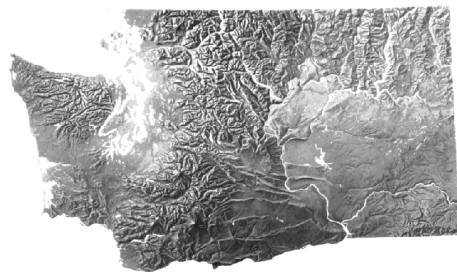


EARTH CONNECTIONS

Resources for Teaching Earth Science

Lesson by Carol Serdar
Washington Department of Natural Resources
March 2003



MINING CUT-OUT COLLAGE LESSON

Washington has an unbelievable mineral resource: sand and gravel (collectively called **aggregate**). Its value to the Washington economy was approximately \$345,990,000 in 2000. The Washington Department of Natural Resources (DNR) monitors these sand and gravel **mines** in the state to be sure that the mining is done properly and that the land is **reclaimed** for other uses once the mining is finished.

CUT-OUT COLLAGE

Teacher Discussion:

Brain storm and list on the board all the items in the community that depend upon the mining industry. Have two columns listed on the board with the titles "Metallic minerals" and "Nonmetallic minerals."

Some examples of **metallic minerals** mined in Washington are gold, zinc, silver, and magnesium. Indicate what products would not be available if these rocks were not mined. (Examples: gold fillings, silver is used in the photographic process and for jewelry, etc.)

Nonmetallic minerals mined in Washington are sand and gravel, quarry rock, clay, and diatomite. List all the things we would have to do without if these minerals were not mined. (Houses, roads, schools, outside basketball courts, skateboard parks, sidewalks, playgrounds, foundations of buildings, rock retaining walls, etc.)

Activity:

1. Discuss the adage, "A picture is worth a thousand words." Select a key idea and show students how to search for representative illustrations. Also discuss how one can start with pictures and assign meaning or ideas to them. (Example: Find a picture that shows a retaining wall made of cinder blocks. Then find a picture of a bulldozer or excavator. When the two pictures are put together you can have a story about how the cinder blocks were made.)
2. Challenge the students to create collages that represent a particular type of mining operation (quarry vs. gravel pit; open pit mine vs. underground mine). The collages should include:
 - a. Title of the collage (like "Mining at the Preston Quarry" or "Gravel Mining near Lake Mary Ann" or another title that describes the collage,
 - b. Pictures of the commodity being mined or pictures of the mine,
 - c. Map of the area (county or city) with the mine's location marked,
 - d. A picture of the land prior to mining (wheat field, undeveloped lot, or forested land),
 - e. Picture of a site being mined,
 - f. People, either workers or people buying rock or other mined products,
 - g. A picture of what the mine will look like after mining is completed and the land is reclaimed (for forestry, pasture, lake, golf course, park, or other uses).

Essential Academic Learning Requirements:

1.2 Students will recognize the components, structure, and organization of systems and the interconnections within and among them.

1.3 Students will understand that interactions within and among systems cause changes in matter and energy (taking rock and making it into roads).

3.2 Students will know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.

Grade levels:

Grades 5-8

Subjects:

Earth science, social studies, and writing

Concepts:

Rocks are an important element to our daily lives; mineral resources come from our own neighborhoods; without mining we would not have simple things like roads and sidewalks. Students will have an opportunity to illustrate what they know about mineral resources and mining by creating a collage of cutouts from magazines and newspapers.

Skills:

Reasoning, restructuring, representing, identifying attributes and components, identifying relationships, and elaborating

Objectives:

Students will learn to make the connection between the mining industry and simple every day items that make our lives easier. The students will select pictures and words from magazines and newspapers to illustrate important ideas about mining and mineral resources.

Materials:

Wide assortment of magazines (mining ones work well or catalogs with heavy machinery) and newspapers;

paper cut to the size preferred for the collage;

scissors;

paste or glue or tape.

Time Needed:

1-2 hours depending on amount of time spent on discussions before collage making or how detailed the writing will be.

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"The World is the geologist's great puzzle box" ...Louis Agassiz, Swiss naturalist (1807-1873)

Examples:

1. Gravel mining near a river may have equipment or pictures of a beautiful lake (post-reclamation of a mine). If no excavators are present in the picture, students can cut out the shape of an excavator to add to the collage.
2. A quarry in a hillside can show the **benches** as mining progresses. Other pictures may show blasting occurring or dynamite that is needed to make smaller rock, so it can then be sent through a crusher to make the varying sizes of crushed rock which are sold for different uses.
3. Upon completion of the collages, have the students write a story about the connection between the mining operation and the environment: "while there is a right to mine, it comes with a responsibility." Discuss why private companies have public duties. Students can write a story about the mining operation and people (workers or neighbors).

