

Understanding: Volcanoes: Teacher's Guide

Grade Level: 6-8

Curriculum Focus: Earth Science

Lesson Duration: Two class periods

Program Description

Once, the power of volcanoes was thought to be the work of the gods. Now scientists better understand the subterranean forces that cause these steaming mountains to spew fire and molten rock. Follow the pace and rhythm of geologic movement and time, and see how scientists track this motion to predict the next time a volcano will blow.

Onscreen Questions and Activities

Segment 1, Understanding: Volcanoes, Part One

- Pre-viewing questions:
 - What important function do volcanoes perform for the Earth? (*Volcanoes act like cooling vents by releasing heat from Earth's core.*)
 - What is the difference between magma and lava? (*When liquid rock is below ground it's called magma. Liquid rock that has been forced above ground is known as lava.*)
 - Discuss the implications of the plate tectonic theory. How has this theory changed the way people think about the geological history of Earth?
- Activity: Have students research shield, cinder, and composite volcanoes. Divide the class into three groups and have each group make a model of one type. Compare the slope, diameter, and composition of the different models.

Segment 2, Understanding: Volcanoes, Part Two

- Pre-viewing questions:
 - What is the "Ring of Fire"? (*The "Ring of Fire" is a 10,000-mile belt of volcanoes marking the borders of several Pacific-area tectonic plates.*)
 - What is a fumarole? (*A fumarole is a hole or vent in the ground near a volcano that emits trapped gases from inside the volcano.*)
 - How do you think monitoring ground motion, geochemistry, and lava flows helps scientists draw conclusions about volcanic activity?
 - Could a volcanic eruption ever be controlled? How would this benefit society?

- Activity: Have students research the eruption of Mount St. Helens and track its short- and long-term ecological effects. Using a map, graph the destruction and recovery of the environment and species in the area.
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Lesson Plan

Student Objectives

Students will understand:

- There are three types of volcanoes: shield volcanoes, cinder cones, and composite volcanoes.
- A shield volcano produces lava, or molten rock, when it erupts; a cinder cone produces ash; and a composite volcano is a combination of the first two.
- Each type of volcano has a distinct shape.

Materials

- *Understanding: Volcanoes* video and VCR, or DVD and DVD player
- Basic information about volcanoes (such as an article from a good encyclopedia)
- Computer with Internet access
- Paraffin or broken crayons
- Stove or hot plate
- Double boiler
- Wax paper
- Metal tray
- Refrigerator
- Sand
- Large paper cup
- Newspaper
- Rulers

Procedures

1. To prepare for this activity, line a metal tray with wax paper and place it in the refrigerator until chilled.
2. Review with your students what they already know about volcanoes. Make sure they understand the terms *magma*, *lava*, *vent*, and *crater*. Then tell them that there are three different types of volcanoes, and they are going to make models of each type.



3. On the chalkboard, write the names of the three different types of volcanoes: shield volcano, cinder cone, and composite volcano.
4. Have students use the research materials you have provided or the Internet to find a description for each type of volcano, an explanation of how each type is formed, and an actual example of each type. Before students begin making their models, they should know the following:
 - A shield volcano is formed when a large amount of free-flowing lava, or molten rock, spills from a vent, or opening in the earth, and spreads widely. The lava gradually builds up a low, broad, dome-shaped mountain. (Example: Mauna Loa in Hawaii.)
 - A cinder cone builds up when mostly ash erupts from a vent and falls to the earth around the vent. The accumulated ash forms a cone-shaped mountain that appears flat on top. (Example: Parícutín in Mexico.)
 - A composite volcano is formed when both lava and ash erupt from a vent. The materials pile up in alternate layers around the vent and form a cone-shaped mountain that comes to a point on top. (Examples: Mount Fuji in Japan, Mount Vesuvius in Italy.)
5. Divide your class into three groups, and assign each group one type of volcano to model.
6. To make a model of a shield volcano, students will need adult supervision. Have students follow these steps with the help of an adult:
 - a) Melt 2 or more cups of paraffin or broken crayons in a double boiler, and very slowly pour the hot liquid onto a chilled metal tray covered with wax paper.
 - b) Stop pouring when the pool of melted paraffin is 5 inches in diameter.
 - c) Allow it to cool.
 - d) Remelt the remaining paraffin, and then pour again.
 - e) Stop and wait.
 - f) Repeat several more times.
7. To make a model of a cinder cone, have students follow these steps:
 - a) Pour sand from a large paper cup onto some newspaper.
 - b) Continue pouring until your "volcano" is about 8 inches high.
8. To make a model of a composite volcano, have students follow the steps for the shield volcano, alternating layers of sand with the layers of melted paraffin or crayons.
9. Have students compare the models.
10. Each student should write a paragraph explaining how his or her model was constructed and which natural materials are represented by the materials used in the model.

Discussion Questions

1. How could you use the theory of plate tectonics to explain how a typical volcano works?
2. Explain how heat built up when Earth first formed. Speculate on how it might be sustained.
3. Hawaiian volcanoes produce two types of the same variety of lava. Pahoehoe is smooth and ropy; aa is chunky. Formulate a hypothesis as to why the same lava can have two different appearances.
4. Explain how gas concentrations could possibly signal a volcanic eruption.
5. Compare Kilauea to White Island volcano.
6. Describe the danger in an eruption such as the ones at Mt. Pinatubo and Mt. St. Helens.

Assessment

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

- 3 points: Student's paragraph provides clear explanation of how model was constructed; accurate account of which natural materials the materials in the model represent; error-free writing.
- 2 points: Student's paragraph provides adequate explanation of how model was constructed; accurate account of which natural materials the materials in the model represent; some writing errors.
- 1 point: Student's paragraph provides vague, sketchy explanation of how model was constructed; partially inaccurate account of which natural materials the materials in the model represent; numerous writing errors.

Vocabulary

fumarole

Definition: A hole in a volcanic area from which hot smoke and gases escape.

Context: Trapped water in volcanoes is turned into steam. Jets of it spew through holes called fumaroles.

ground deformation

Definition: Bulges in the Earth's surface caused by swelling in a volcano's magma chamber.

Context: Bulges in the Earth's surface are outward signs of swelling in the magma chamber. The movement is called ground deformation and is measured by surveying the landscape's tilt.

plate tectonics

Definition: A theory of global dynamics having to do with the movement of a small number of semirigid sections of Earth's crust, with seismic activity and volcanism occurring at the margins of these sections.



Context: Plate tectonics theory says Earth's surface is a jigsaw of plates that drift fast and slow and in all directions, floating on a hot layer of rocks.

pyroclastic flow

Definition: Eruption from a volcano consisting primarily of fragmented rock.

Context: The blast wave traveled downslope at the speed of sound, flattening whole forests and blasting 600 tons of ash into the atmosphere. Pyroclastic flow, the scientists called it.

subduction

Definition: A geologic process in which one edge of one crustal plate is forced below the edge of another.

Context: Subduction occurs when one plate moves under another.

tephra

Definition: Post-eruption layers of land composed of volcanic lava and fragmented rock.

Context: Volcanologists map the build-up of land formed by lava and fragmented rock called tephra.

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 science standards:

- Earth and Space Science: Structure of the Earth system

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/compendium/browse.asp>.

This lesson plan addresses the following national standards:

- Science – Earth Science: Understands Earth's composition and structure.
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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