

# Teacher's Guide

AG IN THE CLASSROOM—HELPING THE NEXT GENERATION UNDERSTAND THEIR CONNECTION TO AGRICULTURE

**Resources**

*Out of The Rock* books, videos and music cds are a valuable source of information and activities for teachers on mining, geology, the environment and economics.

National Energy Foundation  
Resources for Education

3676 California Ave, Suite Q117  
Salt Lake City, Utah 8404  
801-908-5800

<http://www.nefl.org/outoftherock/index.html>

*Mine Safety & Health Administration (MSHA)*

<http://www.msha.gov/KIDS/KIDSHPTM>  
has lessons, maps, photos and games plus links to other mining information

*State of Colorado, Division of Minerals and Geology-Department of Natural Resources*

Find mining information about your county at: <http://mining.state.co.us/>. Children can play games and find links to related websites at <http://mining.state.co.us/kids/dmgkids.htm>.

*Mineral Information Institute*

501 Violet Street Golden, CO 80401  
303/277-9190

[www.mii.org](http://www.mii.org) has free teaching materials, homework help, mineral photos and maps.

*Women in Mining Education Foundation*

P.O. Box 260246, Lakewood, Colorado  
80226-0246 303-298-1535

Fun classroom activities at

<http://www.womeninmining.org/activity.htm>

**Other Reading:**

*Geology Rocks!: 50 Hands-On Activities to Explore the Earth*

by Cindy Blobaum

published by Williamson Publishing 1999

An introduction to concepts for young geologists as well as a great place to find ideas for activities and experiments to aid him or her in exploration of the earth! The text is written in a witty manner, yet still provides a wealth of information.

Comments, questions, suggestions and feedback about the Colorado Reader are welcome.

Contact: Colorado Reader Publisher:

Colorado Foundation for Agriculture

Bette Blinde, Director, P.O. Box 10, Livermore, CO 80536

Phone (970) 881-2902, Fax: (970) 881-2587

**Pages 1,2 & 3**

**More about Natural Resources**

If you've ever played the guessing game *Twenty Questions*, you know one of the first questions asked is, "Is it animal, plant or mineral?" That's because almost everything that is not derived from a plant or animal is made from minerals and petroleum products.

From the time you get out of bed in the morning, brush your teeth and wash your face, to the time you go to bed, you are continually using products that are made from minerals.

Your toothbrush and toothpaste, soap, comb, toilet, sink and shower are all made from materials that were mined or pumped from the ground.

Do you eat breakfast? Your breakfast cereal is fortified with zinc and other minerals. Don't forget the ceramic bowl, juice glass and metal spoon are all made from minerals. The muffin you ate is made with baking soda. Many fabrics such as polyester and nylon are made from petroleum products. Even the zippers and buttons on your clothes are probably made from metal or plastic.

Did you drive a car or ride on a bus today? They are both made of many types of metal that are mined. Cars and trucks use gasoline to run. There is asphalt in the road they drive on; limestone in sidewalks; and bricks, shingles and windows in your house and other buildings.

Many walls are made from gypsum. The floors may be made with ceramic tiles. Copper is used for electrical wiring. The list goes on: light fixtures, bulbs, computers, calculators, crayons, pencils, blackboards, chalk, chairs and desks. Even the paper found in books and magazines has a clay coating on it.

You can't go a day without using products that were mined. Minerals are some of our most valuable and widely used natural resources.

**Page 2 Activity:**

Find your county or region on the Colorado Mining map. Identify the different types of mining and/or extraction (in the case of oil and gas) that are taking place in your area. Don't forget the mining of rock and aggregates such as sand, gravel and stone. They are important commodities that provide the basic infrastructure materials for Colorado's booming economy of the late 1990s and 2000s.

(continued on page 2)

**Page 3 Investigate Colorado Answers**

1. In which Colorado county are diamonds mined? (It's in the northern part of the state.) \_\_\_\_\_
2. What do people in Baca County mine besides sand and gravel? (Baca is in southeastern Colorado.) \_\_\_\_\_
3. In which county, Lake or Summit, is molybdenum (pronounced mah-lib-da-num) mined? (Both counties are in central Colorado.) \_\_\_\_\_
4. In what county was cadmium (pronounced cad-me-um) mined? (It's in the southwestern part of the state.) \_\_\_\_\_
5. What do people in Teller County mine besides sand and gravel? (Teller County is in central Colorado.) \_\_\_\_\_
6. In which county, Boulder or Jefferson, was copper mined? (Both counties are located near Denver county.) \_\_\_\_\_
7. What do people in Fremont County mine besides sand and gravel? (It's in the south central part of Colorado.) \_\_\_\_\_

(continued from page 1)

Production of these commodities has increased steadily over the past decade.

Select a mineral and learn about how it is mined. Compare the mining techniques of your mineral with other minerals.

The overall value of mineral production in Colorado was almost \$800 million in the year 2000. Coal led all mineral sectors (with the exception of oil and gas) in revenues. The total value of oil and gas produced in Colorado during 2000 was \$2,830 million. Coal continues to meet 82% of Colorado's electricity needs.