The most famous reclaimed quarry in our area is Butchart Gardens, near Victoria, B.C. In 1888, Robert Pim Butchart began manufacturing Portland cement from limestone deposits at Tod Inlet. When the limestone was depleted, his wife Jenny began reclaiming the land, making what is now called the Sunken Garden in the abandoned quarry.

VOCABULARY

Aggregate – Any of several hard materials (rock), such as sand, gravel, slag, or crushed stone, used for mixing with a cementing material to form concrete, mortar, or plaster. Crushed rock can also be used as the foundation for a road or a gravel driveway.

Benches – A strip of relatively level earth or rock, raised and narrow. A small terrace or comparatively level platform; a level layer worked separately in a mine.

Metallic mineral – Metals like gold, silver, copper, or iron.

Nonmetallic mineral – Other mined materials, like clay, coal, granite, or sand and gravel.

Mine – An opening or excavation in the earth for the purpose of extracting minerals.

Reclamation – returning disturbed land, as in mining activity, to original condition; to recover wasteland, to obtain useful materials from waste products.

Lesson Extension:

1. Visit a local surface mine (see the yellow pages of your local phone book, under "Sand & Gravel"). Many operators have "down days" when you might be able to schedule a tour because the pit or mine is safer for visitors. Some operators have many things to be proud of: unique systems of moving the rock around the site; inventive ways of crushing bedrock; mining methods (blasting or using an excavator); and ways to handle stormwater runoff without contaminating an adjacent body of water with muddy water. Ask to speak with an operations manager to schedule a tour.
2. Interview someone who works with sand and gravel discharge permits or surface mine reclamation permits.
3. Visit these websites:
<http://www.wa.gov/dnr/htdocs/ger/staff.htm>
<http://www.wa.gov/dnr/htdocs/ger/regions.htm>

References cited

- Hunting, M. T., 1956, Inventory of Washington minerals; Part II--Metallic minerals: Washington Division of Mines and Geology Bulletin 37, Part II, 2 v.
 National Energy Foundation, 1995, Out of the rock--Integrated learning activities for students: National Energy Foundation, 1 v.

Permission granted on 27 March 2002, Gary Yager, Bureau of Land Management Assistant District Manager in Spokane, WA. Adapted from a teachers' guide, *Out of the Rock: Integrated Learning Activities for Students*, 1995.

✓ For helpful materials about mineral resources and their use in daily life, see *Earth Connections* #7 "Web Sites for Information about Minerals." (It's online at <http://www.wa.gov/dnr/htdocs/ger/pdf/earthcn7.pdf>)

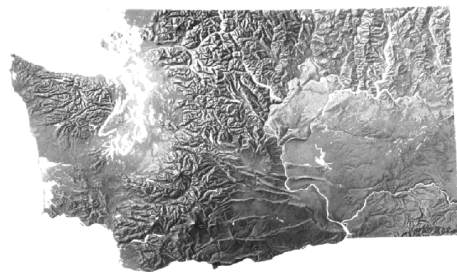
Your annual quota of earth materials

"A large truck pulls up in front of your property and the driver unloads: 9,140 pounds of stone, 8,580 pounds of sand and gravel, 800 pounds of cement, 490 pounds of clay, 440 pounds of salt, 310 pounds of phosphate rock, 1,070 pounds of other nonmetals, and 1,342 pounds of metals. An identical shipment...over 22,000 pounds, or 11 tons... made once a year for every man, woman, and child in this country" indicates how many mineral resources are used in the U.S. yearly. from: Bates, R.L.; Jackson, J.A., 1982, Our modern stone age: William Kaufmann, Inc., p. 1-2.

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Washington Department of Natural Resources
March 2003



EVERYONE NEEDS A ROCK

Background:

Throughout time, societies have valued rocks and mineral resources in their natural state. The great stone circle at Stonehenge, England, is a famous example that is still controversial. The arrangement of those massive stones mark the seasons and cycles of the year but historians are still not sure what peoples placed them there and now they managed it. The monolithic stone figures on Easter Island were carved by unknown ancients. Each year thousands of people travel to see the naturally occurring stone features in the western United States at Devil's Tower, Yellowstone National Park, Bryce Canyon, Zion National Park, the Grand Canyon, and Yosemite National Park. Today as always, people have strong feelings about rocks and minerals.

There are museums with remarkable rock collections and other geologic specimens in many cities and at most major universities. Dave Knobloch's article, "Guide to Geologic, Mineral, Fossil, and Mining History Displays in Washington" describes such collections around Washington State. But there are also rocks and mineral resources to be appreciated in almost every neighborhood. The first step in discovering some of these natural wonders is to look and observe.

