

## ACTIVITY: GEOLOGY ROCKS

### Overview

The Earth is constantly changing and evolving. Some of these changes occur naturally while others are caused by human actions. By studying Earth's dynamic geologic make-up and rock cycle, students will understand the forces and processes that create Earth's various landforms and develop an appreciation for the importance of geology in people's lives. Through this appreciation, students will develop a sense of responsibility and respect for the land and demonstrate good citizenship behaviors that will ensure a healthy environment for the future.

### Objectives

Students will be able to

1. describe and illustrate the layers of the earth;
2. explain the rock cycle, including the identification and formation of rock types and the difference between weathering and erosion;
3. demonstrate an understanding of plate tectonics, fossil evidence, earthquakes, and volcanoes;
4. create a timeline of sequential events leading to today's geological features and hypothesize future possibilities;
5. describe and demonstrate responsible behaviors and good citizenship regarding human impact on the land.

### Background

There are four main layers of the earth – the *crust*, *mantle*, *outer core*, and *inner core*. The *crust* is Earth's outer layer composed of solid, rocky material. If the Earth were compared with an apple, the crust would be as thin as the apple's skin. The *mantle* is the middle layer made of a soft, solid material (like butter left out on the dinner table). The *mantle* is very hot and under tremendous pressure. The *outer core*, which begins more than 1,800 miles beneath the surface, is hot molten liquid. Scientists think this is rich in iron and nickel. The movement of this liquid probably causes Earth's magnetic field. The *inner core*, also mostly iron and nickel, is squeezed solid due to extreme high pressure. The combined inner core and outer core at the center of the Earth is larger than the planet Mars.



**SCIENCE:** Earth Patterns, Cycles, and Change - Geology

**CHARACTER:** Responsibility, Respect, Citizenship

**GRADE LEVEL**  
5th Grade

**VIRGINIA STANDARDS OF LEARNING**  
Science: 5.1, 5.7, 6.9, ES.6, ES.8  
English: 5.1, 5.3, 5.7, 5.8

**LENGTH/DURATION**  
4-6 weeks or intersperse activities throughout the year

**MATERIALS**  
hard-boiled eggs, poster board, rock samples, paper, pencils, shaved crayons, flour, water, wooden blocks, pie plates, bread (white and wheat), peanut butter, raisins, dark chocolate chips, honey, marshmallows, jelly, gummy worms, plastic straw or sections of plastic tubes

**VOCABULARY**  
geology, crust, mantle, inner core, outer core, rock cycle, igneous, sedimentary, metamorphic, weathering, erosion, core sample, minerals, plate tectonics, divergence, convergence, transform boundary, subduction, folded, uplift, magma, lava, volcano, rift, earthquake, fossils, stewardship

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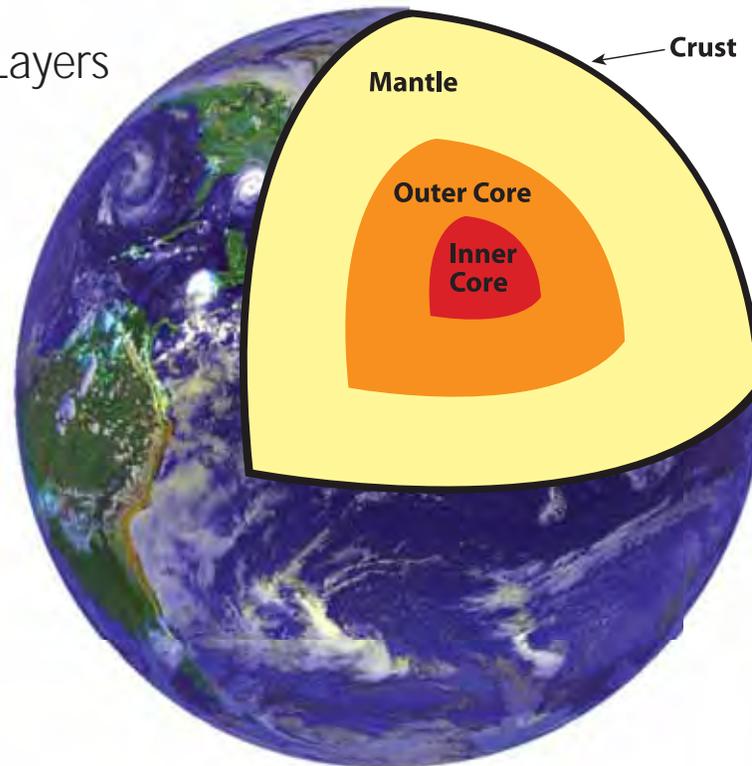
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Scientists believe that the Earth is approximately 4.6 billion years old. Its geology is constantly changing, being restructured and reformed through natural phenomena and also by human impact. The modern theory of *plate tectonics* (formerly called continental

