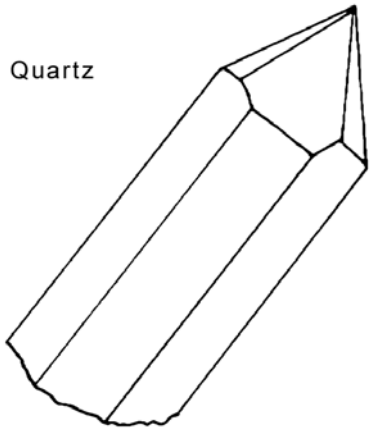
MINERALS AND ROCKS – GRADE 2

OBJECTIVES:

1. Describing minerals.
2. Comparing mineral and rock properties.



VOCABULARY:
Characteristic - used to identify and classify rocks.
Lithosphere - Earth's outermost layer.
Property – used to identify and classify minerals.

PROCEDURE:

Activity 1: Mineral properties.
Materials: *Rock Cycle* slideshow; mineral kit; periodic table placemat

1. Pass out periodic table placemats. Show slides 1-6 from the *Rock Cycle* slideshow to introduce the idea that minerals make up rocks. Also explain how some minerals are made up of one element (native element) and some are made up of more than one element. Have students find some of the native elements and some of the elements that make up minerals on their placemats (ie; copper, iron, silicon, sulphur)

2. Starting at slide 6, introduce the idea of describing minerals by their properties. Help students come up with words to describe shape (cube, rhombus, diamond), the color or if it is clear to describe minerals.

3. Have students work in pairs and pass out a mineral kit to each pair. Have students study the four minerals (calcite, quartz, fluorite, pyrite) then write down three properties of each on page 2 of their workbooks. There are words on the bottom of the page that might be helpful when describing these particular minerals. They can come up with their own words too.

4. After 10-15 minutes discuss with the class what they came up with.

Background Information

Minerals are composed of either one type of **element** (a native mineral) or two or more elements (a **compound**). Minerals are identified by their physical properties such as **color; hardness** or how easy it is to scratch the surface using a nail (talc is very soft and quartz is hard); how shiny or metallic the mineral looks when light reflects off of its surface; **streak** or the color the mineral leaves when rubbed against a hard surface (graphite leaves a black streak).

Activity 2: The 3 types of rocks and the environments where they were formed.
Materials: *Rock Cycle* slideshow; *Ricky The Rapping Rock* storybook song; rock kit

1. Read / sing *Ricky The Rapping Rock.*
2. Go over slides 9-11. Review the three main groups of rocks. Be sure to tell students that there are many different types of rocks within each of the three groups. Brainstorm possible terms for describing rocks with the students(bumpy, smooth, heavy, color, glassy).
3. Explain that identification and classification of an individual rock is based on a variety of characteristics and criteria, and that they will start to learn some of these in this lab.
4. Give each pair of students a rock kit and instruct them to categorize all the rocks by type (igneous, metamorphic, sedimentary). Be sure to instruct students to leave the rocks in their individual bags. Bag are labeled with rock name.
5. Once rocks are separated have students think of one more characteristics to describe each rock. They can add their word to the list on page 3-4 of their workbooks.
6. Have them fill the illustrations on page 4 with the rock type that was formed in that environment.

Background Information

The name of a rock reflects certain **characteristics**. For example, obsidian will resemble glass and scoria will usually be dark red with holes. Rock names also refer to a texture. For example granite will have interlocking minerals and sandstone will have a gritty, sandy feel.

Young children need to experience these characteristics before they can internalize the name of a rock. They need to describe and compare the characteristics, as they learn the rock's name. Just knowing a name of a rock is not enough. Rather than using a formal classification the emphasis is on students developing their own criteria for rock classification.

