

MINERAL EXPLORATION USING REMOTE SENSING

Wisconsin Model Academic Standards:

C.8.3- Design and safely conduct investigations that provide reliable quantitative or qualitative data, as appropriate, to answer their questions.

E.8.5- Analyze the geologic history of the earth using various forms of scientific evidence.

In this activity students will be using quantitative data that they gather to figure out where there is an ore body in their model. They will describe how geologists could use similar information in order to figure geologic patterns and geologic history for a specific area.

Student Objectives:

Students will follow correct and safe procedures while using the magnetic sensor with the Vernier Lab Pro.

Students will make a map of magnetic anomalies on a model to locate potential ore bodies.

Materials Needed:

- Sand in stream tables
- Small magnetized nails of various sizes (magnetite pieces?) buried in the sand
- Six magnetic probes with Vernier Lab Pro
- Six notebook computers
- Graph paper or other large paper
- Colored paper
- Magnetic anomaly map of the United States

Instructional Activities:

This activity is designed to be used the day after completion of an activity on uses of minerals. I will start by quizzing the students (ball-toss quiz) on materials made with minerals in the classroom. The last question I ask will be about mineral sources for iron. When someone eventually remembers or checks their notes and answers hematite and magnetite, I will pick up the samples from the lab, and ask them to imagine that the world is running low on reserves of iron ore, and it is their responsibility to locate more, or else civilization as we know will collapse. What properties of these minerals would they use to efficiently and inexpensively locate more deposits? Guide the discussion to the magnetic properties of iron ores.

Divide the class in to groups, assigning each group to a stream table and computer with probe. Demonstrate the use of the magnetic probe. If this is the first time the students use any of the probes with the Lab Pro, it will require the rest of the period to get them to the point where they will be competent in its use.

Explain that it is their group's task to locate the richest ore bodies in their table, and to map the entire area for its magnetic properties. They must conduct all exploration from the air, never setting foot (or finger) on the surface. It is up to them to decide how many flights to make. Explain that in the real world airplane time costs money, and helicopter time costs even more money.

Assessment Methods:

Assessment will be continual during this activity. Prior knowledge will be gauged during the ball-toss quiz and during the discussion that follows. Groups will be monitored as they practice using the probe to make certain they are competent in its use. The group discussion questions will be checked as each group completes them. Groups will be assisted and checked on their understanding of the mapping process as they make the maps. Finally, the practical assessment will be when they mine the sand. If they pull up some "ore", it will be obvious to them that they know what they are doing.

On the unit test there will be a multiple choice question asking what method of exploration might be efficient for finding iron ores. There also will be one question requiring that they interpret a magnetic anomaly map.

Enrichment:

Student groups that finish early will be directed to: <http://pubs.usgs.gov/fs/fs-0163-95/FS163-95.html> showing small scale magnetic mapping. They also will be directed to the detailed map of Wisconsin at <http://pubs.usgs.gov/of/2002/of02-493/>, and also to <http://pubs.usgs.gov/of/2002/of02-493/>, which shows Wisconsin's gravity fields.

Name _____

Group Name _____

Period _____

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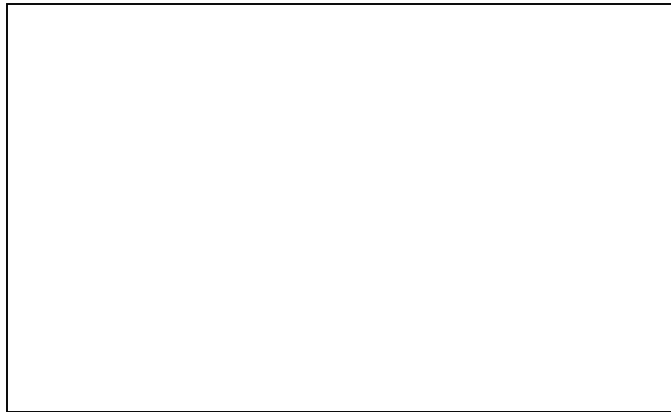
All work is to be discussed with and done with your group. You are each responsible for writing your response on your own paper. The group is required to make one map of the area, making sure that everyone's name is on the map.

Before starting, review and write down the following:

1. What property of iron ore will you be using? _____
2. Why are you looking for the iron ore? _____
3. What are some possible reasons that geologists would use remote sensing?

Fly your probe over the sand in one straight line. Observe the output on the computer. Decide with your group how many flights you will need to get enough data to make a reasonable map of magnetism.

- Draw and label your flight plan:



- Make your flights. Record your data.
- Use the large sheets of white paper to make a full size map showing the patterns of magnetism. Color the patterns.
- When you are done, one person in the group will use one hand in only one place to dig straight down into the sand to mine any ores present.

Look at the map of magnetic anomalies posted at the USGS site http://pubs.usgs.gov/sm/mag_map/mag_s.pdf . Based only on the map, where would you start searching for iron ores? Be specific.