collision (convergence) causes folding and uplifting of rocks. Mountain ranges can form through *subduction* as one plate slides beneath the other or by *uplift* of the plate boundaries at the collision area. Volcanoes form when the subducted plate melts deep in

### The Earth's Layers



drift) states that the outer *crust* of the Earth is separated into several "plates," some containing continents, which move slowly, but continually. Geologists generally agree that there are 6-8 large plates and a number of smaller ones.

There are three main types of plate boundaries: *convergent*, *divergent*, and *transform fault*. Tectonic activity, such as earthquakes and volcanoes, often occurs along these boundaries. A *convergent* boundary occurs when plates move towards one another. Their

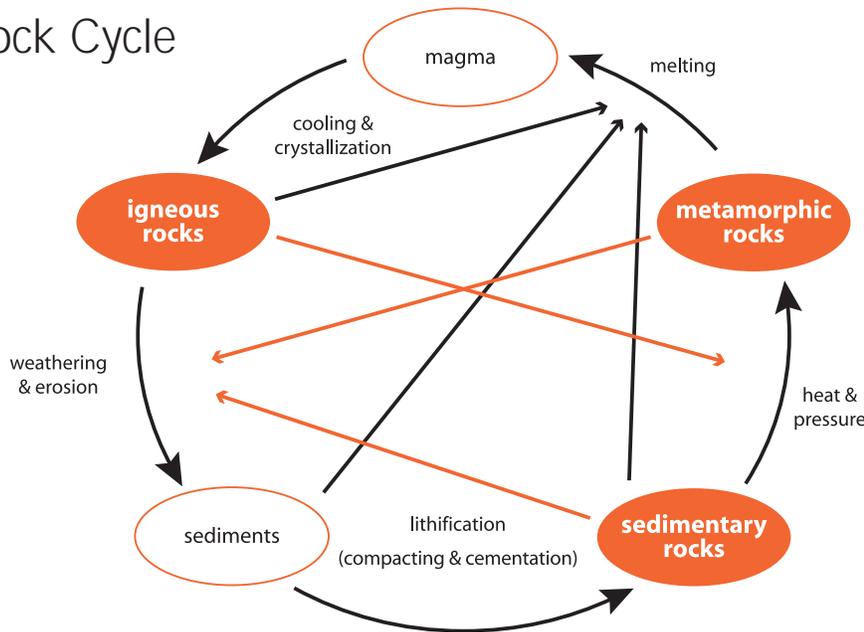
the Earth and the molten rock rises as *magma* to the surface.

A *divergent* boundary occurs when plates pull apart (diverge) from each other. A *rift zone* is formed causing the Earth's crust to thin and form a valley. If the plates continue to pull apart, magma will rise through the rift, causing volcanoes to form.

A *transform* boundary occurs when plates slide laterally past one another. Friction from

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### The Rock Cycle



this movement along plate boundaries can create earthquakes.

The Earth is undergoing continuous change through the formation, weathering, erosion, and reformation of rock. This process is called the *rock cycle*. There are three main types of rocks: *igneous*, *sedimentary*, and *metamorphic*. Rock deep within Earth encounters temperatures high enough to make it melt. This liquid stage is called *magma*. *Igneous* rock is formed when the magma cools and solidifies. Magma that is forced to the surface cools to form *volcanic* rock, while magma that cools beneath the Earth's surface forms *granitic* rock.

As rocks are *weathered* (broken down into smaller pieces) and *eroded* (moved to new locations), the rock fragments (*sediments*) build up in layers. The combined weight of the layers along with other pressures within the Earth causes the layers to compact. The

tiny spaces between rock fragments fill with natural cementing agents and mineral grains in the rock may grow and interlock. Thus *sedimentary* rock has been formed.

Sedimentary rock is also formed under water when shells and skeletons of sea creatures accumulate on the ocean floor. Over a long period of time, these sediments compact and harden to form rock. *Fossils* are most often found in sedimentary rock.

