

Section 2: Mineral Exploration and Mining

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Section 2: Mineral Exploration and Mining

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Bellringer

Section: Mineral Exploration and Mining

“The meek shall inherit the Earth but not the mineral rights.” Write a short paragraph that summarizes what you think this statement means. What would you do if valuable minerals were discovered on land that you owned?

Write your responses in your *EcoLog*.

Objectives

- **Describe** the manner in which mining companies explore for new mineral deposits.
- **Describe** three methods of subsurface mining.
- **Describe** two methods of surface mining.
- **Define** placer deposit, and explain how placer deposits form.
- **Describe** the steps that take place in smelting an ore.

Mineral Exploration

- Exploring rock for mineralization is the first step in finding an ore deposit.
- Rock samples are taken from exploration areas and analyzed to determine ore grade—the metal content of an ore.
- If the ore grade is high enough and the deposit extensive enough, the cost to open a mine may be warranted.

Subsurface mining

- **Subsurface mining** is a mining method in which soil and rocks are removed to reach underlying coal or minerals.
- It is used to mine ore deposits that are 50 m or more beneath Earth's surface.
- *Room-and-pillar mining* is a common method of subsurface mining. This method is used to extract salt and coal.
- A network of entries, called *rooms*, are cut into a seam, a horizontal layer of coal. Between the rooms, pillars of coal are left standing to support the room. When the mining of rooms is complete, the pillars are removed, beginning with the farthest point of the mine.

Longwall Mining

- **Longwall mining** is a more efficient method of removing coal from a subsurface seam.
- A machine called a **shearer** moves back and forth along the face of a coal seam.
- As coal is sheared from the **long wall**, it falls onto a conveyor and is transported out of the mine.
- The miners and their equipment are protected by a row of hydraulic roof supports.

Solution Mining

- Solution mining is an economical method to mine for deposits of soluble mineral ores, such as potash, salt, and sulfur.
- Solution mining dissolves the ore by injecting it with hot water.
- Compressed air is then pumped into the dissolved ore, and air bubbles lift it to the surface.

Surface Mining

- **Surface mining** is a mining method in which soil and rocks are removed to reach underlying coal or minerals.
- Surface mining methods are used when ore deposits are located close to Earth's surface.
- Large quantities of near-surface ores, like coal, gold, and copper are mined with **open-pit mining**.

Surface Mining

- In open-pit mining, ores are mined downward, layer by layer.
- Explosives are used, if needed, to break up the ore, before it is hauled out by trucks.
- Some ores, like gold, are taken to heap leaching pads, to be extracted with chemicals.

Surface Coal Mining

- Coal is mined in several steps on the surface.
 - The soil covering the area to be mined is removed and set aside.
 - The overburden, or rock covering the coal, is removed with heavy equipment and piled alongside the cut.
 - Loaders enter the pit and remove the exposed coal seam.
 - The pit is refilled with the overburden and contoured.
 - The soil is laid on top of the overburden.

Quarrying

- Open pits, called **quarries**, are used to mine near-surface materials such as building stone, crushed rock, sand, and gravel.
- **Aggregates**, which are sand, gravel, and crushed rock, are the principal commodities produced by quarrying.
- Quarries also produce large quantities of clay, gypsum, and talc.

Solar Evaporation

- The solar evaporation process consists of placing sea water, which is about 2.7% sodium chloride, into enormous shallow ponds.
- The sun evaporates the sea water, which causes the sodium chloride concentration to increase.
- Crystalline salt, or halite, forms when the sodium chloride concentration reaches a little over 25%.
- Evaporation is continued until a layer of desired thickness is reached, and the salt is harvested.

Solar Evaporation

- About 30% of the world's salt comes from the solar evaporation process.
- This method is used for salt production in areas that receive little rainfall but have high evaporation rates.
- Solar evaporation is practical in places such as along the Mediterranean Sea, on San Francisco Bay, and in Australia because evaporation exceeds rainfall.

Placer Mining

- **Placer deposits** are deposits that contain valuable minerals that have been concentrated by mechanical action.
- Stream placers are the most important placers. Streams transport mineral grains to a point where they fall to the streambed and are concentrated.
- Placer deposits may also form along coastlines by heavy minerals that wash down to the ocean in streams. These heavy minerals are concentrated by wave action.

Placer Mining

- Placer gold, diamonds, and heavy minerals are mined by dredging.
- A dredge consists of a floating barge on which buckets fixed on a conveyer are used to excavate sediments in front of the dredge.
- The heavy minerals are separated from the sediments within the dredge housing. The processed sediments are then discharged via a conveyor located behind the dredge.

Smelting

- **Smelting** is the melting or fusing of ore in order to separate impurities from pure metal
- It is a process in which crushed ores are melted at high temperatures in furnaces to separate impurities from molten metal.
- In the furnace, material called a *flux* bonds with impurities and separates them from the molten metal. The molten metal, which is desired, falls to the bottom of the furnace and is recovered.
- The flux and impurities, which are less dense, form a layer of *slag* on top of the molten metal.

Undersea Mining

- The ocean floor contains significant mineral resources, which include diamonds, precious metals such as gold and silver, mineral ores, and sand and gravel.
- Since the late 1950s, several attempts have been made to mine the ocean, with varying degrees of success.
- Competition with land-based companies that can mine minerals more cheaply and the great water depths at which some mineral deposits are found are two of the reasons undersea mining has been largely unsuccessful to date.

Quick LAB

Quick LAB



Surface Coal Mining



Procedure

1. Cut off the top part of a 2 L plastic soda bottle to make a container that has an open end.
2. Spread a 5 cm layer of soil on the bottom of the bottle.
3. Spread a 0.75 cm layer of rice on top of the soil to represent a coal seam.
4. Spread a 12.5 cm layer of soil on top of the coal.
5. To excavate the coal, dig out the top layer of soil with a spoon, and place it in a bowl. Measure the volume of this soil by using a graduated cylinder. Record the volume.
6. Dig out the layer of coal, and place it in a second bowl. Measure and record the volume.

Analysis

1. What is the ratio of overburden to coal?
2. What are some factors that you would need to consider if you were going to surface-mine coal economically?

