

ON SITE:

CRYSTALS AT LARGE IN MEXICO

Eloy and Javier Delgado walk slowly into the Naica Cave in Chihuahua, Mexico. The cave is very hot, making it difficult for them to breathe. They enter a room in the cave and before them are huge 4.5-m crystals that are clear and brilliant. How did these crystals grow this large? What kinds of conditions make these crystals possible?

The climate inside the cave The large gypsum minerals are present in the Cave of Crystals, a room in Naica Cave, located 300 m below Earth's surface. Temperatures there hover around 58°C. The air here has a relative humidity of 100 percent. These extreme conditions mean that anyone entering the cave can remain only for a few minutes at a time.

Crystal formations in the cave The crystals in the Naica Cave are a crystalline form of gypsum called selenite. The crystals in this cave grow into three distinct shapes. Crystals that grow from the floor of the cave are plantlike in appearance. They are grayish in color from the mud that seeps into them as they grow. Sword-like crystals cover the walls of the cave. These crystals grow to lengths of 0.5 m to 1 m and are opaque white in color. Within the main room of the cave, there are crystals with masses of up to 27 kg and up to 8.25 m long and 1 m wide.



Cave of Crystals, part of Naica Cave in Chihuahua, Mexico is known for its large crystals.

How did these crystals form? Crystals need several things in order to form. First, they need a space—in this case, a cave. Caves form as a result of water circulating along weak planes in a rock. Over time, the rock dissolves and a cave is formed. Second, crystals need a source of water that is rich in dissolved minerals. Crystal formation also depends on factors such as pressure, temperature, level of water in the cave, and the chemistry of the mineral-rich water.

In 2006, geologists determined that the crystals' massive sizes resulted from the steady temperature of about 58°C while the cave was full of mineral-rich water. As long as the crystals remained in this environment, they continued to grow. Because the crystals are so large, scientists think that the Cave of Crystals had these conditions for thousands of years.

WRITING in Earth Science

Research Visit glencoe.com to conduct research about the processes that form crystals in a cave. Pick a cave and make a brochure describing and illustrating the types of crystals found there.

GEOLAB

DESIGN YOUR OWN: MAKE A FIELD GUIDE FOR MINERALS

Background: Have you ever used a field guide to identify a bird, flower, rock, or insect? If so, you know that field guides include more than photographs. A typical field guide for minerals might include background information about minerals in general and specific information about the formation, properties, and uses of each mineral.

Question: Which mineral properties should be included in a field guide to help identify unknown minerals?

Materials

Choose materials that would be appropriate for this lab.

mineral samples	piece of copper
magnifying lens	paper clip
glass plate	magnet
streak plate	dilute hydrochloric acid
the Mohs scale of mineral hardness	dropper
steel file or nail	Reference Handbook

Safety Precautions

Procedure

1. Read and complete the lab safety form.
2. As a group, list the steps that you will take to create your field guide. Keep the available materials in mind as you plan your procedure.
3. Should you test any of the properties more than once for any of the minerals? How will you determine whether certain properties indicate a specific mineral?
4. Design a data table to summarize your results. Be sure to include a column to record whether or not a particular test will be included in the guide. You can use this table as the basis for your field guide.
5. Read over your entire plan to make sure that all steps are in a logical order.

6. Have you included a step for additional research? You might have to use the library or glencoe.com to gather all the necessary information for your field guide.
7. What additional information will be included in the field guide? Possible data include how each mineral formed, its uses, its chemical formula, and a labeled photograph or drawing of the mineral.
8. Make sure your teacher approves your plan before you proceed.

Analyze and Conclude

1. **Interpret** Which properties were most reliable for identifying minerals? Which properties were least reliable? Discuss reasons that one property is more useful than others.
2. **Observe and Infer** What mineral reacted with the hydrochloric acid? Why did the mineral bubble? Write the balanced equation that describes the chemical reaction that took place between the mineral and the acid.
3. **Summarize** What information did you include in the field guide? What resources did you use to gather your data? Describe the layout of your field guide.
4. **Evaluate** the advantages and disadvantages of field guides.
5. **Conclude** Based on your results, is there any one definitive test that can always be used to identify a mineral? Explain your answer.

WRITING in Earth Science

Peer Review Trade field guides with another group and test them out by using them to identify a new mineral. Provide feedback to the authors of the guide that you use.