

# ROCK DETECTIVES

## **BIG IDEA 6: EARTH STRUCTURES**

### **BENCHMARKS AND TASK ANALYSES**

**SC.2.E.6.1** Recognize that Earth is made up of rocks. Rocks come in many sizes and shapes.

The student:

- recognizes that Earth is made up of rocks.
- investigates the various sizes and shapes of rocks through observation and hands on exploration.

**SC.2.N.1.1** Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.

The student:

- raises questions about the natural world.
- investigates questions in teams through free exploration and systematic observations.
- generates appropriate explanations based on those explorations.

**SC.2.N.1.5** Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).

### **KEY QUESTION**

How can we classify rocks?

### **TEACHER BACKGROUND INFORMATION**

Rocks are solid earth materials that compose the bulk of the Earth. The oldest rock known is approximately 3.7 to 3.9 billion years. Minerals are chemical elements found naturally in or on the Earth. Rocks are made up of minerals, but rocks themselves are not minerals. Rocks come in all shapes, sizes and colors. They can be found almost everywhere. Throughout history, rocks have been used as tools, weapons and building materials.

Soil, a thin blanket covering the bedrock of the Earth, is created as part of the rock cycle. Erosion is the wearing away and movement of rocks and soil by natural forces. Rocks slowly break apart and weather into small, jagged bits and pieces, eventually becoming smooth. Soil, however, is much more than bits of rocks. Soil also contains air, water, humus, and recycling organisms, such as earthworms. It takes hundreds of years to build just a few centimeters of topsoil.

Rocks are best understood by looking at a very simple description of the rock cycle. All rocks originally begin as igneous or fire formed rocks. Igneous are the only original rocks, the other two types being formed by transformation from igneous to sedimentary and/or metamorphic. Igneous rocks are formed from molten liquid materials beneath the earth surface. Magma is the name for the molten materials that cool while beneath the Earth's surface and lava is the name for molten materials that cool while above the surface.

### **MATERIALS**

#### **TEACHER**

class rock collection

#### **PER STUDENT**

box or container

hand lens

science notebook

### **SAFETY**

Remind students to be careful collecting rocks; insects are often found under rocks.

## **TEACHING TIPS**

- It is important for students to observe properties (size, shape, and color, etc.) of rocks. Do not be concerned with having students try to identify rocks according to their names (e.g., limestone, marble).
- NOTE: Scientists may compare properties by naming one property and the opposite of that property as a *not* statement (examples include smooth/*not* smooth, large/*not* large, shiny/*not* shiny).
- Students should begin a rock collection near the beginning of the school year. This activity can be carried out and revisited throughout the year as more rock samples are collected. Discuss rules for collecting: where it is okay to collect, how to transport, how scientists behave with their specimens, etc. Provide a box or plastic container and whenever a student brings a rock to school, place it in the box.
- Rocks are difficult to find in Florida. Much of what students find around campus may turn out to be concrete pieces. Compare the concrete pieces to rocks and discuss, comparing the samples. The concrete can be kept as a non-example. Encourage students to look for rocks on vacations to other states to add to the rock collection. Simple rock collections are available for purchase through educational suppliers.
- Dedicate a time when students may collect rocks on the playground to add to the collection. It would be best to take a container to the playground so the teacher could carry the rocks back to the room

## **ENGAGE**

1. Place the covered container of rocks on a table. Give the following clues and have students try to guess what is under the cloth:
  - These objects are all solids.
  - They come in little or huge pieces.
  - They come from the earth.
  - We often call them stones.
2. Tell the students that you have some rocks in the container and ask them what they know about rocks. Allow time for discussion. You may want to record student responses on a circle map.
3. Ask: *Where do rocks come from?*

## **EXPLORE**

1. Distribute rocks equally to each group. Ask students to closely examine their rocks with a hand lens. Have students record their observations in their student notebooks.
2. Next, the students should share their observations with a buddy (think/pair/share).
3. Ask several students to share their observations with the class.
4. Ask groups to sort the rocks using only one characteristic: hardness, color, shape, size, texture, etc.
5. Write the descriptive word on the board (smooth) and also write on the board the words that describe the other rocks (not smooth). Explain that these are properties of the rock(s).
6. Ask groups to discuss a way to define those terms so everyone can agree on what they mean. (e.g., to be small, must a rock fit under your hand)
7. Have students explore hardness by rubbing rocks together and record observations in science notebook. Discuss the observations as a class.

