Rocks and Minerals

Major Concept: Rock cycle
Minor Concept: Lithosphere, weathering and erosion

	Concept	Skill
Vocabulary:	rock cycle	designing an experiment
	igneous rock	experiment
	intrusive igneous rock	observation
	extrusive igneous rock	measurement
	sedimentary rock	classification
	metamorphic rock	
	lava	
	magma	
	minerals	
	etc.	

Core Content

SC-M-2.1.3 Materials found in the lithosphere and mantle are changed in a continuous process called the rock cycle.

Program of Studies

Grade 7 Earth/Space (Science Structure of the Earth's System) Students will demonstrate the rock cycle ….

Grade 8 Earth/Space Students will investigate the structure of the Earth's system … rock cycle…

Pretest rocks and minerals

Challenge

For this I read them the children's book, Everybody Needs a Rock. We then discuss if any of them have a favorite rock or collection or rocks. Someone always ask if I would identify a rock they have, I encourage them to bring it in. Next, I let them look at my rock collection that I have out on display.

Task # 1 Edible Rocks – 2 days

See Earthly Delights – Edible rocks

Task # 2 Minerals – Days 3-6

Days 3-5 We read and discuss from the student's textbook the section on minerals. We do lots on Hands on Activities from this section. Day 6 I put the students into groups. Their task is to design an experiment to identify 3-4 mineral samples. After they have shown me their design and I approve it I give them 3-4 mineral samples to identify. I give them 2 easy ones and 1-2 hard ones.

Task # 3 Rocks: Days 7-14.

Day 7 we watch 2 videos one on minerals and the other a Bill Nye on Rocks. Days 8-12 We read and discuss from the students text the section on rocks. We do all the hands on activities suggested. Days 13 and 14 This is where I take the rocks that kids have brought in for me to identify. Label these rocks as you get them. Explain to the student how you will need several days to research the rock. (The reason I don't ask classes to bring in rocks is that you get way too many. The kids that are interested just naturally bring them in.) I place the students into groups give them the rocks the, ID books, and materials for them to use to help in the identification. I then tell them to identify the rock and prove it to me. They really like this. They argue and fuss over the identification. It's great.

I follow this unit with one on fossils, which then leads me to soils.

Earth Science Pre-Test Rocks and Minerals

Name ________________________

1. Name the eight (8) properties used to identify minerals. 1. ________________, 2. __________
3. ________________, 4. ________________, 5. __________________,
6. ________________, 7. ________________, and 8. _____________________

2. The softest mineral in the Mohs hardness scale is ______________
   a. fluorite b. talc c. diamond d. calcite

3. The two most common elements in the Earth's crust are ________________
   a. oxygen and silicon c. sodium and iron
   b. oxygen and nitrogen d. aluminum and magnesium

4. Elements that have shiny surfaces and are able to conduct electricity and heat are called _____
   a. metals b. nonmetals c. ores d. gemstones

5. The breaking of a mineral along smooth definite surfaces is called ________________
   a. cleavage b. fracture c. splintering d. foliation

6. Examine the two rock samples. Both are igneous rocks. One, obsidian, looks like black glass. The other, diorite, at a distance appears dark gray. Upclose the diorite, is made of black, gray, and white grains. How can you explain the differences in the two rocks?

____
____
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____

7. You are given a rock sample. Describe how you would determine its density. (Be very specific.) ____
____
____
____
____

Notes about Rocks, Minerals, and the Rock Cycle

The rock cycle is the continuous changing of rocks from one kind into another.

- Minerals are substances that are 1. naturally occurring, 2. have a definite chemical composition, 3. solid, 4. have a crystal structure, and 5. are inorganic.
- Rocks are a hard substance composed of minerals, however rocks can be organic or inorganic, and do not have a definite chemical composition. Example -granite white, pink, gray, etc. because it has different combinations of minerals.
- To identify a mineral 1. color - although this is not very reliable, 2. luster - how shiny, 3. hardness - use the Moh's scale to rate it's hardness on a scale on 1-10, 4. streak - use a streak plate and scratch it across the plate, 5. density - find the mass of mineral, then find the volume and divide and you get density or specific gravity, 6. cleavage/fracture - see how the sample breaks, 7. crystal structure - identify its crystal shape, 8. special properties - some minerals have unique special properties.
- Rocks are classified by the way they form.
- Igneous rocks are rocks formed from molten rocks (either lava or magma)
  extrusive igneous rocks form from lava on the Earth's surface and have small crystals because they cool quickly. Some such as obsidian do not have crystals.
  intrusive igneous rocks form from magma that cools over a long period of time deep within the Earth. They have large crystals. Example granite
- Sedimentary rocks are rocks formed from sediments (of other rocks or animals) that are compacted and/or cemented together. There are 3 kinds of sedimentary rocks
  clastic sedimentary rocks are formed from the fragments of previously existing rock. Example - conglomerate, sandstone, shale
  organic sedimentary rocks are rocks that come from once living organisms (either plants [coal] or animals [limestone]).
  chemical sedimentary rocks are formed when a sea or lake dries up and leaves large amounts of minerals that were dissolved in the water behind.
- Metamorphic rocks are formed when already existing rocks are buried deep within the Earth, tremendous heat, great pressure, and chemical reactions may cause them to change (metamorphise) into different rocks with different textures and structures.
  foliated metamorphic rock are metamorphic rocks with the mineral crystals arranged into bands in parallel layers.

Science Vocabulary Words Week # 26

Name ____________________

SC-M-2.1.3 *Materials found in the lithosphere and mantle are changed in a continuous process called the rock cycle.*

1. rock - a hard substance composed of one or more minerals or minerallike substances.

2. igneous rock - formed from molten rock.

3. sedimentary rock - formed by the compacting and cementing of sediments or by other non-igneous processes at the Earth's surface.

4. sediment - particles of rock or organic materials that have been carried along and deposited by water and/ or wind.

5. metamorphic rock - rock that is changed in form as a result of chemical reaction, heat, and or pressure.

6. rock cycle - the interrelated processes that cause the continuous changing of rocks from one kind to another.

7. extrusive rock - an igneous rock formed from lava.

8. intrusive rock - an igneous rock form from magma.

9. clastic rock - a sedimentary rock formed from fragments of previously existing rock.

10. organic rock - a sedimentary rock that is formed either directly or indirectly from material that was once alive.

11. chemical rock - a non-clastic sedimentary rock formed by inorganic processes such as evaporation.

12. metamorphism - the process in which metamorphic rock is formed.

Open Response Grade 7 Rocks and Minerals

Multiple Choice - At the top of your paper number 1-5.

1. Extrusive igneous rock found in the southern half of the Rocky Mountains indicates that this section of mountains was once ___________?
   a. metamorphic b. volcanic c. oceans d. The Grand Canyon

2. The relationship among igneous, metamorphic and sedimentary rocks and the processes that form them are shown by the ______________?
   a. rock cycle b. foliation cycle c. upheaval cycle d. classification

3. Which of these is an example of an intrusive rock?
   a. granite b. basalt c. shale d. obsidian

4. Which rocks can be changed into sediments by weathering and erosion?
   a. sedimentary b. igneous c. metamorphic d. all of these

5. Metamorphic rocks with mineral crystals arranged in parallel layers, or bands, are _________________
   a. clastic b. intrusive c. porphyritic d. foliate

Do not write on this open response. You also must use the 5-column method.

In Science class we have been learning about the rock cycle.

A. Name the three (3) groups rocks are classified into. State how each group is formed.

As you are walking along in the woods of McLean County a rock catches your eye. Upon closer examination of the rock you notice a fossil imprint of an ancient sea animal in the rock.

B. Explain with details what type of rock you have.

You continue your walk. An unusual rock/mineral catches your eye. You pick it up and put it in your pocket. When you get home and unload your pockets you find the object.

C. Describe what steps you could take to identify the rock/mineral.

You pick them up and put them in your pocket. Buildings and homes are made from them. You collect them, admire them, treasure them, wear them, and many yearn to have them. What are they? Rocks and Minerals.

A. Name and define the three (3) kinds of rocks.

B. Describe the rock cycle.

C. How could you distinguish an igneous rock from a sedimentary rock.

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"IN ONE DAY"

According to the US Bureau of Mines, *during your lifetime, you will use more than 2 million pounds of minerals and metals* including 1.2 million pounds of sand and gravel, 360,000 pounds of coal, 91,000 pounds of iron and steel, 27,000 pounds of clay, 26,000 pounds of salt, 500,000 pounds of coal, 800 pounds of lead, 28,000 pounds of phosphate and potash, 3,200 pounds of aluminum, 1.500 pounds of copper and 840 pounds of zinc.

The following mineral related facts are excerpts from *In One Day* by Tom Parker and *Mined It!* by Peter Harben and Jeanette Harris. They are presented to provide perspective about the relationship of minerals - and mining - to things and events in our lives that are often taken for granted. Minerals and mining play essential roles in modern society.

To maintain our standard of living, every day ...

* 18 million tons of raw material must be mined, cut or harvested to meet the demands of US citizens for "things and stuff'; about 150 pounds for every man, woman and child in the United States.

* 625 acres of land is disturbed by mining; 337 acres are reclaimed and replanted.

* 1,500 tons of lead (a 16 foot cube), 3,400 tons of copper (a 23 foot cube), 7,560 pounds of silver (a 27 inch cube) and 272 pounds of gold (a 7.5 inch cube) are mined and refined.

