WALNUT SHELL GEODES

INTRODUCTION

Geodes are discrete bodies of minerals with various shapes, but commonly globular or ellipsoidal. They are formed by the inward growth of minerals upon the walls of cavities in rocks. Usually geodes are hollow, but may be solid if the process of inward growth of crystals has been carried to completion. This manner of growth distinguishes geodes from nodules or concretions, which grow outward from a nucleus.

Geodes possess relatively solid siliceous or calcareous shells, which are more resistant to weathering than the enclosing rock. Upon weathering the mineral mass will be freed as a discrete entity, a geode. Not all crystalline openings in rocks can be called geodes. Vugs, for example, are inseparable from the enclosing rock—they have no shell.

Geodes and fossils seldom occur together in the same layer. Geodes can range in size from less than 0.1 inch to over 36 inches, but the average size range is about 2 to 6 inches.

An outstanding feature of the geode is the outer shell, which is usually composed of chalcedony, commonly with an outer film of clay. The shell varies in thickness from a mere film to over an inch, but the thickness of the shell is not related to the size of the geode. The outer surface of the shell is rough and pitted. The shell is usually quite distinct from the layers of crystals on the interior, as well as from the enclosing bedrock because of the difference in composition.

One of the most abundant minerals of geodes is quartz. The most common color is milky white, although some clear crystals are often present. The variety of shades of the quartz crystals is due to different oxidation states of an included iron compound. Calcite displays more variations than any other mineral deposited in the geode and is most commonly found as isolated crystals or crystal aggregates on quartz, but in some instances calcite lines the shell.

Some exotic minerals are occasionally found in geodes. Some of the minerals more frequently found include dolomite, ankerite, barite, magnetite, hematite, pyrite, chalcopyrite, sphalerite, limonite, malachite, kaolin and gypsum.

Following are two activities that will allow your students to create a model of a geode in their classroom.

OBJECTIVE

Students study a model that illustrates the processes involved in the growth of a geode.

SAFETY

The walnut shell geode will simulate the geodes found in nature. These experiments will require some student participation with teacher guidance since students will be heating solutions. Potassium alum can be harmful if ingested; so make sure students wash their hands after handling the geodes. Potassium alum is available from laboratory supply companies. Please insure that all safety precautions are followed.

MATERIALS REQUIRED

- A hot plate or other heating source
- An old saucepan
- A large spoon for stirring
- Potash alum (potassium aluminum sulfate)
- Water
- Walnut shell halves
- Empty egg cartons to hold walnut shells filled with crystal growing solution.

ACTIVITY

PROCEDURE (student directions)

1) Put 100 ml of water into a saucepan
   a) Add 36 grams of potassium alum, enough to make a saturated solution.
   b) Gently heat the solution while slowly stirring it with the spoon.
      i) If you cannot weigh the amount of alum, just slowly add it to the water while stirring until no more will dissolve.
      ii) As soon as the solution is saturated, remove it from the heat source and let it cool.
2) Place the walnut shell halves into the egg cartons and carefully pour or spoon the alum solution into the shells.
3) Set the egg carton aside where it won't be disturbed for several days.
4) As the water evaporates, observe and record crystals in the walnut shells that simulate geodes.

EVALUATION

- From the model, what conditions do you suppose are necessary for the formation of a geode?
- Test those conditions by repeating the model varying the conditions. Remember to change only one variable at a time. Start by listing the possible variables.

TEACHER TIPS

- Conditions for formation of a geode include a solution that is saturated inside the cavity moving into that cavity.
  - The solution can become saturated by evaporation, as in the model, or as occurs in nature by the dissolution or injection of more of the chemical that will eventually precipitate or some other change in conditions such as a temperature change that changes the solution to saturated and precipitating.
- The dissolved chemical needs to precipitate.
  - This can be aided by nucleation sites such as rough spots on the inside surface or by the presence of small crystals of the precipitating chemical.
- In a geode, the dissolved chemical needs to be replenished as it precipitates in order for the crystals to continue growing.
- Limitations of the model
  - This model achieves precipitation only by evaporation. Evaporation is probably not a means by which natural geodes form because inside of the geode probably doesn't have access to the atmosphere. Saturation of the precipitating chemical within the cavity must occur by some other means.
  - In this model the crystals precipitate very quickly. In nature, the precipitation would occur over a long time period in which the liquid from which the crystals precipitate is replenished and kept at saturation.

COCONUT GEODE CLASS DEMONSTRATION

The teacher for lower grade levels should do this demonstration. Higher-grade levels should have teacher guidance during the preparation stage.

MATERIALS REQUIRED

- Coconut, white removed, sprayed on the outside with lacquer or enamel paint and dried, prepared as below.
- Saturated potassium alum solution.

PROCEDURE

1) Cut a coconut in half
   a) Clean the white meat out of the coconut shell.
   b) Spray the outside of the coconut shell with lacquer or enamel paint and let dry.
   c) Drill or punch a hole into the top of the coconut.
   d) Then silicone the two coconut halves back together.
2) Carefully pour the crystal growing solution into the drilled hole.
3) Let the coconut sit for a few days.
4) If the solution has not totally evaporated after several days, pour it out.
5) Using a sharp knife or razor blade cut the coconut in half where the silicone seam is. SURPRISE!!