Our Ever-Changing World: The Theory of Plate Tectonics

When looking at a map, the continents look stationary and stalwart. The theory of plate tectonics however, shows our planet is dynamic and ever-changing.

PRACTICAL SCIENCE WITH PHIL FREDA

Just as the theory of evolution signifies the world of biology, the theory of plate tectonics has molded and shaped our understanding of geology.

Geology, according to geology.com, is the study of the Earth, the materials that make it, the structure of these materials, and the processes that act upon them.

A geologist may study floods, earthquakes, volcanic eruptions, and rock layers of the Earth.

What is underlying all of these fields of study though, is the dynamics of a global system known as plate tectonics.

One of the most famous advocates for the theory of plate tectonics was German scientist, geophysicist and meteorologist named Alfred Wagner. (Wikipedia)

He hypothesized that the continents of the Earth were slowly moving about the globe but could not come up with a defined mechanism of how it worked.

Wagner died in 1930 and his hypothesis of what he called "continental drift" seemed to die with him.

According to the Center for Educational Technologies' Classroom of the Future (COTF) Website, the theory of plate tectonics was formulated in the 1960's and 1970's as information from the Earth's ocean floor, magnetic sphere, volcanoes, earthquakes and geothermal heat was obtained.

Also, fossil evidence helped solidify the theory of plate tectonics as fossils of a certain species are seen in two distant parts of the globe, or the fact that marine fossils are found in areas that are nowhere near a body of water.

Wagner's work was thankfully not in vain as new scientific approaches and technologies made it feasible to test his hypothesis.

According to COTF, the theory states that the Earth's outermost later, known as the lithosphere, is broken up into seven large plates: the African, North American, South American, Eurasian, Australian, Antarctic, and the Pacific.

There are also several minor plates as well, including the Arabian, Nazca, and Philippines.

These plates "float" on the asthenosphere, which is an elastic like solid, at a very slow rate of anywhere between an inch to four inches a year.

This may seem very slow, but remember that the Earth is about 4.5 billion years old.

The Earth would have looked very different to the dinosaurs!

Think of the plates as puzzle pieces floating in a bowl of water.

The water would be the asthenosphere. Underneath the Earth that we stand on, there is a massive ocean of molten rock and magma.

Because of activity of the plates constantly bumping into one another, we experience phenomena like earthquakes and volcanoes.

Continental plates can come into contact with one another and the place where they come into contact are called plate boundaries.

Convergent Boundaries

Convergent boundaries are a place where two plates come crashing together.

Since plates move so slowly, these collisions can take millions of years to fully occur.

As one plate collides with other, it is bent downward and subducted underneath.

This causes the other plate to be pushed upward creating everything from mountain ranges and volcanoes to new islands.

In fact, the Rocky Mountains, the Alps, and the Himalayas are all products of convergent boundaries.

On the down side however, convergent boundaries are also notorious for forming massive earthquakes as the extreme friction of the two massive plates coming together actually sends out shockwaves we feel as earthquakes or tsunamis.

In addition, the melting of the subducted plate causes the possibility of forming new active volcanoes.

Divergent Boundaries

This is the exact opposite of convergent boundaries.

These boundaries mark an area where two plates are drifting apart from one another.

The pulling apart of two plates causes the area in the middle to sink into the magma below, causing a rift.

Magma seeps upward to fill the crack just as blood would do for a cut in you skin. As the magma cools and solidifies, just as a scab would on a wound, new crust is formed.

If one of these boundaries happen on land we get results like the East Africa rift in Kenya and Ethiopia or the Rio Grande rift in New Mexico.

If a divergent boundary happens underwater, we get things like the Mid-Atlantic ridge and the East Pacific Rise.

Transform Boundaries

Transform Boundaries are a place where two plates rub against each other, causing friction.

Since the two boundaries are just sliding against one another, no spectacular features are usually formed except fault lines.

The most famous transform boundary is the San Andreas fault in California.

The Part of California to the west of the fault line is moving north as the rest of California is moving south.

Los Angeles, which is on one the plate that is moving north, moves northward, towards San Francisco, at a rate of about two and a half inches per year.

According to COTF, in about 10 million years, the cities of Los Angeles and San Francisco will be side by side!

Unfortunately, the sliding motion of the plates in transforming boundaries cause a lot of earthquakes, as the residents of California are most certainly aware of.

What did the Earth look like long ago?

It is kind of hard to imagine exactly what the Earth looked like in the past but scientists theorize that the Earth was made up a a very large single land mass about 250-million years ago called Pangaea.

Over the last 250-million years the continents drifted apart it to what we see in the present day.

Evidence of this can be seen the eastern coast of South America and the eastern coast of Africa.

If you use your imagination, you can see these two landmasses fitting together like a giant puzzle.

Give it a try!

I can imagine that plate tectonics may seem irrelevant because of how long it takes for changes to occur, but one has to realize that the beauty of mountain ranges, the formation of oceans, and the complexity of ecosystems owe their foundations to plate tectonics.

Think about it!