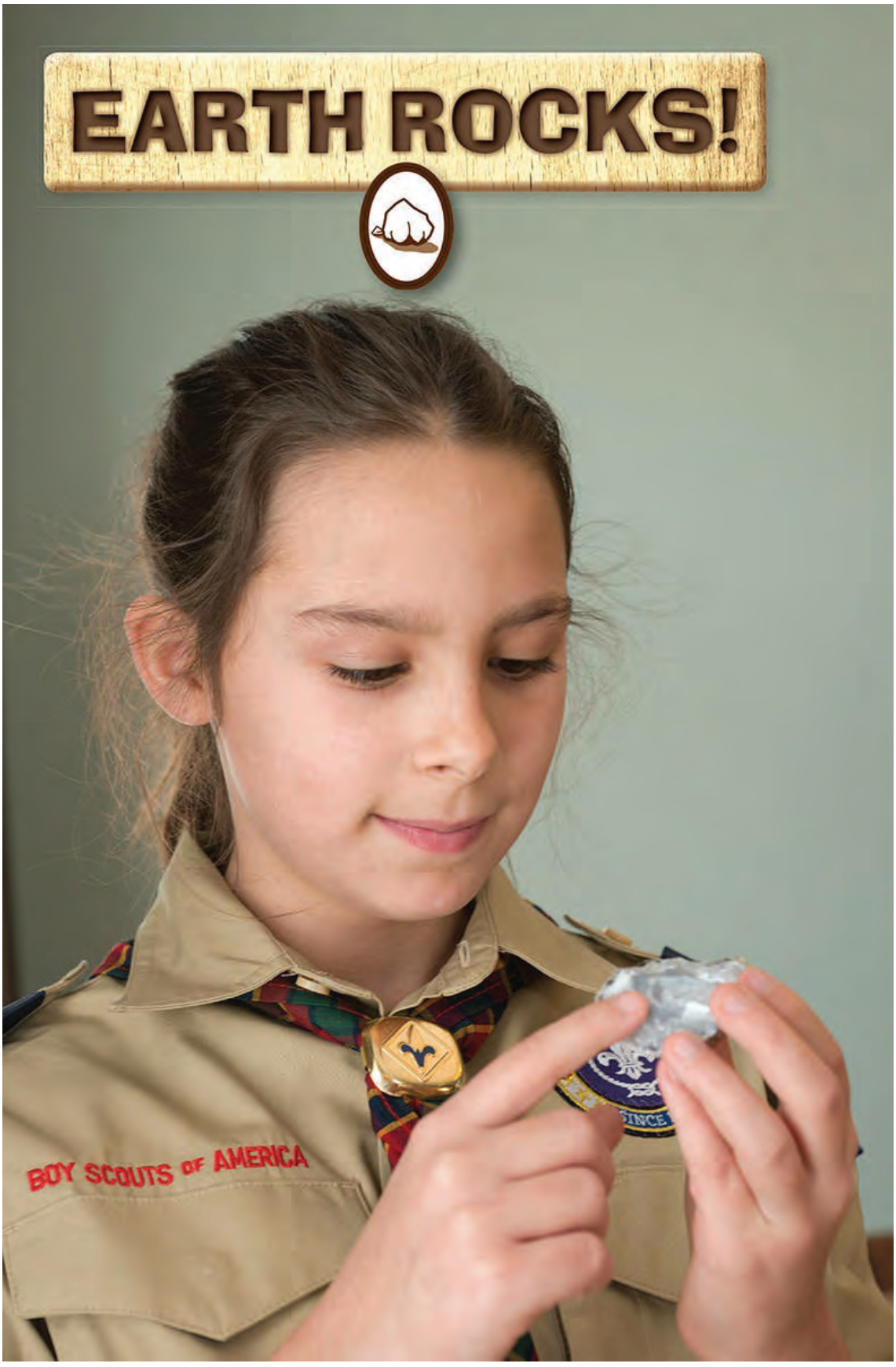

EARTH ROCKS!
BOY SCOUTS OF AMERICA

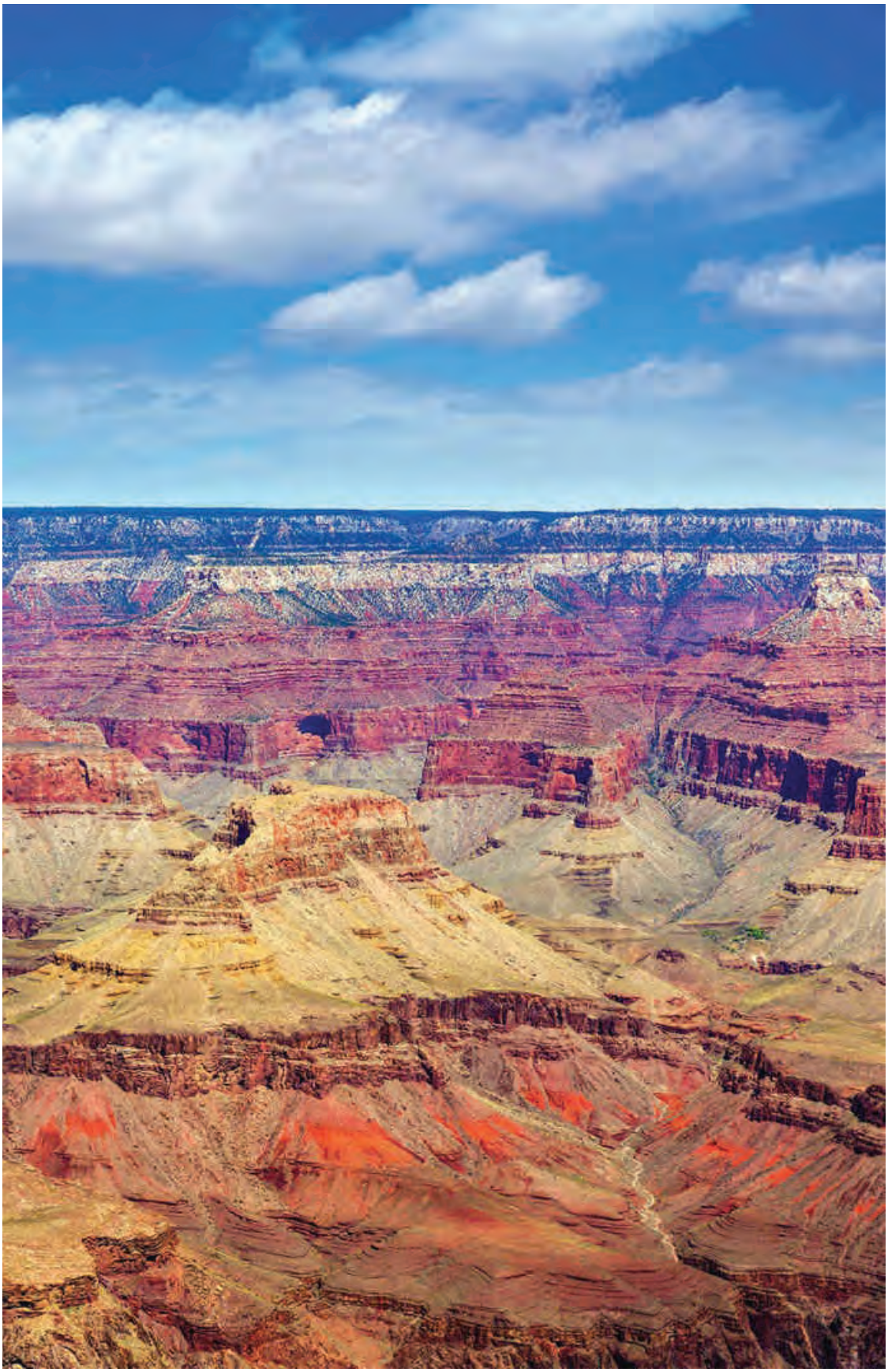
ELECTIVE ADVENTURE

Complete the following requirements.	**Approved by**
1. Do the following:	
A. Explain the meaning of the word “geology.”	_____
B. Explain why this kind of science is an important part of your world.	_____
2. Look for different kinds of rocks or minerals while on a rock hunt with your family or your den.	
3. Do the following:	
A. Identify the rocks you see on your rock hunt. Use the information in your handbook to determine which types of rocks you have collected.	_____
B. With a magnifying glass, take a closer look at your collection. Determine any differences between your specimens.	_____
C. Share what you see with your family or den.	_____
4. Do the following:	
A. With your family or den, make a mineral test kit, and test minerals according to the Mohs scale of mineral hardness.	_____
B. Record the results in your handbook.	_____
5. Identify on a map of your state some geological features in your area.	
6. Do the following:	
A. Identify some of the geological building materials used in building your home.	_____
B. Identify some of the geological materials used around your community.	_____

