

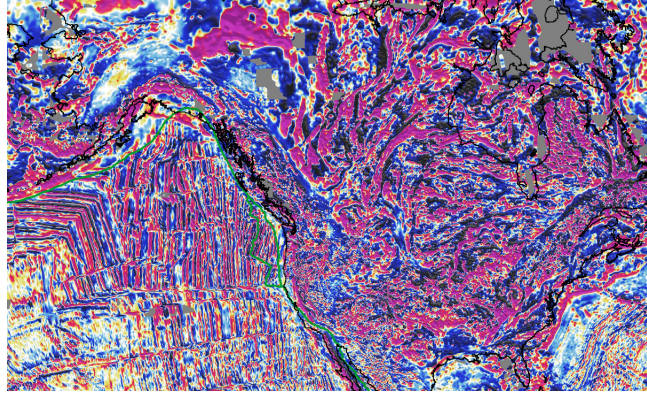
Name: _____

Magnetism

October 26, 2016

1. Modeling the Earth's magnetic field as a magnet, the which end of a magnet is closest to geographic north?
 - (a) The North pole of the magnet
 - (b) The South pole of the magnet
 - (c) None of the above, the magnet would be perpendicular to the Earth's rotation axis
 - (d) None of the above, the variation of the Earth's magnetic field indicates the magnet would be always changing directions quickly

2. Regional surveys over the oceans reveals stripes of alternated positive and negative magnetic anomalies. How can they be explained? (image source: <http://geomag.org/>)



- (a) Magnetite content differences between different volcanic events
 - (b) tilted crust blocks
 - (c) Differences in magnetite and olivine concentrations between volcanic events through time
 - (d) past geomagnetic reversal (interchange of Earth's magnet poles) whose traces have been preserved in the remanent magnetization of successive volcanic events on the ocean floor
 - (e) Erosion and chemical alteration due to ocean waves
3. In Vancouver, a magnetic anomaly along a line of data collected over a susceptible body most likely has
- (a) A small negative peak towards the south and a larger positive peak towards the north
 - (b) A small negative peak towards the north and a larger positive peak towards the south
 - (c) A large positive peak with small negative lobes to the side
 - (d) A positive peak to the north and a negative peak of equal magnitude to the south

4. Which of the following can be determined from the modelling results shown below

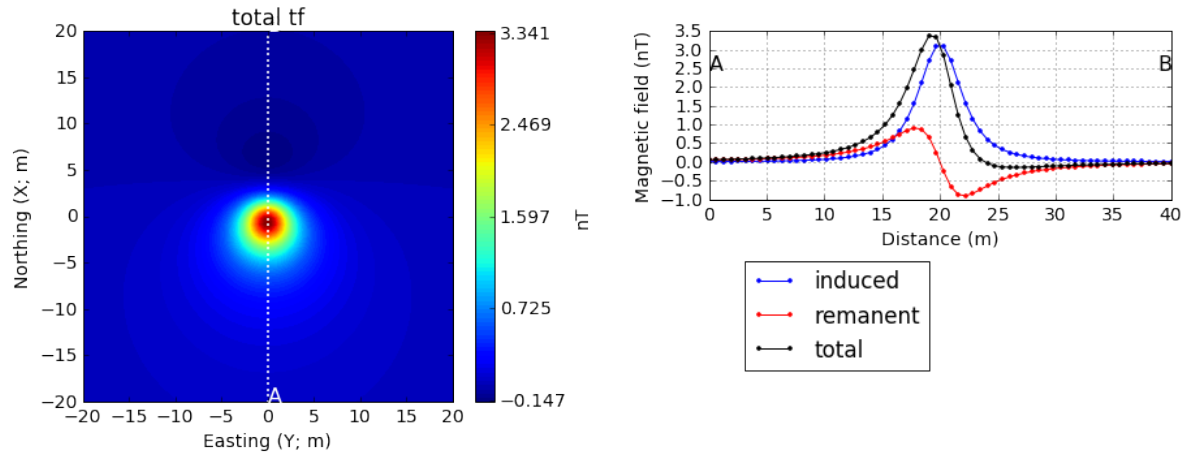


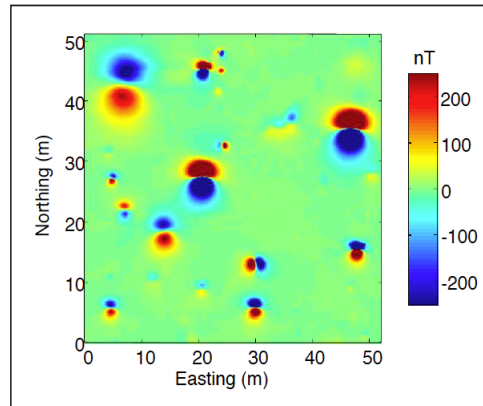
Figure 1:

- (a) The inducing field is horizontal, simulating a survey at the equator
 - (b) The induced magnetization and remanent magnetization vectors are in the same direction
 - (c) The inclination of the inducing field is $+90^\circ$, simulating a survey at the North Pole
 - (d) The inclination of the inducing field is vertical, but there is not enough information to determine if it is $+90^\circ$, or -90°
 - (e) The declination of the inducing field is either $+90^\circ$ or -90°
5. Induced magnetization
- (a) Is the magnetic behaviour of a material caused by an external magnetic field.
 - (b) Is a magnetic property that is a permanent part of the material.
 - (c) Is the measurement a magnetometer records.
 - (d) Describes the interaction between two independently magnetized bodies.

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6. Magnetic susceptibility (κ) of soils is complicated. Which of the following is NOT likely to affect a sample's value of κ ?
- (a) Source of particles deposited to make up the soil.
 - (b) Water saturation of the soil.
 - (c) Capacity to organically produce magnetite.
 - (d) Amount of magnetite present.
7. Which of the following CAN be corrected for using data gathered at a base station?
- (a) (i) magnetic storms and (ii) regional trends.
 - (b) (i) diurnal variations and (ii) magnetic storms.
 - (c) (i) regional trends and (ii) geologic features larger than the survey area.
 - (d) (i) small geologic features and (ii) diurnal variations.
8. Which two of the following statements are incorrect regarding magnetism surveys: I. The source of this survey is Earth's magnetic fields. II. As the depth of magnetic material increases (getting deeper), magnetic moment of this material decreases. III. Magnetometer measures combination of Earth's inducing fields and anomalous fields. IV. Anomalous magnetic field is usually bigger than the Earth's magnetic field.
- (a) I, II
 - (b) I, IV
 - (c) II, III
 - (d) II, IV
9. What are the units of magnetic susceptibility?
- (a) Tesla (T) or nano-Tesla (nT)
 - (b) Gauss (G)
 - (c) Gammas (γ)
 - (d) unitless

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10. A geologist is interpreting two total field magnetic data sets both over identical magnetite deposits. Data set A is from the Canadian Arctic (latitude +59) and data set B is from Antarctica (latitude -59). Consider only the main feature on the anomaly. What should we expect?
- (a) Deposit A will show as a positive anomaly and deposit B will show as a negative anomaly.
 - (b) Deposit A will show as a negative anomaly and deposit B will show as a positive anomaly.
 - (c) Data sets A and B will be almost identical.
 - (d) Data set A will have a larger anomaly because it is closer to the north pole.
11. When doing a total field magnetic survey, you observe a monopole anomaly. What does that tell you about the geometry of the target?
- (a) You should win a nobel prize for finding magnetic monopoles.
 - (b) It is a confined body.
 - (c) It has a very long horizontal dimension.
 - (d) It has a very long vertical dimension.
 - (e) It doesnt say anything about the target. The inducing field must be vertical.
12. Define the total magnetization vector.
- (a) vector sum of the induced and remanent components.
 - (b) projection of the remnant magnetization vector onto the inducing field.
 - (c) sum of the squares of the components.
 - (d) projection of the sum of the induced and remnant magnetization onto the inducing field.
13. In which of the following situations may diurnal corrections, using base station measurements, be required?
- (a) when the magnitude of the measured anomaly is small
 - (b) when the standard deviation of the data is larger than the variation observed in the base station
 - (c) if the measurements were acquired over a short period of time
 - (d) during periods of intense solar activity
 - (e) a and d are correct
 - (f) b and c are correct

14. The following data were collected over a UXO site. What accounts for the multiple orientations of the dipolar anomalies?

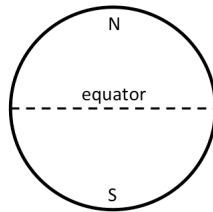


- (a) The shape of the UXO varies.
- (b) The orientation of magnetometer varied as the data were collected.
- (c) The background geology is interfering with the signal.
- (d) The UXO are remanently magnetized in various directions.

1 Short Answer

15. (4 pts) Suppose you are provided with a total field magnetometer and asked to carry out a magnetic survey at the equator to find a compact magnetic object buried at depth. Your survey line passes in a north-south direction directly over the item. On the first plot below, show the direction of the induced magnetization in the body and show the secondary fields. In the second plot, sketch the total field anomaly.

Plot 1:



Plot 2:

