Lab Activity
Mid-Atlantic Ridge

Key Features:
Constructing Profiles of:
- Atlantic Ocean floor
- Age of the Atlantic Ocean bedrock
- Magnetic Polarity of ocean bedrock

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Introduction:

During World War II, extensive mapping of the Atlantic Ocean Basin revealed a large, underwater mountain chain located in the approximate middle of the Atlantic Ocean. This mountain chain, called the Mid-Atlantic Ridge, is elongated north to south, and is part of a worldwide network of underwater ridges over 80,000 km long.

Further, the sampling and age dating of the rocks comprising the ocean floor suggested the oldest rocks formed during the Jurassic Time Period, which began about 200 million years ago. However, the Earth is 4.5 billion years old. Why aren’t there any older rocks in the Atlantic Ocean basin, and are the ages of the rocks related to the presence of the ridge?

The discovery of the ridge and the age of the rocks led to many questions concerning the Atlantic Ocean basin and its origin. In this activity, you will investigate these questions.

Objectives:

- Construct and analyze a profile of the Atlantic Ocean basin.
- Construct and analyze a profile of the age of the Atlantic Ocean bedrock.
- Construct and analyze a profile depicting the magnetic polarity bedrock near a mid-ocean ridge.

Materials:

- Colored pencils, pencil, ESRT’s.

Procedure A: Using the data table below, construct a profile view of the Atlantic Ocean Basin on the grid provided on the following page. Note: The data points plot from east to west across the ocean basin.

Data Table: Distance vs. Depth of Atlantic Ocean Basin

<table>
<thead>
<tr>
<th>Distance (km)</th>
<th>Depth (km)</th>
<th>Distance (km)</th>
<th>Depth (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Cape Cod, MA</td>
<td>4000</td>
<td>The Mid-Atlantic Ridge</td>
</tr>
<tr>
<td>200</td>
<td>0.2</td>
<td>4100</td>
<td>2.5</td>
</tr>
<tr>
<td>400</td>
<td>0.6</td>
<td>4200</td>
<td>0.3</td>
</tr>
<tr>
<td>600</td>
<td>2.1</td>
<td>4300</td>
<td>1.1</td>
</tr>
<tr>
<td>900</td>
<td>3.0</td>
<td>4400</td>
<td>0.5</td>
</tr>
<tr>
<td>1200</td>
<td>3.5</td>
<td>4500</td>
<td>2.7</td>
</tr>
<tr>
<td>1500</td>
<td>3.4</td>
<td>4800</td>
<td>3.1</td>
</tr>
<tr>
<td>2000</td>
<td>The Great Abyssal Plain</td>
<td>5300</td>
<td>2.8</td>
</tr>
<tr>
<td>3000</td>
<td>3.1</td>
<td>5800</td>
<td>Land’s End, Great Britain</td>
</tr>
<tr>
<td>(Data continues above.)</td>
<td></td>
<td>6100</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Profile of the Atlantic Ocean Basin

Discussion Questions A:

1. Inspect your profile. What caused the large ridge in the approximate center of the Atlantic Ocean basin to form?

2. If there were no seafloor spreading in the Atlantic Basin, how would your profile look different?
**Procedure B:** The generalized map below shows a portion of the Atlantic Ocean floor located between South America and Africa. Isolines show the approximate age, in million years, of the ocean-floor bedrock on each side of the Mid-Atlantic Ridge. Points A, B, and X represent locations on the ocean floor.

1. On the grid below, construct a line graph of bedrock age by plotting the age of the bedrock shown by each isoline that crosses line AB. Points A and B are plotted on the grid. Connect the plots from A to B with a line.

2. Estimate the age of the ocean-floor bedrock at point X. _______________________________

3. Explain why the age of the ocean-floor bedrock increases as the distance from the Mid-Atlantic Ridge increases.
Procedure C:

1. The diagram below represents the pattern of normal and reversed magnetic polarity of the seafloor bedrock on the east side of a mid-ocean ridge center. The magnetic polarity of the bedrock on the west side of the ridge has been omitted.

2. Complete the diagram below by shading the pattern of normal polarity on the west side of the ridge center. Assume the rate of plate movement was constant on both sides of the ridge center. Your answer must show the correct width and placement of each normal polarity section.

3. Draw arrows on the profile on both sides of the mid-ocean ridge that indicate the direction of sea floor spreading that is occurring.

4. Label the location(s) of the youngest bedrock.

5. Label the location(s) of the oldest bedrock.

6. Label the location of the hottest crustal temperatures.
Discussion Questions C:

1. Approximately how many millions of years ago did the Atlantic Ocean split apart?

2. Do the rocks get older or younger as you go away from the Mid Atlantic Ridge towards the continents? Why?

3. According to the ESRT, what type of plate boundary is located at the Mid Atlantic ridge?

4. In the Mid Atlantic Ridge area, are the North American and Eurasian Plates currently moving toward or moving away from each other?

5. The Mid-Atlantic Ridge separates pairs of crustal plates, such as the North American Plate and the Eurasian Plate. Identify one other pair of crustal plates separated by the Mid-Atlantic Ridge.

6. The rocks that form the center of the ridge are mafic, fine-grained, commonly vesicular, and sometimes glassy. What type of rock are they (igneous, sedimentary, or metamorphic)? How did they form?