SNAPSHOT OF ADVENTURE

Rocks and minerals are more than just things that lie in the ground. Yes, they help form our planet, but people also use them to create things that make our lives easier. In this adventure, you’ll dig into the world of rocks and minerals and discover some surprises about the science of geology—like how

the ground beneath your feet is constantly on the move.



COMPLETE THE FOLLOWING REQUIREMENTS.

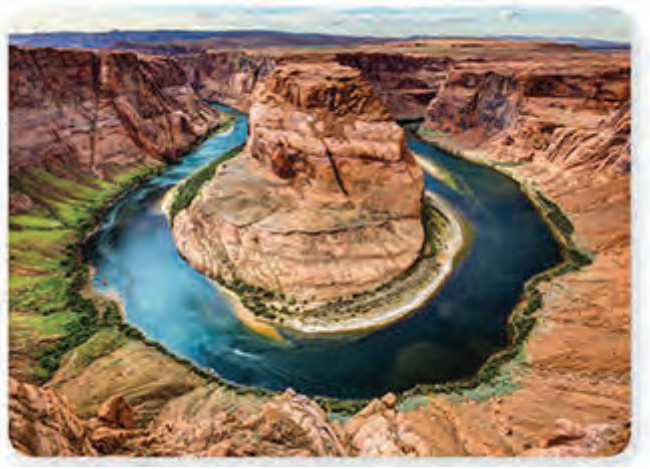
REQUIREMENT 1 | Do the following:

REQUIREMENT 1A | Explain the meaning of the word "geology."

REQUIREMENT 1B | Explain why this kind of science is an important part of your world.

Geology is the study of the earth, including the materials it is made of, the structure of those materials, and the processes that act on them. An important part of geology is studying how the earth changes over time. While the earth might not seem to change much, it is actually always changing. Wind and rain wear down mountains, earthquakes shake the ground, and volcanoes spew melted rock into the air. Even the continents are moving. North America is actually moving to the west-southwest about an inch a year!

A geologist is a scientist who studies the earth. Some geologists study how the earth was formed and how it changes. Other geologists study earthquakes and volcanoes and try to reduce the damage they cause by learning how to predict them. Still others work to improve our lives by using rocks and minerals to supply many of the things we use every day.



Horseshoe Bend, Arizona

Petroleum geologists study the earth's natural resources of oil and gas. Engineering geologists and structural geologists work on building projects. Hydrogeologists work with our water resources. Environmental geologists study the effects we humans have on our planet Earth. What type of geologist would you like to be?

REQUIREMENT 2 | Look for different kinds of rocks or minerals while on a rock hunt with your family or your den.

Everywhere you look there are rocks and minerals. They are part of your world every day. Some rocks are small pebbles, and some are gigantic mountains. Your own backyard and neighborhood are good places to begin collecting rocks. Think about how these rocks were formed and how they ended up where you found them.

Collecting Specimens

One way to begin a collection of geologic specimens is to visit a business that sells building or landscaping stones. These businesses might have small scraps of marble, granite, sandstone, limestone, pumice, shale, or slate they will give you. A nearby science museum might also have rock specimens for sale.

You can also go on a field trip. If possible, go with a rock hound, a collector who knows a lot about rocks. A rock hound will know which rocks contain useful materials. Look for minerals in gravel or sand pits, road cuts, diggings, mountains, hills, and stream banks. Keep your rock samples small. Small ones are easier to carry and easier to care for.

