# Magnetic Anomalies and Calculating Spreading Rates

(Modified from *Laboratory Exercises in Oceanography* , B.W. Pipkin et al., 2001, Freeman & Co Publishers)

When we map magnetic anomalies across an oceanic ridge, alternating bands of high and low magnetism (normal and reversed polarities) appear on both sides of the ridge, each side the mirror image of the other. Such a pattern provides strong evidence for seafloor spreading and the theory of plate tectonics.
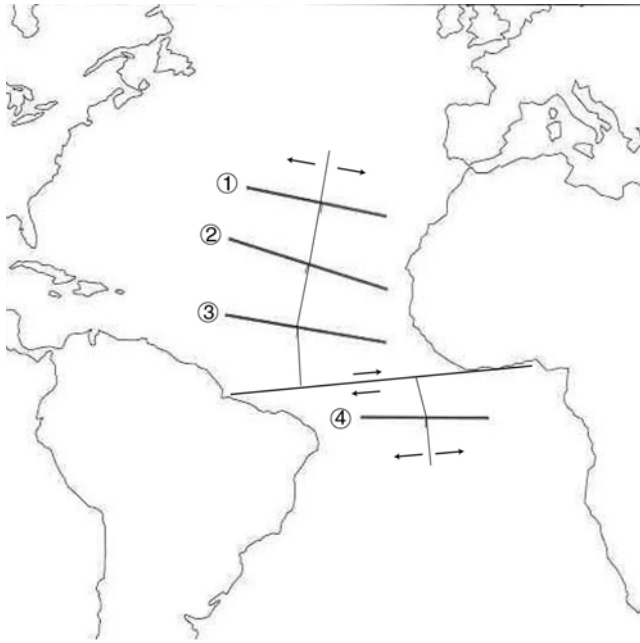
The map at left shows a portion of the Atlantic Ocean where four magnetic transects were made by a research vessel as it crossed the Mid-Atlantic Ridge on four different traverses.

On the back of this page, you will find detailed measurements of rock polarity and magnetism for each of the transects (shown in the same configuration as the real map shows). When the measurement curve on the traverse is above zero, the strength of the magnetic field is greater than normal because it is normal polarity, and the magnetism in the rocks is added to the strength of the present field. Where the curve drops below zero, the strength of the magnetic field is less than normal because the magnetism of the rocks has a reverse polarity and thus reduces the present strength of the magnetic field.

Instructions

1. On each track on the back, mark points where the magnetic curve intersects the line of zero field strength. Start at the ridge and work outwards on both sides. These points are the points of reversals, when the magnetic pole switches from normal to reversed polarity or vice versa. Use a pencil!
2. Connect the equivalent points on each track (start from the middle and go outwards).
3. With your pencil, shade in the areas of each negative anomaly.
4. Color the bands of the positive anomalies and complete the legend accordingly.
5. **Are the anomalies perfectly symmetrical across the ridges (mirror images)? Why or why not**?
6. **Are the anomalies the same thickness along all ridges segments? Why or why not**?
7. Refer to the recent geomagnetic time scale below, and determine the age at which each band begins (start from ridge and work outwards). Label your drawing accordingly.
8. **Calculate the average spreading rate of the Atlantic <u>along each segment</u> for the past 5 m.y.** Use map scale to find distance. Use reversal boundary that occurred 5 Ma for rocks of the same age. Full spreading rate = distance between rocks of same age ÷ age of rocks. Half spreading rate = distance between ridge crest and rock of known age ÷ age of rock. Note: Divide answers in km/m.y. by 10 to get cm/yr.

Magnetic polarity description and name	Event ended	Event began
Brunhes normal epoch	Present	700 Ka
Matuyama reversal epoch	700 Ka	2.4 Ma
Gauss normal epoch	2.4 Ma	3.3 Ma
Gilbert reversal epoch	3.3 Ma	4.2 Ma
Normal	4.2 Ma	5 Ma

Magnetic polarity description and name	Event began	Event began
Reverse	5 Ma	5.5 Ma
Normal	5.5 Ma	6.2 Ma
Reverse	6.2 Ma	6.7 Ma
Normal	6.7 Ma	7.7 Ma

+
0
−
Oceanic ridge axis
①

+
0
−
Oceanic ridge axis
②

+
0
−
Oceanic ridge axis
③

| 0-700Ka |
| 2.4-3.3Ma |
| 4.2-5Ma |
| 5.5-6.2Ma |
| 6.7-7.7Ma |

Color of youngest
positive anomaly

↓

Color of oldest
positive anomaly

400 300 200 100 50 0 50 100 200 300 400
Kilometers

④

+
0
−
Oceanic ridge axis