* 3,000 new homes and 650 mobile homes are completed. (concrete and asphalt foundations and driveways; iron and zinc nails; copper and aluminum wiring; window glass; steel beams and window frames; asphalt roofing; clay, feldspar, talc and silica in porcelain sinks, bathtubs and toilets; iron, brass, steel, aluminum in plumbing fixtures; carpeting; iron, zinc, brass light fixtures and bulbs; clays in brick fireplaces and tiles; counter tops of marble and granite; putty to stick them together of limestone and gypsum; wallboard made from gypsum)

* 640 acres - one square mile - of carpeting is woven. (barite, calcium carbonate)

* 9.7 million square feet of plate and window glass - about 223 acres - are used; enough to cover 200 football fields. (silica sand, trona)

* 2,750 acres of pavement are laid, four times as much surface area as is mined, and enough concrete and asphalt to make a bicycle path 7 feet wide from coast to coast. (sand, gravel, stone chips, limestone)

* 150,000 lead-acid car batteries are replaced. (lead)

* 4,000,000 eraser tipped pencils are purchased. That's enough erasers to correct all the mistakes from 1,500 miles of notebook paper - about 129 acres of goofs. (graphite, kaolin, pumice)

* 426 bushels of paper clips - 35,000,000 are purchased. Seven million are actually used; 8-9 million are lost and almost 5 million are twisted up by nervous fingers during telephone conversations. (iron, clay, limestone, trona, steel)

* 650,000 x-rays are snapped. Each requires lead shielding for technicians and patients. (silver, iodine, lead)

* 164 square miles of newsprint is used to print 62.5 million newspapers; enough to line a bird cage 12 miles wide and 13 miles long. (trona, kaolin)

* 3 million gallons of paint are used - enough to spruce up 200,000 homes. (titanium, iron, silica, wulfenite, mica)
* 400 acres of asphalt roofing are nailed down. (silica, borate, limestone, trona, feldspar, talc, silica sand)
* 187,000 tons of cement are mixed, enough to construct a four foot wide sidewalk from coast to coast. (limestone, sand, gravel, stone chips)
* 150,000 miles of copper wiring is added to telephone networks to carry the 80 million calls we make.
* 3.6 million light bulbs are purchased. (tungsten, trona, silica sand, copper, aluminum)
* 120 million glass bottles and jars are used. (trona, silica sands)
* 250,000 tons of steel are used, enough to forge a spike the size of the Washington Monument. (iron, clay, limestone, trona)
* 10 tons of colored gravel for aquariums is purchased.
* 40 acres of leather is used, most of it to cover feet and hold up pants. (chromite)
* 80 pounds of gold are used to fill 500,000 dental cavities.
* 550,000 pounds of toothpaste - 2.5 million tubes - are used; enough to fill a small jet airliner. (calcium carbonate, zeolites, trona, clays, silica)
* 21 million photographs are snapped, more than 29 acres of wallet-sized photos. (silver, iodine)

Supplies of mineral products are driven by consumer demand. Before processing, raw, non-fuel minerals contribute more than **$30 billion per year** to the US economy. Another **$300 billion** is added when the minerals are processed to produce steel, aluminum, copper, brick and glass. And finally, by the time finished products like automobiles, toasters, glassware and china, cans, bottles, vacuum cleaners, airplanes, TV sets and computers reach the hands of consumers, **more than $5 trillion** will be added to the economy because we are able to mine and process mineral resources.

REMEMBER:

"If it can't be grown, it has to be mined"

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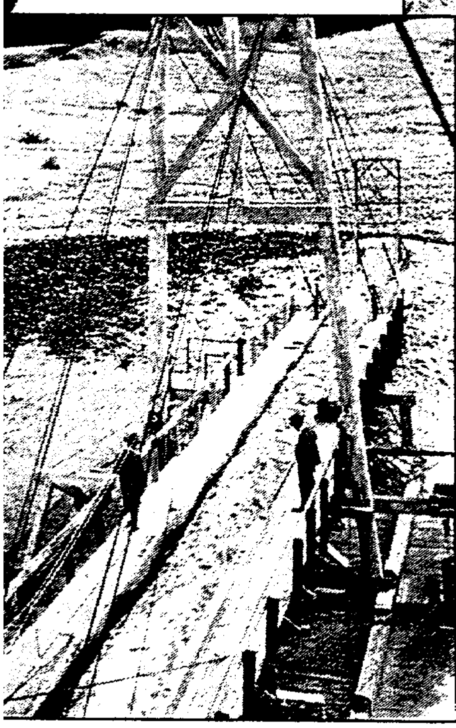
Old miner's cabin at Bidwell Bar, Butte County, 1906. *Photo by Norwood Silsbee.* DMG photo A7254

Miners drifting (that is, following the vein) 2,100 feet underground with an air-driven machine drill, Nevada County. Empire Mine, 1900. *G.W. Starr Collection.* DMG photo A7151.



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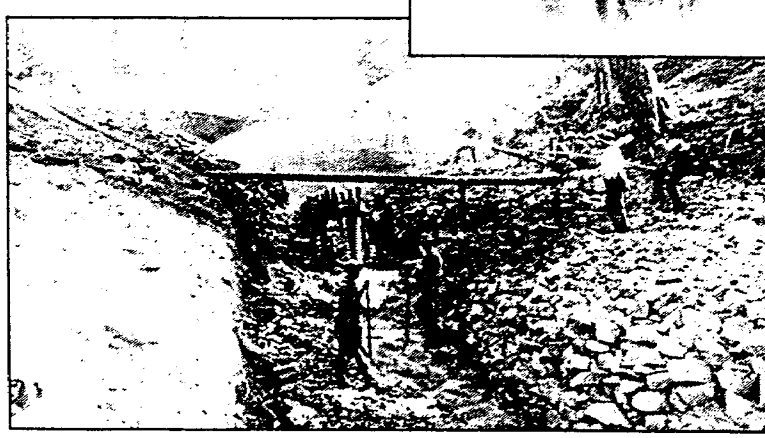

Monitors (giants) at a hydraulic mine in Banks Gulch, San Bernardino County. Hocumac Mining Co., 1896. *Photo by Levens.* DMG photo B7846b.

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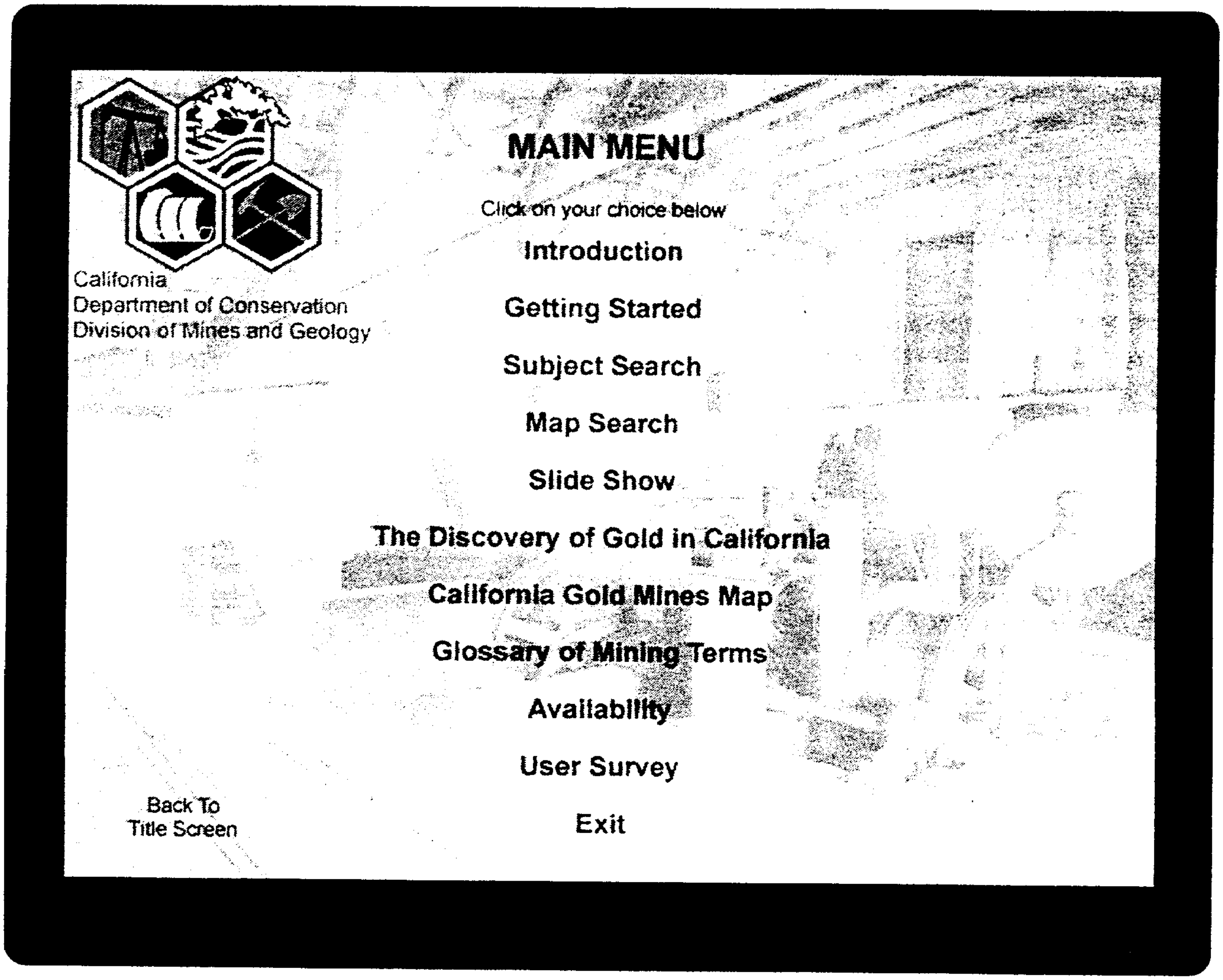

Searching on this easy to use CD-ROM can be done by name of mine, county, photographer, subject and year, or by county map search. Other features include, a "slide show," an article on California Gold Discovery, a California historic gold mines map, a glossary of mining terms, and printing capability. The cost is $15.00 and includes sales tax, postage, and handling. You may place a phone order by using a credit card. The number is (916) 445-5716.