## **EXPLAIN**

Ask:

*Where do rocks come from?*

*What do you think causes rocks to break down in nature? (the process of breaking down rocks is weathering)*

*What happens to the small pieces of rocks created? (small pieces of rocks become the basis of soil)*

*How did you decide if your rock with smooth? Shiny? etc. (We can observe and describe rocks using our senses.)*

## **EXTEND AND APPLY**

1. Distribute different rocks to each group & have students sort the rocks based on the property given by the teacher.
2. Teacher could then assign a scale i.e. largest to smallest, darkest to lightest for a different sorting activity.
3. To work in partner groups, have one student select a rock and place it on his/her desk. His/her partner will then select a rock from the box with a common characteristic. When placing it next to the first rock, the partner must state the characteristic the rocks have in common. A similar activity done as a class project could be done having the partner whisper his common characteristic to teacher and others could be asked to guess which characteristic the partner matched. To reinforce oral skills, student should select a rock from the collection and hiding it from his team members or classmates; he should describe it verbally and in as much detail as possible. After showing the rock to the teacher, student should return it to the collection and jumble the rocks. Ask a volunteer to find the rock based on the student's description.

## **ASSESSMENT**

The teacher observes that:

- science notebooks contain predictions, observations and explanations.
- students were engaged in the activities and discussions.

# ROCK SHAKERS

## **BIG IDEA 6: EARTH STRUCTURES**

### **BENCHMARKS AND TASK ANALYSES**

**SC.2.E.6.1** Recognize that Earth is made up of rocks. Rocks come in many sizes and shapes.

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The student:

- raises questions about the natural world.
- investigates questions in teams through free exploration and systematic observations.
- generates appropriate explanations based on those explorations.

**SC.2.N.1.5** Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).

### **KEY QUESTION**

Why do rocks come in many different sizes?

### **TEACHER BACKGROUND INFORMATION**

Rocks are solid earth materials that compose the bulk of the Earth. The oldest rock known is approximately 3.7 to 3.9 billion years. Minerals are chemical elements found naturally in or on the Earth. Rocks are made up of minerals, but rocks themselves are not minerals. Rocks come in all shapes, sizes and colors. They can be found almost everywhere. Throughout history, rocks have been used as tools, weapons and building materials.

Soil, a thin blanket covering the bedrock of the Earth, is created as part of the rock cycle. Erosion is the wearing away and movement of rocks and soil by natural forces. Rocks slowly break apart and weather into small, jagged bits and pieces, eventually becoming smooth. Soil, however, is much more than bits of rocks. Soil also contains air, water, humus, and recycling organisms, such as earthworms. It takes hundreds of years to build just a few centimeters of topsoil.

Rocks are best understood by looking at a very simple description of the rock cycle. All rocks originally begin as igneous or fire formed rocks. Igneous are the only original rocks, the other two types being formed by transformation from igneous to sedimentary and/or metamorphic. Igneous rocks are formed from molten liquid materials beneath the earth surface. Magma is the name for the molten materials that cool while beneath the Earth's surface and lava is the name for molten materials that cool while above the surface.

Earth's surface is constantly changing. Movements at plate boundaries build up the earth's surface, forming mountains. At the same time, two processes wear down the earth's surface. Weathering changes earth by breaking rocks and other matter into smaller particles called sediment. Erosion sweeps these weathered particles away. Mechanical weathering includes ice wedging, release of pressure when a large mass of rock reaches the earth's surface, abrasion, and plant action. Chemical weathering includes oxidation and dissolving by acids. Weathering means breaking rock apart by water, wind, and other forces. Erosion means the movement of those rock particles.

## **MATERIALS**

### **Teacher**

1 piece chart paper  
marker  
safety goggles

### **Per student**

Rock Shaker Chart

### **Per group**

1 coffee can w/lid  
2 or 3 rocks  
safety goggles  
masking tape or large rubber bands  
paper towel  
student notebook  
hand lens

## **SAFETY**

Be sure lids are secured on coffee cans before shaking rocks. Using tape or large rubber bands to secure lids is suggested. Do not use glass containers for this activity. Caution students' to not place their faces close to the can when removing the lid. Dust particles will rise up when the lid is removed.

