Exploring Waste and Recycling, Part 1: Ore Minerals and Mining

An ore deposit is rock material containing a mineral or minerals from which an economically desirable element or compound can be extracted at a reasonable profit.

1. Suppose you want to invest in a mining operation. If you know the total mass of an ore deposit, the percent of that deposit that is a mineral containing the element you want, and the chemical formula for the mineral, how would you determine the amount of the desired element in the deposit? Brainstorm with 2 of your classmates (i.e. in groups of 3) to figure out the steps you would follow to figure this out. Describe those steps below (using words, not numbers). *Hint: You will need to obtain some information from the periodic table of elements and do several calculations*.

2. In your mineral lab, you learned to identify some ore minerals that are commonly mined from ore deposits in order to obtain iron. These include hematite, magnetite, and limonite. In the spaces below, follow the steps you described above to calculate how much iron vs. how much waste material (i.e. everything else) is present in each of the hypothetical deposits below. Clearly show all of the steps and be sure to label with units, where appropriate. Space for your work on this question continues on the back side of this page.

   Deposit A: 35 million (35,000,000) tons of ore containing 46% limonite [FeO(OH)]

Amount of Iron: _____ Amount of Waste: _____

   Deposit B: 28 million (28,000,000) tons of ore containing 58% magnetite [Fe_3O_4]

Amount of Iron: _____ Amount of Waste: _____

Deposit C: 45 million (45,000,000) tons of ore containing 30% hematite [Fe_2O_3]

Amount of Iron: _____ Amount of Waste: _____

3. Which of the 3 hypothetical ore deposits above contains the most iron by weight, and therefore is worth the most money? For this simple example, assume that all other costs are equal.

4. Next, think about some of the other probable costs associated with a mining operation. Consider all of the steps involved (from discovering the deposit to bringing it to market), all of which must be considered before going into business if you want to make a profit. List as many as you and your group can think of. (Note: Some should be related directly to mining and geology, but others will not.)

5. Finally, consider all of the waste involved in the process of obtaining minerals – both in removing the ore from the ground, and (for at least some materials) in separating the desired element or compound from the rest of the material. What do you think (or know) is done with all of this waste material?