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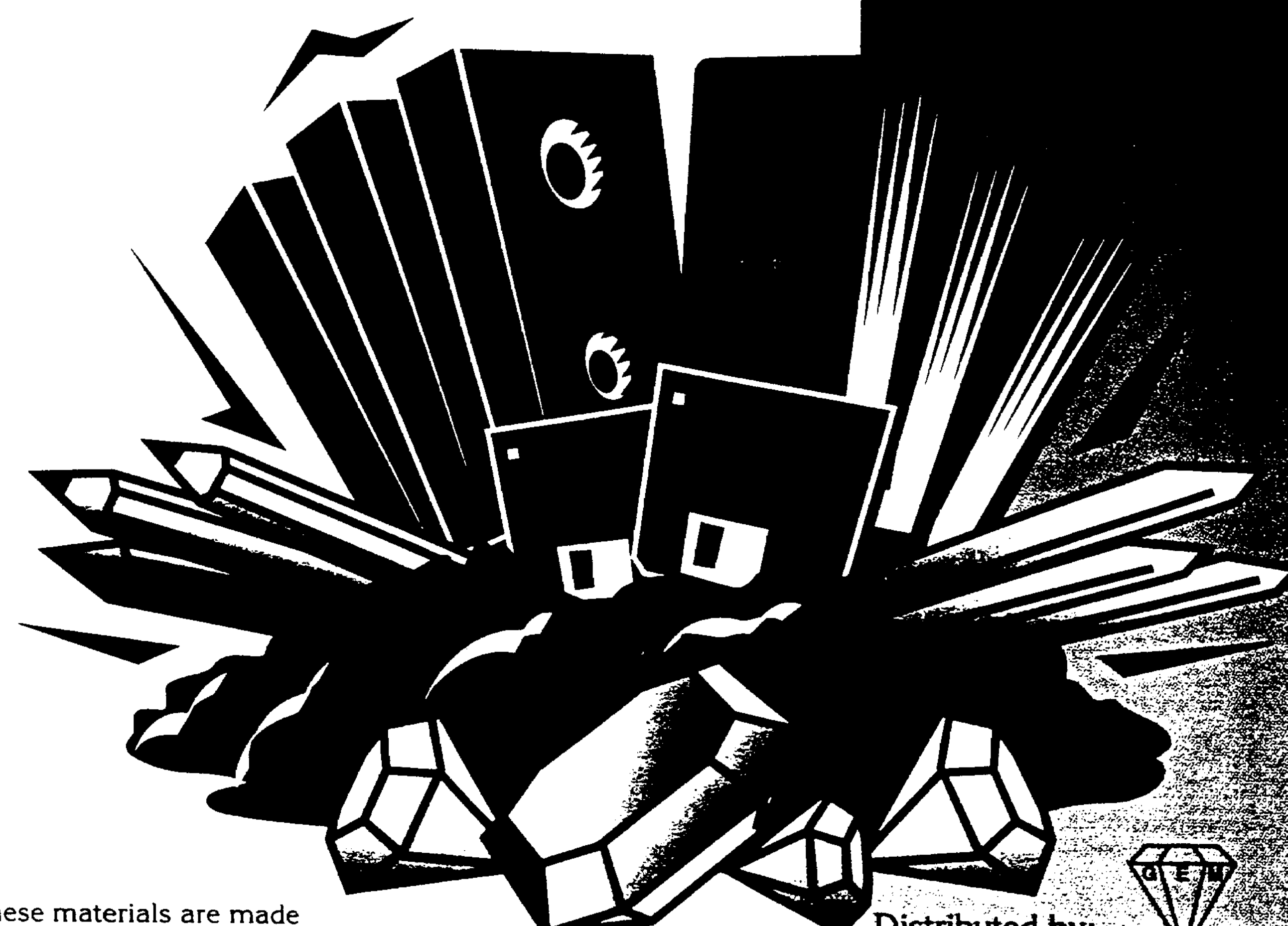

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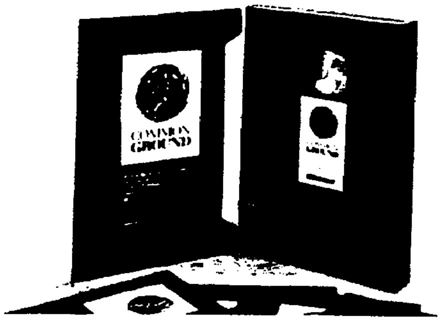

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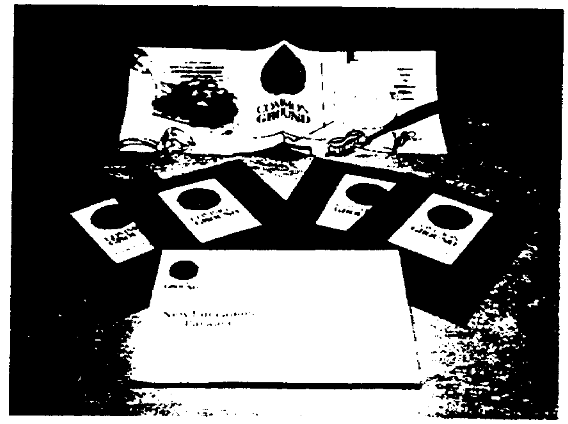

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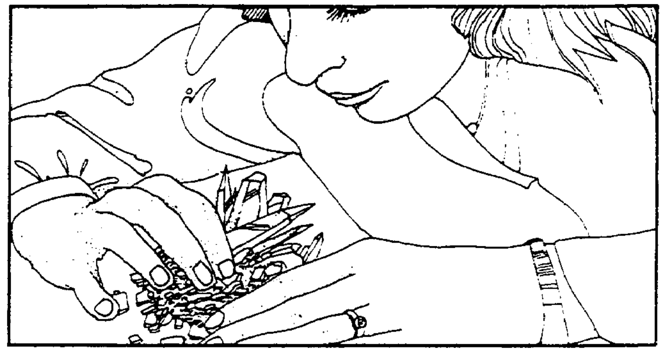
- *Mountains to Metal* poster (English and Spanish versions available)
- *The Mining Industry and Minerals* newspaper for teachers
- *Coal Energist* newspaper for teachers
- *Mining Glossary and Games*



Call the National Energy Foundation for pricing/ordering information on these materials.

How You Can Obtain *Out Of The Rock*

Option 1: *Out of the Rock* book. $25.00*

Option 2: *Out of the Rock* packet. Includes book, *Out of the Rock* video, *Out of the Rock* poster, *Rocks & Minerals* poster, *Mountains to Metal* poster, *From the Mine to My Home* poster, all in an *Out of the Rock* tote-bag. $48.00*

Option 3: *Out of the Rock* teacher training program. ....Call for a price quote.

*TEACHERS: TO RECEIVE EDUCATOR'S DISCOUNT (20%) ON OPTIONS 1-2, ORDER MUST BE ON SCHOOL STATIONERY, SCHOOL PURCHASE ORDER, OR MUST BE ACCOMPANIED BY NEF EDUCATOR'S DISCOUNT COUPON.

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Item Number	Description	Quantity	Unit Price	Extended Price
1100R	*Out of the Rock* book		$25.00	
32ROCKKIT	*Out of the Rock* packet		$48.00	

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Less Discount ______
Total Materials ______
Shipping (10%) ($3.00 Minimum) ______
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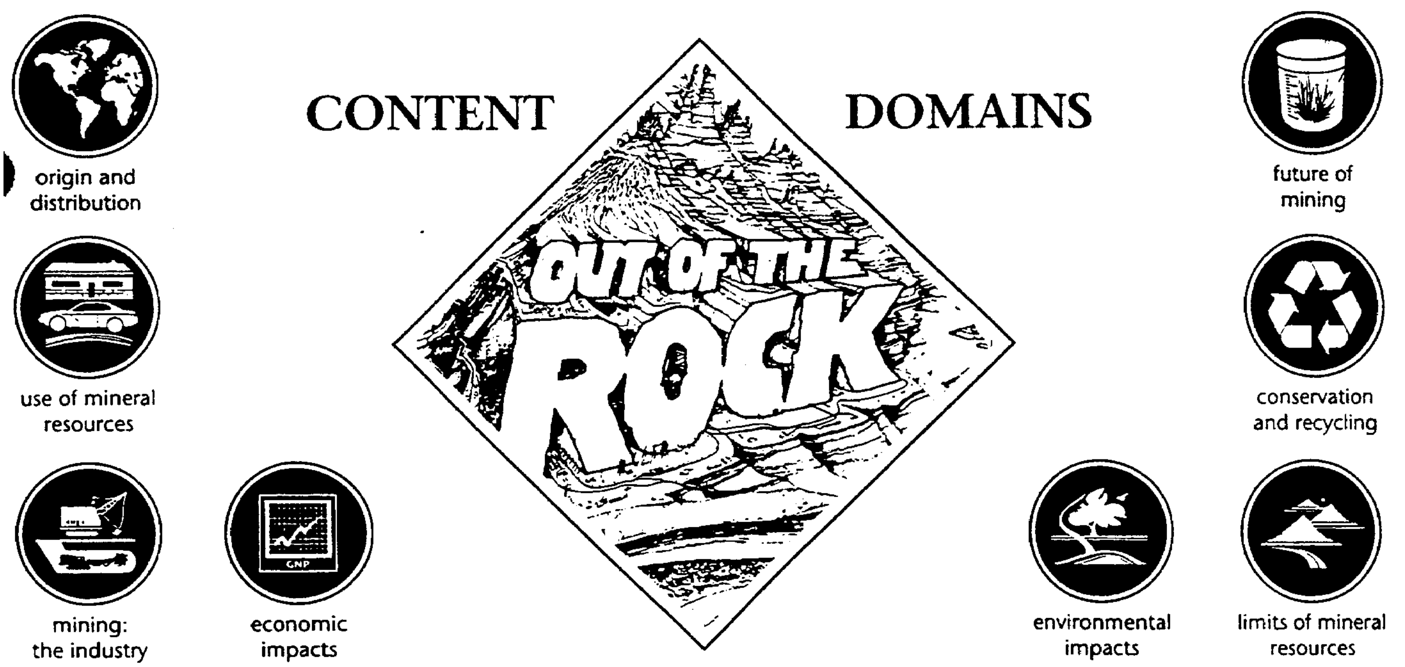
INTRODUCING

OUT OF THE ROCK

a comprehensive mineral resource and mining education program for grades K-8

Finally, there's a comprehensive mineral resource and mining education program that teachers and students will truly enjoy and understand. The National Energy Foundation, in conjunction with the U.S. Bureau of Mines, proudly presents Out of the Rock, a dynamic 544 page program of integrated activities and information that answers basic questions about our earth's minerals, how we locate, extract, process, manufacture and recycle them.

COMPONENTS THAT MAKE OUT OF THE ROCK AN EXCELLENT TEACHING TOOL



A Conceptual Framework
Important mineral and mining content domains and concepts

From the Ground Up
Background information about minerals and mining

Resources
Information and contacts to collect information and materials for teaching about minerals and mining

Tools of the Trade
Information on tools used in the mining industry

Focus on Careers
Information on careers in the mining industry

Large Group Activities
Activities on minerals/mining designed for large groups

Glossary
Definitions which include key mineral and mining terms, key vocabulary, and skills and processes

Integrated Learning Activities
Over 90 learning activities that can be infused into disciplines teachers normally teach

SOURCES OF MINERAL EDUCATION MATERIALS

NAT'L ENERGY FOUNDATION
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Salt Lake City, UT 84116
(801) 539-1406

MINERAL INFORMATION INST.
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Denver, CO 80202-4015
(303) 297-3226

DJ MINERALS
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Butte, MT 59703

(406) 782-7339

SME\GEM
8307 Shaffer Parkway
Littleton, CO 80127
(303) 973-9550

AMM PUBLICATIONS
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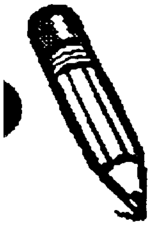
Gettysburg, PA 17325
(717) 337-9292



U.S. Geological Survey

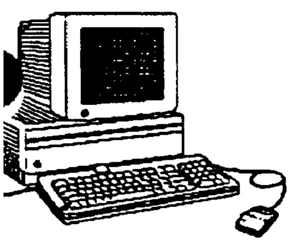
Library

Earth Science Education Collection

of

resource materials for K - 12th grade earth science educators

- Children's Books
- Textbooks
- Curriculum Materials
- Classroom Activities
- Videotapes
- Slide Sets
- Computer Software
- Maps
- Posters
- Science Equipment



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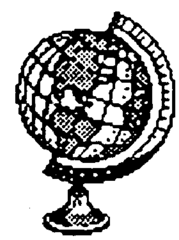
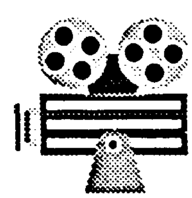


Hours: Monday - Friday, 7:45 a.m. - 4:15 p.m.

after hours by appointment (call 415/329-5029)

For more information about the collection call (415) 329-5081

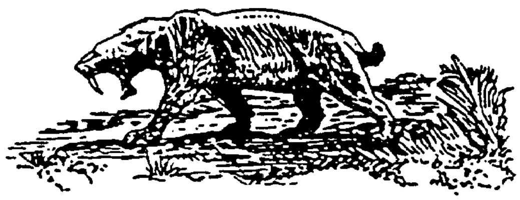
The Earth Science Education Collection is located in the
U.S. Geological Survey Library
in Building 5 on the USGS Campus,
on the corner of Homewood Place and Linfield Drive
off Middlefield Road in Menlo Park, CA.