## **TEACHING TIPS**

You can play "Rock" music while the student's shake the cans.

## **ENGAGE**

1. Review some of the properties of rocks that the students discovered in *Rock Detectives*, such as shiny, dull, rough, smooth, multi-colored, made of different materials, etc.
2. Ask: *Do you think your rock from the previous lesson has always been the same size as it is now?*  
*Have you ever taken a trip to the mountains?*  
*What are mountains made of?*  
*If you look at the bottom of the mountain, what do you think you'll find?*

## **EXPLORE**

1. Distribute the materials to each group and the materials to each student. Read and discuss the information on the Rock Shaker Chart.
2. Ask students in each group to take turns observing their group's rocks. They should take turns making a record of the rocks' sizes by tracing around them in the top section of the Rock Shaker Chart. Remind students to use the hand lens to closely observe their rocks, and then color the rock pictures and show any special features of their rocks.
3. Direct students to place their rocks in the coffee can, put on the lid, and tape it with masking tape.
4. Tell students that they will be taking turns shaking the can for 4-5 minutes as a group. You will tell them when to begin and when to pass the can to the next group member. Each student should shake the can for about one and a half minutes.
5. After shaking, tell the students to carefully remove the lid from the can and pour the rock pieces out on a paper towel. Dust particles from the rock will rise out of the can when the lid is removed. Caution the students to not put their face close to the can.
6. Allow enough time for the groups to count and examine the pieces of rock and make their second drawing on the chart.

## **EXPLAIN**

1. Allow groups to share their findings.  
Ask:  
*How many rocks did you put in the coffee can?*  
*Are your rocks still the same size?*  
*Did the color of the rocks change?*

*Do the rocks feel the same after they were shaken?  
Why are some rocks smoother than others?  
Do you think your rock from the previous lesson has always been the same size as it is now?  
How do you think rocks get broken in nature?*

### **EXTEND AND APPLY**

Use literature and magazines to find examples of mountains, boulders and various sizes of rocks. Rock tumblers are an excellent way to make a long-term investigation of this activity.

### **ASSESSMENT**

The teacher observes that:

- science notebooks contain predictions, observations and explanations.
- students were engaged in the activities and discussions.
- the Rock Shaker Chart is completed.

# Rock Shaker Chart

Trace around your group's rocks before shaking.

How many minutes did you shake your rocks?

How many pieces of rock were there after shaking?

Draw a picture of your group's rocks after shaking.

# SOIL SLEUTHS

## **BIG IDEA 6: EARTH STRUCTURES**

### **BENCHMARKS AND TASK ANALYSES**

**SC.2.E.6.2** Describe how small pieces of rock and dead plant and animal parts can be the basis of soil and explain the process by which soil is formed.

The student:

- collects and observes different types of soil.
- uses science tools to observe different soils.
- discusses where the materials found in the soils came from (decayed plants and animals) and how soil is formed.

**SC.2.E.6.3** Classify soil types based on color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.

The student:

- classifies soil types based on color and texture.
- classifies soil by its ability to retain water.
- classifies soil by its ability to support the growth of plants.

**SC.2.N.1.1** Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.

The student:

- raise questions about the natural world.
- investigates questions in teams through free exploration and systematic observations.
- generates appropriate explanations based on those explorations.

**SC.2.N.1.5** Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).

### **KEY QUESTION**

What are the properties of soil?

### **TEACHER BACKGROUND INFORMATION**

Soil is a mixture of rock, mineral particles, and organic matter. Weathering forms the rock and mineral particles of soil. These particles are inorganic parts of soil. Other inorganic parts are water and air. Most organic material in soil comes from decaying plants and animals. This material is called humus. Bacteria and fungi break down plant and animal remains and form humus.

Soil is made up of layers called horizons. The first layer is mostly decaying leaves, twigs, and animal remains. The second layer is topsoil, the third is subsoil, and the bottom is weathered rock. It takes thousands of years for a soil to mature.

As rocks of various types break down the particles mix with decaying matter and other particles in their environment to form soil. Soil is considered the upper layer of the earth's crust that supports plant growth. Soil is made up of air, water, sand, silt, clay, and humus. Humus is made up of decaying matter, providing nutrients for plant life.

