



Reaping Rocks

Purpose

To make predictions about the origin of lunar rocks by first collecting, describing, and classifying neighborhood rocks.

Background [also see “Teacher's Guide” Pages 6, 7, photo on 15, 16]

Geologists are scientists who study the formation, structure, history, and processes (internal and on the surface) that change Earth and other planetary bodies.

Rocks and the **minerals** in them give geologists key information about the events in a planet's history. By collecting, describing and classifying rocks, we can learn how the rocks were formed and what processes have changed them.

Geologists classify rocks into three types:

Igneous - rock formed when magma cools and hardens either below the surface (for example, granite) or on the surface during volcanic events (for example, basalt).

Sedimentary - rock formed by the collection, compaction, and cementation of mineral grains, rock fragments, and sand that are moved by wind, water, or ice to the site of deposition.

Metamorphic - rock formed when heat and/or pressure deep within the planet changes the mineral composition and grain size of existing rocks. For example, metamorphism changes limestone into marble.

We find all three rock types on Earth's surface and the rocks are constantly changing (recycling), very slowly because of heat, pressure, and exposure to weather and erosion.

The Moon's surface is dominated by igneous rocks. The **lunar highlands** are formed of **anorthosite**, an igneous rock predominantly of calcium-rich **plagioclase feldspar**. The lunar **maria** are made of layers of **basaltic lava**, not unlike the basaltic flows of the Columbia River Plateau or of Iceland. The orange glass found on the Moon's surface is another product of volcanic activity. Moon rocks are not exposed to weather nor are they eroded by wind, water, or ice. The Apollo astronaut's footprints are as fresh as the day they were made.

Preparation

Review and prepare materials listed on the student sheet. Spend time familiarizing the students with rock and mineral identification.

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Students may need more than one copy of “My Own Rock Chart” because it has spaces for only three samples. You may want to collect empty egg cartons, small boxes, or trays that the students could decorate themselves to display their rocks. Use of magnifying lenses or a stereo microscope would greatly enhance observations.

“Moon ABCs Fact Sheet” may come in handy during the wrap-up when students try to make predictions about the Moon rocks.

In Class

Talk about the qualities of rocks that we can describe: shape, size, color, texture, and the place where it was found. Then discuss the three rock classifications emphasizing that geologists classify rocks and interpret the origins of rocks based on their observations.

Encourage students to collect a variety of rocks with different colors and textures from your own locality, if possible. Remind them to choose naturally occurring materials — not cement or brick fragments! If it is not possible to collect rocks from the neighborhood, then try to obtain a commercially available set of common rocks. More than one student may choose the same rock. Students could also cut out pictures of rocks from magazines or study pictures of rocks in text books.

After each rock has been labeled with owner’s name and location where it was found, have the students look carefully at the rock. To help them train their eyes, ask questions like: What colors do you see? Do you see grains? Are the grains large or small? Does the rock look glassy? Or does the rock show a banding pattern? Does the rock look frothy with a lot of holes? Do you see pebbles cemented together? Does the rock contain fossils?

Ask students to describe their rocks with as many adjectives or descriptive phrases as possible. Have the students classify the rocks as igneous, sedimentary, or metamorphic, and then try to interpret the rock origins. “My Own Rock Chart” is designed to help organize their observations and interpretations.

Wrap-up

Conclude the activity by challenging the students to predict what the lunar rocks look like and the possible origins based on what they have just learned about Earth rocks and based on the material in the “Moon ABCs Fact Sheet.”

Display these rock collections and keep them until the students have a chance to compare with the lunar samples in “The Lunar Disk” activity on Page 39.



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Key Words

geologist

mineral

rock

igneous

sedimentary

metamorphic

Materials

rocks

empty egg carton, box, or other collection tray

labels

magnifying lens or stereo microscope

“My Own Rock Chart”

“Moon ABCs Fact Sheet”

Procedure

1. Display your **rocks** on a tray or **egg carton**, and **label** each one with the location of where you found it.
2. Look carefully at each rock with and without a **magnifying lens or stereo microscope**. What details can you see under magnification?
3. Describe what you see by filling out “**My Own Rock Chart**.” Use as many adjectives or descriptive phrases as you can.
4. Classify your rocks as igneous, sedimentary or metamorphic. Try to interpret how your rocks were formed; that is, the origins. Add this information to your chart.
5. Now, based on your chart and the “**Moon ABCs Fact Sheet**,” predict what the Moon rocks will look like.

6. How do you think the different Moon rocks might have formed?

My Own Rock Chart

Interpretations		Observations					
Origin	Classification	Collection Site	Texture	Colors	Size	Shape	Rock Sketch

Moon ABCs Fact Sheet

Property	Earth	Moon	Brain Busters
Equatorial diameter	12,756 km	3,476 km	How long would it take to drive around the Moon's equator at 80 km per hour?
Surface area	510 million square km	37.8 million square km	The Moon's surface area is similar to that of one of Earth's continents. Which one?
Mass	5.98×10^{24} kg	7.35×10^{22} kg	What percentage of Earth's mass is the Moon's mass?
Volume	---	---	Can you calculate the volumes of Earth and the Moon?
Density	5.52 grams per cubic cm	3.34 grams per cubic cm	Check this by calculating the density from the mass and volume.
Surface gravity	9.8 m/sec/sec	1.63 m/sec/sec	What fraction of Earth's gravity is the Moon's gravity?
Crust	Silicate rocks. Continents dominated by granites. Ocean crust dominated by basalt.	Silicate rocks. Highlands dominated by feldspar-rich rocks and maria by basalt.	What portion of each body is crust?
Mantle	Silicate rocks dominated by minerals containing iron and magnesium.	Similar to Earth.	Collect some silicate rocks and determine the density. Is the density greater or lesser than the Earth/Moon's density? Why?

Moon ABCs Fact Sheet

Property	Earth	Moon	Brain Busters
Core	Iron, nickel metal	Same, but core is much smaller	What portion of each body is core?
Sediment or Regolith	Silicon and oxygen bound in minerals that contain water, plus organic materials.	Silicon and oxygen bound in minerals, glass produced by meteorite impacts, small amounts of gases (e.g., hydrogen) implanted by the solar wind. No water or organic materials.	Do you think life ever existed on the Moon? Why or why not?
Atmosphere (main constituents)	78 % nitrogen, 21 % oxygen	Basically none. Some carbon gases (CO ₂ , CO, and methane), but very little of them. Pressure is about one-trillionth of Earth's atmospheric pressure.	Could you breathe the lunar atmosphere?
Length of day (sidereal rotation period)	23.93 hours	27.3 Earth days	How long does daylight last on the Moon?
Surface temperature	Air temperature ranges from -88°C (winter in polar regions) to 58°C (summer in tropical regions).	Surface temperature ranges from -193°C (night in polar regions) to 111°C (day in equatorial regions).	Why are the temperatures of Earth and the Moon so different?
Surface features	25 % land (seven continents) with varied terrain of mountains, plains, river valleys. Ocean floor characterized by mountains, plains.	84 % heavily-cratered highlands. 16 % basalt-covered maria. Impact craters-- some with bright rays, crater chains, and rilles.	Compare maps of Earth and the Moon. Is there any evidence that plate tectonics operated on the Moon?