CLASSROOM ACTIVITY

# Yellowstone: Monitoring the Fire Below

Volcanoes are not all fiery cones of smoke and lava. Some can be much more subtle. Yellowstone Park, though famous for its tranquility, has been the location of some of the most violent volcanic eruptions in Earth's history. Explore the feature "Yellowstone," and learn how scientists are studying its hidden dangers.

## CLASS DISCUSSION

### Establish Prior Knowledge

Call on students to share what they know about Yellowstone National Park. Point out that although it looks like a peaceful setting, below the surface is an active volcano. You may wish to direct them to the interactive Different Magmas, Different Volcanoes (http://www.amnh.org/sciencebulletins/content/e.f.yellowstone.20060601/assets/294/) to explore four types of volcanoes.

**The Scientific Method**

Research scientists use the Scientific Method (see page three) to investigate the natural world. *Yellowstone: Monitoring the Fire Below* can be used to illustrate various methods scientists use to collect data.

### Exploration

Have students watch the video and read the synopsis. Suggest that as they watch the video, they take notes about the data collection techniques that scientists are using at Yellowstone. Use the following questions to guide a class discussion.

- What are the basic assumptions about the geologic activity at Yellowstone? What information do scientists have about previous eruptions?
- The techniques that scientists use to collect data and test their hypotheses can be grouped into three different categories: **observation** – collecting observational data in the field; **experimentation** – designing and conducting a controlled experiment, and then collecting data from the experiment; and **modeling** – gathering data from computer simulations. Which of these techniques is illustrated in this feature story? How?
- What data is being collected by the scientists featured in the video? Why?
- What observations and data might cause scientists to change their hypothesis about whether or not Yellowstone could erupt?
- How can the data be used to help predict future activity at Yellowstone?

### Wrap-Up

Use the following question to wrap up your discussion:

- What hypothesis might scientists propose based on these observations and data?

### Extend

Students who wish to learn more can visit these related links from NASA:

- NASA EARTH OBSERVATORY: NATURAL HAZARDS: VOLCANOES
  http://earthobservatory.nasa.gov/NaturalHazards/natural_hazards_v2.php3?topic=volcano
  Amaze your students with these satellite photos of recent volcanic events around the world.

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# Yellowstone: Monitoring the Fire Below (continued)

- ATMOSPHERIC SCIENCE DATA CENTER: VOLCANO TYPES
  http://eosweb.larc.nasa.gov/EDDOCS/Aerosols/Volcano_Types_Lesson.html
  In this activity, students research and identify the various types of volcanoes around the world.

- NASA EARTH OBSERVATORY: SENSING REMOTE VOLCANOES
  http://earthobservatory.nasa.gov/Study/monvoc/
  See how satellite technology is enabling scientists to detect volcanic activity around the world within just a few hours!

- WINDOWS TO THE UNIVERSE: SURFACE AND INTERIOR OF THE EARTH
  http://www.windows.ucar.edu/tour/link=/earth/Interior_Structure/overview.html
  Explore how the relationship between Earthís surface features and its interior. From the National Corporation for Atmospheric Research.

- ATMOSPHERIC SCIENCE DATA CENTER: EXPLODING VOLCANO
  http://eosweb.larc.nasa.gov/EDDOCS/Aerosols/exploding_volcano.html
  Simulate explosive volcanic pressures with this easy-to-do hands-on exercise.

# Scientific Process

The Scientific Method is a dynamic and open-ended process that scientists use when they investigate a question they have. It is not a series of prescribed steps that scientists follow to prove a hypothesis. Rather, it's a general plan that helps guide their investigation. And while all scientists use the Scientific Method, they might not use all the steps, or they may complete the steps in a different order. For example, a scientist might make observations and collect data about a subject that interests him or her for years before formulating a hypothesis.

## DEFINING A QUESTION TO INVESTIGATE

As scientists conduct their research, they make observations and collect data. The observations and data often lead them to ask why something is the way it is. Scientists pursue answers to these questions in order to continue with their research. Once scientists have a good question to investigate, they begin to think of ways to answer it.

## FORMING A HYPOTHESIS

A hypothesis is a possible answer to a question. It is based on: observations scientists make, existing theories, and information they gather from other sources. Once they have a hypothesis, scientists can begin to think about how to test it.

## TESTING A HYPOTHESIS

Evidence is needed to support or disprove the hypothesis. There are several strategies for collecting evidence. Scientists can gather their data by observing the natural world, performing an experiment in a laboratory, or by running a model. Scientists decide what strategy to use, often combining strategies. Then they plan a procedure and gather their data. They make sure the procedure can be repeated, so that other scientists can evaluate their findings.

## ANALYZING THE DATA

Scientists organize their data in tables, graphs, diagrams, and even photographs. If possible, they check the data by comparing it to data from other sources. They are looking for patterns that show connections between important variables in the hypothesis they are testing.

## DRAWING CONCLUSIONS

Scientists must decide whether the data clearly support or do not support the hypothesis. If the results are not clear, they must rethink their procedure. If the results are clear, scientists write up their findings and results to share with others. The conclusions they draw usually present new questions for them to pursue.