Activity:

Ask the students the following questions to assess their knowledge or to stimulate interest in the activity:

"What are five ways we use rocks?"

"Have you made a rock creation: if so, describe it."

1. Discuss with the students where rocks come from and why they are important. (Include things like rock for roads, foundations of houses, skateboard parks, bauxite for aluminum cans, gold and silver for fillings...)
2. Read *Everybody Needs a Rock* aloud to the class.
3. Have each student write or tell his or her own personal rule #11, based on the story.
4. Take the class rock hunting. Rules 1 through 10 must be used. The students will learn these as you read the story. A review may be needed. Be sure to remind them to use their own rule #11. This could be done as a field trip to a canyon or a park or a walk on the school grounds.
5. Perform the "smelling test" as outlined in the story. Have the students share with the class where their rock came from.
6. Check for understanding:
 - Have the students make up their own rock game, "I happen to have a rock here in my hand..."
 - Have the students write a story about where their rock came from. Have them illustrate their stories.

Vocabulary:

Rockhound – one who hunts and collects gemstones or minerals (such as quartz, agate or petrified wood) as a hobby; an amateur mineralogist.

Essential Academic Learning Requirements:

1.1 The student will use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize rocks.

Grade levels:

Grades K-6

Subjects:

Earth science, social studies, language arts/writing

Concepts:

There are many different kinds of rocks (and mineral resources) and everyone may value them differently.

Skills:

Observing, classifying/categorizing, discussing, writing

Objectives:

The students will recognize the individual beauty of rocks and will develop an interest in where rocks come from.

Materials:

1. The book, *Everybody Needs a Rock* by Byrd Baylor (available at the library, or for sale through many bookstores)
2. Paper and pencil for each student.

Time Needed:

One hour or longer if trip outside to look for rocks.

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EVERYONE NEEDS A ROCK

Lesson Extension:

1. By examining the colors in the rock, students may also want to investigate the mineral content in their rock. (Provide copies of *Field Guides to Rocks and Minerals*.)
2. Over the next month, keep a list of any rocks you find in your neighborhood. (Examples: Pebbles in the driveway cement, rock walls around the neighbor's garden, marble in an important building, a piece of artwork in the park, or the new path near the Tower at Percival Landing in Olympia).

List: the location the rock was found; a description of the rock (color, size, texture); what the type of rock is if you know or can find out (does a name plaque give the name of the mineral?). You may want to consult a rock identification book for help. (Simon & Schuster's *Guide to Rocks and Minerals*, Philip's *Minerals, Rocks and Fossils*, or the Peterson *Field Guide: Rocks and Minerals* are a few of the good reference books with helpful photos and descriptions. Every library has these or similar books.)

Every student's list should answer the questions:

- K-3 Where did you see the rock? What color was it? Was it smooth or rough? Was it dull or shiny? How big was it?
- 4-6 For each rock type found, list the location and how it was being used (driveway for paving, bank building foundation, city park sculpture, etc.). Give the color, size, texture. If the rock is identified on a sign or plaque, include the information.

(Example: There is a large piece of green serpentine in the downtown Olympia Timberland Library in which a seal is sculpted. According to the label, the serpentine is most probably from Jade Creek, near Mount Vernon, Washington).

References and Suggested Readings:

- ★ Baylor, Byrd; Parnall, Peter, illustrator, 1974, *Everybody needs a rock*: Scribner, 32 p.
- ★ Bishop, A. C.; Woolley, A. R.; Hamilton, W. R., 1999, *Philip's minerals, rocks and fossils*; 2nd ed.: G. Philip, in association with the Natural History Museum, 336 p.
- ★ Knoblach, D. A., 1994, *Guide to geologic, mineral, fossil, and mining history displays in Washington*: *Washington Geology*, v. 22, no. 4, p. 11-17.
- ★ Pough, F. H., 1996, *A field guide to rocks and minerals*; 5th ed.: Houghton Mifflin Co. (Peterson Field Guide 7), 396 p.
- ★ Prinz, Martin; Harlow, George; Peters, Joseph, editors, 1978, *Simon & Schuster's guide to rocks and minerals*: Simon and Schuster, 607 p.
- ★ Waugh, Peter; Sunderland, Don, illustrator, 2002, *The great Cannon Beach mouse caper*: Educare Press, 99 p.

