

Earth's Story Through a Rock

Respect Rule: Look, Listen, Learn, and Leave Alone (until instructed).

Overview

“Geology is the study of the earth, and yet it has become more than that. It is a living science that involves our daily lives and everything we do. Without rocks and minerals our modern civilization is not possible. Geology helps us to understand earthquakes, tsunamis, volcanoes, glaciers, and the building and erosion of our mountains. Rocks and minerals provide the raw materials for our roads, buildings, computers, cell phones, and they even help sustain our bodies. An understanding of geology will enable us to develop our oceans and the distant places we will travel in space.

“Geology plays a principal role in our ecosystem and our connection to Mother Nature. We all need to maintain a healthy balance between ourselves and our surroundings, and we need to become lifelong stewards of our environment. Geologists and those of us who pursue rocks and minerals as a hobby are sustained by trips to the field to study and to collect specimens. Field trips are fun and keep us well grounded in our place in nature and the ebb and flow of life. When you come home with a quartz crystal, you also come home with the memory of snow-capped mountains, trout in a stream, fields of wild flowers, and a forest full of wonder and beauty.”

—Claude Huber,
Calaveras Gem and Mineral Society

This activity will encourage student's awareness that the earth is continually changing through a rock cycle of the three basic types of rock- igneous, sedimentary, and metamorphic.

Background

There are four layers that make up the earth:

1. Inner Core: a mass of iron with a temperature of about 7,000 degrees F. Although such temperatures would normally melt iron, immense pressure keeps it in a solid form. The inner core is approximately 1,500 miles in diameter.

2. Outer Core: a mass of molten iron about 1,425 miles deep that surrounds the solid inner core. Electrical currents generated from this area produce the earth's magnetic field

3. Mantle: a rock layer about 1,750 miles thick that reaches about half the distance to the center of the earth. Parts of this layer become hot enough to liquefy and become slow moving molten rock or magma.

4. Crust: a layer from 4–25 miles thick consisting of sand, rock and soil.

The earth was formed about 4.6 billion years ago. The planet was so hot that the entire earth was molten and liquid. As the earth cooled, the lightest materials floated to the top and the heaviest materials sank to the center. The outer part of the earth, the crust, consists of the lightest rock.

Rocks are made up of one or more minerals that have been:

1. cemented together
2. squeezed and heated together
3. melted and cooled together

Twelve minerals are called rock-forming minerals and they make up the essential minerals in the three rock types. Elements that make up rocks are never created or destroyed although they can be redistributed, transforming one rock type to another.

There are three basic types of rock: igneous, sedimentary and metamorphic. The crust of the earth consists of 65% igneous rock, 27% metamorphic rock, and 8% sedimentary rock. The dry land surface of the earth consists of 75% sedimentary rock and 25% igneous rock and metamorphic rock.

The rock cycle shows how the earth is continually changing. Magma within the earth produces igneous rocks. These rocks can be cooled slowly or fast, uplifted, weathered and transformed into sedimentary rocks. Heat and pressure can transform igneous and sedimentary rocks into metamorphic rocks. Further



Objectives

Students will:

1. discover the rock cycle; 2. collect, identify and classify three rock types.

Grade Level

2–6

Adult/Student Ratio

1 adult/class

Where

School grounds or any field trip experience

Skills

Observing, identifying, classifying, sorting, labeling, discussing, listening, cooperatively problem solving, recording

Key Words

Igneous Rock
Sedimentary Rock
Metamorphic Rock
Magma
Inner Core
Outer Core
Mantle
Crust

“
**Let Nature be
your teacher.**
”

—William Wordsworth

heating can change these rocks into magma and the cycle continues.

