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

- Where are most volcanoes found?
- Why do scientists study volcanoes?
- How do volcanoes help people?

Follow-up Activities

- Students can build their own models of an erupting volcano using a cup of liquid soap, a cup of baking soda, a cup of red, powdered, watercolor paint and a cup of white vinegar. Students can create a mock volcano using crumpled paper, papier-mâché, clay, sand or potting soil molded around a plastic soda bottle. Students should mix together the soap, baking soda and paint, and pour the mixture through a funnel into the bottle. The vinegar can be added when students are ready for the eruption. Encourage students to compare this "eruption" with a real volcanic eruption. How are they similar and different?
- Share the story *Dear Katie, the Volcano Is a Girl* by Jean Craighead George with your class (Hyperion Books for Children, 1998). Discuss with your class the difference between the scientific facts and the myths in this story. Encourage your students to write their own myths about the eruption of a volcano.
- Encourage students to create a comic strip that illustrates the stages of a volcanic eruption. Frames can indicate magma in the magma chamber, magma in the central vent, lava coming out of the crater and lava building up the volcanic mountain over time. The students' strips can be gathered in a class "Volcano Comic Book."

Suggested Internet Resources

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

- **volcano.und.edu/vwdocs/kids/kids.html**
  The Volcano World Web site offers "Kids' Door" pages that include a great deal of information about volcanoes for children. Students can read stories, legends and myths about volcanoes, in addition to testing their knowledge and research skills with a self-quiz. Activities, projects and games are also provided.
- **www.fema.gov/kids/volcano.htm**
  The Federal Emergency Management Agency for Kids Web site is a helpful resource for students learning about volcanoes. Exciting photographs of erupting volcanoes are provided, along with volcano facts and information about active volcanoes.

(Continued)

- **library.thinkquest.org/J001393/volcanoes/1.htm**
  This site, created by elementary school students, is a creative presentation of information about volcanoes. Students take a virtual trip to Hawaii to learn about volcanoes and to become a volcano expert. Self-quizzes are provided throughout the trip.

Suggested Print Resources

- Herman, Gail. *The Magic School Bus Blows Its Top: A Book About Volcanoes.* Scholastic, New York, NY; 1996.
- Simon, Seymour. *Volcanoes.* HarperCollins Publishers, New York, NY; 2006.
- Van Rose, Susanna. *Volcanoes & Earthquakes.* DK Publishing, New York, NY; 2004.

TEACHER'S GUIDE CONSULTANT

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Earth Science for Children™

All About Volcanoes

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.

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Program Summary

Volcanoes are openings in the surface or crust of the Earth through which melted rock called magma can flow out during eruptions. Once magma reaches the Earth's surface, it is called lava. As escaping lava cools, hardens and builds up over time, it creates a volcanic mountain. Many volcanoes form at the edges of the huge, cracked rock plates that make up the Earth's crust. These plates are like jigsaw puzzle pieces that float on the magma below.

If we could cut a volcano in half to look inside, we would see three important parts. A huge pool of melted or molten magma builds up right under the crust, forming what is called a magma chamber. Extremely hot liquid magma from the chamber pushes on the crust above it, finding cracks and weak spots through which it can make its way to the surface. The main pathway through which the magma travels is called the central vent. Once magma reaches the Earth's surface, it erupts as lava from a funnel-shaped opening at the top of the vent called the crater. Lava can also erupt from other cracks or weak spots in the sides of a volcanic mountain.

Shield, cinder cone and composite volcanoes are three types of volcanoes formed in different ways. A shield volcano has runny lava that flows out of the crater and down the sides, forming a wide, shield-shaped mountain. A cinder cone has a much more violent eruption, usually exploding in fiery clouds of ash, rather than flowing lava. When a cinder cone erupts, pieces of rock, some as fine as sand and others the size of houses, fly into the sky. This type of volcano usually forms cone-shaped mountains from layers of ash and cinders. Composite volcanoes are formed as layers of cinder and hardened lava build up over time, creating a volcanic mountain with steep, even sides. All types of volcanoes can be labeled as active, dormant or extinct. Active volcanoes erupt regularly. Dormant volcanoes have erupted in the past, but have not done so recently. Extinct volcanoes may not have erupted for thousands of years, but that doesn't mean that they can't erupt again.

