

## Mining for Minerals

### *Background*

What would happen if we could not get any more minerals? We would not have aluminum for our soda cans or gold for our jewelry. Cars certainly wouldn't exist as we know them now! When we look around our homes and see all the ways in which we depend on minerals, it is hard to imagine our lives without them.

Have you ever thought about how we get these minerals? Many of the minerals we use are deep in the earth and must be dug out. This can be an expensive and dangerous task. In the early 20th century, the United States averaged over 1500 deaths a year in mining operations.

When done efficiently, mining can be very profitable. Minerals are used all over the world and some are in high demand. The world's growing population needs more resources, and many companies are searching in new areas and digging deeper into the earth to find these valuable minerals.

### *Mining for Minerals*

During this activity, you will work in a group to form a mining company. Your objective is to locate deposits of cuprite, a copper ore, and extract the ore from the wax landform cast. Once extracted, the ore must be refined to copper and sold at the market value. Your company has a startup budget of \$5,000 for research and exploration costs. The mining operation must make more money than is spent during the process.

Materials: topographic map, wax landform model, metal scoop, borer w/plunger, weigh boat, electronic balance

#### Procedure – Research & Exploration:

1. Using the topographic map, locate areas for which your group would like to get the results of the sediment samples from the riverbed. Your teacher will provide you the sediment sample readings that you commission. The higher the concentration of copper, the closer the sediment is to large deposits. The result of each sample's analysis costs \$500.
2. Once your group has discovered an area that may contain cuprite, you may purchase one or more core samples. Use the borer to take core samples of the wax mountains that you think contain cuprite. If there is cuprite there, your core sample will have blue clay in it. The thicker the band of blue, the thicker the deposit of copper ore is. You will also be able to determine the depth of the deposit. Each core sample costs \$100.
  - ★ How to use the borer:  
After pinpointing an area to test, slowly push the borer tube straight down into the mountaintop. After it hits bottom, slowly pull it out. Use the plunger to eject the core sample from the borer tube.
3. Keep track of your expenses on the worksheet. If you have not used the entire \$5,000 budget, the remainder will be tacked on to your profits at the end of the project. If the exploration goes over budget, that amount will be subtracted from any profits.

#### Procedure – Mining Operation:

4. Once your group has located a mineral deposit, you must decide the best way to remove the ore. Decide whether a surface or a subsurface operation is better, on the basis of the landscape and the depth of the ore. Also consider the location of the mine. Mines closer to streams have a greater impact on the environment. You cannot mine near a river or a lake. For every 0.1 g of overburden (wax) removed by surface mining, your cost is \$100. For every 0.1 g of overburden removed by subsurface mining, your cost is \$150. Remember that the impact and reclamation fees for surface mining will be greater than for subsurface mining.

- Before you begin mining, mass two weighing boats, record the values, and label one "ore" and the other "overburden." As you remove the overburden to extract the ore (the blue clay), place the overburden in its boat and the ore in the other. Once your group has decided they have recovered all the ore in the mine, weigh each of the boats. Subtract the initial mass of the boats to obtain the mass of overburden and of ore removed.
- Use the Budget Sheet to record the amount of overburden removed and calculate the cost of mining the clay.

**Procedure – Refining & Reclamation:**

- The final step in mining is to refine the ore into a purer form of the metal. This process usually requires a lot of energy and sometimes uses harsh chemicals. The cost to refine the ore your group has recovered is \$500 per 1.0 g of ore. On the Budget Sheet, calculate the total cost to refine all the clay.
- Once refined, the amount of pure metal obtained from the ore is about 10% of the mass of the ore. So, for every 1.0 g of ore, you will get 0.1 g of refined metal. The current market value for the refined metal is \$5,000 per 0.1 g. On the Budget Sheet, calculate the total amount and the sale price of the copper extracted from your ore.
- Calculate the profit your group made on the entire operation.
- From the total value of the metal recovered, subtract the mining costs, refining costs, and amount spent for research/exploration. An additional cost for reclamation of the land from the mining site must also be subtracted from the profits. If your group chose to create a surface mine, subtract \$2,500 from the profits, if you chose a subsurface mine, subtract \$1,500. If the mining was done close to streams or sensitive habitats, this value may be higher.
- Answer the questions in the *Results & Analysis* section.

**Budget Sheet**

**Research/Exploration**

Description	Cost	Balance
		\$5,000
Remainder of budget		

**Operation**

Amount of overburden removed (g)	
	x \$100/0.1 g (surface) x \$150/0.1 g (subsurface)
Total cost for mining	

**Refining**

Amount of copper ore extracted (g)	
	x \$500/1.0 g of copper ore
Total cost for refining	

**Total Yield**

Amount of copper ore extracted (g)	
	x 0.1 g of refined copper
	x \$5000/0.1 g of refined copper
Total amount from sale of copper	
Profit (i.e., amount from sale – costs – reclamation fee)	

Reclamation fee = \$2500 for surface mine, \$1500 for subsurface mine

### *Results & Analysis*

On a separate sheet of paper, answer the following questions thoroughly using complete sentences. You may complete your work on the computer. Staple your work, including the graph(s) to the back of this packet.

1. What are two methods used in prospecting for minerals?
2. Describe the difference between surface mining and subsurface mining.
3. What are the advantages and the disadvantages of each type of mining?
4. Was your team's mine profitable? What might have made it more profitable?
5. What are some ways to reduce the environmental impact of mines?