

17. When did mammals become the dominant life form on Earth?
18. During which geological time period did primitive humans appear? Modern humans?
19. What evidence do scientists have to justify and explain the theory of continental drift?
20. What is Pangaea?
21. How does the molten rock of the Earth's mantle contribute to continental drift?

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 the trend of life forms developing from simplistic to more complex organisms throughout time.
- Have students explain why scientists separate Earth's history into smaller segments.
- Discuss the value of fossils in understanding past geological events.

Follow-up Activities

- The numbers involved in geological time scale are staggering. Using the geological time scale calculator at the following Web site — <http://www.athro.com/geo/hgframe.html> — have the class create their own metaphors for geologic time. For example, the history of time could be the distance from the classroom to the other end of the hall. As a group, develop an illustrated time line, marking off the eras and periods, and placing the major evolutionary events in appropriate places.
- Have each student select a geological time period and imagine they are organisms that live during this time. Ask them to describe their environment in a short story.
- Have students research how the appearance of land in their region has changed over time. Was it once under water? Covered by glaciers? Tropical? Ask them to report on the evidence of the geological changes to that location.

Suggested Internet Resources

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

- www.ucmp.berkeley.edu/exhibit/geology.html
This online exhibit from the "Geology Wing" at the University of California Museum of Paleontology surveys the history of the Earth, focusing on changes in life through time and the locations where fossils have been found.
- tapestry.usgs.gov/ages.html
These pages from the United States Geological Survey Web site show how geologists study rocks from various time periods.
- kids.earth.nasa.gov/archive/pangaea/index.html
This page from NASA for kids discusses continental drift and how it is observed by scientists.

Suggested Print Resources

- MacDougall, J. D. *A Short History of Planet Earth: Mountains, Mammals, Fire, and Ice*. Wiley, New York, NY; 1996.
- Smith, Norman F. *Millions and Billions of Years Ago: Dating Our Earth and Its Life*. Watts, Danbury, CT; 1993.

TEACHER'S GUIDE CONSULTANT

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Geological History

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

The history of the Earth covers a very long time — billions of years, in fact! Since humans have only been on the Earth for a tiny fraction of that time, how do we know about the Earth's history? Scientists have learned a great deal about the past by studying the rocks that make up our planet. The study of these rocks is called geology. Geologists have determined that the Earth was formed roughly 4.6 billion years ago. By "reading" different rock layers and examining the fossils they contain, geologists have constructed a time line of the Earth's history.

The longest segment of Earth's history — almost 4 billion years — is known as Precambrian time. This began when Earth formed out of gas and dust and lasted until 570 million years ago. In the beginning, the Earth was made of molten rock with no atmosphere, no oceans and no life. As the Earth cooled over millions and millions of years, condensed water vapor fell as rain, filling up valleys and canyons, and creating the oceans. Eventually, primitive microscopic bacteria appeared and then ancient creatures like jellyfish, coral and clams developed. Simple plants in the oceans began to fill the atmosphere with oxygen at the end of Precambrian time.

The Paleozoic Era came next, lasting 345 million years. Organisms became larger and more complex during the six periods of the Paleozoic Era. First came the Cambrian Period, lasting 70 million years. This was a time of warm shallow seas teeming with primitive creatures. The Ordovician Period, also lasting 70 million years, saw many volcanoes and the development of primitive fish. During the Silurian Period, mountain ranges pushed up from the sea and the first land plants and bony fish appeared. It wasn't until the Devonian Period, around 400 million years ago, that land animals emerged. During the Carboniferous Period, much of the Earth was covered by vast sheets of ice. Insects flourished at this time, as well as large primitive trees. In warmer places, the first reptiles and sharks evolved. During the Permian Period at the end of the Paleozoic Era, the motion of the Earth's crustal plates had brought much of the total land together, fused in a huge continent known as Pangaea. The Permian Period, which lasted 55 million years, had giant ferns, amphibians and reptiles dominating the land.

The next segment in geological history was the Mesozoic Era, comprised of three different periods. The Triassic Period, lasting for 35 million years, was when dinosaurs and small mammals first appeared. During the Jurassic Period, lasting 54 million years, dinosaurs ruled the world! Finally, the Cretaceous Period saw the start of flowering plants and the extinction of dinosaurs, possibly caused by an asteroid crashing into the Earth.