Sedimentary and igneous rocks can be altered by the tremendous pressures and high temperatures associated with the movement and collision of tectonic plates. *Metamorphic* rock is formed under these extreme conditions. Ultimately, any of the rock types may again return to a hot, molten state deep in the Earth, thus completing the rock cycle.

Studying geology helps people to understand how today's geological formations were created and to predict future changes. The

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consequences of natural events and human activity can be better analyzed with knowledge of the underlying rock formations. Geologists often take a "core sample" by drilling into a rock formation and pulling out a layered specimen of the rocks to determine a timeline of geologic events for that area.

Stewardship of the land can begin with an understanding of geology and how natural and human impacts affect the Earth. Through this understanding, a student may develop a new sense of respect for our environment and a new commitment to the responsible, caring, and protective behaviors of good citizenship.



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### LESSON

#### Motivational Activity

Use a hard-boiled egg to illustrate the layers of the Earth. See “All Cracked Up,” Project *Earth Science: Geology* or “Our Earth,” *Delta Science Module II – Earth Science: Earth Movements*. First, gently tap the egg on a hard surface to create several cracks in the shell. Using a marker, outline enough of the cracks so that there are eight large “plates.” Carefully cut the egg in half lengthwise and make a dot in the center of the yolk with the marker. The shell represents the Earth’s crust, the outlined cracks the tectonic plates, the egg white the mantle, the yolk the outer core, and the dot the inner core. Discuss the fact that the real tectonic plates on the Earth’s crust actually move, causing geological phenomena such as earthquakes and volcanoes.

#### Activities

1. Have students “build” the Earth. Divide into four groups. Have Group 1 (2-3 students) hold hands and stand close together to represent the inner core. Have each core member flex his/her muscles to represent dense, solid metal. Have Group 2 (4-5 students) form a circle around the outside of the inner core and hold hands. This group represents the outer core and should move counter-clockwise, slowly moving their arms up and down to represent the moving liquid content. Group 3 (6-8 students) represents the mantle. Have them form a circle around the outer core with joined hands, chanting “hot rock, hot rock.” Group 4 (8-10 students) holding hands in a ring around the outside of the mantle represents the crust. Have them face

outwards and move slowly, chanting “moving plates, moving plates.”

Have students create a computer-generated model of the earth using *Kidpix*, *ClarisWorks*, or other available graphics software. They should review or research the components of the image, then draw and label the crust, mantle, inner core, and outer core. **Option:** Create a bulletin board display showing the layers of the Earth. Start with an unlabeled diagram of the Earth’s layers. Have the students conduct research to find facts about each layer and then label and illustrate the diagram.

2. Read to the class *The Magic School Bus: Inside the Earth* and *The Magic School Bus Blows Its Top!*



3. Introduce the theory of *plate tectonics*. Students can use dough and block models to simulate typical tectonic plate movement and the resulting landforms: uplift - plates crash into one another, creating mountains; subduction - one plate slips under another causing folding of the upper layers; divergent - plates drift apart and separate causing rifts; and transform

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fault – plates slip laterally past each other causing earthquakes. See "Plate Tectonics," *Project Earth Science: Geology and Delta Science Module II – Earth Science: Earth Movements*.

4. Have the students research the timeline of major geological events leading to the earth's features of today. This should include scientific data regarding plate tectonics and the creation and causes of local (or worldwide) land formations. Culminate their investigations with a display of posters, illustrated timelines, and/or dioramas. **Note:** Have the students research and create geologic timelines for the local area and use them for the *Building Respect for the Past, Present, and Future* lesson.
5. Introduce and discuss the rock cycle and the processes of rock formation. Use shaved crayons - layered, pressed, and then heated - to simulate the formation of the 3 types of rocks. See "Rock Around the Clock," *Project Earth Science: Geology*.
6. Create a "sandwich" of earth layers using various types of bread and fillings. Have several sets of materials available and coverings for individual desks. Tell the following stories and ask students to simulate the history of various geological formations by building layered sandwiches.
  - a. White sand erodes from upper rocks and is transported by rain, melting snow, and gravity into a flowing stream to the foot



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of a mountain. The sand is carried along the stream into a river that eventually widens, causing the flow of the water to slow down. This allows the white sand to drift slowly to the bottom. Over many years, this sand becomes cemented together, forming a layer of white sandstone. **First layer - white bread.**

