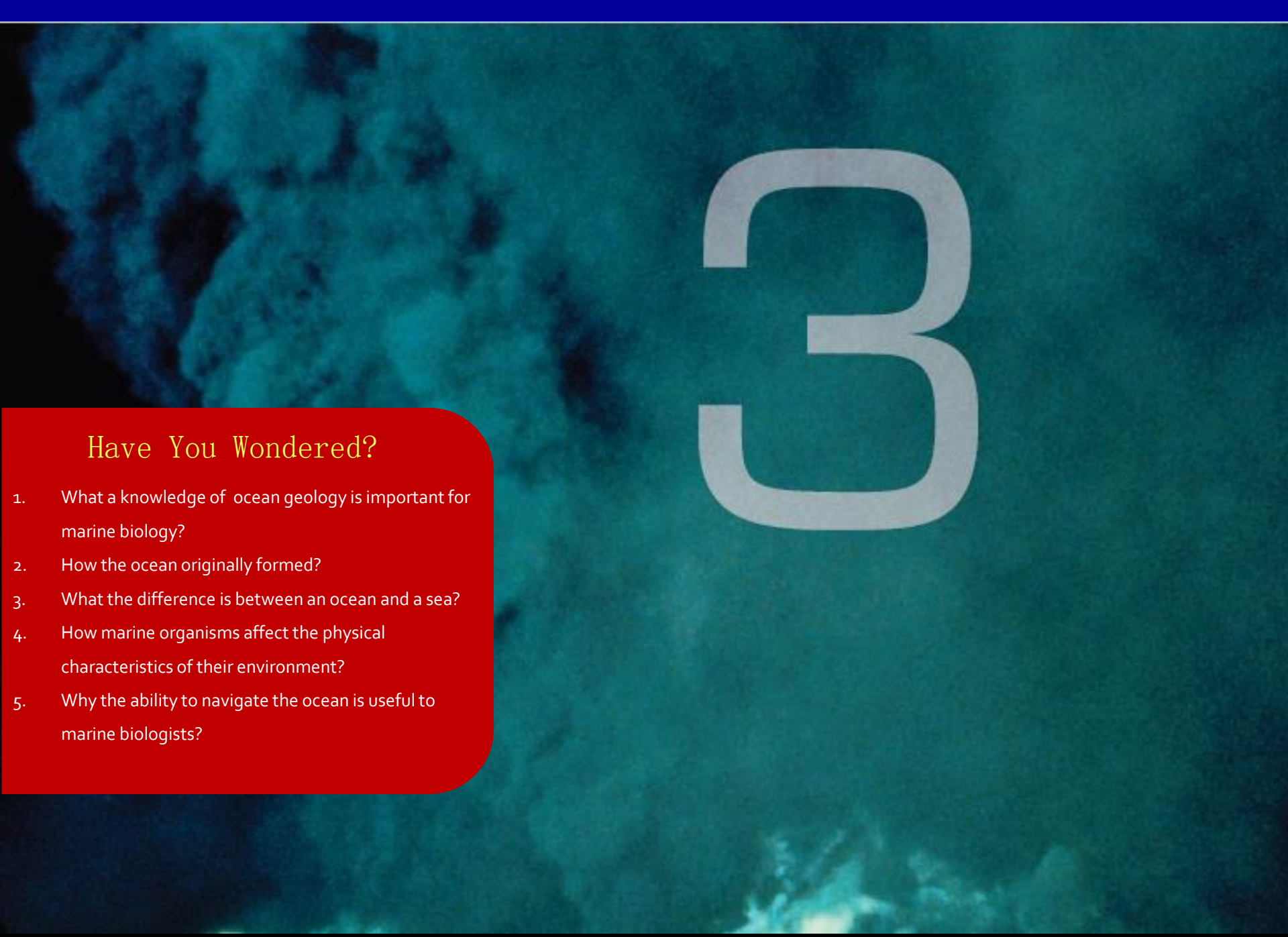


Have You Wondered?

1. What a knowledge of ocean geology is important for marine biology?
2. How the ocean originally formed?
3. What the difference is between an ocean and a sea?
4. How marine organisms affect the physical characteristics of their environment?
5. Why the ability to navigate the ocean is useful to marine biologists?

Geology of the Ocean

- The physical characteristics of the environment play an important role in determining the kinds of organisms that can live in a given area and the traits that they will exhibit. Before we begin our study of the ocean's inhabitants and their interactions with each other and their environment, we need to gain a basic understanding of the physical characteristics of the ocean itself.

