**Wegener’s Theory of Plate Tectoni** **cs**

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[www.docstoc.com](http://www.docstoc.com/docs/119874651/geography-plate-tectonics-earthquakes-volcanoes)

**Introduction Page**



 Hello reader, welcome to the Theory of Plate Tectonics virtual booklet. In this virtual booklet, you will be learning about the ins-and-outs of the Theory of Plate Tectonics. Additionally, you will also learn about the processes that occur in the concept of tectonics and how all of the activity that results from the motion of tectonic plates can be related to each other. Subduction zones, convergent boundaries, rift valleys, sea-floor spreading, divergent boundaries, transform boundaries, volcanoes, earthquakes, hotspots, island chains, and mantle plumes are all topics related to Plate Tectonics and are covered in this booklet.

The Theory of Plate Tectonics was first introduced by the geophysicist Alfred Wegener in 1912. He had proposed that all of the Earth’s continents were once one supercontinent named “Pangea.” At first, his ideas were bluntly rejected by the vast majority of other geophysicists and scientists at the time. Wegener had little proof to prove that his ideas were valid, however that changed over time. Gradually, more and more data was collected to prove his theory. Then during the 1960s Wegener’s idea finally was the commonly accepted theory for the reasoning behind the location of the tectonic plates today. This theory is also commonly accepted to explain why there are earthquakes, how and why plates will subduct, converge, or diverge, and finally how the shifting of plates affects the environment around them.

[commons.wikimedia.org](http://commons.wikimedia.org/wiki/File%3AAlfred_Wegener_1910.jpg)

Alfred Wegener, the proposer of the Theory of Plate Tectonics was born Nov. 8, 1880, and died on Nov. 2, 1930.

[thecontrariancorner.com](http://thecontrariancorner.com/?p=7830)

According to Wegener’s theory, the Earth’s crust is actually divided up into plates known as tectonic plates that shift along the surface of the Earth.



[science.nasa.gov](http://science.nasa.gov/science-news/science-at-nasa/2000/ast06oct_1/)

This is Pangea, as described in Wegener’s Theory of Plate Tectonics.

**The Theory of Plate Tectonics**

**Definition of “Tectonic”**

The word “tectonic” means relating to the composition of the crust of the Earth. “Tectonic plates” are the plates lining the Earth’s surface that make up the crust. Research conducted based upon Wegener’s theory reveals that there are fifteen tectonic plates that can be found along the crust of the Earth, and these plates are not immobile. Though the plates do move, they do so very slowly. In fact, each tectonic plate moves at about a rate of only one yard per century. Each plate would have averaged about fifty miles in thickness.

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The fifteen tectonic plates are the following: Pacific, Juan de Fuca, North American, Cocos, Nazca, Caribbean, Antarctic, Scotia, South American, African, Eurasian, Arabian, Indian, Australian, and Philippine Plates.

**Theory of Plate Tectonics vs. Contracting Earth Theory**

Wegener’s Theory of Plate Tectonics explains that the supercontinent named “Pangea,” which was mentioned earlier, broke up in to seven separate pieces, and that each piece is one of the seven modern day continents. As each continent moves, the area of each ocean shifts, explaining the reason for the locations of the oceans. Therefore Wegener’s theory explains that the Earth is “dynamic,” or “active.” The plates of the Earth are always shifting and will

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When plates collide with each other, the great amount of pressure would force the crust upwards, resulting in a mountain range.

never stand still. The fifteen tectonic plates described in his theory will

converge, diverge, or subduct with one another as they shift along the Earth. These processes will be explained in greater detail later in this booklet.

Wegener had proposed his idea when there was already a commonly accepted theory to explain the fundaments of the Earth. This was the Contracting Earth Theory. The “Contracting Earth” Theory explains that the Earth was once one a massive molten blob of lava. As time passed, the Earth cooled, and in the

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Plate Tectonics also explains the location of the Earth’s seas and oceans because the movements of the plates either increases or decreases the area size of certain bodies of water.

process of doing so the Earth shrank. The pressure from the

shrinking land would force extra lava out from volcanoes, and the

pressure would also form various different kinds of land features.



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Wegener’s Theory of Plate Tectonics was vastly different from the Contracting Earth Theory.

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James Dwight Dana had proposed the Contracting Earth Theory.

**Subduction Zones/Convergent Boundaries**

**Subduction** **Zones & Tectonic Plates**

A subduction zone is a trench as much as 70 miles wide that is formed when two plates collide with each other. The younger of the two tectonic plates will go over the older plate because the younger plate would have a lesser density than the older plate. The older tectonic plate will dive steeply down (subduct) under the other as a result of being denser than the younger one. Continental plates that collide at subduction zones come together to form geologic features such as mountain ranges. Volcanoes can also sometimes be found near a subduction zone. The activity at subduction zones may result in an earthquake or tsunami.

sio.ucsd.edu

As the Cocos Plate comes into contact with the Caribbean Plate, the Cocos subducts while the Caribbean overrides as a result of the Cocos having a greater density than the Caribbean Plate.