## **MATERIALS**

### **Teacher**

clean jar filled with soil  
chart paper  
marker  
class set of soil samples collected from different areas  
small containers for planting seeds  
seeds

### **Per student**

hand lens  
craft stick  
newspaper  
paper plates or containers for soil samples  
spoon for digging  
science notebook

## **SAFETY**

- Remind students to not touch any living things found when collecting soil samples.
- Students should wash hands after the lab is completed.

## **TEACHING TIPS**

- Try collecting the class set of soil samples from area that allow for a variety of properties. Playground sand and beach sand are different and comparable. Soils collected from under heavily wooded areas and around landscaped areas also allow for different explorations and are comparable.
- Ask students and teachers to bring soil samples back from vacation.
- Suggestions for fast growing seeds include, grass seeds, radish, marigolds.

## **ENGAGE**

1. Show students a jar of soil. Ask if they know what is in the jar. Record their responses on a Circle Map.
2. Give each student a spoon and paper plate. Take the students outside and have them gather a soil sample. Be certain that students get their samples from different places.

## **EXPLORE PART 1**

1. Have students cover desks with newspaper. Distribute materials to each group.
2. Tell students to make observations in their science about the soil. Encourage them to look, smell, and touch the soil. Remind them use their hand lens. They can use the craft stick to sort through the soil and look for different parts.

## **EXPLORE PART 2**

1. Show students a class set of soil samples. Have student classify the soil samples based on color, texture, particle size and any other student generated ideas.
2. Have students predict which samples of soil a plant would grow in.
3. Fill small containers with the different types of soil and add seeds.
4. Water each soil with the same amount of water at the same time. This is important to test the ability of the soil to retain water.
5. Place containers in the same area of the room so conditions are as equal as possible for the sprouting of seeds.
6. Have the student observe the cup daily and record observations in their science notebooks about which types of soil sprout seeds.

## **EXPLAIN**

1. Remind students of the *Rock Shakers* activity and review how rocks break down from large boulders to small grains of sand.

2. Ask:  
*What kinds of things can be found in soil?* (Make a list of the different things groups saw in the soil, discuss whether these things are living/dead/nonliving.)  
*Did you find anything you think should not be in the soil?* (trash/ litter)  
*How would you describe the soil?*  
*How does it look? How does it feel? How does it smell?*  
*Why do you think we need soil?*
3. Return to the Circle Map to add/delete from their brainstorming. Conclude that soil is made up of living things and once living things, such as worms, bugs, leaves, and roots. Soil is also made up of things that have never lived, such as rocks and sand. The pieces are all different sizes. Rocks around the world are constantly, slowly changing into dirt.

### **EXTEND AND APPLY**

1. Discuss how important soil is for life on earth. (Plants need soil to grow, and we need plants for food and medicines.)
2. Have students bring in samples of soil from their yards in small baggies. Give each student a paper plate and a plastic spoon. Let students choose spoonfuls of three soil samples to examine and compare and contrast. Discuss the properties of the different soils.

### **ASSESSMENT**

The teacher observes that:

- science notebooks contain predictions, observations and explanations.
- students were engaged in the activities and discussions.

# HOW DO VARIOUS SOILS CHANGE WHEN WATER IS ADDED?

## **BIG IDEA 6: EARTH STRUCTURES**

### **BENCHMARKS and TASK ANALYSES**

**SC.2.E.6.3** Classify soil types based on color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.

The student:

- classifies soil types based on color and texture.
- classifies soil by its ability to retain water.
- classifies soil by its ability to support the growth of plants.

### **KEY QUESTION**

How does water change soil?

### **TEACHER BACKGROUND INFORMATION**

*Vocabulary needed:*

*Rock:* a naturally formed fragment of a mineral

*Soil:* the covering of the Earth made up of tiny rock particles and decaying organic material, capable of supporting life

*Sand:* gritty, granular material made up of rocks and minerals

*Clay:* substance composed of mostly finely grained minerals, capable of being changed in shape when moist, but becoming hard when fired or dried.

*Silt:* particles smaller than sand (.0625 mm). Texture is silky, rather than gritty.

