2. Earth Resources

These activities introduce the practical side of minerals, or how rocks and minerals are used in everyday life. We are surrounded by our mining heritage, from gypsum in walls to brass knobs on doors or clay in flowerpots and on pages of glossy magazines. Mineral resources may be divided into three classes: metals (iron, copper, nickel, etc.), nonmetals (sand, clay, limestone, salt), and fossil fuels (coal, oil, natural gas). The following activities will help you appreciate the role mining and minerals play in day-to-day life.

Activity 2.1: Everyday uses of rocks and minerals.
In a group, circle around a flipchart, chalkboard or white board. Look around and list everyday things and the rocks and minerals you think went into them. (If using a good old black chalkboard, you can start with the chalk itself and the slate of the chalkboard.)

Activity 2.2: Minerals in the home.
Write a report or make a poster about at least 10 rock and mineral products in your home or in a particular room in your home: your bedroom, bathroom, kitchen, living room, etc.

Activity 2.3: Collecting everyday objects and the rocks and minerals that went into them.
Build a collection of everyday objects and minerals that went into them. You can get specimens by collecting them in the field, trading with other club members, or purchasing them at nature stores, museum gift shops, rock shops, or gem shows. Here are examples to get you started: a penny and a copper nugget; a nail and a piece of hematite; a tube of fluorinated toothpaste and a fluorite crystal; laundry detergent and a borate mineral; a fishing weight and a galena crystal. Display your collection of everyday objects and their source minerals at a local gem show, the library, during show-and-tell at school, at one of your club meetings, or wherever else a public display might be possible.

Activity 2.4: Field trip to a mine or quarry.
Take a field trip to a mine or quarry. Afterwards, write a report for your Youth Leader or make a presentation at the next club meeting describing what was being mined, how it was being mined, and how it's ultimately used. If you were able to get a sample of what was being mined, bring it to your next meeting and show-and-tell everyone about it.

Activity 2.5: Field trip to a hardware store.
Take a "field trip" or "scavenger hunt" to a local hardware store or home building supply store. List things you see there and their source rocks and minerals.

Activity 2.6: Careers in the earth sciences.
Learn about careers in the earth sciences (mining, teaching, gemology, the jewelry business, seismology, etc.). Maybe even interview someone in such a job, such as a local jeweler. Write a brief paper imagining yourself in such a career and some adventure you might undertake in that job. For instance, an oil geologist might be taking a boat ride to an off-shore oil platform. A paleontologist with a museum or university might be prospecting for fossils in the Gobi Desert. A gemologist might be cutting the world's largest blue diamond. What would be an interesting job to you?

2. Earth Resources

□ 2.1 Everyday uses of rocks and minerals

□ 2.2 Minerals in the home

□ 2.3 Collecting everyday objects and the rocks and minerals that went into them

□ 2.4 Field trip to a mine or quarry

□ 2.5 Field trip to a hardware store

□ 2.6 Careers in the earth sciences

To earn your Earth Resources badge, you need to complete at least 3 of the 6 activities. Check off all the activities you've completed. When you have earned your badge, sign below and have your FRA leader sign and forward this sheet to the AFMS Juniors Program chair.

_____
Date completed

_____ _____
My signature Youth leader's signature

_____
Name of my club

Leader's preferred mailing address for receiving badge:

_____

_____

_____

Back-up page 2.1, 2.2, 2.3: Everyday objects and the minerals that went into them.

You could conduct Activity 2.1 as a single group activity or make a competition of it, dividing the kids into two or more teams and seeing who can make the longest list in 10 minutes. To conclude the activity, you might unveil a collection of mineral specimens, revealing the actual raw materials that went into some of the things in the room.

Sitting at my computer when I first considered Activity 2.1, I quickly saw a brass lamp, windows made of silica, all sorts of things made of plastic derived from petrochemicals, bricks in the fireplace derived from clay, an old tin cup holding my graphite pencils, a gold wedding ring on my finger, walls made of plasterboard comprised of gypsum, steel nails in the furniture, and paint on the walls containing diatomite as filler. In fact, the television off to the corner contains no less than 35 different metals and the telephone handset has no less than 42 different minerals! To get kids primed to think about what things are made of, you might hold up a couple common items that serve as good teaching examples:

1) an old watch you can take apart (especially one with luminescent hands) has a glass/silica top, a metal body made of brass, aluminum, etc., interior parts that might include gemstones, radioactive minerals for luminescence, etc.
2) a salt shaker with an aluminum top and glass body, filled with salt (halite) crystals.
3) an incandescent light bulb with glass exterior (made from silica, soda ash, lime, coal, and salt), brass or aluminum screw-in base, tungsten filament, copper and nickel lead-in wires, molybdenum tie and support wires, aluminum heat deflector, etc.
4) a pencil may have a wooden body, but it's filled with a rod composed of graphite mixed with kaolinite and has an eraser that may hold pumice for grit and that is held in place with a band of metal that may be aluminum (bauxite) or brass (copper and zinc/sphalerite). Wow! As many as 5 or 6 rocks and minerals in a common pencil!

