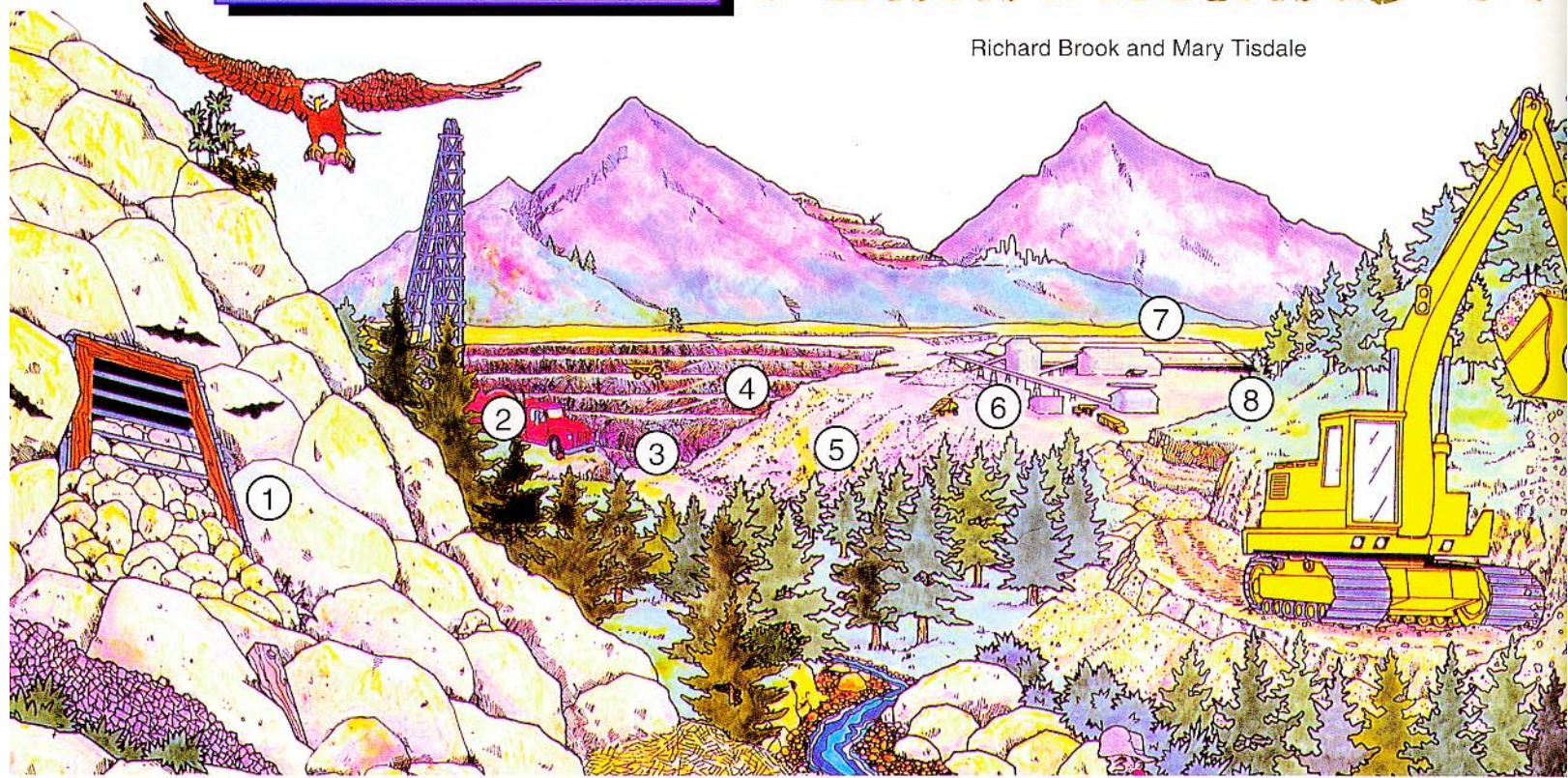




MINING BRINGS UP

Richard Brook and Mary Tisdale



America is fortunate to have abundant supplies of minerals. Mineral resources, found throughout the nation both on private and public lands, are essential raw materials needed to maintain our standard of living. The former U.S. Bureau of Mines estimated, based on our current standard of living, that each American consumes about 19 short tons (17 metric tons) of newly mined minerals each year. As a nation, this totals about 5 billion short tons (4.5 billion metric tons) of minerals consumed each year.

