



Earth's Changing Surface

Subject

Earth Science

Grade level

5-8

Duration

Two class periods four days apart, allowing a few minutes every day for observation

Objectives

Students will

- explain how caves are formed;
- demonstrate how speleothems are formed; and
- describe the difference between stalactites and stalagmites.

Materials

- Food coloring (optional)
- Glass jars (jelly jars or chemistry beakers), 2 per student group
- Plastic-coated plate or petri dish, 1 per student group
- Plastic spoon, 1 per student group
- Thick twine, 1 length per student group
- Baking soda, about $\frac{1}{2}$ cup per student group
- Warm water
- Magnifying glasses, 1 per student group
- Science logs, 1 per student
- *Earth's Changing Surface* video and VCR or DVD and DVD player
- Computer with Internet access (optional)

Procedure

1. Introduce the lesson by talking about caves. What are caves? How are they formed? What kinds of rock and crystal formations are found inside caves? A good way to introduce this information is to view the "Exploring Caves" segment of *Earth's Changing Surface*.
2. After watching the program, tell students they will make their own stalactites and stalagmites using baking soda, water, and string. Make sure students understand that although their classroom models should form within a few days because you are using concentrated solutions and help from the sun, natural speleothems in caves take thousands of years to form.

3. Divide students into groups of five and give each group the supplies they will need to make their speleothems (baking soda, warm water, jars and plate or petri dish, plastic spoon, twine, and food coloring). Have students place their jars about 6 to 12 inches apart in a warm, sunlit, and stable area of the classroom where they can be left out untouched for a few days.
4. Direct students to fill the jars about halfway with warm water and dissolve as much baking soda as possible to create a saturated solution. They may stir a few drops of food coloring into the solution. Then have them pour a small amount of dry baking soda on the plate or petri dish and place it between the two glasses. Have students saturate their lengths of twine in the water-baking soda solution and drape them between the glass jars. They will place both end of twine well into the glasses and make sure the center drips directly over the plate or petri dish.
5. Once students have set up their group experiment, have them draw a picture of it in their science logs and record any predictions about what will happen over the course of the experiment. Tell students they will observe their experiment once a day for several days. Each student will record the changes in a science log because their records are an important part of the scientific process. Discuss the experiment and ask students to tell you their predictions.
6. For the next three days, have students spend a few minutes observing their experiments, discussing them with their group, and recording the changes in their science logs. Give the groups a magnifying glass to closely observe the crystals; stalactites and stalagmites should form by the fourth day.
7. End the experiment once stalactites and stalagmites have formed. Have students make one final entry into their science logs to record how the experiment changed and if they made accurate predictions. Discuss the formations. Did crystals form up from the dishes or down from the twine? Talk about the classroom formations and why they formed as they did. Allow students to walk around the classroom and observe all the experiments. Talk about the different kinds of speleothems in caves. What are the differences between stalactites and stalagmites? How closely do the classroom formations mirror natural speleothems? Allow students to spend time looking at pictures of real speleothems on the following Web sites:

http://www.lcc.ctc.edu/departments/natural_sciences/pictures/cavepics.xtm

<http://www.nps.gov/wica/Speleothems.htm>

<http://www.nps.gov/jeca/tour-pictures.htm>

Evaluation

Use the following three-point rubric to evaluate students' work during this lesson.

3 points: Students actively participated in class discussions; worked cooperatively in their groups; used science materials wisely; correctly recorded information about the experiment in their daily science log; and could explain the differences between stalactites and stalagmites.

2 points: Students somewhat participated in class discussions; worked somewhat cooperatively in their groups; used the science materials somewhat wisely; recorded

two or three days of the four day experiment in their science logs; and could explain the differences between stalactites and stalagmites with assistance.

1 point: Students somewhat participated in class discussions; were unable to work cooperatively in their groups; were unable to use the science materials without teacher assistance; recorded one or two days of the four day experiment in their science log; and could not explain the differences between stalactites and stalagmites.

Vocabulary

deposition

Definition: The act or process by which an agent of erosion (such as wind or water) leaves behind sediment

Context: The formations inside the Caverns of Sonora, near San Antonio, Texas, erosion and deposition worked together.

erosion

Definition: The act or process of being worn away by the action of wind, water, or glacial ice

Context: Erosion helps create caves, canyons, and other marvels of nature.

speleothem

Definition: A calcite deposit created when the calcium carbonate dissolves in water seeping through limestone cave walls

Context: Like caves, speleothems form very slowly over time.

stalactite

Definition: a deposit of calcium carbonate resembling an icicle hanging from the roof or sides of a cavern

Context: Speleothems that grow downward from the ceiling of a cave are called stalactites

stalagmite

Definition: A deposit of calcium carbonate formed on the floor of a cave by the drip of calcareous water

Context: The formations on the bottom of caves that grow upward from deposits of mineral-rich water are stalagmites.

weathering

Definition: To undergo or endure the action of the elements

Context: The powerful forces of weathering, erosion, and deposition contribute to the formation of caves.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K–12. To view the standards, visit <http://books.nap.edu>.

This lesson plan addresses the following national standards:

- Science as Inquiry: Understandings about scientific inquiry
- Earth and Space Science: Structure of the earth system

The National Council for Geographic Education (NCGE) provides 18 national geography standards that the geographically informed person knows and understands. To view the standards online, go to www.ncge.org.

This lesson plan addresses the following standard:

- Physical Systems: The physical processes that shape the patterns of Earth's surface

Credit

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