Please note: First-time borrowers should bring a letter of introduction on school or institution letterhead.

Teacher Feature

EARTH SCIENCE TEACHER RESOURCES



CALIFORNIA DEPARTMENT
OF CONSERVATION
Division of Mines and Geology
801 K Street, MS 14-33
Sacramento, CA 95814-3532

Contact Vernettia Syphax,
Educational Outreach Coordinator:

☎ (916) 323-5336
FAX (916) 327-1853

DMG participates in geoscience career fairs, conferences, and earthquake preparedness fairs. DMG earth scientists make classroom presentations that are customized to accommodate the students' ages and interests. Individualized earth science teacher packets are also offered.

NASA EDUCATIONAL
AFFAIRS DIVISION
Elementary and Secondary
Programs Branch
NASA Headquarters, Code: XEE
Washington, D.C. 20546
(202) 453-8396

U.S. GEOLOGICAL SURVEY
345 Middlefield Road, MS 919
Menlo Park, CA 94025-3591
☎ (415) 329-4006
FAX (415) 329-5110
e-mail: usgsmd@fwl.edu

The education program includes teaching materials and resources, teachers workshops, internships, curriculum consulting and a special collection of K-12 earth science materials in the USGS Library.

AMERICAN ASSOCIATION
OF PETROLEUM
GEOLOGISTS (AAGP)
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(918) 584-2555

AMERICAN GEOLOGICAL
INSTITUTE (AGI)
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Alexandria, VA 22302-1507
(800) 336-4764 or
(703) 379-2480

AMERICAN GEOPHYSICAL
UNION (AGU)
2000 Florida Ave., NW
Washington, D.C., 20009
(800) 424-2488

NATIONAL SCIENCE TEACHERS
ASSOCIATION (NSTA)
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Arlington, VA 22201-3000
☎ (703) 243-7100
FAX (703) 243-7177

THE SCIENCE EDUCATION
ACADEMY of the
BAY AREA (SEABA)
730 Harrison Street
San Francisco, CA 94107
☎ (415) 565-3000
FAX (415) 241-2746

Through its Journal and the Internet-based SEABA Interactive Catalog, SEABA locates professional development programs, field trips, speakers, and other science education resources.

CALIFORNIA ACADEMY of SCIENCES
Golden Gate Park
San Francisco, CA 94118
☎ (415) 750-7100
FAX (415) 750-7346
e-mail: casmd@fwl.edu

Educational services include teacher workshops and materials, classroom field trips, library services, and field trips for adults and children.

NASA AMES RESEARCH
CENTER TO-25
Moffett Field, CA 94035-1000
☎ (415) 604-5000
FAX (415) 604-3445
e mail: narcmd@fwl.edu

Classroom instruction materials focus on the earth, space, and environmental sciences. The Center visits schools and holds teacher workshops.

RANDALL MUSEUM
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San Francisco, CA 94114
(415) 554-9600
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A hands-on education center offering seismology, geology, and lapidary displays.

U.S. DEPARTMENT OF ENERGY
1301 Clay Street, No 700 N.
Oakland, CA 94612
(510) 637-1809
e-mail: usdoemd@fwl.edu

Programs include the Environmental Restoration and Waste Management Educational Outreach Program, and Speakers Bureau.

GOVERNOR'S OFFICE of
EMERGENCY SERVICES
Earthquake Program
1300 Clay Street, Suite 400
Oakland, CA 94612-1425
(510) 286-0873

Publications, videos, and scripted slide shows on earthquake preparedness.

AMERICAN WATER
RESOURCES ASSOCIATION
5410 Grosvenor Lane, Suite 220
Bethesda, MD 20814-2192
(301) 493-8600

Offers K-12 water resources educational materials. A group of water resource specialists is being assembled for classroom visits.

NATIONAL ENERGY FOUNDATION
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FOR EDUCATION
5225 Wiley Post Way, Suite 170
Salt Lake City, UT 84116
☎ (801) 539-1406
FAX (801) 539-1451

Creates and distributes instructional materials dealing with energy, water, mineral resources, science, technology, conservation, the environment, and other natural resource topics.

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N.W., Suite 220
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spacelink.msfc.nasa.gov
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NASA Education Satellite Video conferences.

Video Conference Coordinator
NASA Aerospace
Education Services Program
300 North Cordell
Oklahoma State University
Stillwater, OK 74078-0422
(405) 744-7015

Dr. Malcom V. Phelps
Educational Technology Branch
Education Division, Code FET
NASA Headquarters
Washington, DC 20546
(202) 358-1540

The videos cover space science topics and are interactive.

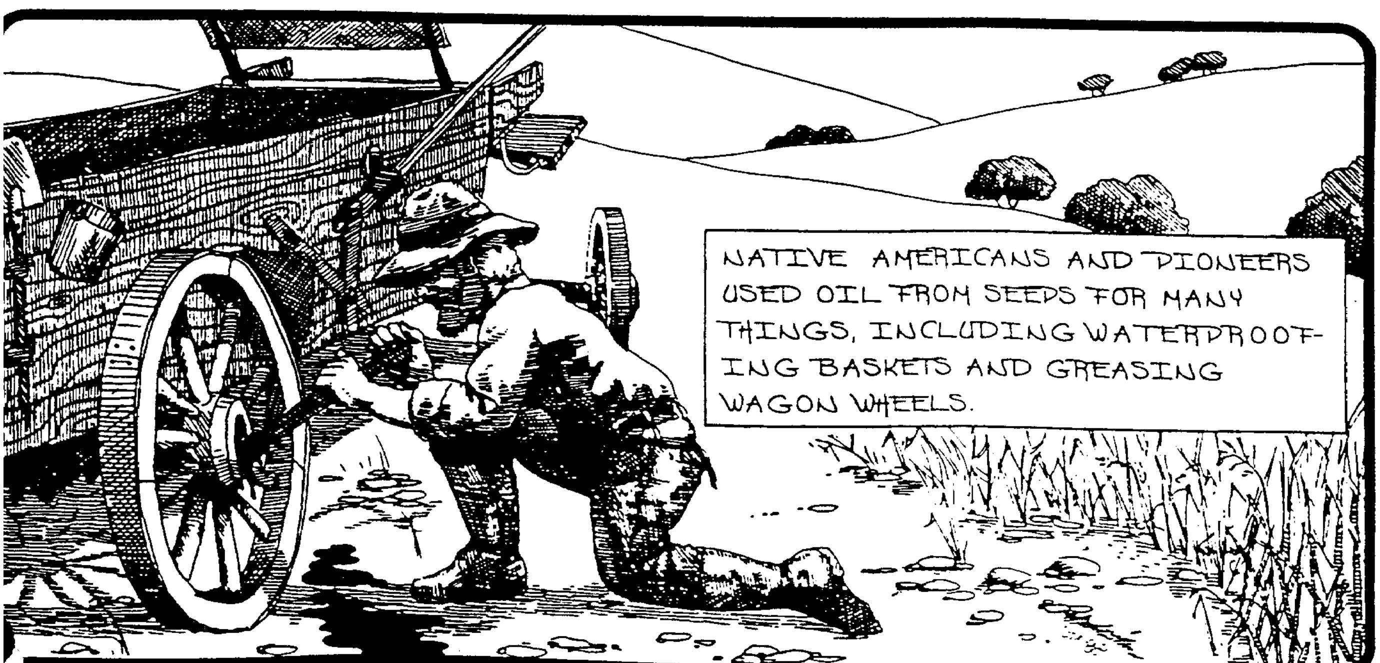
CALIFORNIA DEPARTMENT
OF CONSERVATION
Division of Oil, Gas,
and Geothermal Resources
801 K Street, MS 20-20
Sacramento, CA 95814
(916) 445-9686

Resource materials are available for grades 4-8:

- **Videotape**. *Oil and Gas in California*. Introduction to oil and gas in California, from formation and extraction to refining and distribution. $25.00.

- **Publication**. *Oil and Gas in California*. Comic-book style introduction to oil and gas in California, from formation and extraction to refining and distribution. Free.
- **Slides**. *Oil and Gas in California*. Based on the publication above. A slide presentation (53 color slides) with script, companion publication, and map of California's oil, gas, and geothermal fields. $15.00.
- **Publication**. *Geothermal in California*. Comic-book style introduction to geothermal resources in California, from formation to development. Free.

Materials may be ordered by telephone or over-the-counter from any division office (consult local telephone book). The Sacramento office (address above) also accepts mail orders.



From *Oil and Gas in California*. Drawings by Jim Spriggs, Division of Oil, Gas, and Geothermal Resources.

