WASH OUT!

POINT OF INQUIRY
How are mineral resources removed by natural processes from rocks?

CONCEPT
Knowledge of early geologic processes is important in understanding how mineral resources are formed.

LEARNING OUTCOME
The student will observe the leaching process by dissolving salt out of sand and precipitating the salt as solid crystals.

CURRICULUM FOCUS:
Science, Language Arts

SKILLS/PROCESSES:
experiment, observe, write, evaluate, conclude, compare

KEY VOCABULARY:
dissolve, impurities, leaching, percolation, precipitation, mixture

MATERIALS
for each group of students: 5 small paper clips, magnet, 15 mL or 1 tbsp. salt, 80 mL or 1/3 cup water, 3 paper cups, coffee filter

Background
Mixtures are “aggregates of two or more substances that are not chemically combined.” You can tell a mixture from a chemical compound because a mixture can be physically separated. Methods of separating mixtures include magnetic separation and separating by density, such as in gold panning, floatation, and leaching.

Leaching is the action of dissolving out parts of a mixture by percolating liquid. An analogy could be the hot water in a coffee maker flowing through the ground coffee beans so that the resulting solution contains a substance that was previously trapped in the beans. Similarly, some metals are easily dissolved in acid or water, and may be leached out of their original ore by sprinkling the liquid on a large pile of the crushed ore (called a “leach pad”) and then collecting the liquid that drains out the bottom. The metal can later be removed from the solution by precipitation or other means, and the water or acid reapplied to the top of the crushed ore to repeat the process. In some cases special bacteria may be added to the leach pad to convert the metal to a more easily dissolved form.

Preparation
Mix together sand, salt and paper clips in a paper cup for each group of students.

Learning Activity
Ask students the following questions to assess their knowledge and to stimulate interest in the activity:

What is leaching? Can you think of other processes that are similar to leaching?

1. Introduce the class to the meaning of the words mixture and leaching.
2. Tell students that their task is to “mine” the iron and salt from the “ore” provided. They may do this any way they develop, using materials provided by you. For students that require more guidance, help them realize that if a cup is punctured so that water can drain from the bottom, then lined with a coffee filter it will separate the sand from the water.

3. Have the students organize and maintain a scientific log to record the steps followed and note their related observations.

4. Set aside one cup of plain tap water for the class as a “control” for comparison.

5. Set any resulting solutions aside in a warm place for at least a week to partially evaporate. Observe the crystals forming. For faster results, pour the leachate & control into shallow pans.

6. Review your results and summarize your findings.

Check for Understanding

Examine the solutions and crystals in the cups.

1. What are the crystals in the experimental cups? (salt)

2. Where did this material come from? (it was dissolved from the ore by the water—separated by leaching)

3. Is it a pure substance or could other substances (impurities) also be dissolved in water? Compare to the control cup. This would be a good place to explain that water already contains dissolved substances from the ground, pipes, hot water heater, water treatment plant, etc., which are responsible for the different tastes of tap water and for the “spots” on dishes.

4. Compare the dissolution of the salt to natural weathering of rock by water at the surface and underground.

5. Can all minerals be separated by leaching? (No, some ores are chemical compounds and cannot be physically separated, some substances will not dissolve in water.) Where in nature does leaching occur? How might the process of leaching in nature cause problems in the environment?

6. Ask the students to explain contamination of ground water in the vicinity of dumps, buried leaking toxic waste barrels, poorly managed landfills, and the depletion of valuable mineral resources in bare soil exposed to rainfall. Ask how these problems could be reduced by lining dumps and landfills with clays, regulating what goes into dumps and landfills, or vegetating exposed soils to slow water movement.

To Know and Do More

Contact a hazardous waste disposal company or governmental organization for more information. Complete the next activity titled, “Leaching, Not Leechoing.”