World Ocean

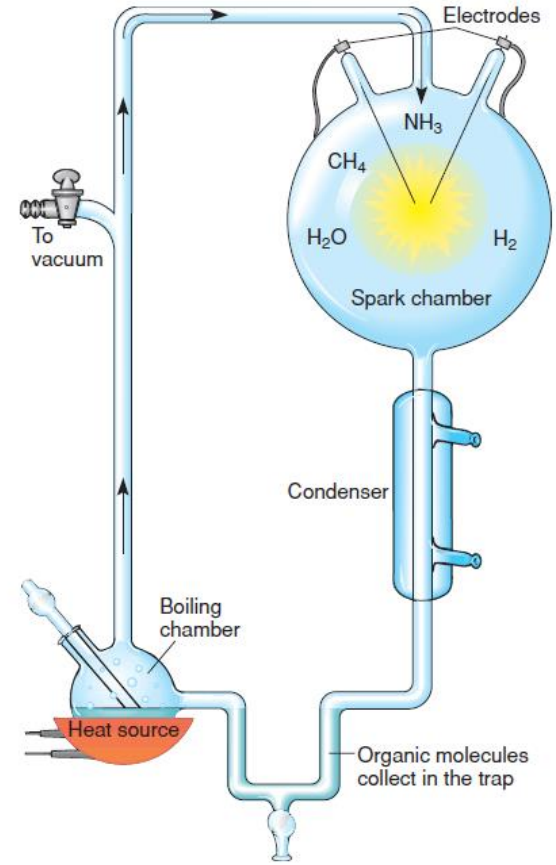


Figure 3-1 MILLER'S APPARATUS. Using an apparatus similar to the one shown here, Stanley Miller was able to demonstrate that simple organic compounds, including some necessary for life, could have formed under the conditions found on the primitive earth.

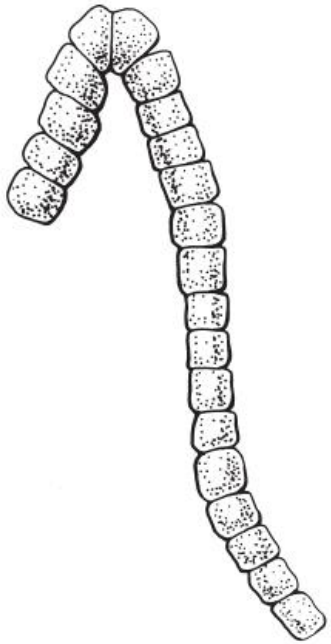


Figure 3-2 OLDEST KNOWN FOSSILS. These fossils of marine bacteria are between 3.4 and 3.5 billion years old and represent some of the earth's earliest life forms.

The *world ocean* is the continuous mass of water that covers nearly 70.8% of the earth's surface.

An *ocean basin* is a portion of the deep ocean floor.

A *sea* is a body of water that is smaller than an ocean and is more or less landlocked.

A *gulf* is a small body of water that is mostly cut off from an ocean or sea by land formations.