CLASSROOM WORKBOOKS & TEACHING AIDS

"Coal Country" (set of five computer disks for Macintosh requires 11 megs hard drive; 5.5 megs RAM. For DOS 3.5" disks only; PC/Windows software requires 13 MB of hard drive; Microsoft Windows 3.1 or later; 8 megs RAM) Learn about coal formation, deposit locations, mining techniques, and common uses of coal in everyday life. An interactive program using animation, music and colorful graphics to stimulate the viewer's interest. Available in:
3.5" DOS **Order No. 22-1000** $7.50
MAC **Order No. 22-1001** $7.50

"Common Ground Educational Package" A companion to the Common Ground video. Individual teaching packets for Grades 3-5, 6-8, & 9-12 PLUS a Poster "Modern Mining and You".
Order No. 14-CG $2.00

"Mighty Minerals" Teaching unit for the 4th grade classroom. Students will learn some of the basic characteristics/uses of each mineral presented.
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"Mined It!" A fairy tale about metals and minerals that reveals their indispensable role in everyday life. 60 pag of story, illustrations, glossary, notes on minerals, ana word puzzles.
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"Out of the Rock" (544-pages) A comprehensive mineral resource and mining education program for grades K-8. This program of integrated activities and information teaches how to locate, extract, process, manufacture, and recycle the earth's minerals.
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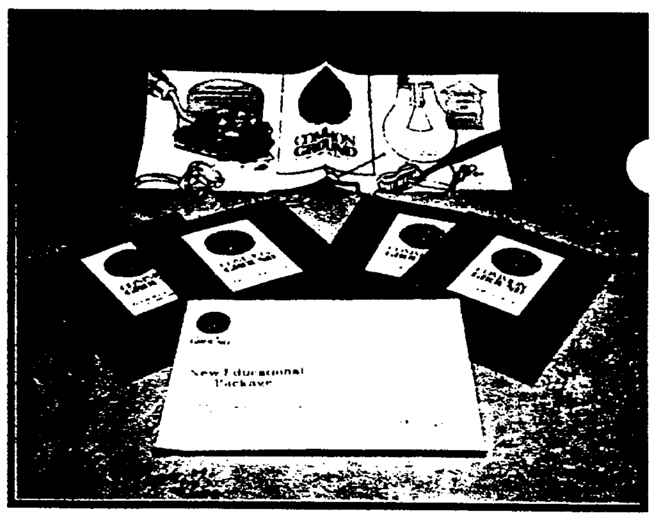
"Discover Mining!" DOS Computer Disk with three games: *School of Mines, Explore, and Bonanza Gold.* Teaches users about the economics of exploration and mining. Available in:
3.5" **Order No. 14-DM3** $5.00
5.25" **Order No. 14-DM5** $5.00



EDUCATIONAL MATERIALS

VIDEOS

"Common Ground" (26 min) Produced by Caterpillar. For Elementary to Adult audiences; stresses the importance of minerals and mining to our standard of living; covers history, environmental concerns, exploration, mine development, public perceptions and using public involvement as an educational tool. (The *"Common Ground"* package includes a Teacher's Guide, User's Guide, and "Modern Mining & You" informational booklet.) Available in:
VHS **Order No. 22-0905** $10.00
PAL **Order No. 22-0906** $10.00

"Out of the Rock" (29 min) Produced by the U.S. Bureau of Mines. For Jr. High to Adult audiences; examines the importance of minerals and mining; provides examples of minerals use in everything from glass to makeup to toothpaste to wiring. Discusses recycling and environmental issues.Available in:
VHS **Order No. 22-0900** $10.00
PAL **Order No. 22-0901** $10.00

"Tierra de Todos (LAND of ALL)" (Spanish; 26 min) Produced by Caterpillar. The story of modern mining in Latin American – tells of mining's products, advancement and increased concern for the environment. Visits a Dominican nickel mine, a llama farm in Chile, and the copper mining region of the Atacama desert. Available in:
VHS **Order No. 22-0907** $10.00
PAL **Order No. 22-0909** $10.00

"Let's Do Mineral Science" (30 min) Produced by the US Bureau of Mines. Demonstrates six hands-on classroom activities to teach the mining process, the economics of mining, and from what minerals various products are made from. Activity worksheets included with this video.Available in:
VHS only **Order No. 22-0908** $7.00

POSTERS

(All posters $3.00. Bulk order discount: 30 or more of the same poster are $1.80 each plus Shipping/Handling.)

"Rocks & Minerals & How We Use Them" Illustrates the many uses of rocks and minerals. **Order No. 14-RP**

"Rocas Y Minerales a Nuestro Alrededor" Spanish version of Rocks & Minerals. **Order No. 14-RPS**

"From the Mine to My Home" Exploration, mining, processing, consumption, and recycling of minerals. **Order No. 14-MH**

"Electric Generation" Shows how electricity is generated and how it gets to homes and businesses. **Order No. 14-EP**

"Coal" Describes formation, exploration, extraction, transportation, and use of coal. **Order No. 14-CP**

"From Mountains to Metals" Detailed information about exploration, mining, processing and the refining of minerals. Includes reclamation, transportation, manufacturing and uses of minerals. **Order No. 14-MP**

"Switched on Mining" Identifies minerals around girl at computer. **Order No. 14-SM**

"Mining at Play" Even skateboarders depend on minerals – for clothing, equipment, boards & boom boxes. **Order No. 14-PP**

"Aggregates: Nature's Building Blocks" Details the 4 major sets in producing aggregate:site preparation. mining and processing, transportation, and reclamation." **Order No. 14-AP**

WANTED: 5 BILLION TONS OF MINERALS

According to the US **Bureau of Mines**, based on our current standard of living, **every American requires 36 thousand-40 thousand pounds of new minerals each year**. For the US population, that's about ***5 billion tons annually***. While there will undoubtedly be changes in technology that will affect future generations, based on current technology and use, a lifetime supply for a child born in 1992 looks something like this:

MINERAL	POUNDS	PRODUCTS
Lead	800	Batteries, solder, electronic components.
Zinc	840	Brass (alloyed with copper), coatings for steel, used in rubber and paints.
Copper	1,500	Electrical motors, generators, communications equipment, electrical wiring.
Aluminum	3,200	Beverage cans, lawn chairs, aircraft, ships, automobiles.
Iron & Steel	91,000	Kitchen utensils, automobiles, ships, buildings.
Clays	27,000	Bricks, paper, paint, glass, pottery, abrasives.
Salt	26,000	Cooking, plastics, de-icing, detergents.
Coal	500,000	Generating electricity, making iron and steel, manufacturing chemicals.
Stone, Sand and Gravel, Cement, Slag	1,000,000	roads and highways, building construction, schools, offices, factories

Supplies of mineral products are driven by consumer demand. Even before processing, raw, non-fuel minerals contribute more than **$30 billion per year** to the US economy. **Another $300 billion** is added when the raw product is processed to produce steel, aluminum, copper, brick and glass.

And, finally, by the time those materials are converted and sold as consumer goods such as automobiles, toasters, glassware and china, cans, bottles, vacuum cleaners, airplanes and TV sets, **over $5 Trillion** will have been added to the nation's economy all because we have been able to locate, mine and process our mineral resources.

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Importance of Industrial Minerals in Everyday Life

By

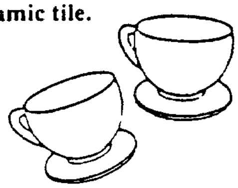
HAL McVEY, Consulting Minerals Geologist
Mineral Marketing, Inc.
Rough & Ready, California

The significance of nonmetallic minerals — termed "industrial minerals" — is little recognized by the vast majority of Californians. According to a U.S. Bureau of Mines estimate, the average American uses about one million pounds of industrial minerals, such as limestone, clay, and aggregate, over the period of a lifetime. The following article was first presented at the Industrial Minerals Conference at Marina Del Rey, California, February 15-16, 1989, and is reprinted here by permission from the author . . . editor.

Few people realize the importance of industrial minerals in their everyday lives. Perhaps a trip through a normal working day will underscore our reliance upon these nonmetallic minerals. The products that contain industrial minerals or utilize industrial minerals in the manufacturing process are highlighted in bold face.

MORNING

As we step out of bed in the morning, we place our feet on the **carpet** (calcium carbonate/limestone is used in the carpet backing). We find our way to the kitchen and switch on the **electric light** and the **coffee pot**, which are made of either **glass** or **ceramics** (both glass and ceramics are manufactured entirely from industrial minerals — silica sand, limestone, talc, lithium, borates, soda ash, and feldspar). In the kitchen, we stand on **linoleum** (calcium carbonate, clay, and wollastonite) or on **ceramic tile.**



While the coffee is brewing, we sit down to read the **newspaper.** At the same time we realize we have to take a trip today, so we consult our **Official Airline Guide** and then have to refer to the **Yellow Pages** of the phone book for the number of the airline. (All of these papers are filled with kaolin clay and limestone: sodium sulfate, lime and soda ash are used in the processing.)

The coffee is ready and we have a piece of **toast** and sneak a piece of **cake** from last night's party (bakery items, such as bread, contain gypsum as an ingredient and **cake icing** has a high content of gypsum). The **plate** we are eating from is composed of **glass, ceramics,** or **China** (a special form of ceramics). We might want a full breakfast or contemplate what we will have for lunch or for the evening meal. Regardless, all of the **food** that we eat everyday is grown and produced completely with industrial minerals. (All **fertilizers** are composed of some combination of potash, phosphates, nitrogen, sulfur, and other minor minerals. The acidity of soils must be regulated with gypsum, limestone, or sulfur. In fact, without industrial minerals there could be no modern-day agriculture as we know it.)

Let's now start getting ready to go to work. We brush our teeth with **toothpaste** (calcium carbonate/limestone/sodium carbonate). Women put on **lipstick** (calcium carbonate and talc) and **powder** (talcum) and men might use **hair cream** (calcium carbonate). Other forms of **makeup** would have various minerals as a constituent. The **lavatory counter top** in the bathroom where we are standing is **synthetic marble** or **synthetic onyx** (titanium dioxide, calcium carbonate and alumina hydrate). **Sinks, lavatories, toilets,** and similar fixtures throughout the house are kept shiny with **cleansers** (silica, pumice, diatomite, feldspars, and limestone). **Kitchen** and **bathroom tiles** are installed and kept in place and maintain their waterproof condition with **putty** and **caulking compounds** (limestone and gypsum).

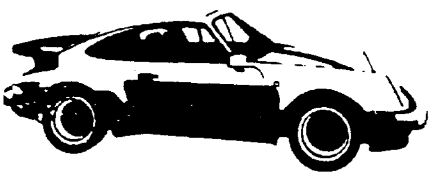
Before we leave we brighten up our wardrobe with some form of **jewelry** (all precious and semi-precious stones — opal, amethyst, aquamarine, topaz, garnets, diamonds — are industrial minerals). There is a less attractive task to do at the last minute, changing the **kitty litter** (attapulgite, montmorillonite, zeolites, diatomite, pumice, or volcanic ash).

As we walk outside, we make a mental note that the **composite roof** needs repairs. (**Fiberglass** is composed of almost the same ingredients as regular glass — silica, borates, limestone, soda ash, and feldspar. Fiberglass and asphalt, along with lesser quantities of either talc, silica sand, or limestone, comprise composition roofing.) And, we are pleased to see that the new **fiberglass siding** on our home looks nice. As we get in the car, we think of the **planting** and **gardening** projects for this evening. In addition to **fertilizers** we will have to buy some **soil amendments** and **planting mixes** today. (Vermiculite, perlite, gypsum, zeolites, or peat make for better growth.)