Development of mineral resources can bring many local and national benefits. Mineral development provides jobs to mine workers, transportation workers who move the mineral to market, and factory workers who transform the mineral into useful products. Nearly 300,000 people work directly in mining throughout the United States. Employment in industries that support mining, including manufacturing, engineering, and environmental and geological consulting, accounts for about 3 million jobs. Sometimes royalties are paid to the mineral owner after the mineral is extracted and sold. Royalties from development of federally owned minerals are important sources of income

for the federal government; federal mineral royalty is about \$400 million annually.

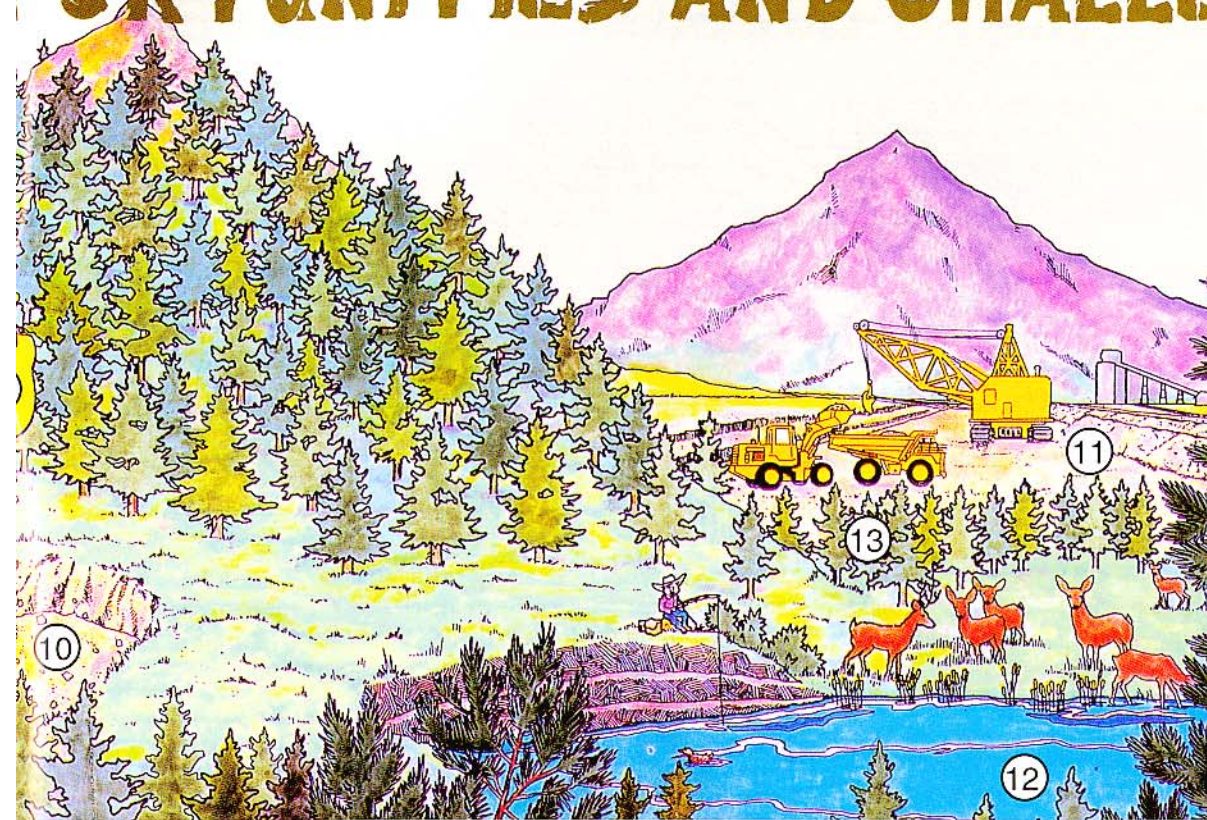
Each mineral has its own crystalline structure, chemical makeup, and physical qualities, such as hardness and color. Rocks are made from minerals. Rocks and minerals are used everywhere and by everyone.

