



Rocks: Earth's Crust

Activities for children and
adults that build upon Play Trail
experiences outdoors



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Getting children comfortable in the outdoors may be one of the greatest gifts we can offer the next generation. Given what we know about the physical and psychological consequences of a sedentary, electronic media-dominated lifestyle, it also might be one of greatest health tips we can offer. A childhood rich in outdoor experiences provides an inexpensive antidote for a number of medical problems, including depression, attention deficit disorder, and obesity.

But there is more. Letting young children freely explore their world outdoors can instill a lifelong connection to the environment. It can also help cultivate an ethic of caring for the environment.

The role of adults in this process focuses less on teaching and more on coaching. While most children want to explore their world, some may be hesitant or even fearful. Parents and other caregivers need to be there to offer encouragement and guidance without stifling the important work called play.

Tips for Adults

We offer the following tips to help make the most of your Play Trail explorations.

1. Find activities in these booklets that are appropriate for your child's age and interests, as well as environments that are readily accessible to you.
2. Share the booklet with your child in advance.
3. Let your child initiate the exploration, but be ready to offer suggestions in the event encouragement is needed. Consider the booklet's investigations to be jumping-off points that pique curiosity.
4. Avoid the tendency to teach. Share the information you glean from these booklets as "incidental" points of interest.
5. Model positive behaviors and respectful attitudes toward nature.
6. Respect your child's fears. Never force a child to touch something they do not want to touch. Courage and interest come about through positive, graduated experiences.
7. Foster play and accept the fact that dirty hands, mud-caked shoes, and wet clothes often come with it.
8. Avoid the tendency to "helicopter." Too often we over-protect and stifle explorations inadvertently.

Earth's Crust

Earth is made up of three basic layers: the crust, mantle, and core. The crust is the outermost layer. It is also the thinnest layer. You encounter it when you walk on soil, a sandy shore, or a rocky trail. The mantle lies beneath the crust. The thickest layer of Earth, it is made of iron- and magnesium-rich rocks and molten rock called magma (called lava once it reaches the surface of Earth). The core lies beneath the mantle. It is the innermost layer of Earth, composed mainly of iron. At 3,000°, the core is hot—even hotter than lava!

An easy way to way to envision Earth's layers is to look at an apple or avocado. The skin of the fruit is comparable to Earth's crust. The flesh (pulp) is comparable to the mantle. The seeds are comparable to the core.

Rocks, together with minerals and soil, make up Earth's crust. Rocks are made of minerals (and sometimes non-minerals, like fossils or glass). Rocks are formed by heat, cooling, or pressure either at Earth's surface or below it. Some are tiny (pebbles). Others are huge (Ayers Rock, or Uluru, in Australia). Rocks can be solid, but they can also be non-solid (magma). Rocks can be ancient. Rocks also can be young—they constantly form, break down, and reform through a process called the rock cycle.

Rock Types

The texture and composition of a rock offer clues about its origin. An *igneous* rock, such as granite or obsidian, originates as hot liquid magma that cools and hardens, such as when the magma reaches cold seawater. A *sedimentary* rock, such as sandstone or limestone, originates as particles of sand, silt, mud, and other materials on Earth's surface are moved by water and wind. The particles settle, become buried by more sediment, and over millions of years, turn into rock. A *metamorphic* rock, such as marble or slate, is an igneous or sedimentary rock that has been exposed to intense heat and/or pressure. These forces change the mineral composition and texture of the rock. Marble, for example, is limestone whose carbonate minerals have recrystallized.

The Rocks in your Kitchen

Chances are that you have a rock collection in your kitchen. Look for a pumice stone in your cleaning supplies, a countertop made of granite, a floor made of slate or even linoleum (since linoleum contains ground limestone), or a marble pastry board or rolling pin.

What rocks can you find in your kitchen?

Eating Rocks

Materials: A piece of a peppermint candy stick, a small oatmeal raisin cookie, and a small Rice Krispies treat

Procedure: Refer back to the preceding page (Rock Types) to review the three types of rocks. Gather the snacks, using only a very small portion for this activity. As you and your child sample the “rock” snacks, compare the specimens, and talk about what makes them different.

A peppermint stick simulates obsidian, an igneous rock formed when magma comes to the surface as lava and cools very quickly. The grains are very fine and the rock shatters like glass. Can you “shatter” the peppermint stick before eating it?

An oatmeal raisin cookie simulates a schist, a coarse-grained metamorphic rock formed by the forces of heat and pressure. Can you see the large “particles” of raisins scattered in the grainy mass?

A Rice Krispies treat simulates a conglomerate, a sedimentary rock with rounded particles held in place in a matrix. The cereal pieces represent the particles, held together in a matrix with marshmallow “cement.”

The next time you go on a rock hunt, look for rocks that mimic the snacks you just enjoyed!

Finding your Favorite Rock

Purchase an inexpensive bag of rocks or gather a collection that contains a variety of rocks. Let your child play with the rocks and begin to make comparisons. Place the rocks in a shallow tub filled with one or two inches of water. Ask your child if the water changes the color of the rocks.