Igneous rocks come in many varieties. However, all igneous rocks began as molten rock (magma) which cooled and crystallized into minerals. Igneous rocks may look different because of two factors: (1) they may have cooled at different rates and (2) the "mother" magma (original melted rock) was of a different composition. Variations in these two factors have created many different types of igneous rocks. When the magma cools at different rates, it creates different sized minerals. Quick cooling magmas have small minerals (with the exception of obsidian, which is actually composed of silica, but has no crystalline structure). Basalt, for example, has small minerals, most of which can only be seen under a microscope. Magma that cools slowly creates rocks like granite

which have large minerals that can be seen with the naked eye. Geologists classify igneous rocks based on both their crystal size and composition. The rock cycle has its origin in igneous rocks.

Sedimentary rocks form at Earth's surface in two main ways: (1) from clastic material (pieces of other rocks or fragments of skeletons) which have become cemented together and (2) by chemical mechanisms including precipitation and evaporation. Sedimentary rocks are usually associated with liquid water (which facilitates erosion, transportation, deposition, and cementation). However, sedimentary rocks may also form in dry, desert environments or in association with glaciers.

Metamorphic rocks are igneous, sedimentary, or pre-existing metamorphic rocks that have been changed by great pressures and temperatures within Earth's crust and upper mantle. The temperatures were not enough to melt rock, or an igneous rock would have formed. The pressures were much greater than those required to simply break the rocks into pieces. They were high enough to change the chemical make-up of the rock by forcing the elements in it to "exchange partners."

All three types of rock make up Earth's **lithosphere**, the outermost layer. The lithosphere averages about 100 kilometers in thickness. It is like an eggshell compared to Earth's total radius (the distance from Earth's core to the surface). The lithosphere is solid rock. Sedimentary rocks are the most abundant rock only on Earth's surface, but igneous and metamorphic are abundant deeper in the mantle.

Igneous

Obsidian - Also known as volcanic glass. Most children recognize obsidian as the rock used to make arrowheads. Native Americans chose obsidian for their arrowheads, or spearpoints, for same reasons that a geologist can recognize it. It is very hard, but more importantly it breaks into sharp edges that easily cut through many materials. Note that broken obsidian looks like broken glass. Obsidian occurs in almost any color, depending on what trace elements are present in it. Black and brown obsidian are most common. Obsidian is an amorphous solid; a solid rock composed of silicon dioxide, but this material lacks crystalline structures. It is one of very few exceptions to the rule that rocks are made of minerals.

The obsidian that is in your kit comes from volcanoes near Clear Lake, California. Obsidian is formed when lava is cooled very quickly. It freezes before crystals can form. Have your students try to determine which part of a lava flow will cool quickly enough to form obsidian (answer - the outer surface or "skin" of the flow).

Pumice - Students will immediately notice that pumice is spongy or "full of holes." This characteristic makes pumice extremely lightweight, it even floats in water (you may wish to show this to your students). It is commonly light gray to

blackish-gray in color. It is easily broken and has sharp edges. Like obsidian, pumice is volcanic glass; it thus looks glassy (especially with a magnifying glass) and lacks visible minerals.

Pumice forms during eruptions of magma containing large quantities of gasses, such as water vapor, sulfur dioxide, and carbon dioxide. The gas "froths" the magma as it erupts, forming bubbles. This is physically analogous to opening a soda can; carbon dioxide bubbles from in the drink as the can is opened. Like obsidian, the magma then cools quickly, preserving the bubble shapes. The gas often escapes, leaving numerous holes in the pumice. Pumice is used as an ornamental building stone. "Pumice rock" is also sold in beauty stores for removing dead skin cells.

Scoria - Scoria is composed of volcanic glass and pre-existing rock fragments that became incorporated into the magma as it erupted. The volcanic glass looks similar to pumice, but is reddish in color because it contains more iron than pumice. Scoria lacks large visible minerals; small ones may be visible with a magnifying glass. Scoria is often sold as "lava rock" for use as a landscaping material.

Granite - Granite is composed of visible minerals, most commonly quartz, mica and feldspar. Quartz looks clear and glassy, mica is black and flaky, and the feldspars (commonly two or more different types are present) are either pale pink/orange or white in color. The relatively large size of the minerals indicates that the magma that formed the granite cooled slowly. This took place deep inside the earth, not on the surface, like pumice or scoria; it is a plutonic rock.

