Lesson Outline for Teaching

Lesson 2: Development of a Theory

A. Mapping the Ocean Floor

1. Scientists mapped the depth of the ocean floor using a device called a(n) echo sounder.
2. In the middle of the oceans are large mountain ranges called mid-ocean ridges.
   - **a.** Existence of these mountain ranges was confirmed through echo-sounder research.
   - **b.** These underwater mountain ranges are much longer than mountain ranges on land.

B. Seafloor Spreading

1. Seafloor spreading occurs when new oceanic crust forms at a mid-ocean ridge and old crust moves away from the ridge.
   - **a.** Molten rock, or magma, rises from the mantle through cracks in the crust. It erupts as lava from volcanic vents along the mid-ocean ridge.
   - **b.** The molten rock cools and becomes basalt, the rock that forms the oceanic crust.
   - **c.** New oceanic crust forms along a mid-ocean ridge, and older crust moves away from the ridge.
2. The topography of the seafloor includes the abyssal plain and rugged mountains.
   - **a.** The rugged mountains that make up the mid-ocean ridge can form in different ways. One way is through large amounts of lava erupting from the center of the ridge, cooling, and building up around the ridge. Another way is through upward-moving magma pushing on the crust above it, causing it to crack and form jagged, angular mountains on the seafloor.
   - **b.** Eventually, sediment forms on top of the oldest oceanic crust, making a smooth seafloor called the abyssal plain.
3. Seafloor spreading helps explain continental drift because it shows that continents move with the oceanic crust as it spreads away from mid-ocean ridges.

C. Development of a Theory

1. Evidence to support seafloor spreading first came from studying the magnetism of rocks on the seafloor.
2. Earth's outer core causes Earth's magnetic field.
   - **a.** The direction of Earth's magnetic field reverses often.
   - **b.** When a magnetic field causes a magnet to point north, the magnetic field has normal polarity.

Lesson Outline continued

c. A magnetic field reverses direction during a(n) magnetic reversal.

d. After a magnetic reversal, a magnet points south because Earth's magnetic field has reversed polarity.

3. Magnetic signatures form when iron-rich minerals in cooling lava align with the direction of Earth's magnetic field.

a. The direction of a magnetic field in minerals can be determined by using a device called a(n) magnetometer.

b. Magnetometers show parallel magnetic stripes on either side of a mid-ocean ridge.

c. These stripes alternate normal polarity and reversed polarity, showing that each stripe was formed at the mid-ocean ridge and then moved away.

4. Sediment collected from the seafloor show that sediment farther away from a mid-ocean ridge is older than the sediment that is closer to the ridge.

Discussion Question

How do magnetometer results show that continental drift is a slow process?

Magnetometer results show stripes of opposite magnetic signatures. Each change in magnetic signature shows a magnetic reversal, which can take millions of years. Because magnetic reversal is such a slow process, it indicates that seafloor spreading is slow. Because seafloor spreading is slow, continental drift must also be slow.