Earth Science and the Environment

Moon Rocks

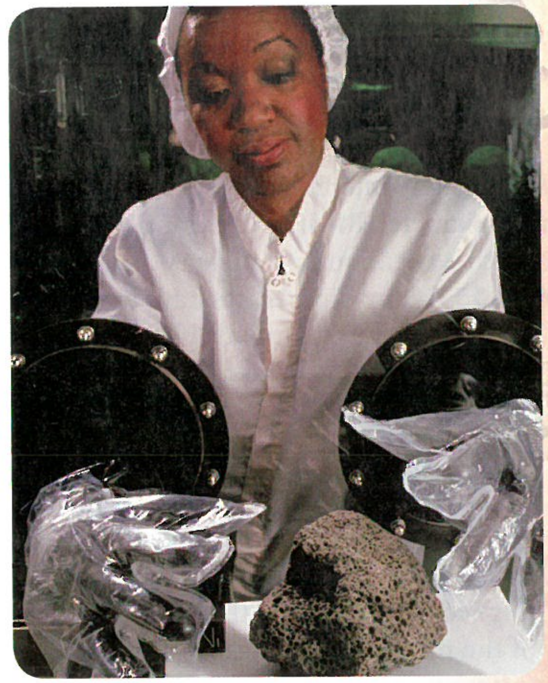
During each of the six Apollo missions, lunar rocks were collected with the hope of providing information about the Moon's origin, history, and environment. How do moon rocks compare with rocks on Earth?

Moon rock types Between 1969 and 1972, astronauts collected approximately 380 kg of lunar rocks. The 2415 individual pieces range in size from a grain of sand to a basketball.

Generally, moon rocks vary in color from gray to black to white to green. Some rocks are glassy, some are hard, and others are fragile. Analysis of the rocks has revealed at least three different rock types on the Moon. Basaltic rocks formed from lava flows and volcanic ash that reached the surface through cracks and fissures caused by meteorite impacts. Breccias formed when meteorites shattered rocks and then fused the pieces together with the heat generated by the impact. Pristine rock is rock that has not been hit by meteorites. Pristine rock is commonly composed of calcium-rich plagioclase feldspar and is gray in color.

Moon rock composition Moon rocks are unique in two ways. First, they contain no water and are not oxidized. Considering how much iron is contained in the rocks, this is a sharp contrast to weathered and rusty iron-bearing rocks on Earth. Second, the surfaces of some moon rocks are covered with tiny pockmarks called zap pits. These are caused by micrometeoroids that impact the rocks on the Moon's surface. Zap pits do not occur on Earth rocks because friction from Earth's atmosphere causes tiny meteoroids to burn up long before they reach Earth's surface.

Moon rock classification Scientists use the same categories for classifying lunar rocks as they use for igneous rocks on Earth.



This scientist is studying a piece of basalt that was collected from the lunar surface during the *Apollo 15* mission.

Based on mineral composition, scientists named a new class of moon rocks called KREEP rocks. These contain high amounts of potassium (K), rare Earth elements (REE), and phosphorus (P). These rocks are more radioactive and higher in thorium than Earth rocks.

Moon rock research Lunar rock research continues at the Johnson Space Center in Houston, Texas. The rocks are protected in stainless steel vaults in a dry nitrogen atmosphere to keep them moisture- and rust-free. Scientists continue to pose questions about these rocks as they study the Moon's origin and history.

WRITING in Earth Science

Lunar Rock Game Use resources to design a game that involves the collection and analysis of lunar rocks by scientists. Trade games with classmates to increase your understanding of lunar rocks.

GEOLAB

DESIGN YOUR OWN: MODEL CRYSTAL FORMATION

Background: **The rate at which magma cools affects the grain size of the resulting igneous rock. Observing the crystallization of magma is difficult because molten rock is very hot and the crystallization process is sometimes very slow. Other materials, however, crystallize at lower temperatures. These materials can be used to model crystal formation.**

Question: *How do minerals crystallize from magma?*

Materials

clean, plastic petri dishes
saturated alum solution
200-mL glass beaker
magnifying lens
dark-colored construction paper
thermometer
paper towels
water
hot plate

Safety Precautions

WARNING: ***The alum solution can cause skin irritation and will be hot when it is first poured into the petri dishes. If splattering occurs, wash skin with cold water.***

Procedure

1. Read and complete the lab safety form.
2. As a group, plan how you will change the cooling rate of a hot solution poured into a petri dish. Each group member should choose a petri dish in a predetermined location to observe during the investigation. Make sure your teacher approves your plan before you begin.
3. Place a piece of dark-colored construction paper on a level surface where it will not be disturbed. Be sure to put the paper in all of the predetermined locations. Place the petri dishes on top of the paper.
4. Using the glass beaker, obtain about 150 mL of saturated alum solution from your teacher. The temperature should be about 95°C to 98°C, just below boiling temperature.
5. Carefully pour some of the solution into each petri dish so that it is half full. Use caution when pouring the hot liquid to avoid splatters and burns.

6. Every 5 min for 30 min, record your observations of your petri dish. Make drawings of any crystals that begin to form.

Analyze and Conclude

1. **Compare** your methods of cooling with those of other groups. Did some methods appear to work better than others? Explain.
2. **Examine** your alum crystals. What do the crystals look like? Are they all the same size? Do all the crystals have the same shape?
3. **Draw** the most common crystal shape in your science journal. Compare your drawings with those of other groups. Describe any patterns that you see.
4. **Deduce** what factors affected the size of the crystals in the different petri dishes. How do you know?
5. **Infer** why the crystals changed shape as they grew.
6. **Compare and contrast** this experiment with magma crystallization.
7. **Evaluate** the relationship between cooling rate and crystal formation.

SHARE YOUR DATA

Peer Review Visit glencoe.com and post a summary of your data. Compare and contrast your results with those of other students who have completed this lab.