Moving Continents

Imagine an earth that has only one large piece of land that is surrounded by one large ocean. Scientists believe that this is what the earth once looked like. There were no mountains, faults, or volcanoes. It was just flat with animals walking all over. Today, the processes that made the mountains, faults, and volcanoes are still being studied. Evidence shows that the earth is still undergoing many geologic changes.

This story begins in the early 1900s with a scientist named Alfred Wegener. Mr. Wegener was a meteorologist (studied weather), geologist (studied rocks), and Arctic explorer who studied the change in weather patterns. While studying this, Alfred made some amazing observations which led him to guess that all the continents had once been joined together in a super continent named Pangaea (meaning "all earth") and that at some point the continents had broken apart and were still moving. He had a lot of evidence to prove this. He first observed by looking at a map that many of the continents' coastlines seemed to fit together much like a jigsaw puzzle. The eastern coastline of South America and the western coastline of Africa looked like they fit exactly together! This observation led Wegener to take a closer look. He began to travel to the different continents and collect rock samples from different mountain ranges. He studied the rock samples and discovered that the rock samples from different mountain ranges were not only the same age but were also made of the same stuff. He concluded from this investigation that mountain ranges on different continents had once been joined together. Wegener also observed that fossils from the same species of plants and animals were found on different continents. The ancient fern, which grew only in tropical climates, was found on the cold continent of Antarctica. Wegener explained this by hypothesizing that Antarctica had once been located near the equator, where the weather is known to be warm and tropical. From his findings Wegener developed the theory of continental drift, which said that the continents are drifting and had once been one big piece of land. Other people didn't believe his idea because there wasn't enough important evidence to explain how the continents could move.

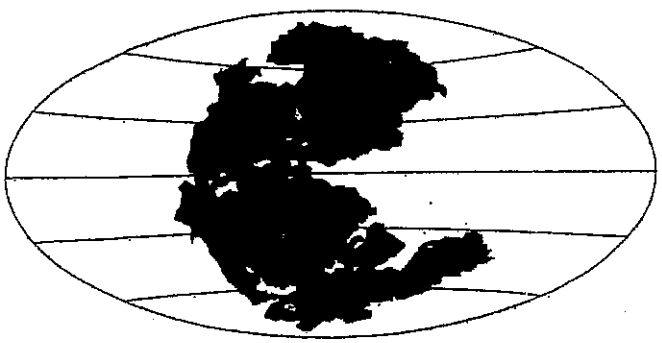
When World War I was happening, soldiers found a crack in the middle of the Atlantic Ocean where magma was seen coming up and forming new crust and underwater mountain ranges. Sonar provided a new toll through which scientists could finally map the topography of the ocean floor. Rock samples were taken from this area, and it was discovered that they were much younger than rocks found on the continents. This new discovery left scientists puzzled until the 1960s, when a scientist named Harry Hess proposed the theory of sea-floor spreading. His theory said that the mid-ocean ridge was a huge crack in the earth's crust where the hot molten mantle was pushed upward, forcing the pieces of crust along the crack to move away from one another, making new crust and expanding the ocean floor. If the ocean floor was getting bigger, why wasn't the earth getting larger? Hess said that there were other areas of the earth where crust was being swallowed in a continuous recycling process. From his ideas and Wegener's ideas, a new theory was born – the theory of plate tectonics.

The theory of plate tectonics says that the earth is divided into pieces or plates that move as a result of convection in the asthenosphere, which is located directly under the solid crust. The asthenosphere flows because it sometimes acts like a solid and sometimes like a liquid. The theory also says that the plates are moving in different directions at different rates which create different geologic features like mountains and volcanoes.

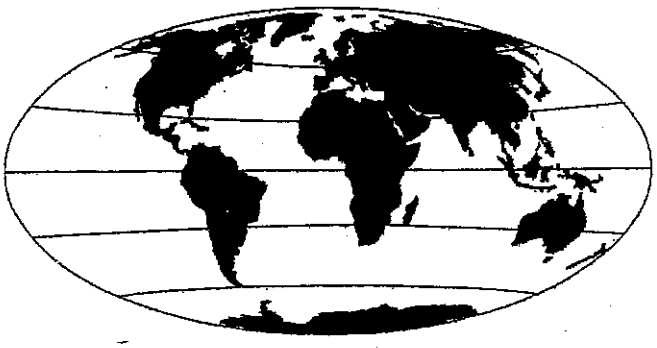
So how do the plates move and what do they create? Imagine a jigsaw puzzle that has been put together. If you try to move those pieces, you would observe that several things might move. In some areas the puzzle would pull apart while in other areas the puzzle would rise up. The same thing happens to the earth's plates along the edges or boundaries where the different plates meet. There are two types of lithospheric plates: continental plates and oceanic plates. Continental plates contain mostly land and are less dense. Oceanic plates contain little or no land and are denser. The table below shows the type of plate, type of boundary, type of movement, and the geologic features they create upon the earth's surface.

Type of Plate	Type of Boundary	Type of Movement	Geologic Feature
Oceanic-Oceanic	Divergent	Plates are dividing.	Mid-ocean ridges and new crust
Continental-Continental	Divergent	Plates are dividing.	A rift valley is formed which over time may turn into a sea
Continental or Oceanic	Transform	Plates are sliding past one another.	Cracks in the earth's crust known as faults
Continental-Continental	Convergent	Plates are colliding.	Tall mountain ranges and a joining of continental crust
Continental-Oceanic	Convergent	Plates are colliding, and the less dense continental plate is pushed under the oceanic plate.	Volcanic mountain ranges and a melting of part of the continental plate
Oceanic-Oceanic	Convergent	Plates are colliding, and one is pushed under the other one.	Deep sea trenches and volcanic islands or island arcs

As you can see from the above table, the earth is a changing place. Through observations and improved technology, we now know that the earth's lithosphere, or crust, divided into plates that are moving because of a convection current in the upper part of the mantle. The interaction between the plates creates many different geologic features that provide evidence that the continents are on the move.



225 Million Years Ago



Present