ON THE ROAD

Once we leave for work we are really immersed in industrial minerals. Our **automobile** is literally composed of industrial minerals. Starting from the ground up, **tires** contain clay and calcium carbonate and the **mag wheels** are made from dolomite and magnesium. All of the glass in the car is made entirely from minerals; so is the **fiberglass body** now on many models. Many components in a car are made of **composites,** which are usually combinations of **fiberglass** and **plastics.** Plastics are manufactured from calcium carbonate, wollastonite, mica, talc, clays, and silica. As we drive to work, we are enjoying numerous industrial minerals — from the **bumpers** to the **dashboard** to the **radiator cap** and the **floor mats.**

The **paint** that makes our car so attractive is composed of industrial minerals — titanium dioxide, kaolin clays, calcium carbonate, micas, talc, silica, wollastonite, and others. In fact, **all paints** that we will encounter today, from that on our house, to the stripe down the middle of the road, to the interior of our homes and offices, will be composed mainly of industrial minerals.



Modern transportation is almost entirely dependent upon industrial minerals and this does not stop with the car. **Gasoline** and **lubricants** depend on industrial minerals. The **drill bit** that was used originally to discover the crude oil was faced with **industrial diamonds. Fluids,** used for ease of well drilling, are almost entirely made from barite, bentonite, attapulgite, mica, and perlite. Clays and zeolites are necessary in the **catalytic cracking process** to produce gasoline and lubricants from crude petroleum.

On our way to work we are literally riding on industrial minerals. **Concrete pavement** is composed of **cement** and **aggregates.** Aggregates are themselves industrial minerals — sand and gravel or crushed stone, such as limestone, dolomite, granite, or lava. **Cement** is manufactured from limestone, gypsum, iron oxide, clays, and possibly pozzolan. Even **asphaltic pavement (blacktop)** contains industrial minerals as aggregates.

AT WORK

The **building** we are about to enter is made from or of industrial minerals. If it is a **concrete** or **stone** or **brick building,** it is made entirely from industrial minerals. If there are **steel structural members**, the steel production process required fluorspar for fluxing, bentonite for pelletizing, and perhaps chromite for hardening. The making of **steel** requires the use of high grade **refractory bricks** and **shapes** made from bauxite, chromite, zircon, silica, graphite, kyanite, andalusite, sillimanite, and clays. **Fiberglass batts** may be used for insulation in our office buildings, just as they are in our homes.

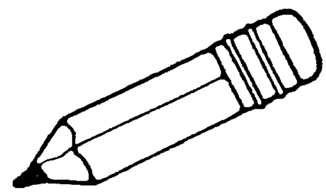
Upon entering the office building, we are often enclosed by **wallboard** or **sheetrock** (gypsum with fire retardant additives, such as clays, perlite, vermiculite, alumina hydrate, and borates) joined together with **joint cement** (gypsum, mica, clays, and calcium carbonates). Certainly the **plate glass windows** are made entirely from industrial minerals. The **floors** or **decks** between floors are probably made from concrete using **lightweight aggregate** (perlite, vermiculite, zeolites, or expanded shales).

To begin our work, we may pick up a **pencil** (graphite and clays) and make a list of things to do. One of the first items is to send out a few invoices that are backed with **self-contained carbon paper** (bentonite or other clays or zeolites). There are some articles to be ordered so we pick up a **catalog** or **magazine** and unconsciously like the glossy feel of the **fine paper,** due to a high content of kaolin clay or calcium carbonate along with titanium dioxide for extreme whiteness. Almost every **sheet of paper** that we use today was made with industrial minerals such as talc, or contains minerals as fillers and coaters. Even some **inks** contain calcium carbonate or other fillers.

The morning has worn on and it is time for a break. In addition to the coffee in the **coffee cup** (remember it is made of industrial minerals), we decide to heat up a roll; and we place it in or on a **microwavable container** (plastics filled and reinforced with talc, calcium carbonate, titanium dioxide, or clays).

While on break, we ponder what we will do for recreation during the weekend. Recreational equipment — **golf clubs, tennis rackets, fishing rods,** and **skis** — are all now commonly made from graphite or, a slightly "older" material, fiberglass. If we are planning a backpacking trip, our **pack frame** and **pots** and **pans** will be made of **aluminum** (all aluminum, for whatever usage, originates with bauxite, one of the most widely utilized industrial minerals). If we use a camp light on our trip, the **mantle** will be made from an industrial mineral, thorium.

Communications equipment employs numerous industrial minerals. The standard product of the industry for many years has been the **silicon chip,** made from quartz or silica as the name implies. **Optical fibers,** made from **glass,** are replacing some copper wiring. The **television screen** or **computer monitor** is made of glass; but critical **tubes** also contain phosphors made from the rare earths or lanthanides, a family of industrial minerals. Even the **superconducting materials,** now so much in the news, are manufactured from industrial minerals (yttrium, lanthanides, titanium, zirconium, and barite).



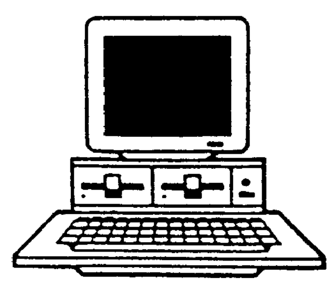
EVENING

After a hard day at the office, we drop in for refreshments with our friends. **Fruit juice** or, for the less temperate, a glass of wine or beer would be refreshing. All of these liquids are filtered through either perlite or diatomite in the purifying and clarifying processes. If we should add **sugar** to any of our drinks, we are enjoying the benefits of minerals since limestone and lime are basic to the production of sweeteners. And, of course, our refreshments will be served in **ceramic mugs** or **glasses** composed entirely of industrial minerals.

Filtering and purification are major uses of the industrial minerals. **Drinking** water is purified and clarified by filtering through minerals, (limestone, lime, and salt). In **waste water treatment** plants, zeolites, soda ash, lime, and salt are used in the filtering process.

Vegetable oils processing includes filtering through clays, perlite, or diatomite. Swimming pool water is filtered and purified by the same minerals.

When we arrive back home, we are not yet through with exposure to our mineral friends. If we take **medicine** or **pharmaceuticals**, we may chew **antacid pills** essentially made from calcium carbonate.



Makeup--A Wealth of Minerals

Have you ever read the ingredients nakeup, shampoo, or toothpaste? might surprise you. Many sonal-care products contain a alth of mineral materials taken m the earth. Take, for example, shadow.

One of the first ingredients listed eye shadow is usually talc - a gnesium silicate mineral. Its ty crystal habit is in part the ison why talc has been an portant ingredient in cosmetics ce 3500 B.C. The plates glide oothly across each other, owing makeup to be applied ily. They lie across the pores in skin and lessen the chance of gging pores, while providing ture to the skin. Yet they are nslucent enough not to be seen. c is resistant to acids, bases, and at and tends to repel water. In dition to eye shadows, talc is used loose and pressed powders, ushes, is a filler in some odorants, and is added to lotions d creams. Talc can also be found chewing gum and armaceuticals.

Mica, a mineral widely used in e shadows, powder, lipstick, and il polish, is added to give luster or arlescence to a product. Mica is sistant to ultraviolet light, heat, ather and chemical attack and heres to the skin. Like talc, it has cellent slip characteristics and ay be used to replace talc in a akeup. When coated with iron ide, mica flakes sparkle with a ld tint.

Kaolin, a clay, is added to makeup absorb moisture. It covers the n well, will stay on the skin, and resistant to oil. Kaolin and other clay, bentonite, are added the earth-based face masks or packs predominately for their cleansing effects. Clays are also used as fillers in different products.

Powdered calcite, a calcium carbonate, absorbs moisture. Because of this, calcite and a magnesium carbonate, processed from dolomite, are added to powders to increase the ability of the makeup to absorb moisture.

When it comes to makeup, color is the name of the game. Minerals provide the color to eyes, cheeks, lips, and nails. Iron oxide, one of the most important color minerals, was used by Cleopatra in the form of red ochre as rouge. Today, iron oxides give red, orange, yellow, brown, and black tones to makeup. Chrome oxides are used for greens; manganese violet for purple; ground lapis lazuli may be added to makeup for blue. Ultramarine blue and pink coloring is made from a mixture of kaolin, soda ash, sulfur, and charcoal. Even gold has historically been used as a colorant. Ancient Egyptians used gold to color skin and hair. Gold can still be found in powders and makeup to add a 'rich' golden sheen to the skin.

As an artist starts a painting with a bright white canvas to give the colors brightness and intensity, titanium dioxide is added to brighten and intensify the color of makeup, and to give whiteness and opacity. Titanium dioxide is also a natural sunblock and, like talc, iron oxides, and gold, it has been used for centuries. Titanium dioxide can be found in any makeup--shadow, blush, nail polish, lotions, lipstick, and powders. Titanium dioxide also makes Oreo cookie frosting extra-white and is the 'M' on M&M's candy.

Minerals also find their way into health-care products we use daily. Salt is effective in treating skin disease and is used in some soaps. Fluorite, processed for fluoride, is added to toothpaste and drinking water to helpprevent tooth decay. Calcium carbonate (calcite) and baking soda (nahcolite) are abrasives in toothpaste. A borax and beeswax mixture is added to cleansing creams as an emulsifier to keep oil and water together. Boric acid is a mild antiseptic and is added to powder as a skin-buffering agent. Zinc oxide is added to creams to allow the cream to cover more thoroughly. Zinc oxide ointment, which contains approximately 20% zinc oxide, is used to heal dry chapped skin. When an unlucky hiker runs into poison ivy, calamine-base lotions are often used to sooth the itchy skin. Calamine is another name for hemimorphite, a zinc silicate mineral.

As you can see, minerals are found in many things we use. So, the next time you are in the supermarket, take a moment and acquaint yourself with the multitude of minerals that are a part of our daily lives.

Authors Donna Boreck and Liane Kadnuck are geologists at the USBM Denver Research Center, Colorado.

YOUR HOUSE COMES OUT OF A MINE

The majority of the raw material used in building your home was furnished by the mining industry.

The foundation is probably concrete (limestone, clay, shale, gypsum, and aggregate mining.)

The exterior walls may be made of brick (clay mining) or stone (dimension stone mining.)

The insulation in the walls may be glass wool (silica, feldspar, and trona mining) or expanded vermiculite (vermiculite mining.)

The interior walls are usually wall board (gypsum mining.)

The lumber in the structure will be fastened with nails and screws (iron ore mining and zinc mining.)

If the roof is covered with asphalt shingles, the filler in the shingles is from a variety of colored silicate minerals from mining.

Your fireplace is probably of brick or stone, lined with a steel box (iron ore mining.)

Your sewer piping is made of clay or iron pipe (clay mining or iron ore mining.)

Your electrical wiring is of copper or aluminum (copper mining or bauxite mining.)

Your sanitary facilities are made of porcelain (clay mining.)

Your plumbing fixtures are made of brass (copper and zinc mining), or stainless steel (nickel and chrome mining.)