#### Page 4

#### More information about Mining Careers from the National Energy Foundation

*Accountants* handle the financial data and keep track of income, expenditures, and taxes. They provide statements and information showing profit and loss, financial position as well as asset and liabilities. They help the mining company run as economically as possible.

*Administrative assistants* in a mining operation do record-keeping, typing of statistics and technical reports, sometimes travel planning and a lot of organizing.

*Attorneys* - There are many legal services attorneys provide to a mining company. They write title searches, obtain legal titles, file mining claims, write leases, negotiate employment contracts and work with governmental agencies. They defend or prosecute any lawsuits concerning the mine or company.

*The Belt Maintainer* maintains the large conveyor belts that carry coal or ore out of the mine. They grease and service the drive motors that run the belts. They change worn rollers and bearings. They also must maintain the pipes and water in the fire line.

*Blasters* are responsible for breaking up the coal, ore or rock. After the drill operators do their job, the blasters insert an explosive charge into the pattern of holes. Special blasting agents are used, sometimes as much as 50,000 lbs. in a single blast pattern. The blasters fire the charge, and then the broken rock can be hauled away.

*Chemists* are skilled in making chemical examinations and investigations. They analyze chemical reactions to improve mineral resource extraction methods and mineral purification. Their research and testing also provide data for reclamation.

*Computer programmers* write the programs for the people in the mine who use them. They also design the programs to fit the needs of the mine. Some programs are designed to

communicate and keep records. Some programs are designed to monitor conveyor systems and gas levels in the mine or other operation systems. The programs have internal alarms to signal problems.

*Drill Operators* drill a carefully designed pattern of holes in the rock. These holes are then loaded with explosives to blast and break apart the rock.

*Environmental Engineers* develop the mining plans to provide the least impact on air, water and social quality of the affected environment. During operation of the mine, they assure compliance with all mining regulations. After the mineral resources are extracted, the environmental engineers develop plans for reclamation, restoring the land to its previous condition or alternate uses.

*Federal Mine Examiners* check working mines for any safety violations. They insure air quality and safe working conditions. They investigate all accidents that occur in their area, and they review accidents nationwide to prevent similar accidents. Federal mine examiners also check abandoned mines, completed workings and sealed mines for safety.

*Geologists* analyze the rocks, looking for the characteristics that may lead to the discovery of mineral resource deposits. They find the mineral resource concentration by taking core samples and testing. Then they determine whether the concentrations are worth mining. They are also involved in the mining process and the reclamation. There are many areas in which geologists can specialize. There are economic geologists, exploration geologists, petroleum geologists, engineering geologists, hydrogeologists and research geologists.

*Haulage Truck Drivers* operate the very large, million dollar trucks that transport the raw ore to the crushers or conveyors or transport the waste to the tailings dump. They often drive hundreds of miles a day.

*Hydrologists* study the surface and underground characteristics of water resources. Their responsibilities are to provide the water resource and protect the supply from over depletion and contamination. Water is essential to mining and mineral processing.

*Mechanics* service and repair equipment. They do a great deal of preventive maintenance to get maximum performance out of the expensive mining equipment.

*Mechanical Engineers* design and maintain the systems within the mine. They design the pump systems according to volume and size needed; also dust collectors, conveyor systems and

fire lines are some of their tasks.

*Metallurgists* devise techniques to separate the valuable materials from the ore. They use processes to recover the desired component in a pure form. They test material to evaluate its properties and they develop ways to recycle materials.

*Mining Engineers* primarily work in the mining industry, planning, designing and operating surface and underground mining operations. These minerals vary from sand and gravel, pumice, gypsum, and coal, to copper, lead, zinc, tungsten, iron, and more exotic minerals such as gold, silver, diamonds and rubies. There are many other career opportunities open to them in the construction and tunneling industry, banking and finance industry, engineering consulting companies, equipment manufacturers, and federal and state agencies.

*Mine Inspectors* work to maintain safe working conditions. They check ventilation, insuring adequate oxygen supply. They test for strength of the roof and ribs of the mine and safety of the equipment. A mine inspector is a trouble shooter for any potential hazards.

*Presidents of mining companies* or divisions are responsible for overall management. They hire key personnel. They obtain and allocate funds. They are responsible for safety and the actual implementation and efficiency of the mining operation plans.

*Pilots* - Airplanes and helicopters are used as an aid in the exploration of mineral resources. They allow a large area to be photographed, mapped, and measured in a relatively short time. Pilots fly the airplanes and, in some cases, are required to operate exploration equipment.

*Purchasing Agents* or buyers purchase everything for the mining operation from the heavy equipment to office supplies. In a large operation there might be several buyers, each with a different specialty.

*Security Officers* patrol the grounds and facilities, monitor people coming in and going out and inspect vehicles. They deal with any security problems such as trespassing or vandalism.

*Shovel Operators* run one of the primary pieces of mining equipment, the large shovel. They load the broken ore into the big haulage trucks. Some shovels hold as much as 60 tons per shovel scoop.

### **More about The Importance of Mining... Hands-on Activity/Discussion:**

Make a one-day journal in which each student lists all the items he/she used that day that contain minerals. In addition, have students search around their home, a hardware store, or a pharmacy for more items to include in their journal.

