

Plate Tectonics

In 1910, Alfred Wegener proposed the theory of continental drift. He noticed that the edges of South America and Africa looked as though they fit together like a large jigsaw puzzle. He believed that the continents had been joined together at one time but had drifted apart. He found evidence to prove his theory. Fossils of plant and animal life matched on the two continents. Rock layers also matched. Wegener's theory was first published in 1915. But he could not answer one question: How did the continents move? He thought they were plowing through the ocean crust, moved by tides. Other scientists knew this could not happen. Wegener's theory was mostly forgotten.

In the 1960's, scientists finally found what was missing in Wegener's theory. Geologist Harry Hess finally could explain how continents moved. Hess believed that sea-floor spreading is the answer to the mystery of continental drift.

The mid-ocean ridge is found throughout the oceans of the earth. This is a 50,000 mile long chain of volcanic mountains in the middle of the ocean. These mountains have a deep crack that runs through them. It is called a rift valley. Sea-floor spreading happens here. It is a slow, regular process. There are no explosive bursts like volcanic eruptions on land.

During sea-floor spreading, magma rises from the mantle. It oozes out of the rift valley. It cools and forms new crust. A small amount of new ocean floor is added to the surface of the earth. It fills the gap at the ridge. As this cycle continues, the newly created crust slowly moves away from the ridge. It is a little like a giant conveyor belt, slowly moving the continents along with it.

You might think that because of sea-floor spreading, the earth would be growing larger. But sea-floor spreading is a recycling process. New crust is created at the mid-ocean ridge. Old crust is pushed back into deep sea trenches. This process is called subduction. Much of the old crust melts into the mantle. This keeps the earth from growing larger.

There is evidence to prove this theory. Scientists studied rocks from the ocean floor. Rocks closest to the ridge were younger than rocks found farther away. Magnetic mapping also helped to prove this theory. Scientists found identical magnetic stripes on both sides of the ridge.

Scientists studied Hess's and Wegener's work. The theory of continental drift was combined with the theory of sea-floor spreading. This led to the theory of plate tectonics.

The theory of plate tectonics says that the lithosphere is broken into pieces called tectonic plates. The plates have a thin layer of crust above a layer of cool hard rocks. Most of them have both continental and oceanic crust. These

Plate Tectonics (cont'd)

tectonic plates fit together like a jigsaw puzzle. There are about twelve large plates and a few smaller ones. They make up the earth's surface.

The plates float like rafts on the asthenosphere. This is a partly molten, flowing layer below the solid part of the earth's mantle. When one plate moves, it affects all the others. The movement of some of these plates causes sea-floor spreading. Today the Atlantic Ocean is spreading. North America and Europe are moving away from each other. The movement amounts to about one to two centimeters per year.

There are several types of plate boundaries. Most are found on the ocean floor. The first type is a divergent boundary. This is where two plates move away from each other. A mid-ocean ridge is an example of this type of boundary. The mid-Atlantic ridge is where new ocean floor is made, causing North America and Europe to be moving apart. When the plates move apart, magma flows up between them. It cools and forms new crust. This is why divergent boundaries are also called constructive boundaries. New ocean floor is being constructed at mid-ocean ridges.

Another type of boundary is called a convergent boundary. This is where plates come together. One plate is pushed under another. These boundaries are also called destructive boundaries. Plate material is destroyed by subduction here. It is melted into the mantle. A deep-sea trench is an example of a convergent boundary.

Along the edge of the Pacific plate, which is the largest plate, is an area called the Ring of Fire. This is a line of volcanoes that are found along major trenches in that area. As plates collide along convergent boundaries, there is much friction and pressure. Earthquakes often occur. They can be severe. As the plate material is subducted, some of it flows upward and produces volcanoes.

Other boundaries are called transform faults. A fault is a deep crack in the earth's surface. At these fault boundaries, the plates slide past each other. For example, one plate may be moving toward the north while the other moves south. Crust is neither produced nor destroyed at these boundaries. Most of these boundaries are found on the ocean floor.

However, there is a famous transform boundary found on land. This is the San Andreas Fault zone in California. This fault zone is about 1,300 kilometers long and more than 10 kilometers wide in some places. It runs through about two-thirds of the state of California. Here the Pacific Plate grinds past the North American Plate. They move about five centimeters per year. There are often earthquakes along this fault.

Other dynamic events also happen along plate boundaries. They cause our planet to be constantly changing. Volcanoes and the formation of mountains are also explained by the theory of plate tectonics.

Plate Tectonics Questions

1. What evidence did Wegener have for his theory of continental drift?
 - a. He had no evidence.
 - b. He knew that plant and animal fossils, as well as rock layers, matched on the two continents of Africa and South America.
 - c. He explained how continents moved apart.
2. Why was Wegener's theory forgotten?
 - a. He could not explain how the continents could move.
 - b. It was not a good theory.
 - c. He did not publish his theory.
3. Who came up with the theory of sea floor spreading?
 - a. Alfred Wegener
 - b. Harry Hess
 - c. ancient Greeks
4. Where does sea floor spreading happen?
 - a. at the rift valley along the mid-ocean ridges
 - b. at deep sea trenches
 - c. at the Ring of Fire
5. What material forms new ocean floor?
 - a. sediment
 - b. magma
 - c. plates
6. Where is old crust melted back into magma?
 - a. at the mid-ocean ridge
 - b. along plate boundaries
 - c. at deep-sea trenches
7. This process of old crust being pulled down and remelted is called:
 - a. sea floor spreading
 - b. subduction
 - c. plate tectonics
8. The evidence that rocks closer to mid ocean ridges are younger than rocks farther away supports the theory of:
 - a. sea floor spreading
 - b. subduction
 - c. plate tectonics

Plate Tectonics Questions (cont'd)

9. The theory of plate tectonics combine which two other theories?
 - a. sea floor spreading and continental drift
 - b. sea floor spreading and tidal theory
 - c. continental drift and fossil theory

10. Large pieces of the lithosphere that float on the asthenosphere are called:
 - a. tectonic plates
 - b. the mid-ocean ridge
 - c. deep-sea trenches

11. The partly-melted lower mantle is called:
 - a. magma
 - b. the lithosphere
 - c. the asthenosphere

12. A boundary where plates move away from each other is called:
 - a. divergent
 - b. convergent
 - c. transform

13. Why is a divergent boundary also called a constructive boundary?
 - a. Magma flows up between the plates and forms new crust.
 - b. Old ocean floor is remelted into magma.
 - c. Animals in the ocean construct nests there.

14. An example of a convergent boundary is a:
 - a. volcano
 - b. mid-ocean ridge
 - c. deep-sea trench

15. A deep crack in the earth's surface is called a:
 - a. ridge
 - b. fault
 - c. plate

16. How do the plates move at a transform boundary?
 - a. They move toward each other.
 - b. They move away from each other.
 - c. They move past each other.

Name _____



Date _____

Plate Tectonics Answers

1. b
2. a
3. b
4. a
5. b
6. c
7. b
8. a
9. a
10. a
11. c
12. a
13. a
14. c
15. b
16. c