More information is available at:

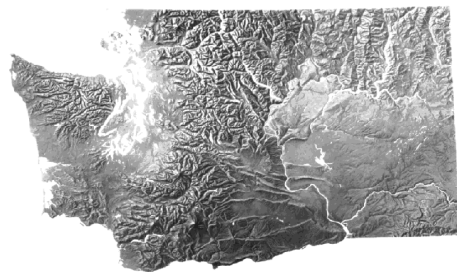
<http://www.askeric.org/Virtual/Lessons/Interdisciplinary/INT0018.html>

Free mineral resources materials for educators are available from the Mineral Information Institute, 501 Violet Street, Golden, CO 80401; (303) 277-9190.
<http://www.mii.org/>

EARTH CONNECTIONS

Resources for Teaching Earth Science

Additional Resources
March 2003



Mount St. Helens 504 Corridor

Mount St. Helens National Volcanic Monument Headquarters (360) 247-3900. Up the 504 corridor, there are five visitor centers. **Mount St. Helens Visitor Center at Silver Lake** (state operated) (360) 274-2100 focusing on volcanoes of the world, Mt. St. Helens, and cultural history; **Hoffstedt Bluffs Center** (360) 274-7750 (county operated) with a restaurant and gift shop (closed during winter); **Forest Learning Center at Mount St. Helens** (360) 414-3439 (closed during the winter) is operated by the DOT and Weyerhaeuser focusing on economic effects of the blast, human culture and the replanting and revegetation efforts; **Coldwater Ridge** (360) 274-2131 (open year-round) with a restaurant, focuses on biology and recovery. **Johnson Ridge** (360) 274-2140 (closest to the volcano) focuses on geology (closed during winter). See also <http://www.fs.fed.us/gpnf/mshnmv>.

Port Townsend Marine Science Center

In 2003, leading researchers, working with PTMSC, will offer free (thanks to Washington Sea Grant), all-day, hands-on, field-based workshops on the following topics. Sessions are designed to give participants knowledge, skills, resources and tools to broaden their own educational offerings to the general public on these vital topics. After the workshop series, participants will be expected to plan and conduct further educational outreach in their own communities. These Saturday workshops are for teachers, environmental educators, governmental agency representatives and the general public. A \$20 registration fee for each workshop holds your spot and will be refunded the day of the workshop. Register immediately as workshop space is limited. To register, contact PTMSC at (360) 385-5582, info@ptmsc.org; <http://www.ptmsc.org>.

Mar. 29, 2003 Human impacts on the shoreline. Instructor: Hugh Shipman, WA. Dept of Ecology (1/2 day boat trip along PT waterfront; 1/2 day onshore)

Apr. 19, 2003 Shoreline processes. Instructor: Jim Johannesen, Coastal Geologic Services, Inc.

May 10, 2003 Collaborative planning and resource sharing. Instructor: Mary Knackstedt, Puget Sound Action Team and PTMSC staff.

National Science Teachers Association's Monthly Electronic Newsletter for Science Educators

Monthly, "Science Class" features a curriculum topic that is supported by a range of NSTA-approved teaching resources: news stories, Internet "SciLinks," NSTA journal articles (sorted by grade range), books and more. In addition, every issue includes a column on professional development as well as NSTA news highlights. If you would like to subscribe to "Science Class" go to <http://www.nsta.org>.

Distance colleges and universities

For a listing of all colleges and universities, including those with distance learning, see <http://www.collegedegree.com>.

Intel Science Talent Search

This is America's oldest and most highly regarded pre-college science competition. For over 60 years, the competition often referred to as "The Junior Nobel Prize," has provided an incentive and an arena for U.S. high school seniors to complete an original research project and have it recognized by a national jury of highly regarded professional scientists. The projects are a result of inquiry-based learning methods designed to nurture critical reasoning skills, to experience science through the use of the scientific method, and to demonstrate how math and science skills are crucial to making sense of today's technological world and making the best decisions for tomorrow. For more information, see <http://www.intel.com/education/sts/aboutsts.htm>.

2003 Northwest Section of the National Association of Geoscience Teachers Summer Conference

June 17-19, 2003. Members of the National Association of Geoscience Teacher (NAGT) Pacific Northwest section will explore Earth Science education and the interesting geology of the southeastern Alaska region.

Day One will feature presentations by Alaskan and Northwest Earth Science educators from primary, secondary, community college, college, and university vantage points and will facilitate an exciting knowledge exchange that will help to get the word out regarding how our planet is working. Days Two and Three will be spent looking at roadside outcrops and fjord exposures with liberal sprinklings of high relief landscape and possibly some local and curious wildlife. For more information, see <http://uashome.alaska.edu/~jfc/clc/nagt> or cathy.connor@uas.alaska.edu.

source: Math and Science Course Bulletin,
Nov. 15, 2002