Talk about the things the students used before coming to school that involved minerals or mineral products. Things like: drinking from a glass, eating cereal from a bowl with a spoon, showering with soap, using deodorant, turning on a light, listening to a radio, using a computer, cleaning the cat box, riding a bicycle or school bus or using coins.

Have the students draw a picture of your classroom and label everything made from minerals. Find out which minerals are mined in Colorado.

Discuss how our lives would be different if we didn't use minerals.

### **Hands-on Activity: Make Crystal Rock Candy**

Materials:

6 cups of sugar

1 1/2 cups of water

string

pencils

3 heat-proof jars or glasses that will not break when hot

water is added (pint size canning jars work well)

saucepans

spoons

measuring cups

food coloring or flavorings

a stove

scissors

drawing paper and pens or pencils

1. Pour water into a saucepan and bring it to a boil.
  2. Remove the water from the heat and add three cups of sugar. Stir until the sugar is dissolved.
  3. Slowly add three more cups of sugar stirring until all the sugar is dissolved. Reheat the water if necessary.
  4. Pour mixture into the jars or glasses.
  5. Add a few drops of food coloring and/or 1/2 teaspoon of flavoring to each jar if desired.
  6. Tie a piece of string to the pencil. Lay the pencil across the top of the jar so that the string hangs down into the solution. The strings should be long enough so that they stop just above the bottom of the glass.
  8. In a few hours examine the string in the glass. Crystals will begin to form in one hour, and continue to solidify for several days.
  9. If a layer forms on the surface of the jar, break it. When the liquid completely evaporates, the candy is ready.
  10. Look at the crystals and draw a picture of them.
  11. Taste one. If you like it, you can eat it.
- (continued on page 4)

(continued from page 3).

**Page 5**

**More about History...**Exploration for and the discovery of valuable minerals leads to the growth of civilization and settlement of frontier areas. During the 1500s through 1700s Spanish explorers crossed Colorado searching for the fabled Seven Cities of Gold. At that time Native Americans were the only people living in Colorado. In the early 1800s mountain men explored our mountains and fur-traders and trappers settled along trade routes and rivers. It wasn't until the discovery of gold in 1858 that Colorado really became settled to a large degree.

Mining stimulated the development of many other industries, one of which was agriculture. Everyone needs to eat, and fresh food was hard to come by in those days. One gold miner in the 1860s named David Wall seized on the opportunity and decided to raise vegetables. He succeeded in making \$2000 per acre—an enviable amount even by today's standards.

Since 1859 Colorado's mines have produced about 45 million ounces of gold. With the price of gold at around \$418/ounce today that gold would be worth \$18.81 billion. In the Cripple Creek area alone, 22 million ounces of gold were extracted. Mining and supporting industries contribute nearly \$8 billion to our state every year.

**Page 7 Answer to Recycling Arithmetic**

Jesse decided to start a recycling program at his school for a class fundraiser. Local businesses agreed to pay him 2¢ for each can, plastic container or newspaper he collected and took to the recycling center. He was very successful collecting items. The only problem is he forgot to add up the number of items he collected in order to get paid. Help Jesse by adding up the numbers and then multiply the total by 2¢ each to find out how much money he raised.

# Recycling Arithmetic



Write the answers to the 4 problems below on the lines to the right, add them up and multiply the answer by .02 (2 cents) to find out how much money Jessica raised.

3905	26	164	94	<u>4215</u>	
271	750	2075	5	<u>1003</u>	
7	218	3	1763	<u>2258</u>	<u>9360</u>
+ 32	+ 9	+ 16	+ 22	+ <u>1884</u>	<u>x .02 ¢ each</u>
<u>4215</u>	<u>1003</u>	<u>2258</u>	<u>1884</u>	<u>9360</u>	<u>\$ 187.20</u>

**More on Protecting the Environment and Recycling:**

The trend in product design is to use lighter weight materials—substituting plastics for metals—and recycling, all of which reduce the amount of raw materials required. To date, there are no good substitutes for many critical materials. Gold is used in medical devices, computers and other electronic circuitry because it is malleable, highly conductive and does not react with other common materials.

**Page 8**

**More about...**

**STAY OUT-STAY ALIVE!** is a national public awareness campaign aimed at warning children and adults about the dangers of exploring and playing on active and abandoned mine sites. Every year, dozens of people are injured or killed in recreational accidents on mine property. Each April, around Earth Day, "Stay Out-Stay Alive" partners visit schools, communities and youth organizations throughout the country to educate children about the importance of steering clear of active and abandoned mines. To become involved in "Stay Out-Stay Alive," and to download posters and stickers please visit: <http://www.msha.gov/places/placeshp.htm>.

**Hands-on Activity/Discussion:**

Discuss the various ways you can get hurt on an active or abandoned mining site. Have the children create their own brochures, stickers or posters that address the various hazards with the STAY OUT - STAY ALIVE message.

## What is the space shuttle made of?

The orbiter is mainly built of aluminum and titanium. Carbon is used on the outside insulation system. Aluminum alloys (mixtures of two or more metals) are used in the external tank.