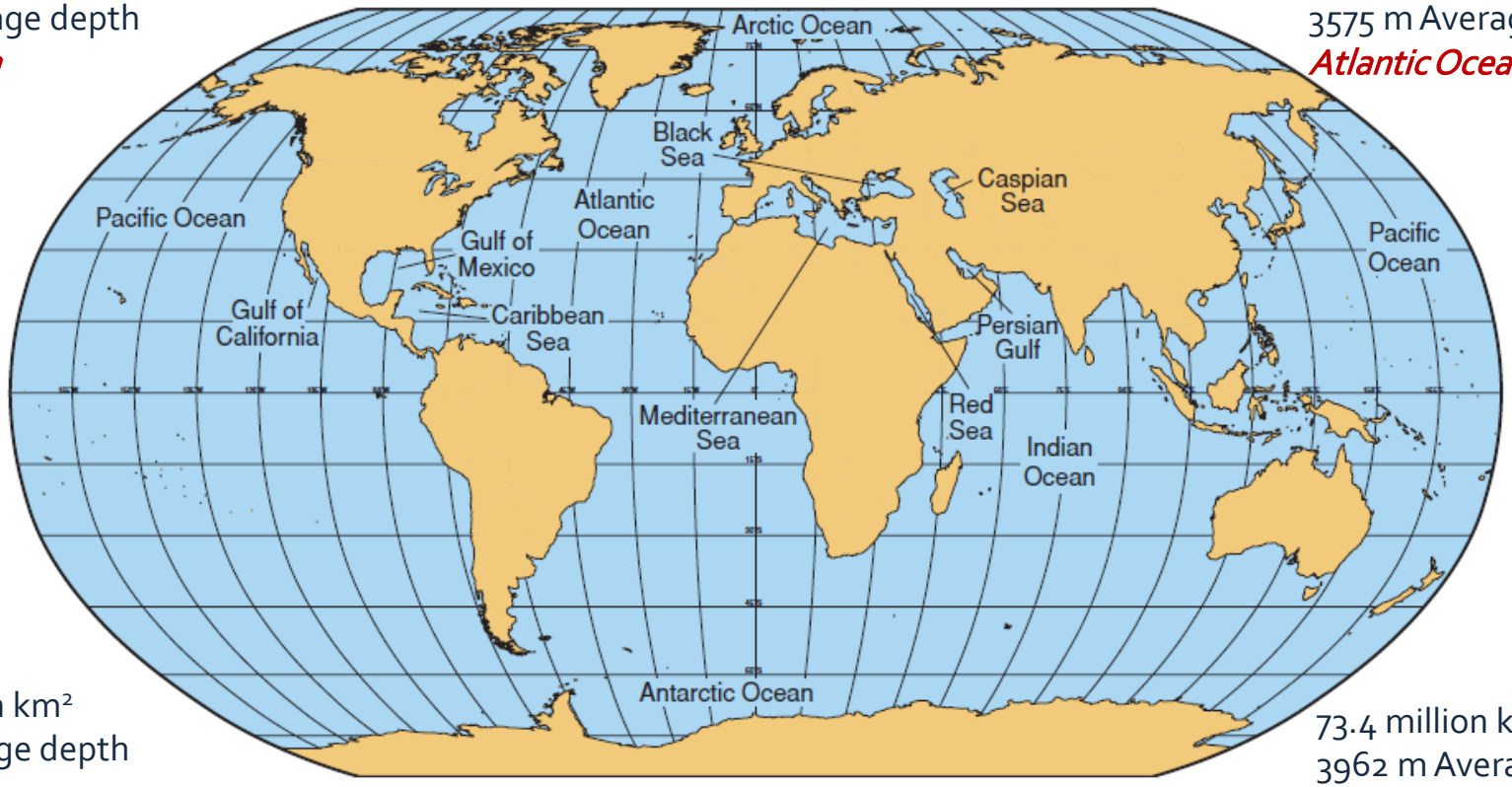
Continental drift is the movement of continental masses as the result of seafloor spreading.

GLOSSARY

World Ocean Today

165.2 million km²
4282 m Average depth
Pacific Ocean

82.4 million km²
3575 m Average depth
Atlantic Ocean



12.257 million km²
1117 m Average depth
Arctic Ocean

73.4 million km²
3962 m Average depth
Indian Ocean

Figure 3-3 **THE WORLD OCEAN.** There are four main ocean basins, and the body of water in each basin is traditionally referred to as an ocean. These are the Pacific, Atlantic, Indian, and Arctic Oceans. Other common smaller divisions of the world ocean, such as seas and gulfs, are temporary features that are named for convenience.

In Summary

- The world ocean is believed to have formed approximately 4.2 billion years ago when water vapor escaping from minerals in the earth cooled and condensed on the earth's surface. It was in this early ocean environment that the first cells evolved. Today the world ocean covers nearly 71% of the planet's surface. The body of water in each of the four major ocean basins is referred to as an ocean. These four oceans are the Atlantic, Pacific, Indian, and Arctic Oceans. Smaller subdivisions of the oceans are seas and gulfs.

