

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

- Given what you know about the Earth's processes of land formation, predict what you think the Earth will look like in a few million years.
- It has been said that we know more about the land formations on the far side of the moon than we do about the landscape of the ocean floor. Discuss why this is so and how modern technology is helping to change this.
- Discuss how it is possible to gather evidence of an event that occurred 300 million years ago.

Follow-up Activities

- Have groups of students create clay models of an imaginary tract of land that contains many land formations such as plains, mountains, plateaus, canyons or valleys. Have them label each formation, and, in a presentation, explain whether or not they believe that their collection of formations could logically coexist in that tract.
- Many national parks are famous because of the land formations that are unique to those areas. Have pairs of students select a national park, obtain photos from books or the Internet and explain the history and nature of the unique land formations of that park.
- Share the book *Legends of Landforms: Native American Lore and the Geology of the Land* by Carole Vogel with your students (Millbrook, 1999). Discuss with students how the legends reflect the geology of the land formations presented in this text. Students can then research a land formation and write their own legend about it.
- Topographic maps illustrate the ups and downs of the Earth's surface, including a representation of its land formations. Provide several topographic maps from resources such as the U.S. Geological Survey (see www.usgs.gov) for students to explore. What can we learn about land formations from a topographic map?

Suggested Internet Resources

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

- kids.mtpe.hq.nasa.gov/archive/pangaea/index.html
"On the Move: Continental Drift and Plate Tectonics" is a Web site sponsored by NASA. This site provides an interactive map of Pangaea and describes continental drift.
- pubs.usgs.gov/publications/text/dynamic.html
"This Dynamic Earth: The Story of Plate Tectonics," offered by the U.S. Geological Survey, presents information about the movement of plates and changes on the Earth's surface over time.

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- www.athena.ivv.nasa.gov/curric/land/landform/landform.html
Athena, part of NASA's Learning Technologies Project, provides Earth and Space Science information for students and teachers. This page offers images of many different types of land formations found on the Earth's surface, in addition to a teacher's overview of the material and activities for students.

Suggested Print Resources

- Gallant Roy A. *Dance of the Continents*. Benchmark Books, New York, NY; 1999.
- Gidwitz, Tom. *Story in the Stone: Formation of a Tropical Land Bridge*. Steck Vaughn, Austin, TX; 2001.
- Perham, Molly and Julian Rowe. *Landscapes*. Watts, Danbury, CT; 1996.
- Sattler, Helen Roney. *Our Patchwork Planet: The Story of Plate Tectonics*. Lothrop, Lee & Shepard Books, New York, NY; 1995.

TEACHER'S GUIDE CONSULTANT

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Land Formations

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

There are many different kinds of land formations that make up the Earth's surface. To understand how these land formations were created, we must first look back more than 4.5 billion years to when the Earth was mainly molten rock. Over time, the surface of the Earth began to cool and harden into the outer crust. Oceans were created as the low areas of the crust filled with rain, and the parts of the crust that were not covered by oceans became the continents. Over 300 million years ago, one huge land mass called Pangaea existed, floating on the Earth's molten mantle. Pangaea later broke into separate continents in an ongoing process called continental drift. Continental drift is a theory that Earth's crust is cracked into sections called plates; it is the movement of these plates that helps change the land. Where plates move apart, the Earth continues to experience volcanic activity, building underwater mountains. Where plates slide under one another, deep trenches are formed as the crust is pushed into the mantle and is recycled into magma.

The Earth's most obvious land formations are its mountains. There are three types of mountains. Volcanoes form mountains, as rising magma exits through plate openings, cools and builds upon itself. Many Pacific islands and atolls are the tops of volcanic mountains. A second type of mountain is formed when plates push against each other from two sides, causing the crust to rise. The Himalayan Mountains, including Mt. Everest, are still rising because of this process. The third type of mountain, called a block mountain, is formed when huge segments of the Earth's crust are uplifted because of great pressure below. California's Sierra Nevada Mountains were formed that way. Because of Earth's processes of weathering and erosion, older mountains are more worn and rounded than newer mountains, which are usually sharper and taller.

