

Geology Rocks

Environmental Education Lesson
EDWARDS CAMP AND CONFERENCE CENTER

SUMMARY

Students will learn the three ways rocks are formed with in the earth's crust. A hike to a rock quarry will allow the students to find various types of rocks and learn to identify them.

USAGE

4th -12th grades

OBJECTIVES

Upon completion of this lesson students will...

- Be able to explain the rock cycle
- Learn the definition of Geology
- Know the 3 different ways rocks are made: Igneous, Sedimentary, and Metamorphic
- Be able to identify 3 rocks in the quarry and tell how they were formed

In addition students could...

- Learn about the two types of weathering: mechanical and chemical
- How weathering affects rocks
- Learn about the glacial history of Wisconsin

MATERIALS

Rock hammers, eye protection, envelope of pictures/ diagrams

INTRODUCTION

Have students sit in a circle. Begin class with a name game. Ask the students what they know about rocks (types of rocks, how rocks are formed, ways rocks break apart) and have them tell you their name. After the name game, introduce the word **Geology** and **Geologist** to the students. Geology is the study of rocks and minerals. A geologist is a scientist that studies rocks and minerals. Let the students know that they are all going to become geologists today. They are going to learn about how rocks are formed and then head out to a quarry where they will study different types of rocks.

ACTIVITIES

How Rocks are Formed?

Rocks are classified into these groups by the way they were formed. The three main rock classifications are Igneous, Sedimentary, and Metamorphic. Discuss the three ways rocks are formed with the students.

Quarry Study:

Students will now search for two samples of each of the three categories of rocks. Go over safety rules in the quarry.

- 1) Walking only, no running
- 2) Watch where you step. Warn others of sliding rocks.
- 3) Use Rock hammers with care. Goggles need to be worn and hammers are used away from group.
- 4) No sliding down quarry. Go slow.

Rock Show and Tell:

After all of the students have found sample of igneous, metamorphic, and sedimentary rocks have them get in to a circle. Students take turns talking about their rocks and how they know what type of rock it is. This will help review concepts about the rock cycle.

Information needed for class:

The Rock Cycle shows how the earth's rocks are changed again and again. The rocks can be changed at times to another type of rock. The rock cycle can begin anywhere in the cycle. Rocks are formed by wind, water, ice (glaciers and freezing breaks apart rocks), volcanoes, earth movement (earthquakes, plates coming together, land slides) Lets start with igneous rocks. Igneous rocks start as magma. The magma (molten rock under the surface) and lava (molten rock on the surface) hardens into **igneous rock**. The igneous rock then breaks apart over time through the process of weathering. These bits of broken rock are washed away by rains and deposited in a river. These pieces of igneous rocks are cemented together with other bits of rock and form a **sedimentary rock** called conglomerate. Over time sedimentary rocks can be buried by earthquakes or other geologic processes. Being buried deep under the surface in areas of high temperatures and pressures or coming in contact with magma can cause these sedimentary rocks to change to **metamorphic rocks**.

Igneous Rocks:

- When magma (molten rock) cools and solidifies, it forms igneous rocks.
- When magma reaches the Earth's surface, it cools rapidly. Note that we call it lava when it reaches the surface. Rapid cooling results in igneous rocks with certain properties.
- When magma cools slowly deep underground, it forms igneous rocks with properties that are quite different from those that form from rapid cooling.
- Slow cooling results in the formation of crystals- the slower the cooling, the larger the crystals. Granite is an example of an igneous rock formed from slow cooling magma. A close look at unweathered granite shows a collection of crystals in no particular pattern. The presence of crystals and the lack of pattern are typical properties of igneous rocks formed from slow cooling magma.
- Rapid cooling of lava results in igneous rock properties quite different from those of granite. Rocks can be glasslike (obsidian) with no crystals. They may be light for their size, and full of holes (pumice) made by escaping gases. They may have very small crystals that can be seen with a microscope (basalt).

Types of Igneous Rock:

Granite is an igneous rock that is composed of four minerals. These minerals are quartz, feldspar, mica, and usually hornblende. Granite forms as magma cools far under the earth's surface. Because it hardens deep underground it cools very slowly. This allows crystals of the four minerals to grow large enough to be easily seen by the naked eye. Look at the photo of granite above, notice the different crystals in the rock.

Granite is an excellent material for building bridges and buildings because it can withstand thousands of pounds of pressure. It is also used for monuments because it weathers slowly. Engravings in the granite can be read for hundreds of years, making the rock more valuable.

Granite is quarried in many places in the world including the United States. The state of New Hampshire has the nickname "Granite State" because of the amount of granite in the mountains of that beautiful state. The Canadian Shield of North America contains huge outcroppings (surface rocks) of granite.

Basalts are dark colored, fine-grained extrusive rock. The mineral grains are so fine that they are impossible to distinguish with the naked eye or even a magnifying glass. They are the most widespread of all the igneous rocks. Most basalts are volcanic in origin and were formed by the rapid cooling and hardening of the lava flows. Some basalts are intrusive having cooled inside the Earth's interior.

Rhyolite is very closely related to granite. The difference is rhyolite has much finer crystals. These crystals are so small that they can not be seen by the naked eye. Rhyolite is an extrusive igneous rock having cooled much more rapidly than granite giving it a glassy appearance. The minerals that make up rhyolite are quartz, feldspar, mica, and hornblende.

Obsidian is a very shiny natural volcanic glass. When obsidian breaks it fractures with a distinct conchoidal fracture. Notice in the photo to the left how it fractures. Obsidian is produced when lava cools very quickly. The lava cools so quickly that no crystals can form.

When people make glass they melt silica rocks like sand and quartz then cool it rapidly by placing it in water. Obsidian is produced in nature in a similar way.

Obsidian is usually black or a very dark green, but it can also be found in an almost clear form.

Ancient people throughout the world have used obsidian for arrowheads, knives, spearheads, and cutting tools of all kinds. Today obsidian is used as a scalpel by doctors in very sensitive eye operations.

Sedimentary Rocks:

- Sedimentary rocks are formed from the breaking apart of other rocks (igneous, metamorphic, or sedimentary rocks) and the cementation, compaction and recrystallization of these broken pieces of rock.
- **Weathering** is the process of breaking down rocks and minerals into smaller pieces by water, wind, and ice. There are two types of weathering: Chemical and Mechanical. Chemical weathering is the breakdown of rocks by dissolving. This happens mostly by water. Mechanical weathering is the physical breakdown of rock. Examples would be through wind, earthquakes, plate movements, waves, etc.
- Shale, sandstone, and limestone are the most common types of sedimentary rocks. They are formed by the most common mineral that is found on or near the surface of the Earth. The mineral that forms these sedimentary rocks is feldspar.
- Some sedimentary rocks form from the precipitation (Precipitation is the separating of a solid from a solution) of minerals from ocean water or from the breakdown of the shells and bones of sea creatures. Sea animals such as coral produce calcium carbonate solutions that harden to form rock.
- As the chemicals, that comes from the mineral or biological precipitation, mix with sediments on the floor of the ocean or lake they crystallize and grow in the spaces around the sediment. When these crystals grow large enough to fill the spaces they harden and form a solid rock.
- Sedimentary rocks that form this way are limestone, halite (rock salt), and chalk.

Types of Sedimentary Rocks:

Limestone is the most abundant of the non-clastic sedimentary rocks. Limestone is produced from the mineral calcite (calcium carbonate) and sediment. The main source of limestone is the limy ooze formed in the ocean. The calcium carbonate can be precipitated from ocean water or it can be formed from sea creatures that secrete lime such as algae and coral. Limestone can easily be dissolved by acids. If you drop vinegar on limestone it will fizz. Put a limestone rock into a plastic jar and cover it with vinegar. Cover the jar and watch the bubbling of the calcium carbonate and also the disintegration of the rock over a few days.

Chalk is another type of limestone that is made up of very small single-celled organisms. Chalk is usually white or gray in color.

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Conglomerate is a clastic sedimentary rock that forms the cementing of rounded cobble and pebble sized rock fragments. Conglomerate is formed by river movement or ocean wave action. The cementing agents that fill the spaces to form the solid rock conglomerate are silica, calcite, or iron oxides.

Notice in the photo above the rounded rock particles in the conglomerate. These rounded particles make conglomerate different from the next rock you are about to study, breccia.

Coal: Organic sedimentary rocks form from the build up and decay of plant and animal material. This usually forms in swamp regions in which there is an abundant supply of growing vegetation and low amounts of oxygen. The vegetation builds so quickly that new layers of vegetation bury the dead and decaying material very quickly. The bacteria that decay the vegetation need oxygen to survive. Because these decaying layers are buried so fast the bacteria use up what oxygen there is available and can not finish the decomposition of the vegetation. The overlaying layers become so heavy that they squeeze out the water and other compounds that aid in decay. This compressed vegetation forms coal. The longer and deeper that coal is buried makes it of higher quality. Peat is the first stage of coal formation.

Metamorphic Rock:

Metamorphic rocks form from heat and pressure changing the original or parent rock into a completely new rock. The **parent rock** can be either sedimentary, igneous, or even another metamorphic rock. The word "*metamorphic*" comes from Greek and means "*To Change Form*".

Types of Metamorphic Rock:

Marble: limestone being heated by the magma and changing to the metamorphic rock called marble (Yellow). Marble is a beautiful rock that is used by humans as building material and for decorative uses as in sink tops or monuments. Artists have sculpted marble into some of the greatest works of art in the world.

Slate: This is the type of rock that is in chalkboards. It is shale (a type of sedimentary rock) that is heated and pressurized.