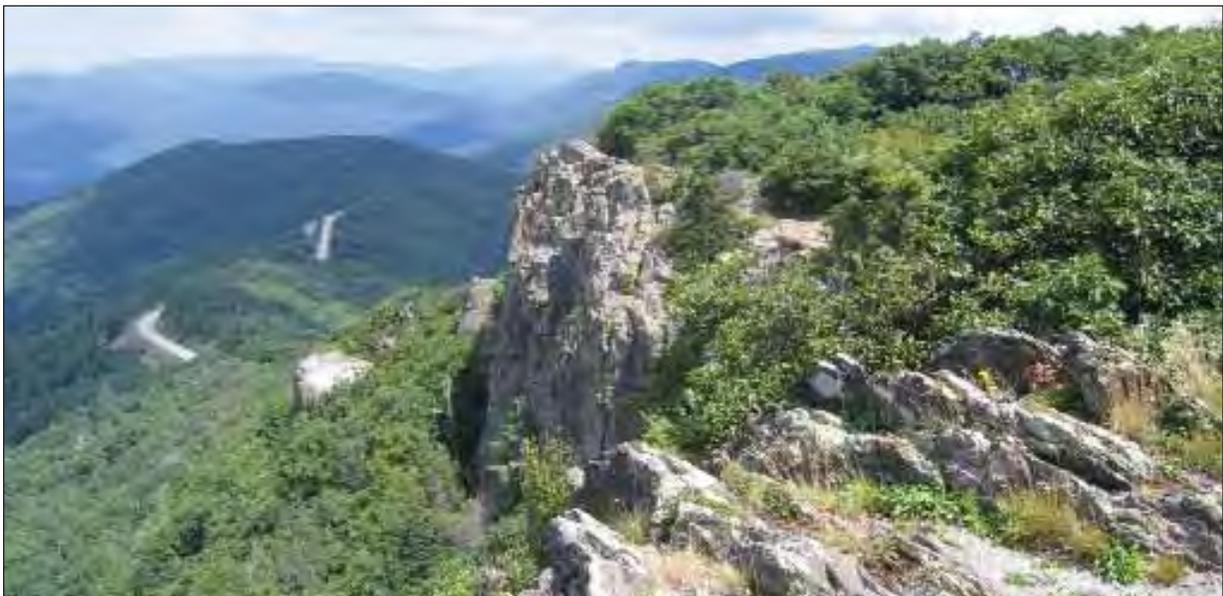
- b. A hurricane passes through the area, bringing torrential rains and wind. Trees, rocks, dirt, and gravel erode into the water and cover the white sand. **Second layer - chunky peanut butter, chocolate chip chunks, raisins.**
- c. Over many years, the river erodes brown silt particles of clay from the land and carries them downstream. Again, the velocity of the water slows as the river widens and the silt gradually drops to the bottom. This eventually forms a sedimentary rock called shale. **Third layer - wheat bread.**
- d. Meanwhile, glaciers are melting on the Earth causing the ocean to rise and cover the area. Millions of tiny marine organisms and shells begin to line the ocean

floor. After many years, the ocean recedes and shells have cemented together forming a layer of rock called limestone. **Fourth layer – jelly.** Many fossils can be found in this layer. **Add candy worms or fish.**

- e. Finally, a layer of brown sand is blown over the entire area. There has been a severe drought and mighty winds have sandblasted large, brown boulders with small bits of rocks. In time this layer will become brown sandstone. **Sixth layer - dark bread.**

The geology sandwich is now complete! Have students pretend to be geologists and use a plastic straw or a section of small-diameter plastic pipe to take a “core sample” of the layers. Have the students examine the core and identify the layers. Relate this to real core samples that help determine the composition and historical sequence of the Earth’s formation.