Plains are vast low areas of flat land. They are formed either by the rising of the bottoms of shallow oceans or by the effects of weathering, erosion and deposition, grinding down, carrying away and spreading out higher land formations. Because of deposition, plains are usually rich places to grow crops. Valleys are formed when rivers cut V-shaped channels down mountainsides. Over time, these valleys widen due to weathering and erosion, and also serve as excellent locations for crops. Glaciers are also responsible for digging out huge valleys as they move forward, scouring everything in their paths and leaving great deposits of material at their edges. Canyons, such as the Grand Canyon, are deep valleys created when a river cuts through a high landscape called a plateau, leaving steep cliffs on either side. When weathered to smaller formations, plateaus become mesas and buttes. Shoreline land formations such as peninsulas and bays are shaped by the weathering of ocean waves. Land formations of the Earth are many and varied!

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.

land formations — Natural features that make up the Earth's surface. Some land formations are created by activity deep within the Earth, while others develop by the action of wind, water and ice.

core — The innermost region of the Earth, comprised of a solid metal inner core and a liquid outer core.

mantle — The middle layer of the Earth, composed of molten, dense, flowing rock located under the crust.

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crust — The surface layer of the Earth, varying in thickness from around 5 kilometers under the ocean to over 30 kilometers under the continents. The crust is cracked into rigid rock plates.

continents — Large, extensive landmasses that make up most of the land on the Earth's surface. There are seven continents on Earth.

Pangaea — A giant continent that is thought to have existed about 300 million years ago and consisted of all of the present-day continents.

plates — Solid rock pieces that make up the crust of the Earth's surface. Plate margins are areas where the crust is being formed or destroyed. These plates float on the mantle.

continental drift — The theory that the continents slowly move as the plates of the Earth's crust move.

mid-ocean ridges — Underwater mountain ranges where magma often erupts from the Earth to form new crust on the surface.

deep trenches — Long and relatively narrow underwater valleys. Deep ocean trenches are formed where one plate slides under another.

mountains — Natural land formations with steep slopes and a peak that rise above the surrounding landscape to high elevations.

volcano — An opening in the Earth's crust through which lava and other materials reach the surface. Volcanic eruptions play a part in the formation of new land.

magma — The molten rock found beneath the Earth's surface in the mantle.

atoll — An island comprised of a ring of coral reefs near the ocean surface, which are usually associated with the crater of an extinct volcano.

sediment — Particles like mud, shells, bones and leaves that have been broken down over time.

block mountains — Mountains formed by the fracturing of the Earth's crust and the uplifting of blocks of the crust from great pressure below.

plain — An area of extensive flat land that does not rise far above sea level.

delta — A large area of fertile land at a river mouth where deposits of eroded materials build up.

valleys — U- or V-shaped, low areas of land with sloping sides, created by moving rivers or glaciers that wear away the land.

glacier — A large mass of moving ice that can dig out huge valleys as it moves.

canyons — (Spanish - "tube") Deep valleys with steep sides, created by rivers cutting through rock.

plateaus — An extensive, raised, flat-surfaced area that has slopes or cliffs on one or more sides. Plateaus rise between 600 and 1,500 meters above sea level, extending for many miles with little relief.

mesa — A large, table-like landform that is the result of plateau erosion.

butte — A table-like landform like a mesa, but smaller in size. Buttes are also the result of plateau erosion.

peninsula — (Latin - "almost an island") A portion of land that is surrounded by water on three sides.

bay — A body of water that extends into the nearby land; bays can be created by waves wearing away an indentation in the shoreline.

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 does the surface of the Earth look like? How was it formed?
- What are some of the different land formations found on the Earth's surface? Compare and contrast these landscapes.
- How do land formations change over time?

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 is the link between current land formations and the Earth's early history?
2. What are the three layers of the Earth?
3. What is the major influence of the mantle on the crust?
4. Explain how the Earth's crust is broken into plates.
5. What is Pangaea?
6. What is the theory of continental drift?
7. How are mid-ocean ridges and deep trenches formed?
8. How does the Earth "recycle" its crust?
9. How are volcanoes involved in land formation?
10. What are the ways in which mountains are formed?
11. What is an atoll? Where are most atolls found?
12. What evidence do we have that some mountain ranges were once part of the ocean floor?
13. Explain the influences of weathering and erosion on land formation.
14. How are rivers involved in land formation?
15. How do mesas and buttes differ from plateaus?
16. How do valleys differ from canyons?
17. Explain how glaciers have been involved in land formation.
18. How are peninsulas defined?

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.

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