There are several good web sites you can consult that provide handy lists and tables linking minerals to everyday objects. Two particularly good ones are the Minerals Education Coalition (www.mineralseducationcoalition.org) and Women in Mining (www.womeninmining.org). (The Minerals Education Coalition web site provides a nice graphic illustrating all the minerals going into a light bulb; the ones I've described above are just a few on their list.) Our U.S. Geological Survey (USGS) has a website for the National Minerals Information Center (http://minerals.usgs.gov/minerals/) that provides statistics and information on minerals essential to the economy. The American Geosciences Institute publishes a digital-only book called *The Consumer's Guide to Minerals.* You can purchase it for a very reasonable price ($4.99 as of January 2016) by going to www.agiweborg/pubs. It explores the myriad uses of minerals in scientific research, manufacturing, medicine, and commercial applications. Following are samples from this book and these websites:

Rock or Mineral	Everyday Object
Barite	Glass; paints; textiles; toothpaste; green color in fireworks
Bauxite (aluminum ore)	Cans & other containers; aluminum foil; autos; airplanes; building components like aluminum siding, window frames

Rock or Mineral	Everyday Object
Borax	Laundry detergent
Calcite	Cement; plaster; glass; steel; toothpaste
Cassiterite (tin ore)	Cups, plates, & cans; coinage; opalescent glass; enamel; weather-resistant vinyl siding; solder
Celestite	Fireworks; caustic soda
Chalk	Chalk; quicklime; mild abrasive; fingerprint powder
Cinnabar (mercury ore)	Batteries; thermometers; barometers
Coal	A “fossil fuel for heating; generating electric power
Copper	Coinage; electrical wiring; electronics; plumbing pipes; brass
Corundum	Ruby & sapphire gemstones; abrasives
Diamond	Jewelry; abrasives; cutting tools and drills
Diatomite	Swimming pool and other filters; toothpaste; metal polishes
Dolomite	Magnesia for medical/industrial uses; crushed road stone
Feldspar	Clay products (pottery; ceramics); glass; gemstones
Fluorite	Toothpaste; hydrofluoric acid; steelmaking; nonstick pans
Galena (lead ore)	Fishing weights; car batteries; machine parts; solder; linings for radiation protection; bullets
Garnet	Sandpaper and other abrasives; jewelry
Gold	Jewelry; dentistry; electronic components; coinage; astronaut face masks are gold-coated to protect against solar radiation!
Granite	Ornamental building stone; monuments; gravel
Graphite	Dry lubricant; brake linings; molds in foundries; pencil lead
Gypsum	Plaster-of-Paris; wallboards; fertilizer
Halite (salt)	Food; highway de-icing; chemicals; source of chlorine
Hematite (iron ore)	Nails & screws; steel; machine parts; tools; chains and fences; bikes; cars; bridges; building frames
Kaolinite (clay)	Tiles; kitty litter; bricks; dinnerware and other ceramics; toilets, sinks & bathtubs; glossy paper; fiberglass; stomach medicines; pencil lead; chimney liners
Kyanite	Sparkplugs; electrical insulators; porcelain products
Limestone	Cement; crushed road stone; building stone; steel making
Lepidolite (lithium ore)	Rechargeable batteries; electric car batteries; ornaments
Malachite	Ornamental stone & jewelry; copper; green pigment
Manganese	Used in making steel
Marble	Architectural & ornamental purposes; statuary
Mica	Electronic insulators; joint compounds; paints; plastics; rubber products; toothpaste; Christmas tree “snow”
Nickel	Coinage; alloys; nickel steel (stainless steel); magnets; electroplating; rechargeable batteries; electric guitar strings
Phosphate	Fertilizer; animal feed supplements
Pumice	Concrete blocks; abrasives; Lava-brand soap; cosmetic stone to rub away dead skin
Pyrite	Sulfuric acid; decorative rock sometimes used in jewelry
Quartz (silica)	Glass; gemstones; spectrographic lenses; clocks & watches; also, quartz sand has many uses when mixed with other substances as in cement
Rutile (titanium ore)	Ore of titanium—used in jetliners & artificial hips & knees
Sand & gravel	Concrete; asphalt; road fill; blocks; bricks