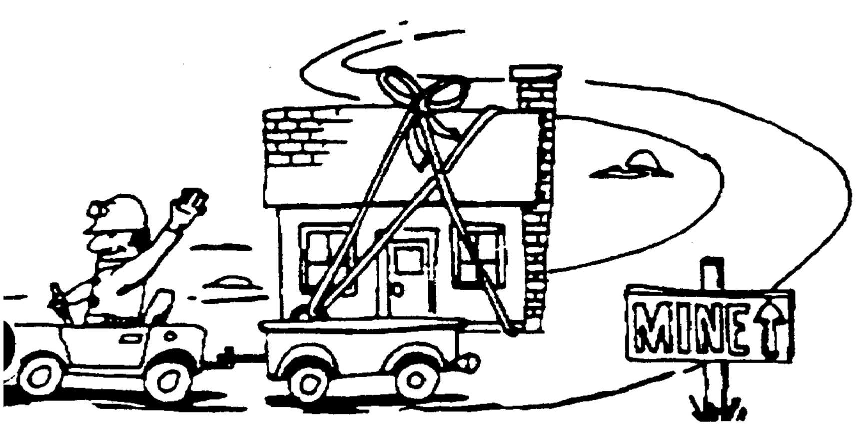
Your gutters of galvanized steel (iron ore mining and zinc mining.)

The paint is manufactured with mineral fillers and pigments (from minerals obtained by mining.)

Your windows are made of glass (trona, silica, sand, and feldspar mining.)

Your door knobs, locks, and hinges are of brass or steel (copper, zinc, and iron ore mining.)

And finally **your mortgage** is written on paper made from wood or cloth fibers, but filled with clay (from clay mining.)



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WHAT'S IN A CAR?

DID YOU KNOW THAT....

About 7.8 million passenger cars were manufactured in the United States in 1986.* Each car is made up of about 15,000 parts, all of which require mineral resources to make. The average car weighs 3,000 lbs. Of that, 139 lbs. are ALUMINUM, 28 lbs. are COPPER, and 20 lbs. are ZINC.

The automotive industry uses over 12 million tons of steel in a typical year, over 17% of the total domestic steel production. Steel is made from IRON ore combined with various enhancing metals such as COLUMBIUM, CHROMIUM, MOLYBDENUM, or VANADIUM.

About 660,000 troy ounces of PLATINUM were used for making automotive catalytic converters in 1986 alone.

Over half of all LEAD used in the U.S. goes into making cars, trucks, and buses, as well as batteries.

The value of machine tool shipments to the automotive industry totaled $2.54 billion in 1985. If it were not for metals such as CHROMIUM, TUNGSTEN, MOLYBDENUM, and VANADIUM, most of these tools would not exist.

The glass in car windows is made from SILICA SAND and LIMESTONE plus other several other mined or quarried commodities, such as BORON.

Even the plastics in a vehicle are made from PETROLEUM, a nonrenewable natural resource, or from COAL.

The gasoline, diesel, oil, antifreeze, transmission fluid, and grease required for operation of a vehicle are all PETROLEUM derivatives and would not exist if no oil were produced.

IODINE is used in the production of high-purity metals, motor fuels, and lubricants. GRAPHITE is used in brake linings.

The roads we all drive on could not be built without mineral commodities like ASPHALT, GRAVEL, and the components of CEMENT.

Therefore, the next time you drive your car, remember that MINERAL RESOURCES, dug from the earth, make it all possible.

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*In 1986, the 50 States and the District of Columbia recorded a total registration of 181,890,000 automobiles, trucks, buses, and motorcycles.

Based on an article in <u>The Pick & Pen,</u> published by Women in Mining, November 1988.

Uses of Minerals

Kentucky Science Teacher's Association Annual Conference
November 5, 1999
Women in Mining, California Chapter
Minerals and Their Uses
Dinah O. Shumway

I have three goals for this lecture. The first is to introduce you to some basic information about minerals. For some of you, the material may be familiar, but I will be brief. Second, I want to introduce you to some basic facts about mining today, and finally, I want to suggest some ways that you might want to introduce minerals into you classroom that will engage your students, and make the subject more interesting and relative.
Can anyone tell me what a mineral is? A mineral is a naturally occurring homogeneous substance made up of an orderly arrangement of atoms which has a unique set of physical properties. In the periodic table there are only 8 elements which can be considered abundant. They are Oxygen, Silicon, Aluminum, Iron, Magnesium, Calcium, and Potassium. & sodium The most common minerals are made up of oxygen and silicon in a combination with some of the other elements. Can you name some common minerals?
Quartz is made up of silicon and oxygen. Feldspars have combinations of silicon, oxygen, aluminum, and sodium, potassium, and calcium. Mica is made up of silicon, oxygen, aluminum, and iron.
There are many other minerals made up of all of the elements on the periodic table and occur in the crust of the earth. However, except in rare instances where they have been concentrated through various natural processes, they are extremely rare and dilute.
Now, what is a rock? Rocks, by extension, are a combination of various minerals. The most common rocks are made up of the most common minerals. Granite, from example, is made up of quartz, feldspar, and biotite, and other minor minerals. Sandstones are made up of quartz, and feldspar, and other minor minerals depending on the source rock. Shales or slates are made up of quartz and other aluminum minerals like mica.
If I were to ask you to name a mineral that is mined in California, what would you say? Of course. GOLD! The gold rush was likely the single most important event in the history of California and the westward movement. People from all walks of life brought many types of expertise and certain physical needs: like food and shelter, which spurred commerce, transportation, and innovation. So, the impact of gold mining on the growth of California and the Western United States cannot be overemphasized, but does anyone know what the most important mineral commodity produced today? The most important mineral commodity produced today is sand and gravel. In fact, most of the mineral production comes from what Geologists call Industrial Minerals, not metals. Would anyone like to guess why some minerals might be called Industrial Minerals? It's because they fuel industry. We make things out of industrial minerals. We make things out of metals also, but industrial minerals are not only used to build infrastructure like roads and buildings, but they are used in plastics, pharmaceuticals, paper products, and just about everything that you can think of, and more uses are being discovered everyday.
California produces many of these important industrial minerals and as you can see from this slide that California has 7% of all the non-fuel mineral production in the U.S. and leads the U.S. in the production of Boron, Diatomite, Cement, Gypsum, Rare Earth concentrates, and Tungsten. California has the most diverse mineral production in the

U.S. and the reason for that is the GEOLOGY. The geology of California is the most diverse in the U.S., except for Alaska, and it is the geology which controls what minerals that are available in any given area. On the geologic map each color represents a combination of different type and ages of rocks or suites of rocks. Often, these suites of rocks are host to some unique minerals.
In the U.S. there are over 40,000 abandoned and active mines and about 26,000 of these are in California. The overwhelming majority of these are gold mines and prospects. You can compare that with the currently active mines in California, of which there are just over 1300. Over 750 are sand and gravel quarries and about 16 are gold mines, of course this number fluctuates with the price of gold.
California has several world class industrial mineral deposits. Among these are:
U.S. Borax operating in the Mojave Desert with over 40 years of reserves. They supply well over half of the world's current borax needs.
U.S. Gypsum in Imperial County, which is the 4th largest producer of gypsum products in the world.
Unocal's Mountain Pass Mine is near the California-Nevada border as you approach the city of Las Vegas and is the largest producer of Rare Earth Minerals in the U.S.
The Hector Mine which is the name-sake of the last major earthquake experienced in California is owned by Elementis Specialties. The hectorite mined here is used to control the flow and viscosity characteristics of paint, cosmetics, printing inks, greases, and drilling fluids
The Searles Lake deposit is owned and operated by "who knows this week", but they are a major producer of mineral salts.
California is the number one producer of cement. There are 10 mines, seven of which are in southern California. This is a picture of the Cushenbury quarry is run by Mitsubishi Cement Co.
And lastly, California had 16 operating gold mines and Homestake, the Viceroy, and Mesquite are the largest producers.

So, now that you have had a quick overview of minerals, I'd like to suggest some ways to introduce minerals into your classroom, and I've gotta tell you that I plagiarized most of this part of my presentation from my friend, Leslie Gordon of the U.S.G.S. Leslie and the U.S.G.S. are a marvelous resource for teachers interested in minerals curricula.
Most kids could tell you that metallic minerals are used to make machinery, appliances, cars, and many communications and hi-tech applications. But the other group of minerals, non-metals, and fuel minerals actually have, as a group, more and varied applications. In fact, some industrial minerals have been manufactured into materials that can even take the place of some metals. Material like ceramic for example, which are made out of clay, talc, and other minerals. Although, industrial minerals are not very glamorous, they can be used very effectively to introduce minerals into the classroom and enhance your student's appreciation form minerals in their lives and maybe make them want to know more.
You don't have to convince us that minerals and mining are interesting and important today, but one of the reasons that we feel that mineral education is important is that not many people realize that minerals are vital constituents to your standard of living.
This is a really boring economic hierarchy chart that I got from a textbook for a human

geography class I once taught. It depicts the place that mining has in the economic scheme of things. Teachers, and government employees deal in information. All the stuff we use to do our jobs comes from things that are manufactured from stuff that is mined. Now, if I had started this presentation with this slide, which does convey some important and overlooked information, you would all be asleep by now.

So, if I would hesitate to start my comments with this slide, why would you start an introduction of really cool minerals to your students by giving them a blank chart like this one? We have all seen this of course. The idea is to have the students determine the physical properties of minerals like those I have in front of me and record their observations on the chart. Like Hardness, Cleavage, Color,...etc. The challenge is to explain to any student WHY one needs to know the hardness or color, or density, and fill in the blanks and indeed be able to tell these minerals apart - wouldn't it?

Each one of these has properties that could be determined by the usual determination that you would use in the classroom. BORING!! "Why do we have to do this?" "So What?" "I Don't Care About these things!" "They are all White!" Any discussion of the uses of various minerals is usually restricted to the last chapter, or a bar column.., "Oh by the way, we actually use some of these minerals to make things."

The uses of the various minerals can be the most attractive aspect of the study of minerals. This aspect can be employed in the classroom to spark interest in the study of minerals and mineral resources or other natural resources. Everyone will respond to information if it is related to their frame of reference. Of course, observational skills, systematic collection of data, and the analysis and presentation of that data is very important in learning the scientific method, however, as an introduction to geology or earth science, there may be a better way.

Most of us are not aware that all of the things that we use everyday come from minerals. You can use this fact to instill an interest in minerals.

It might be more useful to take a backward tactic to introduce minerals into the classroom.

Consider talcum powder, why does it feel so soft and silky? It's because the talc is very soft and is formed of small plates which slide past each other - it's CLEAVAGE. It coats surfaces and keeps things from sticking and will form a water barrier.