Bend and “fold” the sandwich to relate this model to the formation of mountains



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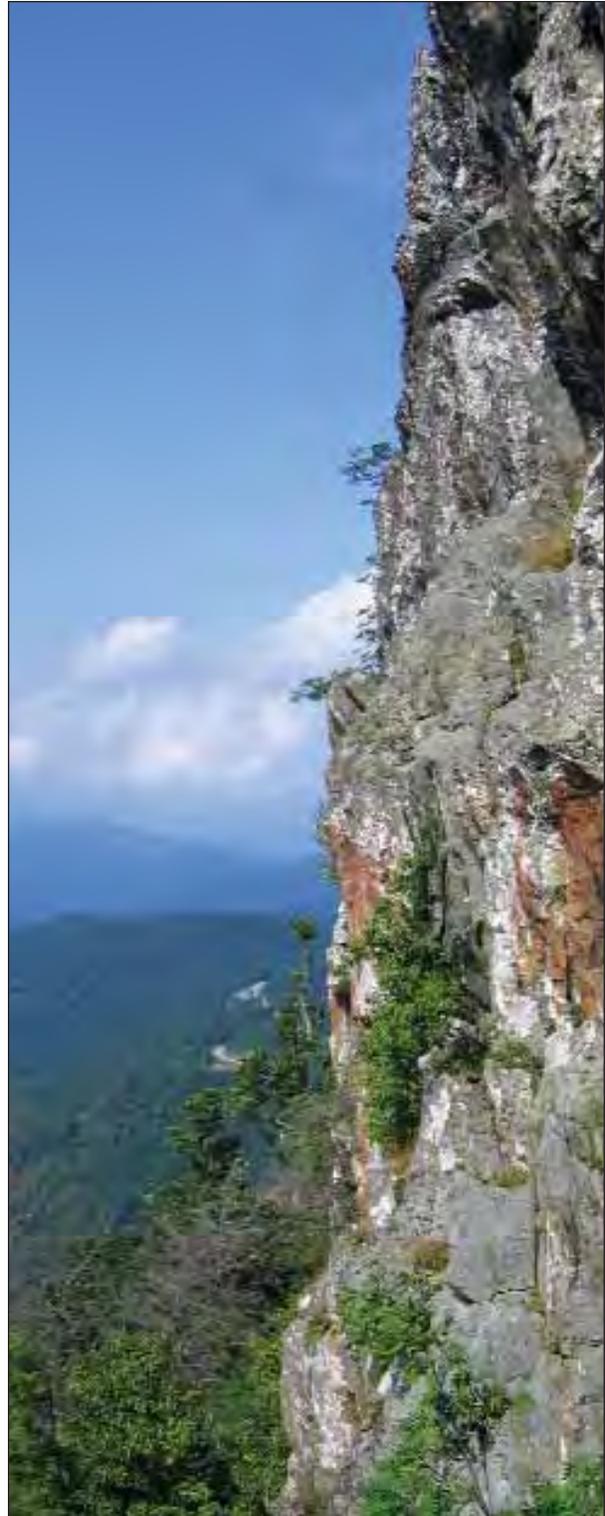
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as plates collide. Have them cut or break their sandwich in half and force one half to “subduct” under the other. Have students visualize the interior layers of mountains, documenting how the order of layers can change. After each “geological event,” have students take another core sample and compare the results. Have the students illustrate, label, and explain the new concepts learned in their journals before eating their geological formations.

7. Review the geological concepts and processes and remind the students that the Earth is constantly changing and evolving. Geological change can occur very slowly, as in the formation of sedimentary rock or the weathering of exposed rocks. Change can also occur suddenly, as in a landslide or an erupting volcano.

Ask the students how geology affects plants, animals, and people. Do plants and animals depend on geology for anything? (Rocks weather and erode and become part of the soil, providing plants with necessary minerals. Rocks provide homes for animals. Rocks can prevent or slow down erosion and provide protection.) Do people depend on geology for any resources? (People depend on “fossil fuels,” oil, coal, and natural gas. Rocks weather and erode, adding minerals and nutrients to enrich soil for farming. People use many metals such as aluminum, iron, copper, and gold. Many types of rock are used for construction and building materials.) How important is geology to living things?



