

Assignment Discovery Online Curriculum

Lesson title:

Unique Landforms

Grade level:

3-4

Duration:

Two class periods

Objectives:

Students will do the following:

- Learn how water and erosion affect the landscape
- Research one of three specific landforms: canyon, cave, and concretion
- Create a visual display illustrating its formation and how it evolved

Materials:

- Internet access
- Poster board, markers, colored pencils
- Print resources

Procedures:

1. Begin the lesson by asking students to name some land formations. Students may be familiar with the following:

- Mountains
- Cliffs
- Caves
- Canyons
- Islands

2. Then ask students if they know how these and other formations developed. After hearing their initial ideas, provide them with the following introduction to rocks and erosion:

- Some kinds of rocks found on Earth forms from volcanic material called magma. These rocks are known as *igneous*.
- Another type of rock, known as *sedimentary*, forms from layers of materials such as sand, small rocks, and minerals that are cemented together by water from rain and chemicals.
- The third type of rock, *metamorphic*, forms deep underground as other kinds of rock change as a result of heat, pressure, and the mixture of chemicals.
- All of these rocks are affected by *water* and *erosion*. Water running over rocks can cut deep holes in the earth, forming caves and canyons. Erosion, the wearing down of the land, can be caused by water as well as by wind, storms, and ice from glaciers.

3. Tell students that during this lesson, they will be divided into three groups to research one of three unique landforms: Carlsbad Caverns in New Mexico, Antelope Canyon in Utah, and Pumpkin Patch Concretions in California. Each group should answer the following questions:

- Where is your landform found? Locate it on a map.
- How did your landform develop?
- What forces of nature caused it to form?
- What is unique about your landform?
- What efforts are being made to preserve the landform?

The Web sites listed below provide information to answer these questions.

Carlsbad Caverns

<http://www.cr.nps.gov/history/online_books/glimpses1/glimpses22.htm>

<<http://www.nps.gov/cave/geology.htm>>

<<http://www.aqd.nps.gov/grd/parks/cave/>>

Antelope Canyon

<<http://www.dowell.com/dondowell/acanyon/slotc.htm>>

<<http://www.antelopecanyon.com/slots.html>>

<<http://www.mysteriousplaces.com/canyons/antelope2.html>>

Pumpkin Patch Concretions

<http://www.desertusa.com/mag98/oct/papr/geo_conc.html>

<<http://www.adventureware.com/pumpkin.htm>>

4. Before students begin their research, you may want to review the following key words. In the explanations given on the Web sites, these words are used to explain how each of these landforms evolved.

- *Reef*: A ridge of sedimentary rock made of shells and other remains of marine animals. Carlsbad Caverns began as a reef.
- *Limestone*: A type of sedimentary rock cemented by the mineral calcium carbonate. Most caves are limestone.
- *Sandstone*: A type of sedimentary rock made from grains of sand cemented by water and acids.
- *Shells*: The remains of marine animals that change over time into limestone.
- *Calcium carbonate*. The mineral from which limestone and other sedimentary rocks form.

5. To help answer students' questions as they conduct their research about these landforms, below is a brief description of how each landform evolved.

- *Carlsbad Caverns*. Geologists think that Carlsbad Caverns began developing 250 million years ago, when a shallow sea covered the area. Plants and animals lived in the sea. When they died, their shells and skeletons accumulated. Over time, the reef hardened into thick, compact layers of shells, algae, sponges, and a mineral called calcium carbonate. Then the sea dried, exposing the reef to the air. Movements under Earth's crust pushed the reef upward, creating limestone mountains. Trees and plants grew on the mountains, causing cracks to form in the limestone. As rain poured into the limestone, the limestone began to dissolve, which began the process of cave formation underground. Eventually, the large rocks that formed the ceiling of the cave fell, creating more underground chambers. As water seeped into the cave, interesting formations, such as stalactites (iciclelike deposits of calcium carbonate formed by the dripping of water from the ceiling of the cave) and stalagmites (a deposit of calcium carbonate formed on the floor of a cave by the drip of calcareous water) formed.
- *Antelope Canyon*. This canyon is an example of a slot canyon, or a narrow, deep crevice in the earth cut by the movement of water and wind. Made of sandstone, Antelope Canyon evolved from hairline cracks that became larger from flowing water. This canyon is a series of passageways of varying widths and heights. Visiting this canyon can be dangerous. In August 1997, a group of people were caught in a flash flood in the canyon. But visitors still come to view the canyon, because it is an extremely beautiful land formation.
- *Pumpkin Patch Concretions*. A concretion is a compact mass of minerals resistant to erosion that forms around a small object made of a different material. The Pumpkin Patch Concretions are rare formations that resemble pumpkins in size and shape. These concretions began as underground sandstone. An above-ground crust of calcium carbonate and other cementing chemicals protected the sandstone. Rainwater dissolved these chemicals at the surface and carried them into the ground, where they clustered around an organic material, such as a leaf, tooth, or piece of shell. Over a long period of time, the erosion from wind and rain stripped the softer material, exposing the “patch” of concretions. Their shapes and textures are quite varied, just as pumpkins can be.

