Paleomagnetism and the Ocean Floor

In the continental drift hypothesis, the ocean floors were not really involved. The hypothesis proposed that the continents moved through the oceans like icebreaking ships plowing through ice. Later studies of the oceans provided one of the keys to the plate tectonic theory. You will observe how the magnetic rocks on the ocean floor can be used to understand plate tectonics.

Problem How are the paleomagnetic patterns on the ocean floor used to determine the rate of seafloor spreading?

Materials

- metric ruler
- calculator

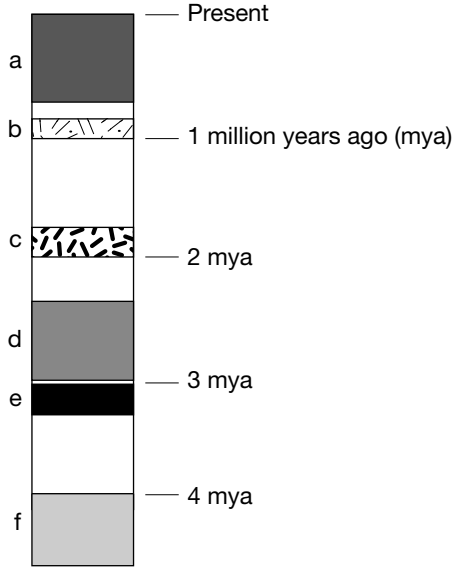

Figure 1

Skills Measuring, Interpreting Diagrams, Calculating

Procedure

1. Scientists have reconstructed Earth's magnetic polarity reversals over the past several million years. A record of these reversals is shown in Figure 1. Periods of normal polarity, when a compass would have pointed north as it does today, are shown in grayscale. Periods of reverse polarity are shown in white. Record the number of times Earth's magnetic field has had reversed polarity in the last 4 million years.

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2. The three diagrams in Figure 2 on the next page illustrate the magnetic polarity reversals across sections of the mid-ocean ridges in the Pacific, South Atlantic, and North Atlantic oceans. Periods of normal polarity are shown in the same grayscale in the illustration above. Observe that the patterns of polarity in the rock match on either side of the ridge for each ocean basin.

3. On the three ocean-floor diagrams, identify and mark the periods of normal polarity with the letters *a–f.* Begin at the ridge crest and label along both sides of each ridge. (*Hint:* The left side of the South Atlantic has already been done and can act as a guide.)

4. Using the South Atlantic as an example, label the beginning of the normal polarity period c, "2 million years ago," on the left sides of the Pacific and North Atlantic diagrams.

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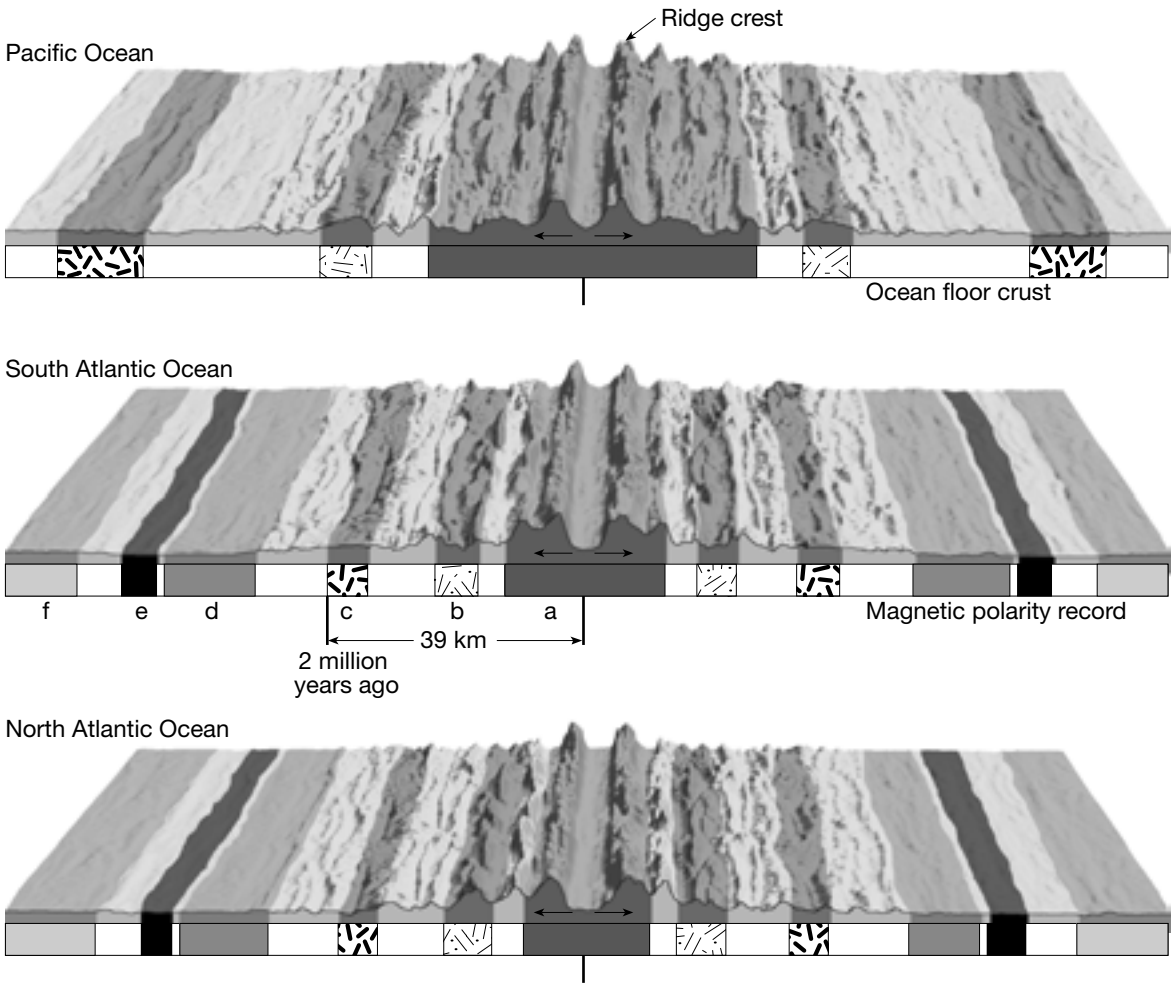

Figure 2

5. Using the distance scale shown with the ocean floor diagrams, determine which ocean basin has spread the greatest distance during the last 2 million years.

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6. Refer to the distance scale. Notice that the left side of the South Atlantic basin has spread approximately 39 kilometers from the center of the ridge crest in 2 million years.

Analyze and Conclude

1. Analyzing Data How many kilometers has the left side of the Pacific basin spread in 2 million years?

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2. **Analyzing Data** How many kilometers has the left side of the North Atlantic basin spread in 2 million years?

3. **Inferring** How many kilometers has each ocean basin opened in the past 2 million years?

4. **Calculating** If both the distance that each ocean basin has opened and the time it took to open that distance are known, the rate of seafloor spreading can be calculated. Determine the rate of seafloor spreading for the South Atlantic Ocean basin in centimeters per year. (*Hint:* To determine the rate of spreading in centimeters per year for each ocean basin, first convert the distance from kilometers to centimeters and then divide this distance by the time, 2 million years.)

5. **Calculating** Determine the rate of seafloor spreading for the North Atlantic and Pacific Ocean basins.

6. **Drawing Conclusions** Which ocean basin is spreading the fastest? The slowest?

7. **Inferring** Do ocean basins spread uniformly over the entire basin? Explain.