Before-the-Field-Trip Activity

Activity: Around and Around

Time: 1 hour

Materials: Rock Cycle Student Worksheet, Rock Cycle Answer Key, white board/large chart paper, vocabulary words on index cards: crust, mantle, magma, sedimentary rock, igneous-slow moving, igneous-fast moving, metamorphic rock, core; dry-erase markers—green, red, brown, yellow, blue; book/video *How to Dig a Hole to the Other Side of the World*

1. Instruct the rock cycle:

- On the board, draw a circle. Explain to the students the circle represents the earth and the earth is very old. Have students estimate the earth's age (approximately 4.6 billion years old). It is continually changing.
- Leave the inner circle (core) white. This is very hot—7,000 degrees F. The inner core made of iron is solid due to the pressure. Student places appropriate vocabulary cards on board. The outer core is molten iron generating electrical currents. Color the second layer yellow and red (yellow represents extreme heat). This layer known as the mantle is hot enough to be slow moving molten rock. Ask if a student can identify what this liquefied moving rock is called. Have a student place the magma card in the second layer on the board.
- Rocks that form from magma are called igneous rocks. Draw a volcano and mountains. As the magma leaves the volcano, draw the magma, turning from red to blue, representing the quick cooling of magma. Draw a red arrow turning blue under the surface, continuing to an uplift and exposure, representing the slow cooling under the earth. Have a student place igneous-slow cooling card and, igneous-fast cooling card on the board. Igneous comes from the Latin word *ignis* which means “fire.”

- Continue the blue arrow circling downward to show weathering and erosion of rock. Accumulated pieces of rock, shells and bones that are formed in layers and cemented together through moderate pressure are called sedimentary rock. As sedimentary and igneous rock are subjected to heat, extreme pressure, and/or hot chemical fluids, the rock transforms into a different kind of rock called metamorphic rock. Further heating can change these rocks into magma and the cycle continues
 - Review completed rock cycle for understanding.
2. Read book or view video *How to Dig a Hole to the Other Side of the World*.
 3. Distribute Rock Cycle Student Worksheet and instruct in completion by coloring, cutting out and labeling the rock cycle.
 4. With a partner, have students explain their worksheet.

Extensions:

- View and discuss Reading Rainbow's video, *The Magic School Bus Inside the Earth* (especially good for a visit to the caverns).
- Choose a rock from the schoolyard or from home and tell the life story of that rock from the rocks point of view.
- Students bring a favorite rock to class (or one found on field trip or outside) and select a partner. One person from each pair gets one minute to talk about his/her rock. Then it is the other person's turn to talk for one minute. After talking, students write for two minutes, and then share what they have written in pairs, small groups, or with the large group (as appropriate).

Field Trip Activity

Activity: Be a Rock Hound

Time: 2–3 hours

Materials: Be a Rock Hound Student Worksheet, Determine Type of Rock Student Worksheet, hand lens (5–10 power), ruler for each student, penknife, rock hammer, safety goggles, Ziploc bags for collection of rocks, Rock Hound Journal, pencil, *Rocks: Quick Guide to Rock Identification*

1. Bring pre-selected rocks for students. Have students select three rocks on the field trip

on/off campus. Rocks can be obtained from the STE Lending Library.

2. Distribute Determine Type of Rock Student Worksheet. Have students select the rock type of their three rocks based on the criteria listed. Allow students the use of the penknife and rock hammer.
3. Have students share their rock selections. Ask questions as to which criteria were used to make their selection.

After-the-Field-Trip Activity

Activity: Your Own Rock Collection

Time: 1 hour or assigned as homework

Materials: Be a Rock Hound Student Worksheet, student rocks collected on field trip, at home, or school grounds, *Everybody Needs A Rock* by Byrd Baylor

1. Read *Everybody Needs A Rock* by Byrd Baylor.

2. Have students use Be a Rock Hound Student Worksheet to guide them in creating their own rock collection at home. Have students bring project back to school to share with the class.

Extension:

Animal Art Rocks: www.nationalgeographic.com/ngkids/trythis/trythis_animal_art.html.

Resources

For the Teacher

STE Lending Library Kit: Rocks
Calaveras County Mineral & Gem Society

For the Student

Coats, Roman, *Rock Collecting*.
Gans, Roma, *Caves*.
McNalty, *How to Dig A Hole to the Other Side of the Earth*.
Wood, Jenny, *Caves Facts, Stories, Activities*, Scholastic, Inc.