**Plate** **Boundaries**

A tectonic boundary is a boundary that is between multiple tectonic plates. More specifically, a convergent boundary is a boundary where plates collide and form a subduction zone. In order for this to happen, however, at least one of the converging plates must been an oceanic plate. The plates that converge may become locked, and the intense pressure that builds up causes a fracture of the

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Converging plates make subduction zones.

rocks, which allows the overlying plate to slip over the one that is sinking all along the fault line. When the rocks fracture, a megathrust earthquake may occur if the fracture was on the fault line, and the plate activity may also trigger a tsunami.

 Besides the convergent boundaries, there are also two other types of tectonic plate boundaries. There are divergent and transform boundaries as well, where plates move and behave differently. These two different kinds of tectonic plate boundaries will be described in greater detail within the next two pages of information.

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Depicted are plates that will transform, diverge, or converge at their given plate boundaries.

**Rift Valleys/Sea-Floor Spreading/Divergent Boundaries**

**Rift Valleys & Divergent** **Boundaries**

At divergent boundaries, two tectonic plates have split apart from each other, known as divergence. As these plates diverge, a linear formation is made, and a gap called a rift is created. As the gap widens even more and eventually stops, the rift is now considered a rift valley. If this process was to occur in the middle of oceanic plates, mid-ocean ridges are created. In addition, if there is a volcano nearby the rift valley, the lava from that volcano may be able to fill in the valley. Rift valleys are usually at the bottom of the ocean because that is where oceanic crust will split.

ajs-geo-blogspot.com

As these two plates diverged, a rift valley formed. Magma is trying the reach up and fill up the bottom of the valley.

**Sea**-**Floor** **Spreading**

In sea-floor spreading, two plates split apart (diverge), and in the process of doing so the plates extend the ocean floor. Along the plate boundary, earthquakes occur and make cracks on the surface. Magma from within the earth rises up in order to fill in the cracks on the ocean floor. Upon contact with the water, the magma cools and solidifies, and this solidified magma adds to the sides of the moving plates. When the cracks of the oceanic crust are filled up and piled by the magma, eventually mountains form in a long chain along the ocean floor. This long chain of islands is known as a mid-ocean ridge.

www.platetectonics.com

The Mid-Atlantic Ridge is a great example of a mid-oceanic ridge, in between the North American and Eurasian Plates.

The boundaries at which plates diverge

are considered to be the areas at which new crust is

created and then added on to the floor of the ocean. Over time, the newly added crust increases the size of the oceanic plates, thus extending the ocean floor. While these extending oceanic plates get larger, the other plates that are being pushed against shrink, because they melt as they subduct underneath the crust of the Earth.

en.wikipedia.org

The spread of the ocean floor caused these two masses of land to separate.

www.pmel.noaa.gov

As the ocean floor extends, it forces other plates to subduct underneath the Earth’s crust.

**Transform Boundaries**

Transform boundaries are formed when tectonic plates slide past each other, instead of when plates diverge, converge, or subduct with one another. Because of the unique characteristics of transform boundaries, the geography of the surrounding land of the boundaries is affected in intriguing ways. Crust is neither formed nor destroyed, since plates are only sliding past each other at transform boundaries. When plates that form a transform boundary create an earthquake, this happens because since the plates have rough and uneven edges, the motions of them sliding past each other causes their rough edges lock together and pressure builds up, suddenly causing one of the plates to move.

www.gweaver.net

This image shows the sideways movements of tectonic plates at transform boundaries.

**Features Found at Transform Boundaries**

Even though transform boundaries can trigger massive earthquakes, the boundaries are not clearly defined by outstanding surface features. In fact, parts of a transform boundary can remain hidden from sight for hundreds of miles. However, there are a few indicating features of transform boundaries. Some of the areas around these boundaries are marked by a linear valley found where rock has been grinded when the tectonic plates slid past each other. Another indicator of a transform boundary in other areas include features such as steam beds that have been split in two, and the two parts have

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The San Andreas Fault is an example of a transform boundary.

traveled in opposite directions. If you were look at the side of a plate at a transform boundary, you would see that the edges of the plate are very uneven and rough. This, as explained previously in the above paragraph, is a part of the reason why the sliding movements of plates at these boundaries cause earthquakes.



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Fracture zones are a surface feature that may indicate certain parts of a transform boundary.