Geophysics 210 Fall 2008 Assignment 4 – Geomagnetism

Question 1

The magnetic dipole for Mercury has a value of $M = 3.2 \times 10^{19}$ Am^2 and the planet has a mean radius r = 2439 km.

Assume the magnetic dipole is perfectly aligned with the rotational axis of Mercury.

$\mu_0 = 4\pi \times 10^{-7}$ H/m.

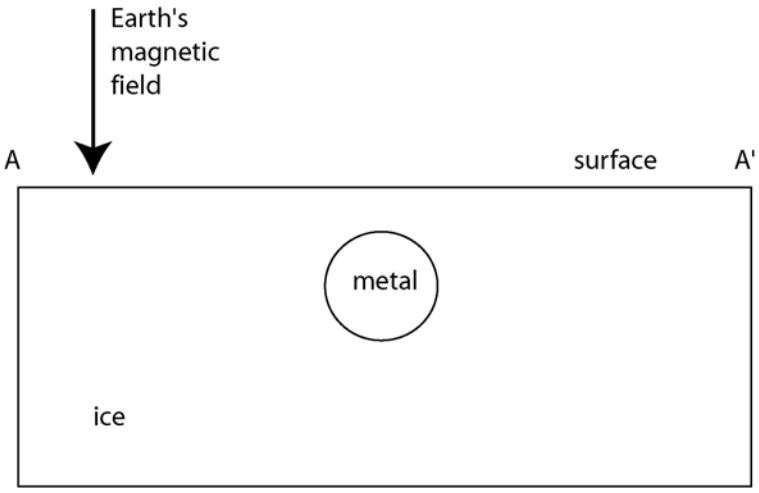
(a) Calculate the maximum and minimum magnetic field strength on Mercury.

(b) Compare these values to the maximum and minimum values on the Earth. For the Earth $M = 7.94 \times 10^{22}$ Am^2 and r = 6371 km.

(c) Where will the maximum and minimum values of field strength occur on Mercury?

Question 2

A long iron cylinder is buried in the ice at the north magnetic pole, with it's axis horizontal. The total magnetic field (**F**) is measured on a surface profile (A-A') that is at right angles to the axis of the cylinder.



(a) Suppose the cylinder has an **induced** magnetic moment. Sketch the variation in the magnitude of **F** along the profile (A-A')

(b) Consider the case when the cylinder has no induced magnetic moment. However it has a strong **remnant** magnetic moment with **M** horizontal and parallel to the profile. Sketch the variation in the magnitude of **F** along the profile (A-A')

In each part, include a figure showing how you have added the magnetic field vectors at key points along the profile.

Question 3

(a) Explain the origin of **seafloor magnetic anomalies** formed at mid-ocean ridges.

(b) Draw a diagram to explain the **polarity** of the magnetic anomaly at a mid-ocean ridge.

Consider two cases (1) high magnitude latitude and (2) magnetic equator.

Question 4 Read Chapters 3 and Chapter 8 from the text book.

This assignment will be due in class on **Tuesday December 2rd 2008**

Office hours will be announced by e-mail.