Determine Type of Rock

Student Worksheet

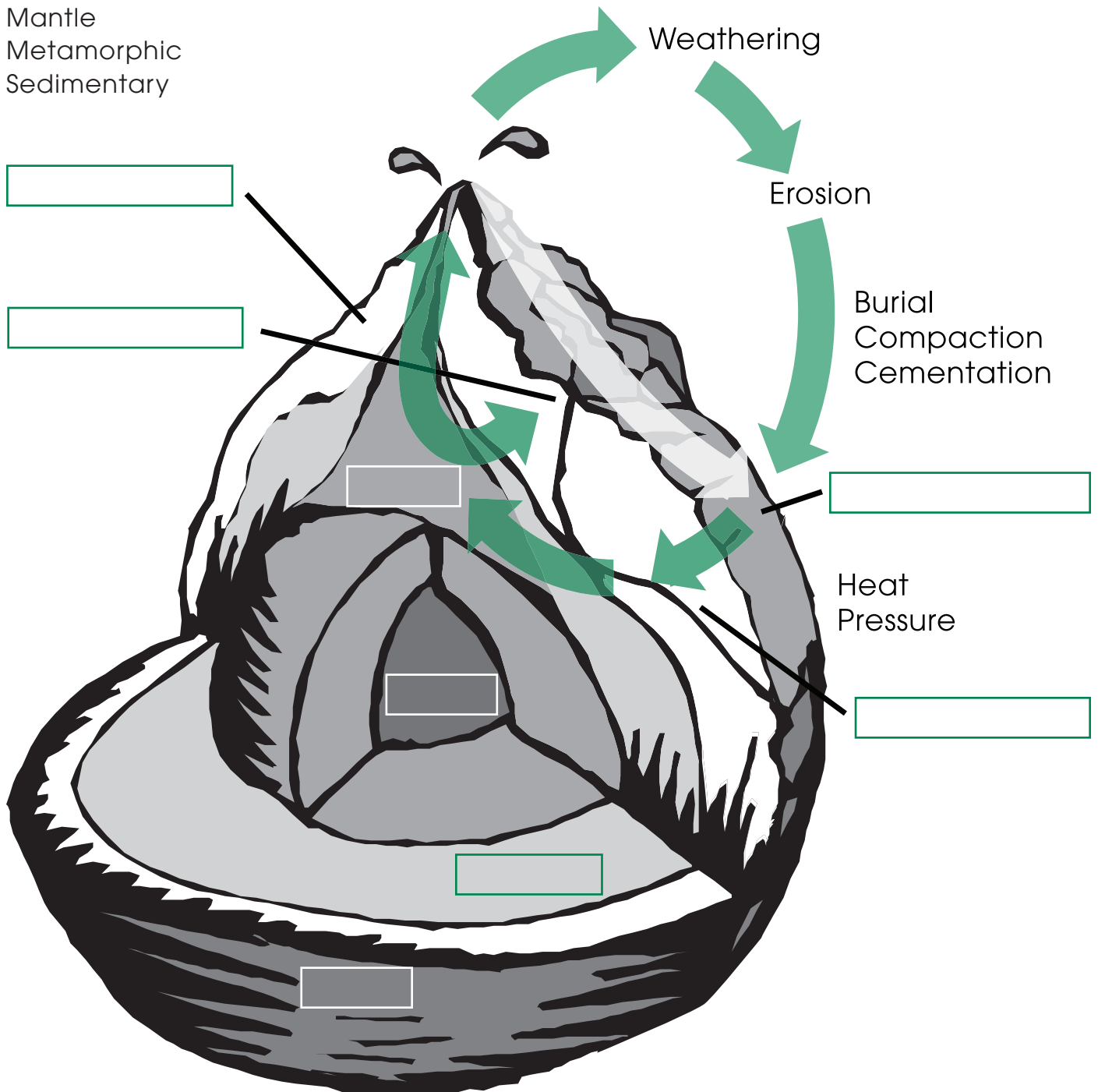
| + = match - = no match | Rock 1 | Rock 2 | Rock 3 |
|--|--------|--------|--------|
| <p>Igneous Criteria: Formed from slow-cooling magma</p> <p>Speckled with large mineral grains</p> <p>Volcanic rock with many holes; light enough to float</p> <p>Dark volcanic rock; shiny-like glass; sharp edges</p> | | | |
| <p>Sedimentary Criteria: Made underwater from the shells of animals; can have many fossils</p> <p>Made from layers of sand; fine, grainy texture</p> <p>Formed when layers of mud and clay are pressed together</p> | | | |
| <p>Metamorphic Criteria: Can be made from granite; wavy bands of dark and light layers</p> <p>Rock made from shale; splits easily into flat sheets</p> <p>Colored layers may be made smooth and shiny; formed from limestone</p> | | | |