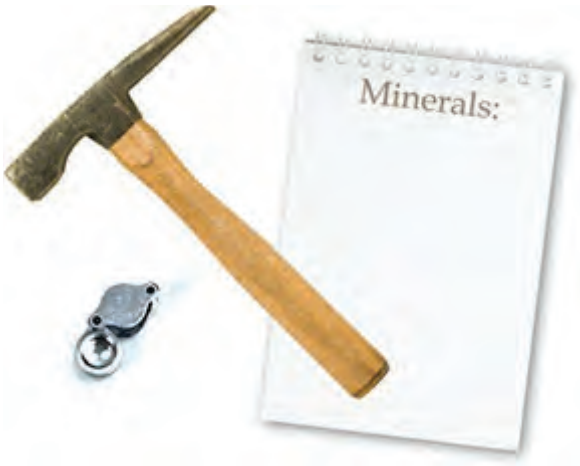
Safety is very important when on a rock hunt. Always have an adult with

you. Stay away from dangerous areas like cliffs, quarries, mines, and mine dump heaps. Be careful when climbing on rocks. And watch out for snakes. They may live under rocks, so always poke around a rock with a long stick before reaching under it.

Collecting rocks is not allowed in national parks and in many state parks. Ask permission before you collect anywhere. If you aren't permitted to collect rock samples, take pictures of your findings to use in a display.

Geologist's Equipment

- Written or verbal permission to collect rocks
- Safety glasses to protect your eyes
- A pocket magnifier for seeing things up close
- A geologist's hammer for pulling rocks out of hillsides and breaking them open
- A cold chisel, half an inch to 1 inch wide, for chipping stone with a hammer and for digging things loose
- Clear plastic food storage bags; write the number of the rock sample on paper and slip it into the bag with the rock sample
- A small notebook and pencil for recording where and when you found a sample; number each sample in the notebook
- Heavy gloves for rough work
- A small daypack for carrying equipment and rocks



Your Collection

You can display your rock collection by putting your rocks in egg cartons, or you can make dividers for shoeboxes. On each rock specimen, paint a spot of quick-drying white enamel. When it is dry, write a number on the spot with a dark felt-tip pen. For each specimen, keep a card with that number. The card is where you will record what the specimen is and where and when you found it.

REQUIREMENT 3 | Do the following:

REQUIREMENT 3A | Identify the rocks you see on your rock hunt. Use the information in your handbook to determine which types of rocks you have collected.

REQUIREMENT 3B | With a magnifying glass, take a closer look at your collection. Determine any differences between your specimens.

REQUIREMENT 3C | Share what you see with your family or den.

Using a guide to rocks and minerals, identify what you have collected or taken pictures of. With a magnifying glass, take a closer look at your collection. Do you see anything different when looking up close? Share what you see with your family or den.

Geologists use the following tests to identify minerals.

- **Color test:** Scratch the specimen on a plate of unglazed porcelain or the back of a piece of tile. The color that appears helps to identify it.
- **Luster test:** How does the specimen look when light is reflected from it? Is it shiny, dull, or greasy?
- **Cleavage test:** How does it split or break up? Does it turn into powder or split in layers? If it breaks into crystals, how many sides does a crystal have?
- **Chemical test:** Does it contain limestone? If a drop of vinegar bubbles on it, the answer is yes.
- **Hardness test:** How hard is it? See the hardness scale in requirement 4.

KINDS OF ROCKS

All rocks belong to one of the three main groups that make up the Earth's crust. They are igneous, sedimentary, and metamorphic rocks.

Igneous Rock

Igneous rock is any rock made by cooling magma (hot, molten material that flows under the Earth's surface) or lava (molten rock that comes out of a volcano). Examples of igneous rock include basalt, granite, and obsidian.

Igneous Rocks

Basalt

Gabbro

Granite

Obsidian

Pumice

Sedimentary Rock

Sediment is gravel, sand, clay, or soil that settles and hardens out of water in riverbeds, ponds, lakes, and oceans. Sediment may contain shells and skeletons. Sedimentary rock is formed in layers, like a giant cake, after sediment has been under great pressure for millions of years. If the sediment was originally sand, it becomes sandstone. Clay turns into shale. Shells and skeletons make limestone. Small pebbles and sand form conglomerate.

Sedimentary Rocks

Breccia

Conglomerate

Limestone

Sandstone

Shale

Metamorphic Rock

Metamorphic rock has been through a process much like baking. (Meta means changed, and morphic means form.) The change is caused by intense heat and great pressure deep in the earth. Under these conditions, sedimentary limestone becomes marble. Sedimentary sandstone turns into quartzite. Igneous granite changes into gneiss (pronounced “nice”).