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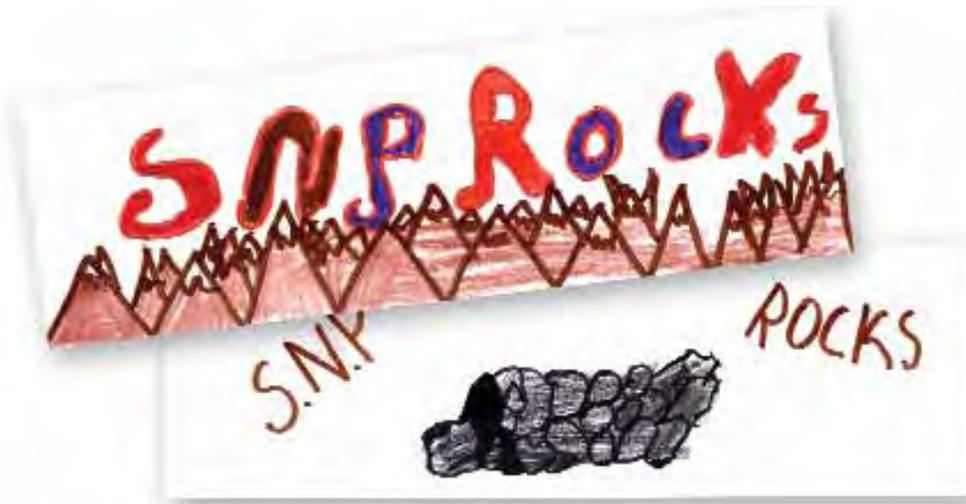
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Take a field trip to a national park or other natural area to see geological features and processes firsthand. Discuss the geological history of the area and observe the formations and geological features. Classify rocks as igneous, sedimentary, or metamorphic. Identify evidence of weathering and erosion. Search for signs of plants and animals that use rocks as part of their habitat. Look for ways people use rocks and geology in the park. Remind the students about the role of

using geologic materials for construction; moving earth and rock for the development of homes, stores, and cities; and damming rivers. Remind the students that geologists think it took millions of years to create these geologic resources. Are these resources that we depend on replaceable? If not, how long before the resources are used up?

Ask the students if people should care about geologic resources. Have the stu-



national parks in the preservation and protection of rocks, geological features, history, and nature.

8. Conclude by asking, "Now that you realize how important geology is to living things, can you imagine life without geology?" We all live on land that is made of rocks and geologic features and depend on many geologic resources. Ask the students if they think human actions can affect the land and geology. Examples include the mining of metals and coal; drilling for oil and natural gas; farming;

students brainstorm ways people can help conserve and protect resources for the future. Examples include recycling aluminum and other metals to reduce mining; using energy-efficient transportation and machines to reduce oil, gas, and coal consumption; following good farming practices to reduce erosion and soil loss; and reducing waste to conserve resources.

Introduce the term *stewardship* and have students discuss the reasons why people should conserve resources and protect the land and the environment. Have students

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express, in a journal or a creative writing format, the personal values, ethics, and behavior changes that they have gained as a result of this study. Allow time to share the writings with others, if desired. Discuss how they will become better, more respectful stewards and responsible citizens as a result.

The students could also create a "contract" with themselves detailing a personal plan for a stewardship activity. Suggest that each person keep the contract in a safe place and review it in 5 or 10 years to see what he/she has accomplished. **Option:** Collect the contracts and return them to the students at a later time.

### Assessments

1. Evaluate the computer-generated model and/or illustration of the earth according to effort, facts, and correct labeling.
2. Observe and document behavior, preparation, participation, and levels of understanding exhibited during classroom activities and discussions.
3. Evaluate any journal entries or written explanations to determine students' knowledge of plate tectonics, rock cycle, fossils, earthquakes, volcanoes, weathering, and erosion.
4. Assess students' research, timelines, and projects based on accuracy, varieties of resources, clarity, labeling of illustrations, and effort. A rubric listing criteria for evaluation should be discussed and posted in advance leading to a positive and inspiring learning experience.
5. Final journal entries, discussions, letters, and written work should reflect students' attitudinal and behavioral changes concerning citizenship, respect, and responsibility for the care of the land.

### Going Further

1. Host an "open house" in your classroom to share projects and concepts learned during the year. Invite parents and other classes to see students act out the rock cycle and plate tectonics.
2. Have the students do the "Lost River Village" activity from *Project Underground* to reinforce land use issues and environmental responsibility.
3. Have students research, classify, and compare geological formations found in other national parks or areas of the world.
4. Have students create a slide show presentation to demonstrate all the geological concepts they have studied. This should include commentary and slides demonstrating good citizenship and responsibility. This could be presented to other classes or schools.

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### Related Subject Activities

1. Art - posters, displays, bumper stickers
2. Social Science - location of landforms in the world, study of the history of an area and events leading up to present conditions
3. Drama – acting out the rock cycle
4. English - research, letters, reports, poetry, debate

### Resources and References

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