For example, computers contain quartz crystals in their highly demanding timing devices, silicon in their processing chips, and gold, silver, and copper in their wiring. Rocks and minerals are used in the production of fertilizers. Ceramic insulators, metallic electrical wiring, antennae, mineral-coated television screens, and ceramic speakers are examples of uses of rocks and minerals in the communications industry. Gravel, crushed stone, tar, asphalt, road salt, and cement all play a major role in transportation. Our homes and other buildings are made of rocks and minerals in the form of copper wiring and pipe, concrete, sheet rock, floor coverings such as tile, metal fasteners such as screws and nails, shingles, glass, aluminum siding, and stone. Consumers use cosmetics, toothpaste, appliances, cookware and tableware, and thousands of other articles all made from substances drawn from the

earth. Modern medicine relies on many drugs, ointments, and tools made from rocks and minerals. The pigments in paint, the stone or metal that forms statues, and the clays used in pottery are examples of rock and mineral use in art. The manufacture of paper involves the use of rock or mineral-based materials to bleach, color, and coat the paper.

Mineral development can also bring less desirable consequences. Development of a mine to extract the mineral resources sometimes requires the construction of roads, buildings, railroads, pipelines, and power lines that impact the surrounding land. Rock and soil that do not contain valuable minerals often must be moved to gain access to the valuable mineral-bearing rock, which is called ore. Improper disposal of this waste rock can create long-term hazards. Processing ore to concentrate the valuable mineral constituent, such as gold or copper, can require large amounts of water, reducing water availability and disrupting aquatic environments. After milling, finely-ground non-mineral rock particles, known as tailings, are discarded in special ponds that may pose long-term environmental consequences.

OPPORTUNITIES AND CHALLENGES



LEGEND

1. mine adit (sealed and closed)
2. truck-mounted drill rig
3. open mine pit
4. steps or stairs
5. waste rock for reclamation
6. ore processing plant
7. lined heap leaching
8. replanting
9. backhoe recontouring access road
10. storage pile of roadcut material
11. strip mine overburden
12. quarry reclaimed as lake
13. reforested area

Artwork and associated research by Shelly Fischman.

Unfortunately, some miners in the past have abandoned mines once the ore was exhausted, leaving tailings, waste rock, and sometimes the mine workings exposed to the environment. Some estimates place the number of abandoned mining sites across the country as high as 200,000. For the past 30 years, mining sites have been required to be restored before they are closed or abandoned.

Many of the abandoned mining sites do not pose significant environmental or safety hazards. Some old sites have been reclaimed as a result of subsequent mining activity; however, there remains a number of abandoned mining sites that may have safety or environmental consequences.

Abandoned sites may have safety or environmental impacts for many reasons. For example, large mining pits or waste rock piles detract from the visual resource values of the landscape. Unsecured adits, shafts, or other mine openings can be safety hazards. Some sites may have radioactive contamination through concentration or release of naturally occurring radioactive materials. Chemical processing of the ore can leave residual contamination in the tailings. Mining exposes deeper parts of the

earth's crust to the natural processes of weathering, oxidation, and bacterial action. In some cases, as waste rock from mining is weathered, heavy metals such as zinc, copper, cadmium, and lead can be leached into the water. Surface and ground waters flowing from abandoned mine sites can contain enough dissolved metals to be toxic to aquatic life and dangerous to human health.

New technologies and laws are helping to identify solutions to these environmental problems. Citizen awareness of the environmental issues, as well as a commitment by the industry and the public, are making restoration of many previously forgotten mining sites possible.

National and state laws now require mining companies to develop operation and reclamation plans to eliminate or minimize environmental impacts. Companies are required to reclaim land disturbed by exploration or extraction. In a broad sense, the mining site is reclaimed when the disturbed land is returned to its pre-mining use or another use determined to be beneficial. In some cases mining pits are transformed into lakes, filled with fish, and used for recreation. In other cases tailings ponds are reclaimed by removing

the water and covering the pond bed with topsoil. After plants are reestablished, the area can again be habitat for birds and animals. Sometimes the mine workings are completely sealed, and other times are partially sealed to provide habitat for bats.

While many of the safety and environmental impacts from mining can be mitigated, some compromise is necessary. To sustain the health and productivity of the land while continuing to enjoy the benefits of mining, difficult decisions are required, including establishing land-use limits based on scientific data and public input. As with any land-use determination, mining brings both promise and problems. Working together, miners and citizens have the opportunity to benefit from mines while addressing conflicts and challenges.

In California, the mineral extraction industry employs 10,000 residents directly and thousands more indirectly.