

- Students can observe the effects of physical weathering caused by plants with this activity. Soak bean seeds in water and then mix them with plaster in a styrofoam cup. After the plaster has set, remove the cup, set the plaster in a tray of water and watch what happens! The seeds will grow within the plaster and crack it open — exactly what plants do to rocks in nature.
- To model the effect of acid rain on statues, take a piece of chalk and place it in a glass $\frac{1}{4}$ full of vinegar. Observe what happens to the chalk. The result is similar to what happens when acid interacts with statues — vinegar is an acid and chalk is made out of limestone, just like many statues.
- As a class research project, have students investigate the effects of weathering and erosion on famous monuments. Students can research any restoration efforts designed to reverse the effects of these forces and can propose strategies to protect monuments in the future.

Suggested Internet Resources

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

- www.ncsu.edu/coast/chl/index.html

On this Web site, students can participate in the decision to relocate a lighthouse due to shore erosion. Information, including images of the beach erosion, is provided to help students make this decision. The site also provides an educators' guide for effectively using this activity in the classroom.

- pubs.usgs.gov/gip/acidrain/

This United States Geological Survey site presents information about acid rain and its effect on statues and monuments.

- nsidc.org/glaciers/

The National Snow and Ice Data Center offers this site about glaciers, including information about how glaciers are formed and how they move. This site also addresses the erosion caused by glaciers.

- schoolsite.edex.net.uk/192/envhome.htm

This student-created Web site contains many facts and images that illustrate weathering and erosion. Students can also test their knowledge of weathering and erosion with a quiz.

Suggested Print Resources

- Cherrington, Mark. *Degradation of the Land*. Chelsea House Publishers, New York, NY; 2000.
- Downs, Sandra. *Shaping the Earth: Erosion*. Twenty-First Century Books, Brookfield, CT; 2000.

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- National Wildlife Federation. *Geology: The Active Earth*. Chelsea House, Broomall, PA; 1997.
- Rybolt, Thomas and Robert Mebane. *Environmental Experiments About Land*. Enslow Publishers, Hillside, NJ; 1993.

TEACHER'S GUIDE CONSULTANT

Conrad M. Follmer

25 years as a K-5 Science & Math Coordinator for a Pennsylvania public school system, currently an independent consultant to elementary schools.

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Weathering & Erosion

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

Rocks and other materials on the Earth's surface are constantly subjected to the powerful forces of weathering, erosion and deposition. Weathering is the breakdown of rock and other materials into smaller pieces. Erosion is the removal or transportation of those smaller pieces of rock and soil, and deposition is the dropping off or depositing of those materials in a new location.

Rocks can be broken down by physical or chemical weathering. Physical weathering is the cracking, breaking up and grinding down of rocks into smaller pieces while maintaining the same mineral composition. This type of weathering is caused by a number of different factors. Changing temperatures cause rocks to crack and flake, ice splits rocks open, living things dig or pry open rocks, gravity causes rocks to fall and shatter, and abrasion breaks down rocks with solid particles like sand.

Chemical weathering is the breakdown of rocks as a result of a change in their mineral composition. In this type of weathering, minerals can either be added to or removed from rocks. Water and acids are the major destructive agents of chemical weathering because they can dissolve minerals that hold rocks together by chemically changing the rock and causing it to crumble. Chemical weathering can be caused by acid rain, plant acids, carbonation and oxidation. Erosion, the transportation of weathered materials, and deposition, the deposit of these materials in a new location, are processes that often occur together. Erosion and deposition can be caused by various factors. Gravity pulls rocks down slopes, wind and running water pick up and carry loose materials, waves fragment the shoreline, and glaciers erode and carve away land as they move.

Over time, humans have learned techniques to minimize the effects of these three forces of nature, such as the construction of levies, jetties and dams. However, the Earth's surface will continue to be shaped and reshaped by the formidable forces of weathering, erosion and deposition.

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.

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

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

deposition — The process of dropping off or depositing weathered materials in a new location.

physical weathering — The cracking, breaking up, wearing and grinding down of rocks and other materials on the Earth's surface by changing temperatures, ice, living things, gravity and abrasion. Rocks that are physically weathered maintain the same mineral composition. *(Continued)*

gravity — A force of attraction between objects.

chemical weathering — The process of breaking down rocks as a result of changes to their mineral composition. This type of weathering is accomplished by water, acid rain, carbonation, plant acids and oxidation.

acid rain — Rain, snow, sleet or hail that has a heavy concentration of harmful sulfuric and nitric acids. Acid rain forms when pollutants from burning fossil fuels combine with moisture in the air.

carbonation — The process in which a weak carbonic acid created by the combination of water and carbon dioxide interacts with another substance. Carbonation dissolves many rocks and minerals.

oxidation — The process in which oxygen in the air combines with minerals to weaken rock. The oxidation of iron causes rust.

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

gullies — Small cuts in hillsides caused by erosion from running water. As gullies increase in size and collect water more frequently, they become stream beds.

deltas — Large areas of fertile land at river mouths where deposits of eroded materials build up.

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

moraines — The deposits left by melting glaciers.

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 do you know about weathering, erosion and deposition? Can you think of instances when you have witnessed the effects of these forces?
- What do you think humans can do to counter the effects of these forces?

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. How do scientists define the terms weathering, erosion and deposition?
2. How are weathering, erosion and deposition related? Provide an example that illustrates their relationship.
3. What are the differences between these three forces?
4. What is the difference between physical and chemical weathering?
5. How do physical and chemical weathering combine to affect rocks?
6. What are the main agents of physical weathering? *(Continued)*

7. Explain how changing temperatures are responsible for the weathering of rock surfaces.
8. How can animals function as agents of weathering?
9. How do plants cause physical weathering?
10. Explain abrasion and give examples of the process.
11. What are the many ways in which water is responsible for weathering?
12. What is acid rain? How is it an agent of weathering?
13. What is carbonation? How does it weather rock?
14. What is oxidation? How does it cause weathering?
15. What are the major agents of erosion and deposition?
16. Using specific examples, explain how water, wind and glaciers can be agents of weathering, erosion and deposition.
17. What is the significance of the Dust Bowl of the 1930s in terms of weathering and erosion?
18. How do weathering, erosion and deposition present problems for people?
19. What techniques do humans use to counter the effects of these forces?

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.

- If you were hired to build a monument for a great hero, how would you design it to limit the natural effects of weathering and erosion over time?
- Which of the three forces (weathering, erosion or deposition) do you think is more potentially damaging? Why?

Follow-up Activities

- To examine the effects of weathering, place a piece of steel wool outside your classroom in an exposed area. For comparison, keep another piece inside the classroom. Observe the steel wool over the course of a month, keeping daily records of its appearance. Discuss the changes, and based on the results, brainstorm methods for protecting steel wool from weathering. Test these methods.

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