

About...” list. Research indicates that students will retain their previous misconceptions — in preference to the new information — until they actively recognize and correct their own errors. Because of this, it is important to lead students to the correct ideas while identifying and correcting any misconceptions from the class list. After reviewing the list, encourage students to share the answers they got to the questions raised, before viewing the program.

Raising a thought-provoking question is a good way to assess the overall depth of student understanding. A couple of suggestions are listed below:

- Why are weathering, erosion and deposition so important for the Earth and its living things?
- Brainstorm lists of positive and negative results of weathering, erosion and deposition. Do you think weathering, erosion and deposition are more helpful or harmful?
- Do you think that your teeth could become chemically weathered by the carbonation over time if you drank a lot of soda pop? Why or why not?

Follow-up Activities

- Students can model the effects of weathering right in your classroom! Have students predict what will happen when water is poured on different substances, such as a mound of sand, dry potting soil, wet soil or a block of sod. Place a sample of each substance in a bowl and pour water on it from a watering can or a cup with small holes in the bottom. Encourage students to observe and record what happens to each sample, drawing conclusions about which substance is best able to resist weathering by running water and why.
- Introducing a rock tumbling kit into the classroom can be an exciting learning experience about the effects of physical weathering. Though you may have to set it up in a closet or have it run only at after-school hours because of the noise factor, students will see how rocks or minerals are rounded over time by the effects of weathering.
- Share with students a book about sand dunes like *Sand on the Move: The Story of Dunes* by Roy A. Gallant (Watts, 1997). Then students can model the role of erosion and deposition in the formation of sand dunes by spreading newspapers over a table, and creating a pile of sand. Students can then take turns simulating wind by blowing through a straw, observing the results of this “wind” on the pile.

Suggested Internet Resources

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

- agc.bio.ns.ca/schools/EarthNet

The EarthNet Project is a Web site developed by the Geological Survey of Canada for Earth Science teachers and students of all ages. It is a virtual resource center for science topics like erosion and glaciers, containing online activities and lessons. (Continued)

- www.fi.edu/fellows/fellow1/oct98/act/payton3.htm
This activity from the Rock Hounds Web site helps illustrate the effects of wind and water on the Earth's surface.
- www.geo.umn.edu/people/grads/gcatania/antarctica/lesson5.htm
“Real Glaciers Eat Rocks” is a page from the Glacier Project Website developed by Rice University to explain how glaciers slowly transform landscapes.
- nesen.unl.edu/teacher/activities/soils.html
This site provides an overview of the processes that form soil and includes some hands-on activities that clearly show how soil erosion can be reduced.

Suggested Print Resources

- Farndon, John. *How the Earth Works*. Reader's Digest, New York, NY; 1992.
- Hiscock, Bruce. *The Big Rock*. Aladdin Paperbacks, New York, NY; 1999.
- Prager, Ellen J. *Sand*. National Geographic Society, Washington, DC; 2000.
- Rutten, Joshua. *Erosion*. Child's World, Chanhassen, MN; 1999.
- Winner, Cherie. *Erosion*. Carolrhoda Books, Minneapolis, MN; 1999.

TEACHER'S GUIDE CONSULTANT

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All About Weathering & Erosion

Grades K-4

This guide is a supplement, designed for educators to use when presenting this program in an instructional setting.

Before Viewing: Research in learning suggests that it is important for the teacher to discover what the students know — or think they know — about a topic, at the start of a new unit, so that their accurate conceptions can be validated and reinforced, and their misconceptions identified and corrected. Therefore, after reviewing the pre-viewing discussion questions provided for your class, create an “Everything We Know About...” list. Preview key vocabulary words and have students raise additional questions they hope will be answered by this program. Most importantly, students should be told that as “science detectives” they must listen closely, so that after viewing the program, they will be able to tell whether or not the facts/beliefs they put on their list were scientifically accurate.

After Viewing: After a brief discussion about the program, challenge your “science detectives” to prove or disprove the accuracy of the facts they put on their “Everything 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 rocks, soil and other materials that make up the Earth's surface are always changing due to the forces of weathering, erosion and deposition. Weathering is a natural process that breaks rocks into smaller and smaller pieces. Erosion is a process that takes place when those pieces are carried away from their original locations, and deposition occurs when the small rocks and soil end up in another area, helping to create new land. Sometimes, as in rockslides, erosion and deposition happen quickly. More often than not, weathering and erosion happens so slowly that you can't even see it.