6. After each group has completed its research, have them create a visual display of their landform. Make sure the displays answers all the research questions. Encourage students to be as creative as possible in illustrating their landform.

7. During the next class period, have each group present its display to the class. After all the groups have shown their work, discuss how the landforms are alike and different. What features do they share? What makes each of these landforms unique?

Discussion Questions:

1. Compare and contrast the way a cave and a canyon form. How is this process similar? How is it different?
2. Describe the role water plays in shaping our landscape. Discuss how rain and flowing water both change the land.
3. Is there an interesting landform near where you live? If so, describe what it is and what makes it unique. If you don't live near an interesting landform, describe one that you have visited or read about in a book.

Evaluation:

Use the following three-point rubric to evaluate how well students conducted their research, created their display, presented their display, and participated in class discussions:

Three points: strong research skills; developed creative and innovative ways to present information; gave a detailed, interesting report to the class; and participated actively in class discussions and activities.

Two points: on-grade-level research skills; developed competent ways to present information; gave a satisfactory report to the class; and was somewhat engaged in class discussions and activities.

One point: weak research skills; did not complete the display; gave a brief report with some errors to the class; and was not engaged in class discussions and activities.

Extension:

The United States: Diverse Landforms

Explain that the United States has almost every kind of landform you can think of. From tall mountains to volcanoes, geysers to islands, they can all be found here. Ask the class to create a map highlighting some of these natural wonders. Tell them to be creative in developing a key to illustrate each landform. Provide some examples for their map, such as the National Seashore in Cape Cod, Massachusetts; the Great Lakes in Michigan; the Florida Everglades; the Grand Canyon in Arizona; and Big Sur in California. Have them use an encyclopedia or atlas to create their map. The following Web site also has useful information: <<http://www.nps.gov/cave/geology.htm>>, as well as the other sites included in the lesson.

Suggested Reading:

A Grand Canyon Journey: Tracing Time in Stone

Peter Anderson. Franklin Watts (A Division of Grolier Publishing), 1997.

The Grand Canyon is an amazing landform created by the roaring Colorado River over the centuries. Through text and photographs, the reader can take a journey to the bottom of the canyon through the many layers of rock, back in time, and learn about the history of our Earth. Some of the topics in this book are prehistoric people who lived in the Grand Canyon area and the amazing effect of water on rock over time. A glossary and further resources are included.

Rocks (Earth Science series, vol. 2)

Grolier Educational, 2000.

Using lots of color photographs woven together with the text, this is an eye-catching introduction to the nature and property of rocks. The first chapter defines rocks and the kinds of minerals found in them. Three further chapters cover the three kinds of rock: igneous, sedimentary, and metamorphic and how they can be identified. Small, boxed insets give added explanations. An extensive glossary helps round out this beautiful presentation.

Vocabulary:

calcium carbonate

Definition: The mineral from which limestone and other sedimentary rocks form.

Context: **Calcium carbonate** is an important mineral, and its interaction with water has resulted in beautiful land formations.

canyon

Definition: Deep crevices in rocks that usually form as a result of flowing water and erosion.

Context: The Grand Canyon is an example of a plateau **canyon**, while Antelope Canyon is a slot **canyon**.

cave

Definition: A natural underground chamber formed by the interaction of rainwater and limestone.

Context: Carlsbad Caverns, some of the most famous **caves** in the United States, have three main levels, the deepest of which is 1,320 feet into the ground.

concretion

Definition: A compact mass of minerals, usually round in shape, embedded in a rock of a different composition.

Context: **Concretions** come in all sizes, shapes, textures, and colors and are an interesting geological formation.

erosion

Definition: The wearing away of the land by wind, water, or the movement of glaciers.

Context: Many of this country's natural wonders are formed by **erosion**.

limestone

Definition: A type of sedimentary rock cemented together by the mineral calcium carbonate.

Context: Most caves are made of **limestone**.

reef

Definition: A ridge of sedimentary rock made of shells and other remains of marine animals.

Context: Geologists think that Carlsbad Caverns began as a **reef** covered by a shallow sea.

sandstone

Definition: A type of sedimentary rock made from grains of sand cemented by water and acids.

Context: **Sandstone** is a common type of sedimentary rock.

shells

Definition: The remains of marine animals that change over time into limestone.

Context: **Shells** are the building blocks of reefs and other geologic formations.

Academic Standards:

This lesson adheres to the National Science Education Standards for students in grades K-4:

- Earth Science
- Physical Science

Credit:

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This lesson was developed in consultation with Dianne Hoffman, consulting teacher in Montgomery County, Maryland.

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