

CLASSROOM ACTIVITY

Zircons: Time Capsules from the Early Earth

Zircons are minerals that typically exist as tiny crystals in rocks. They have, however, a big story to tell. A few zircon crystals have been found that are the oldest Earth materials ever discovered. They reveal clues about periods of geological time for which there is no direct evidence. Almost entirely as a result of studies of zircons, scientists are developing new hypotheses of what Earth's first 500 million years may have been like. Travel to a remote island off Greenland's coast and a zircon-making lab in New York State to learn how geologists are recovering and understanding these time capsules.

CLASS DISCUSSION

Establish Prior Knowledge

Explain to students that the Hadean eon refers to Earth's earliest geological time, when the planet was just forming. It is thought to have been a time when the Earth was covered with molten lava and often bombarded by meteorites and other planetary bodies. Explain that now scientists may be changing their ideas of what that time was like due to their study of the mineral zircon. Call on students to share what they know about the characteristics of minerals and how they form. *(Answers may include: A mineral is a naturally occurring solid. It has a chemical composition and a crystal structure. A mineral may be made of one element, such as copper, or two or more elements that have combined to form a compound. Minerals can form in several ways. One way is in magma. When magma cools, mineral crystals are formed.)* Tell students that, in the video they will see, they'll learn how scientists are investigating zircon crystals and rethinking Earth's earliest geologic time.

Exploration

Have students read the synopsis and watch the video. Use the following questions to guide a class discussion.

- What characteristics make zircon a good mineral to study?
(Answer: Zircon is very hard, resistant to pressure, temperature changes, and melting.)
- How do scientists determine how old a zircon is?
(Answer: When a zircon crystallizes it incorporates uranium. Over time, the uranium decays to lead. So scientists first measure the uranium and lead content of a zircon. Scientists know the rate at which uranium decays, so they can convert the ratio of lead to uranium to determine the age of the zircon.)
- Besides its age, what other information can scientists obtain from the zircon?
(Answer: Scientists grow synthetic zircons under high heat and pressure and then measure the chemical composition. One element they measure is titanium. The amount of titanium is proportional to temperature. The higher the amount of titanium, the higher the temperature at which the mineral crystallized. By measuring the titanium in a natural zircon, scientists can determine the temperature at which it crystallized.)
- Before the study of the zircons, how did scientists view the Hadean Eon?
(Answer: They thought the Earth was covered with molten lava that was about 1200 degrees C. They hypothesized that there were no continents, no ocean, and that life could not exist.)

Wrap-Up

Use the following question to wrap up your discussion:

- How has the study of zircons changed scientists' views about the Hadean Eon?
(Answers may include: The zircons that scientists tested formed at a temperature of 680 degrees C. So scientists now hypothesize that the Earth was cooler, that there were continents and oceans, and that conditions may have allowed life.)