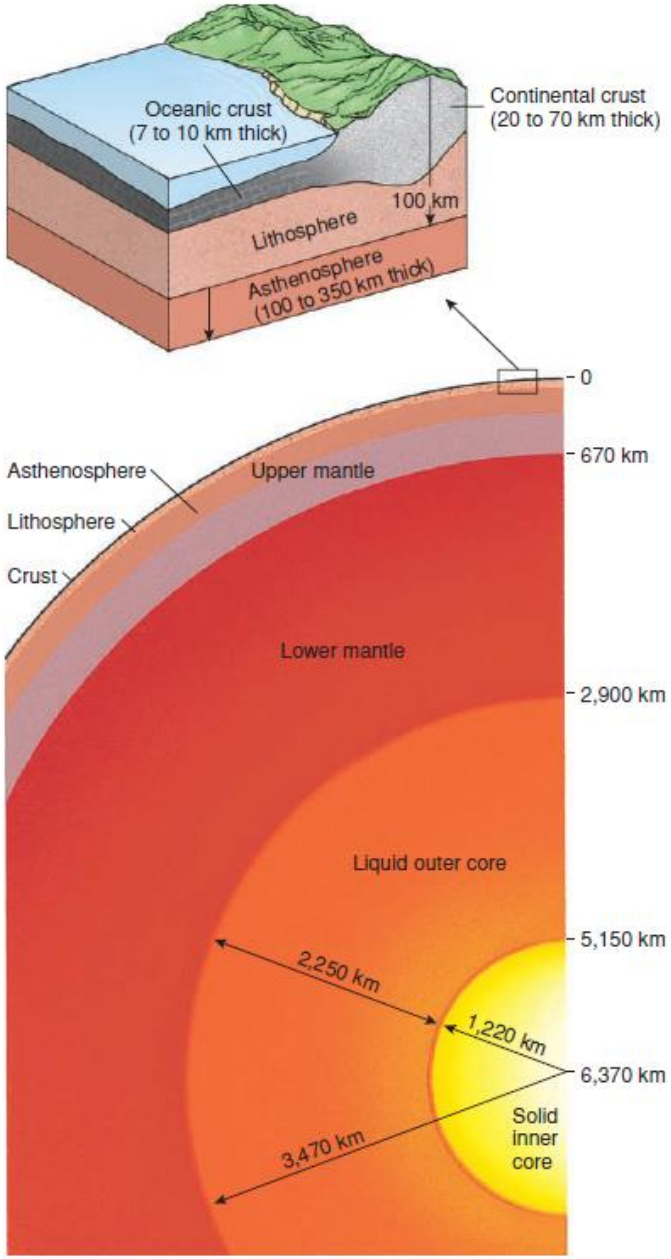


Figure 3-4 COMPOSITION OF THE EARTH. The earth is composed of several layers. The surface layer is the crust, which is fused to the lithosphere, the outermost portion of the mantle just beneath it. The asthenosphere lies beneath the lithosphere and is able to flow under stress.

Figure 3-5 THE SUPERCONTINENT PANGAEA. This map of Pangaea shows how today's continents were once connected to form a single supercontinent approximately 400 million years ago.

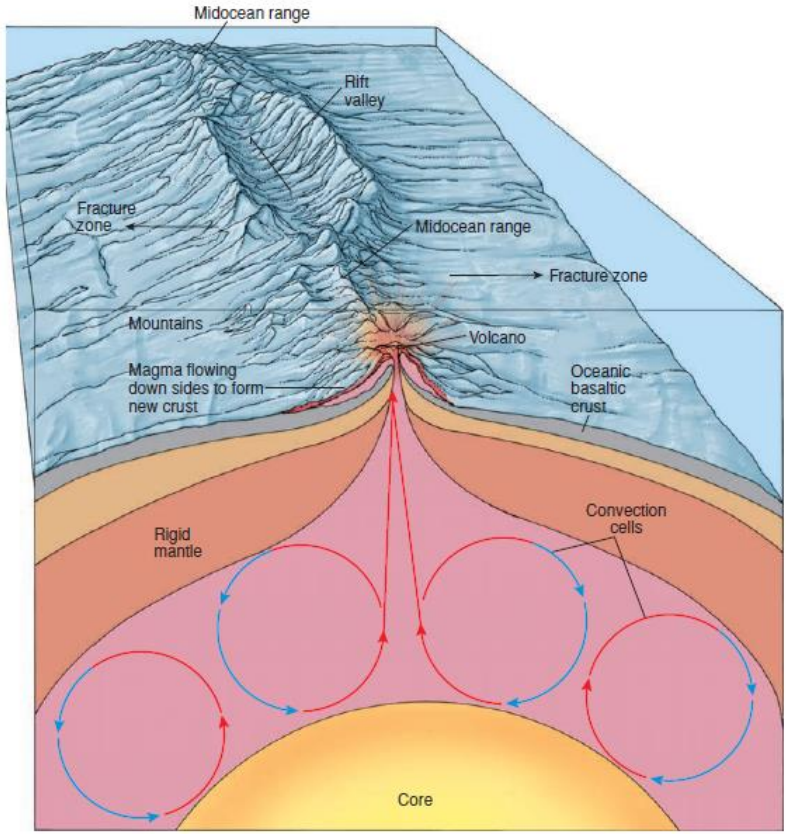


Figure 3-6 FORMATION OF OCEANIC CRUST AND MOUNTAINS. Molten material called *magma* rises from the earth's core to the upper mantle. The hot magma (red arrows) rises because it is less dense than the surrounding material. As magma reaches the mantle it cools (blue arrows), becomes more dense, and sinks back toward the core. This cycling of magma from the core to the mantle and back that results from changes in temperature and density is called *convection*. Occasionally, the heated magma breaks through the earth's crust, forming volcanoes. Lines of volcanoes form mountain ranges called *midocean ridges*.