OR, what do you think you would need from a mineral that would make good sandpaper? Hardness? Maybe, No cleavage? Something that breaks into small uniform shards? Garnets!

OR, what puts the sparkle into make-up? What would make shiny surfaces? Mica.

In the classroom children can examine household items from televisions to kitty litter. Where Does All This Stuff Come From???

Get them into the library. Write letters to manufacturer's. Investigate the manufacturing processes from the raw materials to the finished product. Investigate the source of building stone and aggregate for the concrete and road beds. These will have a local source. Take a field trip.

Read Labels. This is full of minerals. Have the students read the labels and find the minerals, look them up at the library, and find out where the minerals come from. If the students write to the manufacturers or the products or research the history of cosmetics, or coins, or glass, these projects can be dovetailed into math, history, and social studies. By approaching mineral studies from their use, these lessons can be integrated to other areas of an already established curricula. For example, an introduction of the label from a cereal box can be tied into a unit on health and nutrition. Where do "minerals" in cereals come from???

It should be obvious by now that minerals are vitally important to our society and that the only way to procure these minerals is by mining. Teaching the importance of minerals and the uses of minerals could be viewed as a propaganda piece for the minerals industries, but what it should show the children is that all things indeed come from the earth, not just trees and wildlife, but everything.

Regarding recycling and conservation, how much is and can be recycled? What cannot be recycled? Almost every kid knows that you can and should recycle aluminum, but how many kids have heard or seen Bauxite. How many know that glass is made from silica sand?

Most schools have a curricula on the environment or conservation or recycling. Highlighting the importance of minerals in our daily lives can lead to a discussion of the needs of a society and how that relates to the resource supply.

Introducing uses of minerals in not new, it's just traditionally handled as an aside...the last paragraph in the chapter, or an interesting side bar, or the last column in the mineral chart.

By moving mineral use information to a more prominent roll in the lesson, by dragging all of this stuff into the classroom, it will force students to confront the relevance of the study of minerals. After the question of relevance is answered, it may be more palatable to continue with the scientific method to determine the physical attributes of the minerals. Students might be more willing to answer the question of why graphite, which has a hardness of 1, is used to make pencils, and is a good lubricant, yet is a vital ingredient in fishing rods, tennis racquets, and jet aircraft.

Hardness of Minerals

Mineral Hardness: Background

The **hardness** of a mineral is its **ability to scratch another mineral.** Hardness is especially important in minerals used as abrasives and for gemstones, which must be very hard to be durable.

Mineral hardness is measured on a relative scale called **Mohs hardness scale**. Ten more-or-less common minerals are ranked in order of relative hardness from 1 (softest) to 10 (hardest). While there are quantitative hardness scales that materials scientists use, Mohs scale simply tells us this mineral is harder than that one, and not how much harder it might be. A mineral that falls between two minerals on the scale is indicated by 1/2; if it scratches feldspar but not quartz its hardness is 6 1/2.

Mohs Scale

1	talc		1 1/2	skin
2	gypsum		2 1/2	fingernail
3	calcite		3 1/2	copper penny
4	fluorite			
5	apatite	same mineral composition as teeth	5 1/2	glass, steel (up to 6 1/2)
6	feldspar			
7	quartz			
8	topaz			
9	corundum (ruby, sapphire)			
10	diamond			

Follow-up activities on mineral hardness:

Get Mohs hardness scale kit and have students arrange in order. Why are the gemstones - topaz, corundum (ruby and sapphire), diamonds - at the hard end of the scale?

Design sandpaper. Test minerals of varying hardness against wood. Would sandpaper made of calcite work? Most sandpaper is either made of garnets or of minerals similar in hardness to garnet.

Would you rather have a marble countertop (made of calcite) or a granite countertop (made of quartz and feldspar) in your kitchen? Why?

Sculptors of marble use steel tools to cut the rock. What could you use to cut granite building stones? (Stone cutters, like brick cutters use saw blades that are flat pieces of metal with diamonds glued to them. The saw does not cut through stone like a wood saw cuts wood, but scratches a groove deeper and deeper into the stone.)

One more brainteaser: how can you cut diamonds? (Answer: you can't. Nothing scratches diamonds. Diamonds are **cleaved**, not cut. This means they are gently struck with a tiny hammer along a zone of atomic weakness and break along smooth flat planes.)

Activity: Toothpaste

Introduction

This activity relates a mineral property - hardness- to everyday life. Students work in groups to first discover what minerals toothpaste contains, and then to test those minerals for their relative hardnesses. From their results, they draw conclusions about the abrasiveness and effectiveness of various toothpastes.

Preparing for the Activity

You will need a tube of toothpaste still in the box for every three students. The ingredient list is on the box, so that's the only essential part of the toothpaste for this activity. If you don't want to buy all that toothpaste, you can have students save the boxes from their own toothpaste. You should be sure, though, that among the toothpastes you have represented is Tom's of Maine and a smoker's toothpaste like Zact or Topol.

You will also need a set of three minerals for each group of three students: calcite, quartz and apatite. Label the quartz number 1, the calcite 3 and the apatite 2. You can label the minerals very permanently by painting on a small dot of white enamel, and when it is dry writing the number with a crow-quill pen and india ink. Cover the number with clear nail polish and it will last forever. A quicker but less durable labelling technique is to write the numbers on small dot labels, then stick the labels to the mineral with a bit of white glue. Put each set of minerals in a plastic bag to facilitate distribution.

Duplicate a copy of the worksheets for each student. It works best if printed double-sided.

You may also want a large demonstration sample of each mineral, as well as a zircon.

Background

The students should know what a mineral is. You can use this exercise to introduce hardness, or you can use it as a follow-up for that topic.

Doing the Activity

Divide the students into groups of three. Each group should get worksheets for each student, a toothpaste box, and a bag of minerals.

Have the groups discuss the first set of questions, then write answers to them. Have the groups share their answers with the class. Let the kids challenge each other, but don't provide them with any answers.

Have the groups examine their toothpaste box and guess which ingredients are minerals. They can write their guesses on the worksheet. Then let them turn to the next page and check their guesses against the list. Let the class talk about any other ingredients they had questions about.

Then move on to talking about hardness. Be sure students understand the definition of hardness on the page. Let the groups decide how hard toothpaste should be, then write their answers Then have the groups open their bags of minerals, each student taking one sample. Be sure the students understand that apatite is what teeth are composed of. Then have them work together to determine the relative hardnesses of the three minerals by scratching one against another. Let the groups decide what minerals they want in their toothpaste and compare their answer with their toothpaste box. Then open a whole class discussion on the subject.

A couple points you might like to raise: if the toothpaste is softer than your teeth, can it remove stains? What does toothpaste do when it removes stains? This is a good time to mention the smoker's toothpaste. It usually contains zircon, which is harder than quartz. This toothpaste removes nicotine stains by removing tooth. The Sept. 1992 issue of Consumer's Reports rates toothpastes and talks about abrasiveness. You may want to see how your class toothpastes ranked.

Toothpaste

Think about these questions:How does toothpaste work? What is the job of toothpaste and how does it do it? What is toothpaste made of? How could we find out?

Write your group's answers to these questions here.

Share your answers with the class.

Get one tube of toothpaste for each group.

Read the list of ingredients on the side. Are there any ingredients in the toothpaste that you recognize? Are there any that might be minerals?

Write here the things in toothpaste that you think are minerals.

HOW MUCH CHIP IN A CHOCOLATE CHIP COOKIE?

Objective: The purpose of this activity is to develop a working knowledge of the concept of percent composition. Additionally, relate the concept of percent composition to ore body evaluation in mining.

Procedure:

1. Take one of each type of chocolate chip cookie per group.
2. Read through procedure and prepare a data table for information you will collect or calculate.
3. Measure the mass of the cookie.
4. Remove chips completely from each cookie using a toothpick.
5. Measure the mass of cookie dough and the mass of chocolate chip when done.
6. Compare the mass of the original cookie and the sum of dough and chips.
7. If they are not identical, propose an explanation.
8. Calculate the percent composition of chocolate chips for each cookie:

$$\text{percent chocolate chip} = \frac{\text{mass of chocolate chips}}{\text{mass of cookie}} \times 100$$

9. Record the time required to evaluate the cookie.
10. Gather results from other groups (at least two) and average results.
11. After collecting all data and making all calculations, answer the following question:

Which cookie would be the best for mining chocolate chips? Why?

Results/Conclusions:

COOKIE MINING INSTRUCTIONS

Purpose: The purpose of this game is to give the player an introduction to the economics of mining. This is accomplished through the player buying their "property", purchasing the "mining equipment", paying for the "mining operation" and finally paying for the "reclamation". In return the player receives money for the "ore mined". The objective of the game is to make as much money as possible.

Procedures:

1. Each player starts with $19 of play money.

2. Each player receives a Cookie Mining sheet and a sheet of grid paper.

3. Each player must buy his/her own "mining property" which is a cookie. Only one "mining property" per player. Cookies for sale are:

   Mother's Chocolate Chip - $3.00
   Chips Ahoy - $5.00
   Chips Deluxe - $7.00

4. After the cookie is bought, the player places the cookie on the grid paper and, using a pencil, traces the outline of the cookie. The player must then count each square that falls inside the circle. Note: Count partial squares as a full square.

5. Each player must buy his/her own "mining equipment". More than one piece of equipment may be purchased. Equipment may not be shared between players. Mining equipment for sale is:

   Flat toothpick - $2.00 each
   Round toothpick - $4.00 each
   Paper clips - $6.00 each

6. Mining costs are: $1.00 per minute.

7. Sale of a chocolate chip mined from a cookie brings $2.00 (broken chocolate chips can be combined to make 1 whole chip).

8. After the cookie has been "mined", the cookie should be placed back into the circled area on the grid paper. This can only be accomplished using the mining tools - No fingers or hands allowed.

9. Reclamation costs are: $1.00 per square over original count.

This activity can be used as a culminating activity or as an introduction into the rock cycle.

Core Content Goal

SC – M – 2.1.3

Materials found in the lithosphere and mantle are changed in a continuous process called the rock cycle.

Materials

- 2 ½ cups of sugar
- 1 cup of water
- 1 ½ cups of light KARO syrup
- 1 tsp. Flavoring
- 1 tsp. Food color
- Powder sugar
- Flat cookie sheet

Procedure

1. Mix the first 3 ingredients in a saucepan.
2. Bring to a hard crack stage boil (approx. 300 degrees)
3. Remove from heat and add food coloring and flavoring.
4. Pour onto a flat powered sugar coated cookie sheet.
5. Sprinkle candy with powder sugar.
6. Let cool and hardened.
7. Break into pieces.

Discussion

Compare and contrast how making rock candy is similar to the rock cycle by using the filling the chart below.