

**Plate Tectonics** ▪ *Section Summary*

# Sea-Floor Spreading

**Guide for Reading**

- What is the process of sea-floor spreading?
- What is the evidence for sea-floor spreading?
- What happens at deep-ocean trenches?

The longest chain of mountains in the world is the system of **mid-ocean ridges**. In the mid-1900s, scientists mapped the mid-ocean ridges using sonar. **Sonar** is a device that bounces sound waves off underwater objects and then records the echoes of these sound waves. The mid-ocean ridges curve along the sea floor, extending into all of Earth's oceans. Most of the mountains in the mid-ocean ridges lie hidden under hundreds of meters of water. A steep-sided valley splits the top of some mid-ocean ridges.

Earth's ocean floors move like conveyor belts, carrying the continents along with them. This movement begins at a mid-ocean ridge. A ridge forms along a crack in the oceanic crust. **At a mid-ocean ridge, molten material rises from the mantle and erupts. The molten material then spreads out, pushing older rock to both sides of the ridge.** As the molten material cools, it forms a strip of solid rock in the center of the ridge. Then more molten material splits apart the strip of solid rock that formed before, pushing it aside. This process, called **sea-floor spreading**, continually adds new material to the ocean floor.

Scientists have found strange rocks shaped like pillows in the central valley of mid-ocean ridges. Such rocks can form only if molten material hardens quickly after erupting under water. The presence of these rocks supports the theory of sea-floor spreading. More support came when scientists discovered that the rock that makes up the ocean floor lies in a pattern of magnetized "stripes." The pattern is the same on both sides of the ridge. These stripes hold a record of reversals in Earth's magnetic field. The final proof of sea-floor spreading came from rock samples obtained by drilling into the ocean floor. Scientists found that the farther from a ridge the rocks were taken, the older they were.

The ocean floor does not just keep spreading. Instead, it sinks beneath deep underwater canyons called **deep-ocean trenches**. Where there are trenches, subduction takes place. **Subduction** is the process by which the ocean floor sinks beneath a deep-ocean trench and back into the mantle. **At deep-ocean trenches, subduction allows part of the ocean floor to sink back into the mantle, over tens of millions of years.**

The processes of subduction and sea-floor spreading can change the size and shape of the oceans. Because of these processes, the ocean floor is renewed about every 200 million years. The Pacific Ocean is shrinking. Its many trenches are swallowing more ocean crust than the mid-ocean ridge is producing. The Atlantic Ocean is expanding. In most places, the oceanic crust of the Atlantic Ocean is attached to continental crust. As the Atlantic's floor spreads, the continents along its edges also move.