The death of the dinosaurs, 65 million years ago, marks the start of the current era, the Cenozoic, which is known as the Age of Mammals. During the two periods of the Cenozoic, great glaciers formed, continents drifted into their present locations and glaciers melted and retreated, scarring the land and leaving many lakes. Primitive humans appeared along with other mammals. Finally, around 10,000 years ago, modern humans evolved. The physical Earth and its life forms continue to change and evolve.

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.

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geologists — Scientists who study the materials that make up the Earth, their origin and evolution, and the processes that change them.

geological history — The division of all of Earth's past into blocks of time distinguished by geologic and evolutionary events, arranged into segments made up of eras, which are in turn made up of periods.

sediment — A collection of sand and mud fragments that accumulate in layers.

sedimentary rock — Layers of sand, silt and clay that compressed and hardened over time into rock. Fossils are most often found in sedimentary rock layers.

intrusions — Irregular formations of rock that often cut across orderly arranged sedimentary layers.

Precambrian — The longest segment of the Earth's history, lasting from around 4.6 billion years ago to 570 million years ago.

Paleozoic Era — ("Ancient Time") The segment of geological time following the Precambrian, lasting for 345 million years. During this era, the evolution of life accelerated rapidly. This era consists of six smaller segments called periods.

Cambrian Period — The first period of the Paleozoic Era, lasting from around 550 to 500 million years ago, when primitive marine organisms lived in the Earth's warm, shallow oceans.

Ordovician Period — The second period of the Paleozoic Era, lasting 70 million years. During this time, primitive fish appeared and volcanic eruptions were common.

Silurian Period — The third period of the Paleozoic Era, during which mountain ranges pushed up from the sea and plants began to appear on land. Bony fish developed in the ocean.

Devonian Period — The fourth period of the Paleozoic Era when insects and amphibians developed and moved to swampy forests.

Carboniferous Period — The fifth period of the Paleozoic Era, around 350 million years ago, when flying insects and reptiles evolved. During this time, vast sheets of ice covered large sections of the Earth.

Permian Period — The sixth and final period of the Paleozoic Era, during which time amphibians, reptiles and giant ferns flourished.

Mesozoic Era — ("Middle Time") One of the major divisions of geological history, following the Paleozoic era and preceding the Cenozoic Era. It is known as the Age of the Dinosaurs and lasted for 160 million years. This era consists of three periods.

Triassic Period — The first period of the Mesozoic Era, when both dinosaurs and tiny mammals began to appear.

Jurassic Period — The second time period of the Mesozoic Era, when dinosaurs ruled the Earth.

Cretaceous Period — The third period of the Mesozoic Era, when flowering plants appeared and dinosaurs abruptly disappeared.

Cenozoic Era — ("Current Time") The current era, beginning about 65 million years ago with the extinction of the dinosaurs and marked by the dominance of mammals. The Cenozoic is broken into two periods.

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iridium — The metal contained in asteroids, deposited on Earth about 65 million years ago at the time of dinosaur extinction.

continental drift — Starting 300 million years ago, Earth's one continent, Pangaea, broke into smaller continents on plates, which have continued to drift apart over time.

magma — The molten rock within the Earth that erupts as lava.

mantle — Earth's deep middle layer, composed of magma.

crust — The thin, solid surface layer of Earth, which floats on a magma mantle.

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:

- How old is the Earth?
- What are some ways that scientists learn about the Earth's past?
- When did dinosaurs begin to roam the Earth? When did people appear?

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 can rocks tell us about the Earth's history?
2. What are sedimentary rocks? What do they tell us about the history of the Earth?
3. What does "geo" mean?
4. How long ago do geologists believe the Earth was formed?
5. How do we know about events that occurred billions of years ago?
6. How do geologists "read" sedimentary rock layers?
7. What is an intrusion?
8. How do geologists divide the Earth's history into segments?
9. How long did Precambrian time last?
10. How did the Earth form? When did life first appear?
11. How did simple plants change the Earth's atmosphere?
12. What happened during the Paleozoic Era?
13. What were the six periods of the Paleozoic Era?
14. When did the first land creatures appear?
15. How long did the Mesozoic Era last? What were the three periods of this era? How would you describe them?
16. What evidence has been found to support the current theory about the extinction of dinosaurs?

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