants.

Suggested Print Resources

- Busbey, Arthur. *Rocks and Fossils*. Time-Life Books, Alexandria, VA; 1996.
- Kittinger, Jo. *Stories in Stone: The World of Animal Fossils*. Franklin Watts, New York, NY; 1998.
- Parker, Steve. *Collecting Fossils: Hold Prehistory in the Palm of Your Hand*. Sterling Publishing, New York, NY; 1997.
- Taylor, Paul. *Fossil*. DK Publishing, New York, NY; 2000.
- Thompson, Sharon. *Death Trap: The Story of the La Brea Tar Pits*. Lerner Publications Company, Minneapolis, MN; 1995.

TEACHER'S GUIDE CONSULTANT

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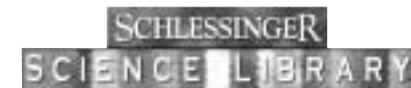
Fossils

Grades 5-8

Students in grade 5-8 classrooms possess a wide range of background knowledge. Student response to this video program is sure to be varied, so the teachers at these grades need all the help they can get! This guide has been designed to help the 5-8 science teacher by providing a brief synopsis of the program, previewing and follow-up questions, activities, vocabulary and additional resources.

Before Viewing: Extensive research tells how important it is for the teacher to discover what the students know — or think they know — about a topic, before actually starting a new unit. Therefore, after prompting discussion with the pre-viewing questions, lead your class to create an "Everything We Think We Know About..." list. You may also wish to preview key vocabulary words, and have students raise additional questions they hope will be answered.

After Viewing: Have your students share video excerpts that fascinated or surprised them, then challenge your students to prove or disprove the accuracy of the facts they put on their "Everything We Think We Know About..." list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.



Program Summary

Fossils are the remains or evidence of living things from a long time ago. They can be skeletons, shells, petrified trees or impressions like footprints. Fossils can even be whole, preserved remains. However, most fossils are not complete organisms because the process of becoming a fossil takes a very long time and the soft tissue of once living things deteriorates before the process is complete. Only hard parts such as shells and bones usually remain long enough to become fossils. Most fossils are found in sedimentary rock layers, which were once muddy, sandy bottoms of oceans or fresh water sites. Over millions of years, organisms were covered under layers of sediment. Under great pressure, these layers turned into sedimentary rock. By studying layers of rock around the world and the fossils in them, scientists have learned what animals and plants were common at certain times in different areas.

Several different types of fossils exist. A mold is created when an organism decays in rock, leaving a hollow space behind in its exact shape. When a mold is filled with minerals, a copy or a cast of the original organism is created. An imprint fossil is an impression originally made in mud that hardened over time. Impressions like footprints are evidence that an organism existed even though remains are not present. Fossils can also be actual remains, such as those of a woolly mammoth, which have been found completely preserved after being frozen in the ground for thousands of years.

Scientists study fossils to gain clues about the history of the Earth and its inhabitants. To help scientists interpret these clues, various scientific techniques are used to determine the age of fossils. One method for dating fossils uses the principle of superposition. This dating technique assumes that fossils found in lower layers of sedimentary rock are older than those found in the upper, newer rock layers. The fossils that scientists rely on to date rock layers are called index fossils — remains of organisms that were only in existence for a specific period of time. Using these methods, scientists are able to estimate or provide a relative date for the surrounding rock. Absolute dating of fossils is more precise and results from an analysis of the radioactive decay of elements over time. Through the study of fossils, scientists are able to guess what the Earth, its climate and its ancient living organisms looked like in the distant past, and how they have changed over the course of Earth's history.

Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the video.

fossil — (from Latin, meaning “to dig”) Preserved evidence of living things that previously existed on the Earth. The science of studying fossils is called paleontology.

weathering — The breaking of rock and other materials of the Earth's surface into smaller pieces. Weathering can be described as physical or chemical and can be caused by forces such as changing temperatures, ice, wind, water and gravity.

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erosion — The removal and relocation of rocks and soil from their original location.

sediment — Sand and mud that have been created from the weathering of rock, shells and other materials on the Earth's surface

sedimentary rock — Rock made from layers of sand and mud that compress and harden over time. Fossils are most often found in sedimentary rock layers.

petrification — The process by which remains such as bones are slowly dissolved and replaced by minerals, turning the original specimens into stone.

mold — The space left behind by a decayed organism that mirrors the outward shape of the original organism.

cast — A fossil formed when the space left by a decayed organism has been filled in with hardened minerals, creating an exact copy of the original organism.

imprint — A fossil formed after a living thing leaves an impression in mud or sand that becomes hardened, providing fossil evidence that the organism once existed.

preserved remains — Fossils that consist of actual organisms. The preserved remains of organisms have been found frozen intact or preserved in tar or amber.

amber — The fossilized form of ancient tree sap or resin.

superposition — The principle that rock layers and the fossils they contain are arranged in layers and that lower sedimentary layers are older than higher layers of rock.

index fossils — The fossils of organisms that are known to have existed only in a specific time period. Rocks can be dated based upon the presence of index fossils.

relative dating — An estimate of the actual age of a fossil based on comparisons with the ages of other objects, organisms or geological events.

absolute dating — A scientific determination of the actual age of a fossil by measuring the rate of radioactive decay of elements that make up the fossil.

Pangaea — The single continent believed to have existed over 200 million years ago, before the present continents drifted apart. Fossil evidence supports this theory.

Pre-viewing Discussion

Before students generate their list of “Everything We Think We Know About...” for this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

- What is a fossil?
- How are fossils created?
- What can scientists learn from studying fossils?

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After the class has completed their “Everything We Think We Know About...” list, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.

Focus Questions

1. What types of fossils exist? How are they formed?
2. Why are the hard parts of organisms, such as the shell, more likely to be preserved than the soft parts?
3. How is sedimentary rock formed?
4. Why does sedimentary rock contain more fossil remains than other kinds of rock?
5. How could a fallen tree trunk eventually become a petrified tree fossil?
6. How are molds, casts and imprints similar and different?
7. Why do so few fossils contain the actual remains of living creatures?
8. Under what unusual condition could the actual remains of an organism be preserved as a fossil?
9. What was so unusual about the scientific discovery of a woolly mammoth in Siberia in 1999?
10. What conditions favor the formation of fossils?
11. What does the principle of superposition tell a geologist about sedimentary rock layers?
12. What are index fossils and how are they used for relative dating?
13. What are relative and absolute dating techniques? How are they similar and different?
14. What have scientists learned from studying fossils?
15. What is Pangaea?
16. What have fossils told us about the existence of Pangaea?
17. What is meant by the term “fossil record”?

Follow-up Discussion

Research indicates that students will retain their previous misconceptions about a topic, in preference to new information, until they actively recognize and correct their own errors. Therefore, it is important to have your students re-examine the facts/beliefs they put on their “Everything We Think We Know About...” list. It might also be helpful to review the list by marking each entry with a “+” or “-” to show which facts were correct and which were incorrect.

Thought provoking discussions provide a good way to assess the overall depth of student understanding. The following are some suggested discussion topics.

- Discuss how the fossil of a sea creature could be found near the top of a mountain.

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