AUSTRALIAN EARTH SCIENCE EDUCATION

Mining Exploration Box Construction and Use

The mining exploration box allows students to simulate geophysical sensing used to discover new mineral resources using a stud finder, rocks and a box. It may be used alone or after an introduction to remote sensing using the MinView program.

Constructing the Mining Exploration Box

Materials (Figure 1)

- Large, shallow plastic or cardboard box with a lid
- Foam or fiberfill that fills the box
- Ore (rock containing metal e.g. pyrite, magnetite, haematite). A piece of aluminium foil may be a good substitute.
- Marking pen
- A knife may be helpful for making holes in foam.
- If the box lid is not flat, cut a piece of cardboard to fit.

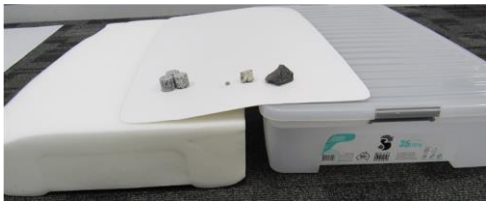

Figure 1: Materials include rock (granite) and ores (pyrite and magnetite). Cardboard was cut to fit the uneven box lid.

Method

1. Place foam into box to fill tightly and cardboard onto the lid of the box for a flat surface.
2. Keep one corner well clear of rocks for stud finder calibration. Lay out rocks on foam, well-separated (Figure 2).
3. Trace around rocks with a marking pen and remove foam as needed to allow rocks to lie flush with surface (Figure 3).
4. Mark the corner for stud finder calibration with the marking pen or contact paper.
5. Replace the lid on the box.

Figure 2: Plan the layout before cutting.

Figure 3: Trace around rocks and cut out foam as needed so the rocks sit flush with the surface of the foam.

Simulating Geophysical Sensing Using the Mining Exploration Box

Aim

To locate metal ore using remote sensing

Materials

- Mining exploration box
- Electronic stud finder with both stud and metal settings (Figure 4)
- Large sheet of paper (to cover box)
- Tape
- Two colours of marking pens

Figure 4: Stud finder needs to have both stud (left) and metal (right) settings.

Method

1. Place the paper over the top of the box and use tape to secure it.
2. Place the stud finder in the calibration corner and use the marking pens to create a key. The 'stud' setting simulates a gravity survey and the 'metal' setting simulates a magnetic survey (Figure 5).
3. Students should decide what pattern to use when surveying the area. Slow movement of the stud finder and frequent calibration give the best results.

Figure 5: Create a key to indicate what setting has provided the results.

4. Set the stud finder to 'stud' and calibrate it in the designated corner (usually by holding down the button until it beeps).
5. Slowly slide the stud finder across the surface of the paper in a search grid. Mark wherever the stud finder gives a strong indication.
6. When finished with the 'gravity' survey, draw lines around the probable deposits.
7. Repeat steps 4-6 using the 'metal' setting to represent a magnetic survey (Figure 6).
8. Several students may wish to try the survey to get the most accurate possible areas marked.
9. When finished, they should mark a spot for exploration drilling.

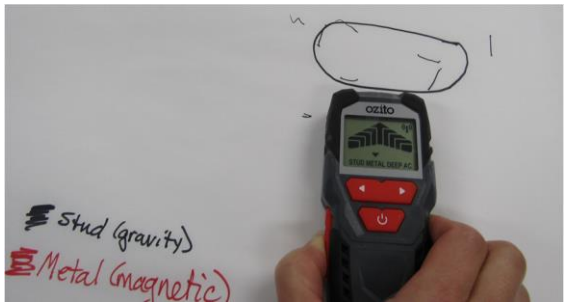

Figure 6: The strong reading on 'metal' indicates that this spot may have a metal-containing ore.

