Chapter 8 Lab Activity

Patterns of Magnetic Polarity Reversals

While no one is quite sure why reversals in Earth's magnetic field occur, the evidence for reversals is permanently recorded in Earth's crust. Oceanic crust has been likened to a tape recorder moving on a giant sea-floor conveyor belt. As magma along sea-floor spreading centers cools and solidifies, magnetic minerals align themselves with Earth's magnetic field at the time. These records of Earth's magnetic field over time are not only helpful in understanding a part of Earth's geologic history, but they also provide the data necessary to make comparisons of spreading rates in different ocean basins. In this activity, you will use patterns of magnetic polarity reversals to compare rates of sea-floor spreading.

Procedure

1 The drawing on the third page of this activity shows the pattern of magnetic reversals for three different spreading centers in Earth's oceans. The top pattern represents the magnetic reversal pattern found at the Mid-Atlantic Ridge in the South Atlantic Ocean. This pattern represents a spreading center that has spread at a relatively uniform rate for approximately 75 million years. Use a metric ruler to draw two vertical lines across the pattern that divide the pattern into three equal pieces.

2 Observe the magnetic reversal patterns for the North Pacific Ocean and the Pacific Antarctic Ocean. The magnetic reversal patterns are the same as for the South Atlantic, but the widths of the stripes vary from pattern to pattern. The variation is due to the spreading rates being different for each spreading center and changing over time. For the North Pacific and the Pacific Antarctic patterns, determine the point on each pattern that corresponds to the two vertical lines you have drawn across the North Atlantic pattern. Draw vertical lines across each pattern at these positions.

3 ⚠ **CAUTION: Handle scissors with care.** Use scissors to cut out the rightmost third of the magnetic reversal pattern for the South Atlantic. Paste the piece onto the bar graph representing the South Atlantic in the column for 0–25 my. Place the part of the pattern that was at a distance of zero at the bottom of the bar graph. Then cut out and paste the middle piece into the middle column, again taking care to align the part of the piece closest to the spreading center with the bottom of the bar graph. Repeat for the final piece of the South Atlantic.

4 Repeat Step 3 for the other two patterns. Make sure that the pattern in each column of these bar graphs matches the pattern in the corresponding column of the South Atlantic bar graph. The end result will be a bar graph recording both time and distance for each spreading center's magnetic reversal pattern.

LAB SKILLS AND OBJECTIVES

- *Measure* the rate of sea-floor spreading using patterns of magnetic reversals.
- *Compare* the rates of sea-floor spreading in several different oceans.

MATERIALS

- metric ruler
- scissors
- paste or glue
- scrap paper

Analysis and Conclusions

1 Is Earth's current polarity normal or reversed? What does normal polarity mean?

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2 How does your South Atlantic bar graph show that the spreading rate has been relatively uniform over the last 75 million years?

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3 For the North Pacific, during which time interval was the spreading rate the fastest? During which interval was the spreading rate the slowest?

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4 For the Pacific Antarctic, during which time interval was the spreading rate the fastest? During which interval was the spreading rate the slowest?

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5 For each of the three ocean basins, use the distance scale to determine, to the nearest 50 kilometers, the total distance from the spreading center to the sea floor that is 75 million years old.

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6 Use your answers to Question 5 to determine which ocean basin has the slowest average spreading rate. Which basin has the fastest?

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7 Use your answers to Questions 5 and 6 to calculate the spreading rate, in centimeters per year, for the slowest spreading center and for the fastest spreading center. Show your work. Hint: $1 \text{ km} = 10^5 \text{ cm}$, $1 \text{ million} = 10^6$.

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8 At a location in the Atlantic Ocean where the spreading rate is 1.5 cm/yr, the distance across the ocean is 6600 kilometers. How many million years has the Atlantic Ocean taken to widen to that distance at that location? Show your work.

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SOUTH ATLANTIC: Distance from spreading center in kilometers

1500   1000   500   0

NORTH PACIFIC: Distance from spreading center in kilometers

3000   2500   2000   1500   1000   500   0

PACIFIC ANTARCTIC: Distance from spreading center in kilometers

1800   1500   1000   500   0

0–25 25–50 50–75
(my)
South Atlantic

0–25 25–50 50–75
(my)
North Pacific

0–25 25–50 50–75
(my)
Pacific Antarctic