Scientists have several tools to help predict eruptions. When hot magma starts rising, the ground and lakes near the volcano begin to heat up. When scientists see major temperature changes, they know that a volcanic eruption is possible. Scientists also use instruments called tiltmeters placed on the sides of mountains to see if a volcanic mountain is changing shape. If an eruption is close, the sides of the mountain actually swell from the pressure of rising magma. Earthquakes, which occur before and during a volcanic eruption, are recorded on instruments called seismographs, alerting scientists that an eruption may be coming.

Though they can be extremely dangerous, volcanoes are not all bad. Volcanoes can form new islands. Cooled lava, in time, actually creates very fertile soil for crops and, in some places, ash and lava rocks are used for paving roads. In some places, people actually use the heat from underground magma to generate electricity and heat their homes. Understanding volcanoes help us to better understand our 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 video.

core — The solid center of the Earth made of very hot, solid metal.

mantle — The layer of the Earth surrounding the core that is made of very hot, melted rock.

magma — The melted rock found beneath the Earth's surface in the mantle.

volcano — A mountain built by magma and other materials that erupt or flow out of the Earth.

lava — Magma that has erupted and reaches the Earth's surface.

crust — The outer layer of the Earth that is made of hard rock.

eruption — The sudden release of materials like lava, dust, cinders, gases or ash from a volcano.

plates — Large, cracked pieces of rock that make up the Earth's crust. These plates float on the mantle.

magma chamber — An underground pool of magma found in a volcano.

central vent — The main opening in a volcano through which lava and other volcanic materials erupt.

crater — The funnel-shaped opening at the top of a volcano.

shield volcanoes — Gently sloped volcanoes that are created by layers of runny lava.

cinder cone volcanoes — Low, cone-shaped volcanoes made mostly from erupting cinders or pieces of scorched rock.

composite volcanoes — The tallest and most explosive type of volcanoes made from layers of cinders and hardened lava.

Pompeii — A town in Italy that was totally covered by hot ash and mud from an eruption of Mount Vesuvius in 79 C.E.

active volcanoes — Volcanoes that erupt constantly or regularly.

dormant volcanoes — Volcanoes that erupted in the past but not recently. Dormant volcanoes are expected to erupt in the future.

extinct volcanoes — Volcanoes that have not erupted for thousands of years and are not expected to erupt again.

tiltmeter — A tool used to monitor the changing shape of a volcanic mountain to predict an eruption.

seismograph — An instrument used to record the motion of the Earth during an earthquake.

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 volcanoes?
- What happens during a volcanic eruption?
- Why do volcanoes erupt?

(Continued)

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. Describe the layers of the Earth (core, mantle, crust).
2. What is a volcano?
3. What happens when a volcano erupts?
4. What is the difference between magma and lava?
5. How is the eruption of a volcano similar to leaving an unopened can of soda in the sun?
6. What makes up the Earth's crust?
7. Why does the Earth's crust crack and break?
8. Where is a volcano most likely to form? Why?
9. Why do we have many more volcanic eruptions on the ocean floor than on dry ground?
10. What are the main parts of a volcano?
11. When an eruption occurs, does lava always flow out of the crater of a volcano? Explain your answer.
12. What is a shield volcano? How is it formed?
13. Describe a cinder cone volcano.
14. How are cinder cone volcanoes different from shield volcanoes?
15. How are composite volcanoes similar to both shield and cinder cone volcanoes?
16. Which would you rather live near: an active, a dormant or an extinct volcano? Why?
17. What is a tiltmeter? What can a tiltmeter tell us about volcanoes?
18. What is a seismograph?
19. How do scientists use seismographs to predict volcanoes?

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 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.

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