Rock or Mineral	Everyday Object
Silver	Jewelry & ornaments; silverware utensils; coinage; mirrors; photography; solar cells; batteries; photosensitive glass
Slate	Roofing shingles; blackboards; patio slabs; the beds on high-quality pool & snooker tables
Sphalerite (zinc ore)	Metals & alloys (brass); rust-proof coating on other metals; nails & screws; batteries; water & gas valves; paint; pigments in rubber; skin creams
Sulfur	Sulfuric acid; fertilizer; gunpowder & other explosives; rubber
Talc	Talcum powder; cosmetics; ceramics; rubber; plastics; paper
Trona, or Soda Ash (sodium carbonate)	Glass containers (such as light bulbs); fiberglass; detergents; medicine; food additives; photography; pH control of water
Tungsten	Filament in light bulbs
Vermiculite	Insulation
Wolframite (tungsten)	Light bulb filaments; cemented carbides; steel additive
Zircon (zirconium ore)	High-temperature ceramics; nuclear reactors; abrasives

Activity. To illustrate a practical use, get diatomite from the swimming pool supply area of a hardware store. Poke a number of holes in the bottom of a large, sturdy paper cup. Line the bottom of the cup with a few layers of cheesecloth. Fill the cup a quarter- to half-full with a mixture of diatomite and pea gravel. Cut the top off a plastic water bottle and insert your cup on top. Pour muddy water into the cup and allow it to sit. You should end up with more-or-less clear water at the bottom of the water bottle (it will still be a little muddy, but not nearly as muddy as it began) as a result of the filtration properties of diatomite, which is composed of microscopic silica "skeletons" or tests of fossil diatoms that are peppered with tiny holes. The porous nature of these tests makes diatomite a perfect filter.

Note: *Kids who write a report about minerals in the home for Activity 2.2 can simultaneously satisfy requirements toward earning their Communication badge (Activity 7.2).*

Back-up page 2.3: Collecting everyday objects and the minerals that went into them.

For pointers on building a collection, see back-up pages for Badge 5 on Collecting.

To help your kids in collecting common minerals, start by approaching your fellow club members to see if they might have supplies of minerals they've collected over the years that they would be willing to donate to the cause (quartz crystals, fluorite, galena, gypsum, hematite, etc.). Also, many common minerals are inexpensive and readily available from show dealers, and sometimes show dealers will offer special bulk discounts if you approach them about your project.

In the retail arena, various nature stores sell common minerals (pyrite crystals, tumble-polished pieces of quartz or hematite, etc.). Toy stores and crafts stores are other spots to try, as well as stores selling teaching supplies and the gift shops of natural history museums.

If you have active mines in your area, they may be willing to donate samples. For instance, the vast borax mine in Boron, California, is happy to lead tours and provide free samples of various borate minerals.

Still other sources (although more expensive) are the various scientific supply houses, such as Ward's, Edmund Scientific's, etc.

Note: *Kids can use this activity to satisfy requirements toward earning their Collecting badge simultaneously (Activity 5.1). And those who put together a public display can use it toward satisfying requirements for earning the Showmanship badge (Activity 6.4).*

Back-up page 2.4: Field trip to a mine or quarry.

There's nothing like showing your kids nature's bounty first-hand and where it originates. Arranging tours at quarries and mines can be a fun adventure. Many mining companies are happy to provide educational tours if contacted well in advance so that appropriate arrangements can be made.

In my home state of California, opportunities abound with inactive and active gold mines, Wild West silver towns like Calico, the borax mine in Boron, diatomite mines near Lompoc, a limestone quarry near Davenport, tourmaline mines near San Diego, gypsum mines near Ocotillo, etc. Growing up in Illinois, I was often taken on organized field trips sponsored by the Illinois Geological Survey to operating limestone quarries, coal mines, and lead mines for fossil and mineral collecting. Later in Maryland, I often searched for petrified wood as well as minerals like garnets in sand and gravel quarries, and I found an abundance of active and inactive coal mines and limestone quarries when I lived in Pennsylvania.

How do you find out about local quarries and mines? One possibility is the Yellow Pages. For instance, in my local phone book, I found Best Rock Mining Company listed under "Mining Companies." Look under "Mining," "Rock," "Quarries," etc. Try the local Chamber of Commerce. Other good bets are state geological surveys, which maintain lists of mineral resources and active mining companies. You can locate your state survey via a Google search on the computer or by looking in the phone book "Blue Pages" under State Government listings, where it might be included under the Department of Conservation or Geological Survey. On the web site of the United States Geological Survey (http://www.usgs.gov/) a handy map of the U.S. allows you to click on your state for regional geologic information.