Continental Drift

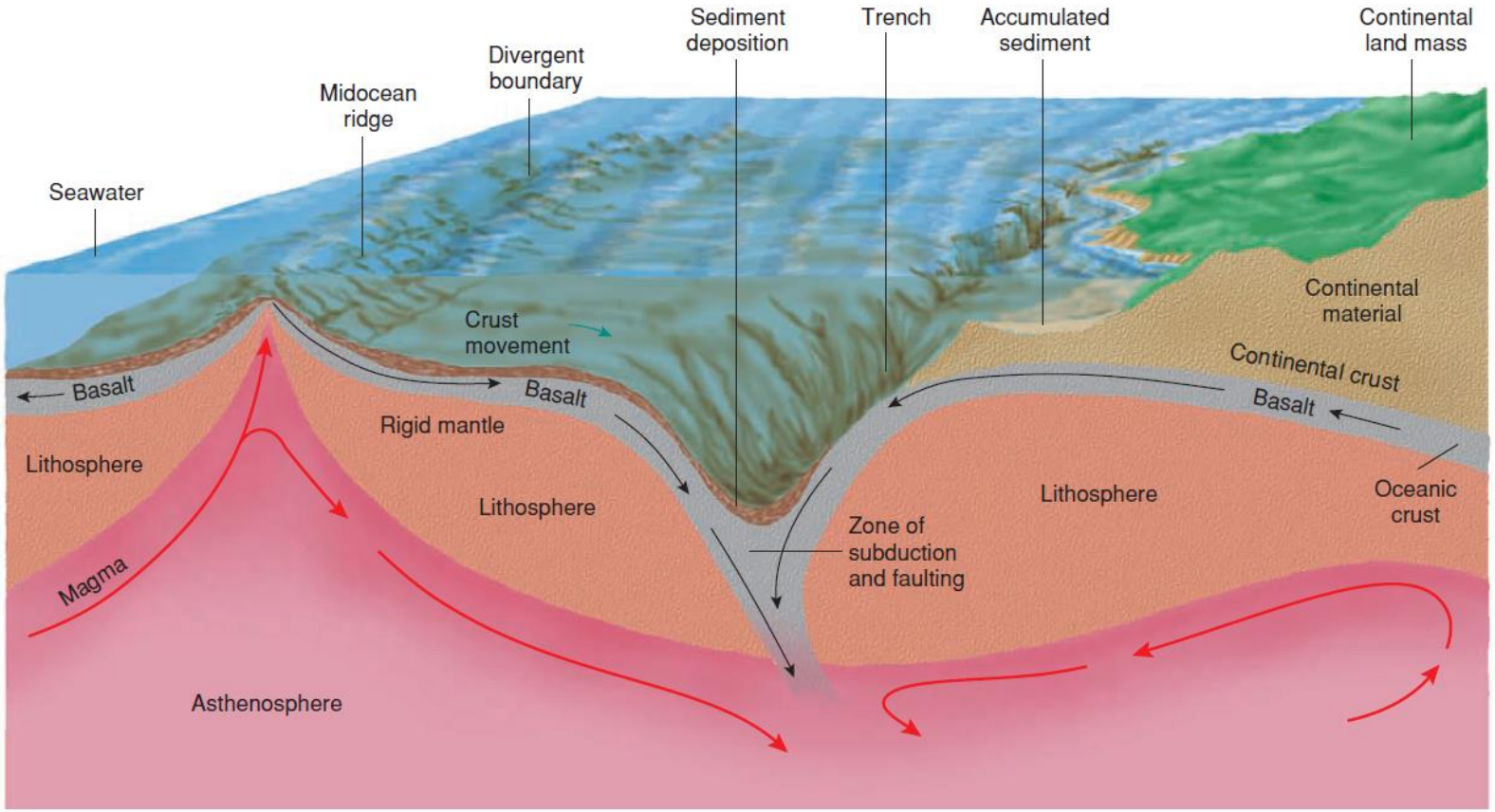
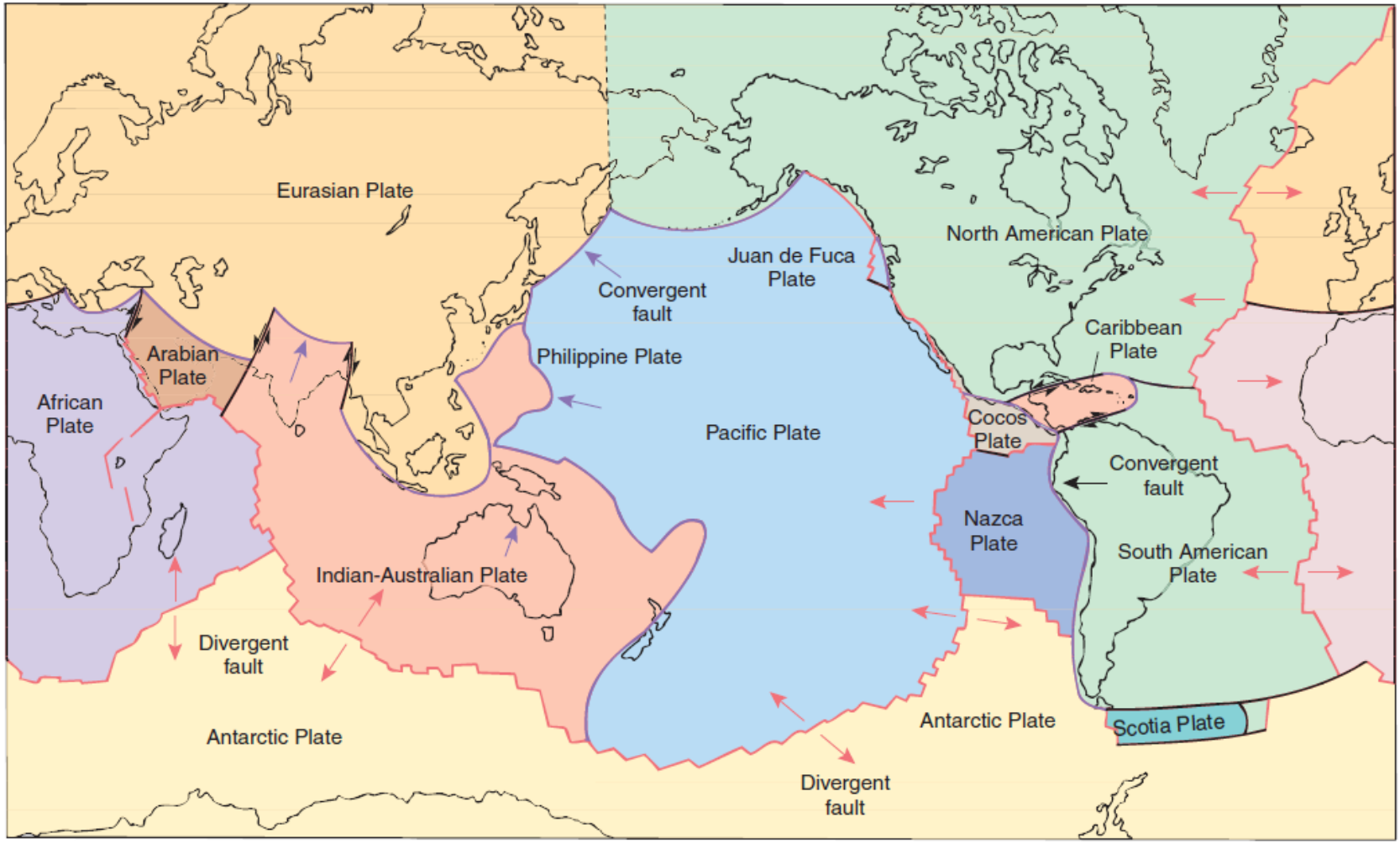


Figure 3-7 SEAFLOOR SPREADING AND CONTINENTAL DRIFT. Rising magma forms new oceanic crust that moves away from the midocean ridges. At subduction zones, old crust sinks and is ultimately returned to the mantle, where it melts and forms new magma. Since the continents rest on the basaltic crust, as the crust moves, the continents are carried along.

Theory of Plate Tectonics



Rift community

WHOI/D. Foster/Visuals Unlimited

Figure 3-9 VENT COMMUNITY. These vestimentiferan worms are members of a thriving community found in the Galápagos Rift. Because sunlight does not penetrate to this depth, these organisms rely on chemosynthetic bacteria for food.

Deep ocean