10. Remove the lid to determine how accurately the area was mapped (Figure 7).

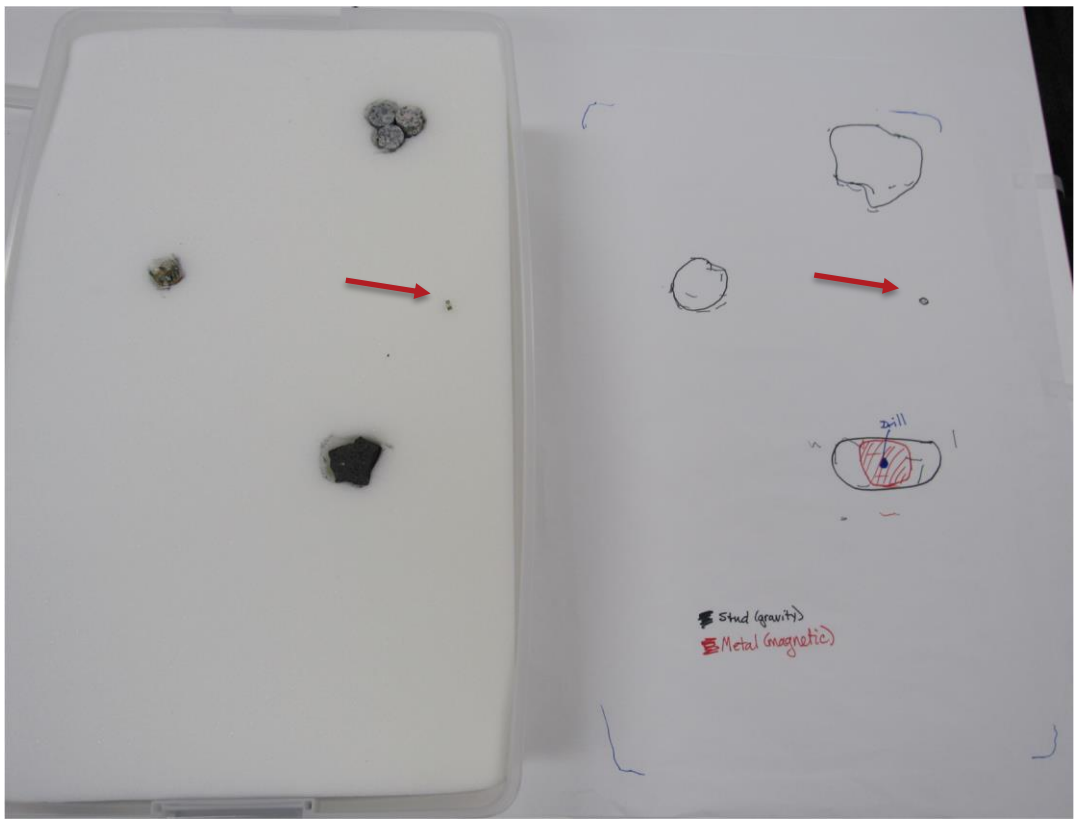

Figure 7: This operator has successfully detected a very small rock (arrow) and the magnetit as a good potential mining target. Note that the area marked is larger than the actual rock. The margin of error is not so great in modern geophysical mapping.

Explanation

- Electronic stud finders work using capacitance. Stud finders contain a capacitor plate that detects changes in the ability of a material to store an electric charge. Differences in density affect capacitance, so the stud finder registers this difference over a stud. This is why it is important to calibrate the stud finder. You want to detect a change in capacitance, rather than a set value. On stud setting, the machine is detecting differences in density. This is similar to geophysical sensing that detects differences in gravity.
- Multifunction electronic stud finders also use magnets to detect metal. Thus, this is an appropriate proxy for a geophysical magnetic survey.
- Free data such as magnetic and gravity scans is vital for modern resource exploration. Direct sampling requires a major investment of time and money. Drilling a geological core is an expensive exercise. Cores are usually 300 – 800 m long and cost roughly $100, 000 to drill. Once a core is collected, it needs to be analysed using a variety of techniques ranging from electromagnetic scanning to chemical analysis.