Rock Cycle

Student Worksheet

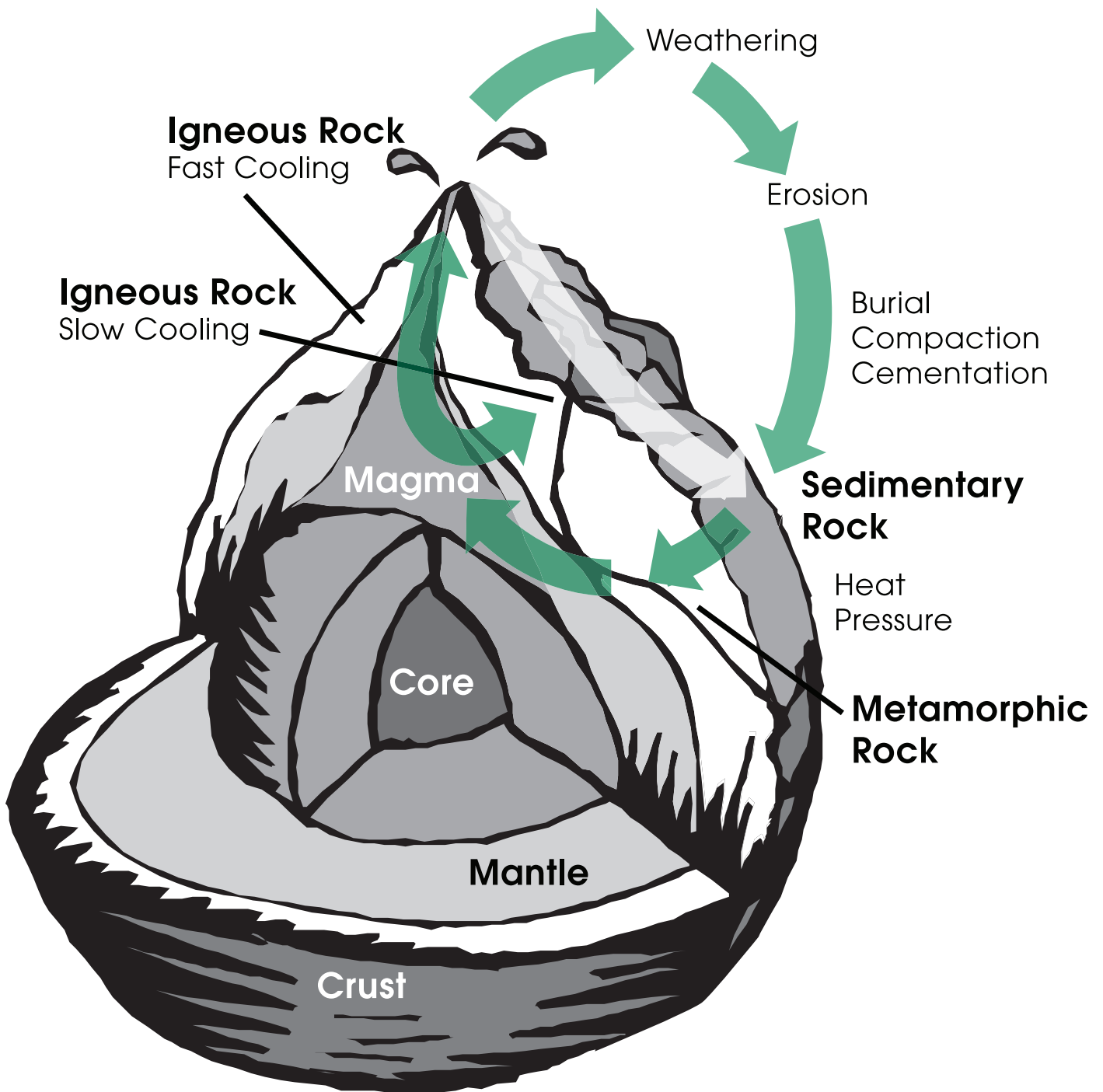
Terms:

