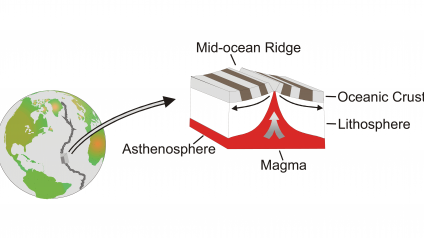
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Dynamic Earth

Sea-Floor Spreading Lab

**Introduction:** According to the theory of plate tectonics (from the Greek, *tetko,* ‘builder’) the Earth’s crust is broken into many slowly moving plates. *Sea Floor Spreading* occurs at the mid-ocean ridge where two plates are moving away from each other. Magma (hot molten underground rock material) rises up into the gap from below and cools to form new seafloor rock. Thus the sea floor spreads out to either side as show in Figure 1. This spreading occurs at about the same rate as your fingernails grow. In figure 1 the lithosphere is the outermost solid portion of the Earth, which includes the crust and part of the upper mantle, and asthenosphere is the rocky substratum below the lithosphere that is hot enough to be deformed and is capable of internal flow.

Figure 1

The pattern of sea floor spreading can be observed by studying the magnetic field of the rock on the sea floor. At the mid-ocean-ridge, magma rises up from the mantle below and cools. As it continues to cool, iron in the rock aligns itself with the magnetic field of the Earth, much like the needle in a compass. When rock solidifies, this magnetic ‘signature’ is locked in place.

Throughout history, the orientation of the Earth’s magnetic field has varied greatly. At times, the magnetic pole in the north has reversed completely and was located near the south geographic pole. Because new ocean floor is constantly moving away from the mid-ocean ridge, these reversals appear as bands of alternating magnetic fields as shown on Figure 1. On average, the Earth’s magnetic field reverses every several hundred thousand years with the most recent reversal occurring about 780,000 years ago.

**Objective:** Using ocean depth data you will construct an ocean bottom profile of the Atlantic Ocean. Using the profile, you will identify features of the ocean bottom in regions of diverging plate boundaries.

**Procedure:**

1. Construct an ocean bottom profile on graph paper using the data chart labeled North Atlantic Ocean Bottom Profile. Make an appropriate scale, and label the vertical axis ‘Depth in Kilometers.’ Once again, using an appropriate scale, label the horizontal axis ‘Distance from U.S. coast in Kilometers.’
2. Once your graph is complete label the following features.
   1. Mid-Atlantic Ridge b. Seamounts c. Continental Shelf
3. On your graph using a red colored pencil draw the direction of plate movement associated with the Mid-Atlantic Ridge. Next, with your red color pencil, draw the convection currents in the asthenosphere that cause the plates to pull apart.
4. With a blue color pencil shade the areas on your map where you would find the oldest age oceanic plate.

**Data Chart:**

**North Atlantic Ocean Bottom Profile**

(Depths are below sea-level; therefore you should start your graph with zero depth near the top of your page)

|  |  |
| --- | --- |
| **DEPHT (KM)** | **DISTANCE (KM)** |
| 0 | 0 |
| 0.2 | 120 |
| 2.7 | 200 |
| 3.7 | 400 |
| 3.7 | 490 |
| 4.6 | 620 |
| 1.8 | 680 |
| 4.6 | 720 |
| 4.6 | 2000 |
| 4.0 | 2500 |
| 2.7 | 2900 |
| 1.8 | 3000 |
| 2.2 | 3050 |
| 2.4 | 3100 |
| 2.9 | 3200 |
| 3.5 | 3500 |
| 3.7 | 3600 |
| 3.7 | 3650 |
| 4.0 | 4025 |
| 2.7 | 4050 |
| +0.5 | 4100 |
| 2.2 | 4125 |
| 4.6 | 4500 |
| 5.0 | 5000 |
| 4.4 | 5300 |
| 3.7 | 5800 |
| 2.7 | 6000 |
| 0.2 | 6075 |
| 0 | 6100 |

**Questions:** Answer in a complete sentence.

1. What process within Earth’s asthenosphere is responsible for plate motions?
2. What evidence indicates that lithospheric plates move over Earth’s surface?
3. How can plates move apart at the mid-ocean ridges and not leave a deep gap in the lithosphere?
4. The rate of plate movement along portions of the Mid-Atlantic Ridge has been determined to be 3cm/year. At this rate how long will it take the Atlantic Ocean to widen another one kilometer? Show your work
5. In the North Atlantic Ocean was two tectonic plates does the Mid-Atlantic Ridge separate?
6. Name three minerals that are abundant in both oceanic and continental crust.