Ask your students if they think granite is made of the same minerals as basalt (no, they cooled differently and came from a different "mother" magma). It may help to have them imagine that the minerals in the granite were tiny; would this make them dark? (No, they would still be light colored). This indicates that rocks composed of different minerals likely have different magma "mothers." Try using the analogy that rocks are like people, no two are the same! Granite is used as an ornamental and building stone.

Sedimentary

Conglomerate - Conglomerate consists of pebbles, gravel, sand, and boulders that have been cemented together to make a solid rock. These materials were mixed naturally in rivers or in some parts of oceans and lakes. Any type of pre-existing rock can become part of a conglomerate. To explain cementation, try telling students that Mother Nature has cement that she sometimes pours onto

the beaches of lakes, oceans, and rivers. When it hardens, it becomes conglomerate, if the pieces are big, or sandstone, if they are small. In reality, the two most common cementing substances are natural solutions of calcium carbonate and silica dioxide. Crystals of calcite and quartz, respectively, precipitate from these solutions in the spaces between grains, cementing the rock together.

Sandstone - The gritty feel of the surface of sandstone hints that this rock was once sand that has been cemented together. Sandstones have quite varied compositions; some are composed entirely of quartz, and others are mixtures of rocks, crystals and fossils. Almost any combination is possible. Sandstones thus come in a wide array of colors. By definition, the grains in a sandstone are "sand-sized"; most students will recognize this if you demonstrate "sand size" by showing them a bag of sand.

Shale - Shale is composed of very small particles of mud, which have been compacted and cemented together. Individual mud grains are very small and will rarely be visible. Shales are quite variable in color.

Mudstone - Mudstone is composed of very small particles (mud) that are cemented together. It can be dark to light because it is the particles that define the mudstone. But if it looks like mud….it is probably mudstone.

Metamorphic

Marble - marble is composed exclusively of large commonly visible crystals of calcite. The gray/white bands in some of the samples are due to impurities within the calcite. Marble actually comes in a variety of colors, including black, gray, white, and pink. Marble, like all rocks that have calcite in them, fizz if you put a weak acid on it (usually 10% solution of hydrochloric acid). Marble forms when a rock containing calcite in it (such as limestone) was put under high temperature and pressure conditions. Marble has been used throughout history because it is easy to break and to carve. Some marble (especially in Italy) is noted for its smooth, small crystals that make it excellent for statues. Many of the statues of Michelangelo were made from marble. Marble is also used as an ornamental building stone. If you live near or in a city, have your students try to find buildings made of marble. If you are in an old school, some of the bathroom stalls or floors may be made of marble.

Serpeninite - Serpentinite has a smooth, soapy feel, a green mottled color, and a somewhat flaky texture. It is composed mainly of the mineral serpentine. Serpentinite is so named because of its mottled color, which resembles the back of a sea-serpent. The geologic origin of serpentinite is still debated, but many scientists agree that it formed from a rock like basalt that was put under high temperature and pressure. Serpentinite is the state rock of California and is used for carving and as an ornamental building stone.

Schist - Schist is composed of visible minerals, mostly micas. Schists form under moderately high pressure conditions; this causes the naturally platy mica crystals to line up, giving the rock a platy look. This is a good example for illustrating the characteristic "squished" look of metamorphic rocks to your students.

Gneiss - Gneiss (pronounced “nice”) metamorphic rocks look layered. During high pressure and temperature, the minerals migrate into layers. There are different types of colors and minerals that reflect the rock that has been squished.

Materials Provided

- 32 Periodic Table Placemats
- *Rock Cycle* slideshow
- *Ricky The Rapping Rock* storybook
- **15 Mineral Kits:**

  Flourite
  Pyrite
  Calcite
  Quartz

- **15 Rock Kits**

  Obsidian
  Scoria
  Granite
  Pumice
  Sandstone
  Conglomerate
  Shale
  Mudstone
  Serpentinite
  Schist
  Gneiss
  Marble