Metamorphic Rocks

Gneiss

Green schist

Marble

Metaquartzite

Slate

USEFUL MINERALS

The Earth contains many useful minerals. Some, like silica (sand), are easy to see and collect. Others, like iron and zinc, are found in rocks. They must be removed from the rock by a process called smelting or refining.

There are three categories of useful minerals: metals, nonmetallic minerals, and fuels.

Examples of Minerals

Metals	Nonmetallic Minerals		Fuels
	Used in building materials and supplies	Precious and semiprecious stones	
Iron Tin Platinum Zinc Mercury Aluminum Lead Gold Uranium Copper Silver Magnesium	Gypsum Potash Limestone Sand Borax Talc Quartz	Turquoise Topaz Garnet Tourmaline Diamond Zircon Sapphire Ruby	Coal Natural gas Petroleum

CRYSTALS

A crystal is a group of atoms that come together in a certain way to form a molecule. Each kind of crystal has special and unique characteristics and shapes. For example, sugar crystals are oval-shaped and slanted at the ends, while salt crystals are in the shape of little cubes. Crystals can be used in many ways: for eating, like sugar and salt, or as jewelry! Diamonds, rubies, sapphires, and emeralds are all different kinds of crystals, formed by different elements and atoms.

THE WEATHERING AND EROSION OF ROCKS

Weathering is what happens when rocks and minerals break apart because of water, ice, wind, heat, or cold. Erosion is what happens when the pieces caused by weathering are carried away. Weathering and erosion are important parts of geology.

Ice Erosion

Ice is another strong force that causes large amounts of physical erosion. In mountainous locations in the world, the rock and soil are commonly frozen together. Ice grows in the cracks of the rocks and pushes the rock particles apart. When the water melts and freezes again, it moves the particles away from each other and the process repeats itself. When water flows down a hillside, it can cause erosion similar to wrinkles in the soil. Glaciers, which are huge pieces of ice, move slowly down a mountain with the force of gravity. The weight of the glacier presses into the ground, forcing it apart and separating rocks. During the movement of glaciers, some of the ice also melts and refreezes as it moves, continuing to pick up rock pieces, dragging them across other rocks in the glacier’s path, and breaking them into even smaller pieces.

Wind Erosion

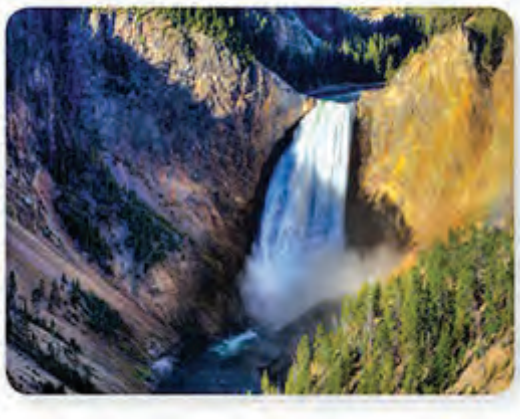
The movement of the wind erodes and creates different landforms. Wind is an invisible force that includes small pieces of rocks and minerals. This kind of erosion is not very strong because it takes a lot of energy to transport sand and dust. This type of erosion is known for smoothing the earth around us. Every time there is wind, the erosion impact can break off smaller pieces of larger rock. Sometimes the little rock pieces break into even smaller pieces. These smaller pieces can stay where the wind carries them until water washes them to another location, waiting for wind erosion to carry them away again.

Water Erosion

Have you ever noticed that rocks in riverbeds and on lake and ocean shores are small and smooth? That’s because of water erosion. Water causes a great deal of physical erosion. When rain falls heavily, flooding can happen, changing everything that the fast-moving water carries with it. Rushing water can also cause mudslides. The force of the rushing water causes sharp edges of rocks to knock loose, which creates smoothness. Water erosion has caused geological landforms such as canyons and rivers. The Grand Canyon, which is a mile deep and 277 miles long, was formed by water erosion.

FOSSILS

You may find fossils while you are looking for rock specimens. A fossil is a trace of animal or plant life from millions of years ago that has hardened in rock. A fossil may be a print of a shell or the skeleton of a fish or bird. It may be a dinosaur's track or a leaf or flower print.



Would you believe that fossils from the sea can be found in a desert? It's

true! This means that the spot where they were found was once an ocean floor. Certain plants and animals live in hot climates, but their fossils have been found in cold countries. This means that these areas were not always cold.