Let your child select a favorite rock from the collection and describe why it is special.

Together read *Everybody Needs a Rock* (Byrd Baylor) or *If You Find a Rock* (Peggy Christian). Talk about the book's message. Encourage your child to find a special place to store his or her favorite rock.



Safety tip: All young explorers want to scramble over big rocks. Be sure to watch your children and keep them safe as they climb.

Sedimentary Rocks

The word *sedimentary* means formed from sediment. Particles such as pebbles, sand, silt, and clay are swept by wind or water and eventually settle in a river, delta, desert, or ocean basin. As the sediment is buried by more sediment, particles near the bottom move closer together. Minerals are added to the mix, working like cement to glue the particles into solid rock. Sand becomes sandstone, and mud and silt become shale in a process that takes million of years.

Layer by Layer

Materials: 2½ tablespoons of Epsom salts (available at a pharmacy), ½ cup of water, ½ cup of fine, dry sand, two paper cups

Procedure: Pour the water and Epsom salts into one paper cup. Stir the salts continuously until they dissolve. Pour the sand into the second paper cup and then pour the salt mixture into it. Stir the mixture until the sand is completely wet. Set the cup aside for one or two hours. Pour off the water that rises to the top. Continue to do this several times the first day.

Set the cup in a place where it will not be disturbed for a week. When it appears your sandstone is dry, tear the sides and bottom of the cup away from the formation. Carefully set the formation on a paper towel to continue drying. You will have “sandstone” a few million years ahead of schedule!

Molding and Casting Fossils

Sedimentary rocks are the rocks most likely to contain fossils. Fossils typically form underwater where the remains of plants or animals are quickly buried by sand, mud, or other sediment. Over time, the remains are buried deeper. This sediment contains minerals that seep into the pores and turn the hard parts of the body into rock. In other cases, the plant or animal's body dissolves after being buried by the sediment and a fossil mold is left behind. If that depression fills with minerals, a fossil cast is created.

Materials: newspaper, clay, petroleum jelly, large seashell, plaster of Paris, plastic cup, water, plastic knife

Procedure: Cover your work area with newspaper. Roll the clay into a ball, place it on the newspaper, and slightly flatten it, making sure the shape is larger than the shell. Coat the outer surface of the shell with petroleum jelly. Press the outer surface of the shell into the clay hard enough to make a deep impression. This represents your fossil mold.

Mix two tablespoons of plaster of Paris and one tablespoon of water in the cup. Stir the mixture with the knife and then let it sit for a minute or two. The plaster will start to heat up. Pour the plaster into the mold, leveling it with the knife if needed. After the cast has hardened overnight, pop it out. This represents your fossil cast.

Checking Out Minerals

A rock is composed of minerals and a mineral is composed of an element or a combination of elements. The mineral gold, for example, is made of one element. The mineral quartz is made of two elements, silicon and oxygen. You can find minerals in sand, soil, rocks, and even seashells.

One of the properties used to identify minerals is hardness, or how resistant a mineral is to being scratched. For example, your fingernail scratches gypsum (what drywall is made of), but nothing scratches a diamond. Mohs hardness scale uses minerals to test hardness, based on a scale from one (talc) to ten (diamond). You can also use common materials to create a hardness test.

Penny Scratches

Materials: Collection of rocks and a penny

Procedure: Scratch one rock from your collection with another. Which is harder (the one that scratches or the one that is scratched)? Keep the harder rock. Set the other one aside and select another rock. Repeat the test and place the second hardest rock next to the hardest rock. Continue repeating the test until you have at least six rocks lined up.

Now conduct the scratch test with your fingernail and then with a penny. Does your fingernail scratch the rocks? The penny? Try

to find other rocks that are either harder or softer than those you lined up. Rocks scratched by a fingernail have a hardness of one or two. Rocks scratched by a penny have a hardness of three. Other household items used to test hardness include a steel knife blade (hardness of four-five), glass (hardness of six-seven), and quartz (hardness of eight).

Safety tip: Only an adult should use a knife or piece of glass when conducting this hardness test.

Citizen Science

Scientists conduct large research studies to gather scientific data. Often they ask for help because the scope of their research is so large. “Citizen science” invites individuals to record their observations about a geologic trend or event on a website. By doing this, everyone can contribute important information to a central database that is analyzed by trained geologists.

The Geological Society of America and other partners have established a collection of citizen science initiatives called EarthTrek. One of these initiatives is the Gravestone Project which maps the location of graveyards and uses marble gravestones to measure the weathering rate of marble. Information on this project can be found online at the EarthTrek Project website.

More titles in the Play Trails series:

Ants: cooperative colonies

Bees: fantastic farmers

Birds: engineers by instinct

Bugs: Small but Mighty

Butterflies: the magic of metamorphosis

Forests: nature's air filter

Habitats: there's no place like home

Leaves: hidden colors

Pond Life: a busy ecosystem

Spiders: silk spinners

The Forest Floor: a living layer



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