## Homework 7: Magnetization & Anomalies from Magnetized Bodies Read Lowrie 5.2.5-5.2.7, 5.3, 5.5 Due Thu, 3/4

The problems below are taken directly from Lowrie's text book; they are the questions that pertain to the reading above.

- **1.** What is remnant magnetism? Describe an example type of remnant magnetism and how it originates in each of the rock types: (a) sedimentary, (b) metamorphic, (c) igneous.
- **2.** Figure 5.5 shows how the vertical component of the magnetic field over a rectangular block differs for blocks of different widths. Have a look at (c), 2m = 10 (sorry the units are not clear in the diagram). Using the concept of how  $B_z$  relates to the of solid angle subtended by the top and bottom surfaces of a vertically magnetized (p. 328), block describe (a) Why  $B_z$  is most positive at x = 0 (i.e., directly over the center of the block), and (b) why  $B_z$  is strongly negative just beyond the edges (i.e., near x/m = 2.3).
- **3.** In an aeromagnetic survey over land and at a flight altitude of 2000 m (above sea-level), the maximum total field anomaly over an ore body was 30 nT. In a repeat measurement at 2500 m altitude, the maximum amplitude of the anomaly was 20 nT. Calculate the depth of the ore body (below sea-level) assuming the ore body is a simple dipole. For simplicity, assume the ore-body is magnetized with the Earth's field and that it is located on the magnetic equator.
- 4. The core of an anticline is made of basalt and the host formation is limestone.
- (a) Using the susceptibilities given by the median values in Fig. 5.13 compute the induced magnetization contrast of the core relative to the host rock,  $\Delta M$ , when the Earth's main field has a strength of  $B_{eu} = 36,000$  nT.
- (b) Assuming the core of the anticline is shaped like a buried horizontal cylinder (see p. 330) and the magnetization  $\Delta M$  is all vertical (as is **B**<sub>eu</sub>). Derive the equation describing the horizontal component of the magnetic anomaly ( $\Delta B_x$ ) as a function of  $\Delta M$ , position relative to the cylinder (*x*,*z*), and cylinder radius *R*. (hint: remember the relationship between *B* and *W*).
- (c) Show the equation for the total field anomaly *T* over the anticline.