Geophysics 4133
Magnetic Interpretation
J.R. Leeman

Name: _____

For each of the following problems neatly show all steps of your work (partial credit may be given if your work can be easily followed). Clearly indicate your final answers and answer all parts of the question including the 'describe' and 'why' questions.

1. Reduce the following magnetic data and plot the magnetic profile with the reduced values. Assume the theoretical field in the survey area has a total magnitude of 50898.00 nT.

| Station | Time | Distance [m] | Reading [nT] | Elapsed Time [min] | Drift Corrected [nT] | Final Value [nT] |
|---|---|---|---|---|---|---|
| BS | 9:40 | | 50905.90 | | | |
| 1 | 10:01 | 0 | 50913.71 | | | |
| 2 | 10:03 | 6 | 50914.46 | | | |
| 3 | 10:05 | 12 | 50915.27 | | | |
| 4 | 10:06 | 18 | 50915.95 | | | |
| 5 | 10:08 | 24 | 50920.31 | | | |
| 6 | 10:12 | 30 | 50927.60 | | | |
| 7 | 10:15 | 36 | 50916.44 | | | |
| 8 | 10:16 | 42 | 50918.96 | | | |
| 9 | 10:17 | 48 | 50919.52 | | | |
| 10 | 10:18 | 54 | 50920.75 | | | |
| 11 | 10:20 | 60 | 50920.98 | | | |
| BS | 10:40 | | 50927.46 | | | |

2. Using the data you reduced in problem 2, use half-width relationships to determine the approximate depth of the anomalous body.

3. The geomagnetic poles were located at 79.74°N, 71.78°W and 79.74°S, 108.22°E as of 2005. The geomagnetic pole is slowly drifting away from North America. Using the 2005 locations construct a graph to demonstrate how the inclination of the magnetic field varies from -90° to 90° latitude along a great circle with its longitude passing through the geomagnetic pole locations. (We assume a geocentric dipole.)

4. A magnetic survey was undertaken approximately one half mile west of Dodgeville, Michigan in order to locate the Scales Creek lava flow. Data shown in Table 2 were collected on three 700 foot long N S lines. Line #2 is located 55 feet west of Line #1 while Line #3 is located 95 feet west of Line #1. The data shown below were taken using a EG&G UniMag II proton precession magnetometer (model G 846). Each magnetic field value represents the average of three readings taken at each station. Station 1 located at the north end of each line. A stopwatch was used to measure elapsed time. The magnetic base is located 134.5 feet along an azimuth of 500 from the center line of Elsie Road where it intersects Superior road.

   Correct the data for diurnal variation assuming a linear rate of change between reoccupation of the base station. Assign the base station a value of zero nanoteslas, and calculate the relative magnetic effect for all stations. Plot all three survey lines on the same graph. From the graph, determine the strike direction (elongation direcion of tilted lava flow) and the dip direction of the Scale Creek lava flow from the shape of the anomaly and position of the anomaly maximum along each line.

| Station | South Distance (feet) | Line #1 Reading (nT) | Time (minutes) | Line #2 Reading (nT) | Time (minutes) | Line #3 Reading (nT) | Time (minutes) |
|---|---|---|---|---|---|---|---|
| Base | | 58808 | 0 | 58831 | 0 | 58823 | 0 |
| 1 | 0 | 59013 | 11 | 58932 | 9 | 58962 | 10 |
| 2 | 50 | 59495 | 14 | 58994 | 11 | 58952 | 15 |
| 3 | 100 | 58964 | 16 | 59071 | 12 | 58935 | 17 |
| 4 | 150 | 59278 | 18 | 59212 | 14 | 59112 | 19 |
| 5 | 200 | 59370 | 19 | 59394 | 15 | 59305 | 22 |
| 6 | 250 | 59312 | 24 | 59432 | 17 | 59342 | 27 |
| 7 | 300 | 59485 | 27 | 59469 | 18 | 59357 | 29 |
| 8 | 350 | 60651 | 29 | 59976 | 20 | 59487 | 30 |
| 9 | 400 | 62524 | 33 | 61201 | 22 | 59827 | 32 |
| 10 | 425 | 62764 | 34 | 61774 | 23 | 60575 | 33 |
| 11 | 450 | 62489 | 39 | 61954 | 25 | 60769 | 37 |
| 12 | 475 | 61882 | 40 | 61545 | 26 | 60906 | 39 |
| 13 | 500 | 61528 | 42 | 60900 | 27 | 60659 | 41 |
| 14 | 550 | 58642 | 46 | 59830 | 30 | 59949 | 46 |
| 15 | 600 | 58059 | 54 | 58505 | 34 | 58654 | 50 |
| 16 | 650 | 58176 | 56 | 58117 | 36 | 58343 | 53 |
| 17 | 700 | 58154 | 57 | 58184 | 37 | 58343 | 56 |
| Base | | 58790 | 70 | 58823 | 51 | 58823 | 67 |

5. Describe one engineering/environmental application of magnetic surveying and one deeper geologic application.

6. Why is magnetic surveying faster than gravity surveying?

On my honor, I affirm that I have neither given nor received inappropriate aid in the completion of this exercise.

Name: _____

Date: _____