After a field trip to a mine or quarry, have kids prepare written reports or make individual or group presentations at the next club meeting describing what was being mined, how it was being mined, and how it's ultimately used. They can also bring and share samples collected at the mine (some mines allow this; others don't) and perhaps use the experience as the basis for an educational display case at your next show or to share at their school or a science fair.

If you can't make it to a mine or quarry, never fear! The World Wide Web comes to the rescue. Check out "Virtual Quarry Interactive" (www.virtualquarry.co.uk), which offers a simulated field trip to a rock quarry and, under "Teacher's Desk," 20 lesson plans related to quarrying and rock products used in everyday life. It's a British site, so the narrator has an accent and some of the terminology may be unusual for American students (e.g., "lorry" instead of "truck"), but it's a fun, informative site, nonetheless.

Note: *Kids can use this activity toward satisfying requirements for the Field Trips badge simultaneously (Activity 8.3). Also, kids who write a report or give a talk about their trip can simultaneously satisfy requirements toward earning the Communication badge (Activities 7.1 and 7.2).*

2.5 Field trip to a hardware store.

A home building supply or hardware store, especially one that also has a garden center, is a great place to vividly underscore just how much that's all around us derives from rocks and minerals. This makes for a great indoor field trip that can be turned into a scavenger hunt to see which kids (or teams of kids) can come up with the biggest list of everyday items and the rocks and minerals that went into them. If doing an activity like this with a fairly large group of kids, contact the store manager in advance to ensure a warm welcome. You may find they're willing to help in the hunt!

To get you started, here are a few things that come immediately to my mind as to what you can find in your local hardware store derived from common rocks and minerals:

- electrical wiring, pipes, and plumbing fixtures (made from copper)
- steel and iron nails (made from iron ores such as hematite and magnetite)
- aluminum and tin siding and roofing (made from bauxite and cassiterite)
- brass screws and ornamental plates (brass is an alloy of copper and zinc)
- lead solder (made from galena)
- diamond on drill bits and saw blades used for cutting title, concrete, etc.
- diatomaceous earth for swimming pool filters
- plaster and plasterboard or drywall (made from gypsum)
- sandpaper (several varieties: garnet, silicon carbide, and corundum, or emery)
- glass (made from silica sand)
- crushed stones for ornamental use (red or black volcanic cinders or scoria, limestone, marble, etc.)
- sand
- bricks and ceramic products (made from fired clay, or kaolinite)
- salt (or halite) for melting icy buildup on sidewalks
- slate slabs for high-priced shingles and flagstones
- slabs of various sorts for ornamental use, as in kitchen countertops (made from granite, marble, labradorite, etc.)

Using this list as a starting point, see what else your kids can find. Again, this can make for a really fun event if you turn it into a competitive scavenger hunt with prizes at the end.

Back-up page 2.6: Careers in the earth sciences.

As a multi-disciplinary science, geology draws from and applies chemistry, physics, biology, mathematics, and engineering. Subfields include geophysics, hydrogeology, oceanography, paleontology, environmental engineering, mining and mineral resources, and more. Geology students learn about earth processes and their effects on the general environment and life. Well-trained geologists help in charting pathways that are both environmentally and economically sound in addressing issues related to human interaction with both resources and hazards, crafting solutions to benefit the general public. In addition to geology, gemology is a career direction for kids interested in minerals and gemstones, whether as a miner seeking new sources of rough gemstones, a distributor in the wholesale business, a retailer, or an artisan crafting fine jewelry.

Great resources to help kids learn about such careers are web sites for the Minerals Education Coalition and Women in Mining: www.mineralseducationcoalition.org and www.womeninmining.org. You and your kids can also explore the web site of the U.S. Geological Survey: www.usgs.gov. And there are the American Geosciences Institute (AGI, www.americangeosciences.org) and the Gemological Institute of America (GIA, www.gia.edu). If you live near a college or university that has a geology department, you might contact the department because they will often have information about careers in geology for advising their students. Here are just a few ideas:

- college or university professor of geology or paleontology
- laboratory research worker and technician
- natural history museum curator
- petroleum geologist
- staff geologist or field geologist for a mining company
- mining engineer
- geophysicist
- planetary geologist for NASA
- surveyor
- cartographer
- independent consultant assessing geological hazards for the construction industry
- seismologist for the United States Geological Survey (USGS)
- metallurgist
- environmental scientist conducting environmental impact studies and remediation
- marine geologist
- hydrogeologist or hydrologist evaluating and developing groundwater resources
- gemologist
- independent fossil or rock and mineral dealer
- professional jewelry designer and craftsperson
- jewelry store owner

Encourage kids to read about—or even interview someone in—one of these careers.

Note: *Kids who write a paper for this activity can use it toward satisfying requirements for the Communication badge simultaneously (Activity 7.2).*