Forces like wind, snow and rain are responsible for the physical weathering of rocks, causing them to be worn down, cracked or broken into smaller pieces. Wind picks up sand and other particles, blowing them against rocks, buildings, statues and other surfaces. Waves crashing against rocks at the shoreline wear away those rocks, turning rock particles into sand. In fast-flowing streams, rocks tumble against each other, smoothing and rounding out rough surfaces. These are all examples of abrasion. Temperature changes, especially from day to night, also cause physical weathering. The cold of night causes rocks to shrink or contract. In daylight, the sun heats and expands the outer layers of rock while the insides are still cold. This temperature difference causes outer layers of rock to flake off. Because water expands when frozen, water that seeps into cracks on rocks' surfaces can freeze and cause rocks to split open. Animals and plants can also cause physical weathering. Animals that burrow into the ground, digging their homes under and between rocks, are unknowingly responsible for exposing those rock surfaces to wind, water and temperature changes. Like the splitting of rocks by freezing water, the pressure of growing plant roots that have moved into cracks and holes in rocks cause them to split open as well.

Rocks are also changed through the process of chemical weathering. Chemical weathering can occur when certain chemicals called acids dissolve rocks and change them into new substances. Many of the minerals that make up rocks will slowly dissolve as the weak acids found in water react with the rocks. This type of weathering can be seen in the many interesting rock formations often found in limestone caves. The water that slowly soaks and drips into the cave changes the rocks over many years. Some plants also give off weak acids that can dissolve or change rock surfaces.

Once weathering breaks down land, the process of erosion carries rocks and soil away, while the process of deposition helps create new land somewhere else. Many of the same forces that cause weathering, such as wind, running water, waves and ice, can also carry away rocks and deposit them elsewhere. Wind picks up and carries dust, sand and other things. When the wind stops, these fragments fall to the ground in new locations. During heavy rains, when the soil can hold no more water, the excess water called runoff carries away topsoil that is not protected by plants. Heavy runoff can create streams that wear away the land. As streams flow into rivers, the soil, sand and rocks carried by the water are deposited along the sides and at the mouth of rivers.

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Although weathering, erosion and deposition cause some problems for people, these natural processes also have benefits. For example, while topsoil is washed or blown away by wind and rain, rich new land that is good for growing crops is deposited along shores and at river deltas. Ocean waves weather and erode rocks, but the sand that is deposited on shorelines often protects homes along the shore from damage by storms. Glaciers gouge out huge mountain valleys, and they are also responsible for creating thousands of lakes from melting blocks of ice. As these large sheets of ice move over the Earth, they carry soil and rocks and deposit them in new places, creating new land formations. Understanding the ongoing natural cycle of weathering, erosion and deposition helps us understand our changing Earth.

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 show.

weathering — The breaking up of rock and other materials of the Earth's surface into smaller pieces. Weathering can be described as physical or chemical.

erosion — The moving of rocks and soil to other places.

deposition — The dropping of weathered materials in a new location.

physical weathering — The cracking, breaking, wearing and grinding down of rocks by changing temperatures, ice, living things and abrasion.

abrasion — The grinding or rubbing away of rocks by solid particles that are carried by wind and water.

Mount Rushmore — A mountain in South Dakota into which the world's largest sculptures have been carved — the heads of four United States presidents.

granite — Extremely hard rock that forms from volcanic activity.

chemical weathering — The changing of rocks into new substances by water and acids.

acids — Chemicals that can break down or change some other substances.

carbonation — The process by which a weak acid is created by combining water and carbon dioxide gas bubbles. Carbonation dissolves many rocks and minerals.

runoff — Water from melting snow and rain that carries rocks and soil away.

delta — The area at the mouth of a river where eroded materials are often deposited. The soil in a delta is very good for growing crops.

glaciers — Gigantic deposits of ice that can move and erode the landscape.

Pre-viewing Discussion

Before students generate their list of "Everything We Know About..." 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 are some ways that the surface of the land changes over time?
- How strong are rocks? What forces of nature are strong enough to break rocks into pieces?
- How can dirt, sand and rock pieces move from one place to another?

After the class has completed their "Everything We Know About..." list, and before watching the show, 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

You may wish to ask your class the following questions to assess their comprehension of key points presented in the program.

1. What is weathering?
2. Can you give an example of weathering in action?
3. What is erosion? What causes it?
4. What is deposition? What does deposition have to do with erosion?
5. Can we easily see the effects of weathering, erosion and deposition? Why or why not?
6. How does wind cause physical weathering?
7. Water can cause weathering. How does water do this?
8. How can changes in temperature cause rocks to erode?
9. How can a rabbit or a flowering plant be responsible for causing rocks to be weathered?
10. What are acids?
11. What does soda have in common with the acids responsible for the chemical weathering of rock?
12. What are some differences between physical and chemical weathering?
13. What is runoff? How does runoff create erosion?
14. Explain how glaciers can be responsible for weathering, erosion and deposition.
15. In what ways can humans help to stop weathering and erosion?
16. What are some benefits of the natural processes of weathering, erosion and deposition?

Follow-up Discussion

The most important part of this segment is to examine both the facts and beliefs generated by the class in their "Everything We Know"
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