Wind and water erosion have changed the earth’s landscape and helped to move fossils and other geological items over time. Fossils have even been discovered on top of mountains.

Sedimentary rock usually contains fossils. Geologists study the rock layer in which the fossils were found. Then they can tell when the country was warm and for how long. Fossils show us what plants and trees lived millions of years ago and where.

They show the changes that have happened through the years. You probably can find fossils in your own neighborhood. Look in diggings, road cuts, or stream banks—wherever cuts have been made through layers of sedimentary rock.

REQUIREMENT 4 | Do the following:

REQUIREMENT 4A | With your family or den, make a mineral test kit, and test minerals according to the Mohs scale of mineral hardness.

REQUIREMENT 4B | Record the results in your handbook.

A long time ago, a geologist named Friedrich Mohs figured out that you can test the hardness of minerals by seeing whether they can scratch other materials or whether other materials can scratch them. He created a scale that gives different minerals hardness values from 1 to 10.

Mohs Hardness Scale

Scale No.	Mineral Example	Scratch Test
1	Talc	Scratches easily with fingernail
2	Gypsum	Barely scratches with fingernail
3	Calcite	Barely scratches with copper penny
4	Fluorite	Scratches easily with file or knife blade
5	Apatite	Barely scratches with file or knife blade
6	Feldspar	Doesn't scratch with file or knife blade; scratches easily with glass
7	Quartz	Easily marks steel and hard glass
8	Topaz	Is harder than common minerals
9	Corundum	Scratches topaz
10	Diamond	Scratches corundum; hardest mineral

Many experienced rock collectors carry a mineral testing kit on their rock-hunting trips to test hardness and other mineral characteristics. Knowing the hardness of a mineral will not always tell you its identity, but it will help rule out some possibilities.

You can buy a mineral testing kit, but it's more fun to make one yourself using materials you can find around your home or buy cheaply.

Here's what you need:

- Penny

- Small piece of glass
- Piece of unglazed tile
- File or pocketknife
- Small bottle of vinegar
- Eyedropper
- Minerals

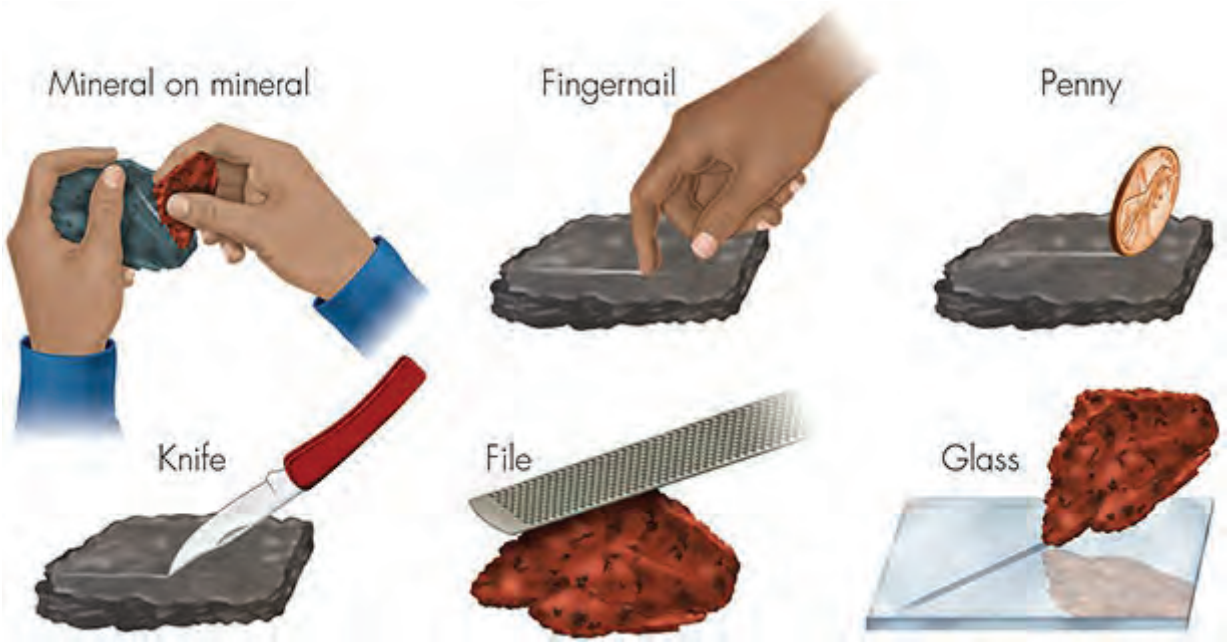
Here's how to use your kit:

Step 1. Scratch the tile with your mineral to determine the "streak" of the mineral. The streak is the color of the resulting powder. It's usually a more consistent color than the apparent color of the mineral. You can refer to a mineral identification chart to find out what minerals have this streak.

Step 2. Use the eyedropper to put a drop of vinegar on the mineral. If the vinegar fizzes, that means the mineral contains calcium carbonate.

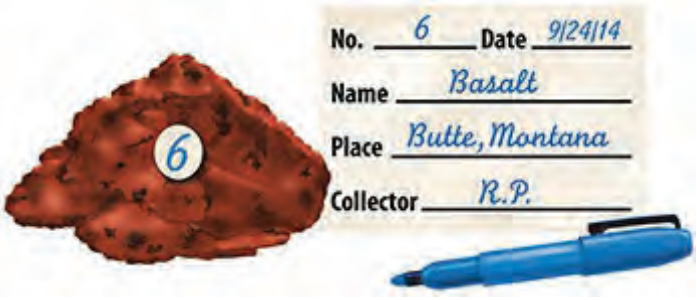
Step 3. Test the hardness of the mineral by trying to scratch it, in order, with your fingernail, the penny, and the file or knife. Then, try to scratch the file or knife and the glass with the mineral. Refer to the chart to determine the mineral's hardness. For example, if you can scratch the mineral with your fingernail, it measures 1 or 2 on the scale. If the mineral can scratch the file or knife, it measures at least 7 on the scale.

Hardness tests



Streak test for color

Labeling

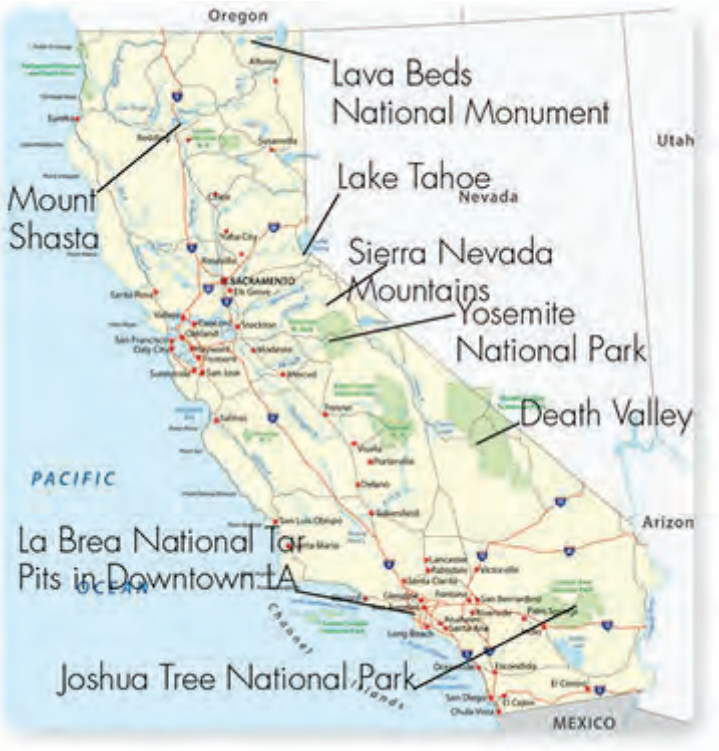


Mineral Types	Description	Scratch Test	Scale No.

REQUIREMENT 5 | Identify on a map of your state some geological features in your area.

Geological features are all around us. Mountains, plains, lakes, rivers, swamps, and caves are just some of the natural features that may be found near where you live. And there may be man-made features like dams, quarries, mines, canals, and channelized streams.

Mark some of those features on a map of your area. Try to imagine what forces created them. Imagine going back in time to see how those features were created.



While you're exploring the past, see if you can discover how your area has changed over thousands and even millions of years. (A good place to start is a local science or natural history museum.)