- Core
- Crust
- Igneous (fast cooling)
- Igneous (slow cooling)
- Magma
- Mantle
- Metamorphic
- Sedimentary



Rock Cycle

Answer Key



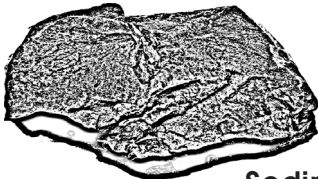
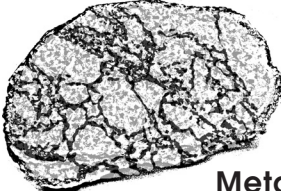
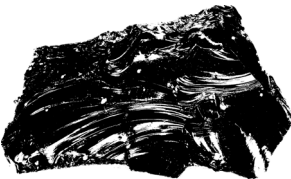

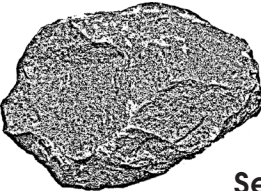
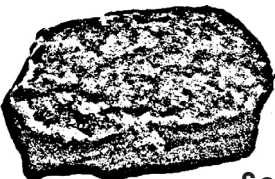

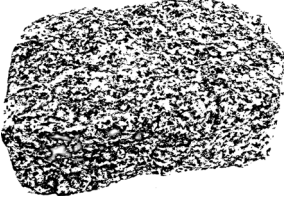
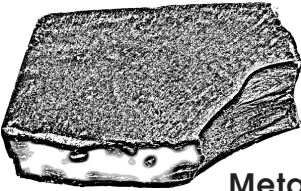
Be a Rock Hound

Student Worksheet

Make a rock collection. Cut out the rocks. Put them in three groups: igneous, sedimentary, and metamorphic. Read each description and match it to the rock it tells about. Fold back on the dotted line and glue each rock in the correct place.

| Igneous | Sedimentary | Metamorphic |
|--|---|--|
| formed from slow-cooling magma; speckled with large mineral grains | made underwater from the shells of animals; can have many fossils | can be made from granite; wavy bands of dark and light layers |
| volcanic rock with many air holes; light enough to float in water | made from layers of sand; fine, grainy texture | rock made from shale; splits easily into flat sheets |
| dark volcanic rock; shiny like glass; sharp edges | formed when layers of mud and clay are pressed together | colored layers may be made smooth and shiny; formed from limestone |



| | | |
|--|---|---|
|  <p>shale Sedimentary</p> |  <p>marble Metamorphic</p> |  <p>obsidian Igneous</p> |
|  <p>pumice Igneous</p> |  <p>limestone Sedimentary</p> |  <p>sandstone Sedimentary</p> |
|  <p>gneiss Metamorphic</p> |  <p>granite Igneous</p> |  <p>slate Metamorphic</p> |

Be a Rock Hound

Answer Key

Rocks should be pasted in this order from top to bottom: Igneous—granite, pumice, obsidian; Sedimentary—limestone, sandstone, shale; Metamorphic—gneiss, slate, marble.

| Igneous | Sedimentary | Metamorphic |
|----------------|--------------------|--------------------|
| Granite | Limestone | Gneiss |
| Pumice | Sandstone | Slate |
| Obsidian | Shale | Marble |