*Humus:* the decomposed organic component of soil providing its' dark brown or black coloration

Basically, soil comes from rocks. It has additional materials combined with the tiny rock particles, differing by location. Rocks are best understood by looking at a very simple description of the rock cycle. All rocks originally begin as igneous or fire formed rocks. Igneous are the only original rocks, the other two types being formed by transformation from igneous to sedimentary and/or metamorphic. Igneous rocks are formed from molten liquid materials beneath the earth surface. Magma is the name for the molten materials that cool while beneath the Earth's surface and lava is the name for molten materials that cool while above the surface. Through weathering, erosion, and other natural and human effects on igneous and/or metamorphic rock small particles are transported and mix with bones, shells, and other organic and inorganic matter. Under pressure these particles are formed into sedimentary rock. Metamorphic rock is rock that has changed from one form to another due to extreme pressure or temperature. Rocks' properties are used in their classification. A geologist is a scientist who studies the history of the earth and its life especially as recorded in rocks.

As rocks of various types break down the particles mix with decaying matter and other particles in their environment to form soil. Soil is considered the upper layer of the earth's crust that supports plant growth. Soil is made up of air, water, sand, silt, clay, and humus. Humus is made up of decaying matter, providing nutrients for plant life.

### **MATERIALS:**

#### **Per group:**

soil samples from previous lesson

water

craft sticks

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#### **Per student:**

Science notebooks

index sample cards (teacher made), 3 per group  
newspaper to cover desks  
styrofoam trays or paper plates  
plastic spoon, one per group

### **SAFETY**

Students should be encouraged to wear goggles or demonstrate care to prevent problems with dust particles in eyes.

### **TEACHING TIPS**

- Place newspaper on the tables prior to the activity to limit a mess. Collect samples of clay, sand, and humus. Spread layer of glue on an index card, sprinkle with the soil sample, and make a 3-card collection for each group. Prepare a few days ahead so that glue is dry.
- Set up work areas for groups of 3-4 students by covering an area with newspaper. Put hand lenses, craft sticks, plastic spoon, a cup of water and three plastic cups of soil (one clay, one sand, one humus) at each work area. Provide each group with a sample card, made previously by teacher, for each type of soil.
- Identify ahead of time locations around the school which may have different kinds of soil (softball field for clay, sandy soil under trees, hums in garden or shrub area).

### **ENGAGE:**

- *What are some of the things you can do with mud?*
- *Has anyone made a mud pie?*
- *Which soil will be best for making mud pies? Why?*

### **EXPLORE: Day 1**

1. Have students observe the three soil samples with hand lens.
2. Have students place a small amount of water on the soil samples until the samples create a thick muddy consistency. Have students observe the changes and record them in their science notebooks.
3. Have students manipulate the soil samples to study the textural characteristics after water is added.
4. When soil samples are wet enough to change and retain their shapes, have students create a small solid shape or form from their soils and set them aside to let dry.
5. Have students predict how the forms will look tomorrow.
6. Add water to teacher samples and make observations as additional amounts are added. The teacher sample should turn into a fluid mixture.
7. Have students draw a picture of the samples and write their observations and predictions in their notebooks.

### **EXPLAIN Day 1:**

1. Discuss the students' predictions.

### **EXPLORE Day 2:**

1. Have students observe the molded soil from day one and discuss their findings (e.g., sandy soil has fallen apart, humus is soft and crumbles, clay retains its shape).
2. Have students record their observations in their science notebooks.

### **EXPLAIN Day 2:**

1. Have students discuss and explain why each sample looks as it does after drying. Have students record their explanations in their science notebooks.
2. Discuss how people would use this information (to pick plants for soil types).

### **EXTEND AND APPLY**

1. Give each group of students a sample of each soil type and tell the students to examine the soil samples with the hand lens.
2. Discuss the characteristics of each type of soil, paying close attention to size of particles, color, shape, and hardness. Ask: *How big are the particles of sand? Of clay? Of humus? What shape are the particles found in humus, clay and sand? Are they all the same? Do all the sand particles look the same?* Have students respond to the questions in their notebooks.
3. Have students compare the three soil samples and write their comparisons in their science notebooks.

### **ASSESSMENT**

The teacher observes that:

- science notebooks contain predictions, observations and explanations.
- students were engaged in the activities and discussions.