You may discover things like this:

- During the Devonian Period (408 million to 360 million years ago), a shallow sea covered much of eastern North America from New York

through Kentucky to Texas.

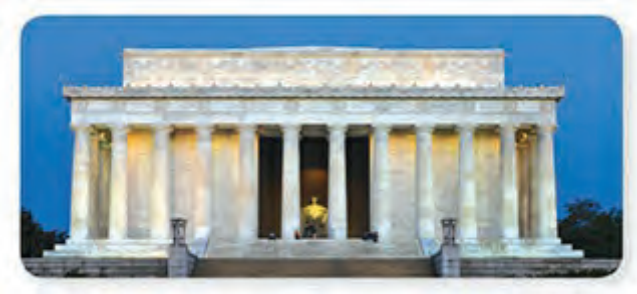
- The Colorado River has been forming the Grand Canyon for the past 17 million years.
- During the Wisconsin Glacial Episode (85,000 to 11,000 years ago), glaciers covered Canada, New England, the Upper Midwest, and parts of Idaho, Montana, and Washington.
- In the 20th century, the U.S. government built dams on many rivers to control flooding and generate hydroelectric power. One of the most famous, the Hoover Dam, impounds Lake Meade in Nevada and Arizona.

REQUIREMENT 6 | Do the following:

REQUIREMENT 6A | Identify some of the geological building materials used in building your home.

REQUIREMENT 6B | Identify some of the geological materials used around your community.

Although your home may be made mostly of wood products, plenty of geological building materials went into it as well. The chart shows some common geological materials used in construction. Can you add others?



The Lincoln Memorial is made of marble.

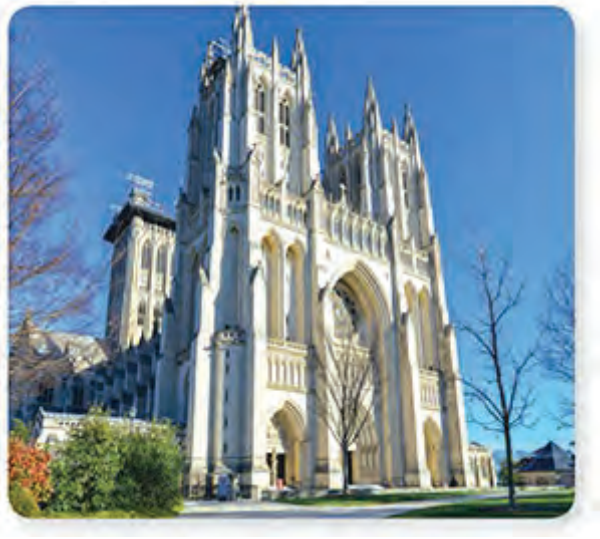
Geological Materials in Construction

Ore	Metal	Use
Hematite Limonite Magnetite	Iron	Beams, girders, posts, nails, machines, screws
Azurite Malachite Chalcocite	Copper	Electric wiring, gutters, roofing, pipes
Sphalerite	Zinc	Galvanized pipe, sheet metal
Bauxite	Aluminum	Siding, windows, doors, roofs
Quartz	Silicon	Glass
Kernite Borax	Boron	Glass
Limestone	Calcium	Cement, building stone

Here are a few places to look for some types of rocks in your community:

- **Granite.** This strong igneous rock is used often in city buildings. Look for it on the outside of buildings. It can be gray, pink, or a deeper rose color. It has a speckled pattern. The darkest flecks are mica crystals, and the glasslike areas are quartz crystals. You can find both rough and polished granite in buildings.

- **Sandstone.** In eastern cities, many older homes called brownstones were built of brick and then covered with brown sandstone blocks.
- **Slate.** This metamorphic rock, changed by heat and pressure, was once clay. It can be split into slabs. You might find an old sidewalk made of gray slate. Chalkboards in schools used to be made of smooth black slate. Some roofs are made of slate.



The Washington National Cathedral is made of limestone.

- **Marble.** Look for marble in the lobbies of office buildings and banks. A streaky, swirling pattern of mixed color and a smooth, shiny surface will be the main clues. Marble comes in many different colors. The main color might be black, gray, green, pink, or white. You can find marble in museums and parks, too. Pure white marble is often used for sculptures, statues, and monuments.