CLASSROOM ACTIVITY

The Rise of Oxygen

Follow geologists as they hunt for, pickaxe, and test rock samples from the 2.5-billion-year-old Huronian Supergroup, a sedimentary formation in Ontario, Canada. The scientists are in search of an exact record of how much oxygen gas Earth's developing atmosphere contained at key moments in geologic time. These crustal relics, which have interacted directly with ancient atmospheres, have the power to tell scientists when and how the Earth built up its incredible life-support system to foster more and more complex organisms.

CLASS DISCUSSION

Establish Prior Knowledge
Ask students what they know about the formation of Earth's atmosphere. Tell them that this feature story explores the relationships between the Earth, the atmosphere, and their impact on the beginnings of life on our planet.

Exploration
Ask students to take notes while they are watching the video. Use the following questions to guide your class discussion.

- The Earth formed approximately 4.5 billion years ago. Do scientists think the atmosphere formed at the same time? Why or why not?
- How do scientists think the early atmosphere might have formed?
- Why is sulfur so important in determining the age of oxygen?
- What is the correlation between the rise of oxygen and life emerging from the water to populate the land?
- What are some of the data scientists are looking for, and how are they being used to tell the story of oxygen?
- There are no samples of the early atmosphere, so how do scientists learn about it?
- Why is the Huronian Supergroup formation of particular interest to scientists?
- What are some of the techniques scientists used to learn more about the rock samples?

The Scientific Method

Research scientists use the Scientific Method (see page three) to investigate the natural world. You can use *The Rise of Oxygen* to illustrate how scientists formulate and test hypotheses.

Wrap-Up
Use the following questions to wrap up your discussion.

- What questions do you have about the history of life on Earth?
- How might one investigate these questions?

CLASSROOM ACTIVITY

The Rise of Oxygen (continued)

Extend

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

Life on Earth and Elsewhere

http://www.solstation.com/life.htm

Follow the timeline beginning with the birth of our solar system to the beginnings of life on Earth, and read about how NASA scientists use data about Earth's early evolution to study the possibilities of life elsewhere in the Universe.

The Evolution of the Cosmos

http://cmex-www.arc.nasa.gov/VikingCD/Puzzle/Prebiot.htm

How did the planets form? When did life evolve on Earth? Find out the answers to these questions plus much more on this fun-to-read site.

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.