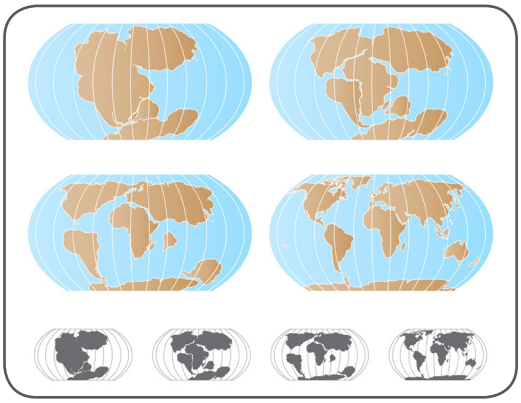
Getting to Know: Development of Plate Tectonic Theory

On a map of Earth, you may have noticed that the continents almost look like puzzle pieces. The coastlines of South America and Africa, for example, can be positioned in such a way that they match up perfectly.

Scientists have noted this pattern for hundreds of years. However, they could not come up with a satisfying theory to explain their observations. Then, approximately 100 years ago, a scientist named Alfred Wegener began to develop a theory that explained why the continents fit together, and he ultimately helped to reshape how we see the Earth's geology.



Scientists believe the continents were all connected once but have drifted apart.

What is the basic premise of plate tectonic theory?

Plate tectonic theory states that the Earth's crust is divided into several plates. These plates glide on the slowly moving rock of Earth's mantle. The constant movement of the plates is responsible for geological events such as volcanic activity, earthquakes, and continental drift.

Misconception 1: ***I thought that the continents were always the same shape and in the same place. Are you saying that isn't true?***

That is not true. Multiple lines of evidence from geology and paleontology show that the continents have changed shape and position many times in Earth's history. Although the continents move very slowly, they can move thousands of kilometers over millions of years.

How did the theory of plate tectonics originate?

The theory of plate tectonics evolved out of the theory of continental drift. German scientist Alfred Wegener originally proposed this theory. Wegener observed that many coastlines on opposite sides of the ocean appeared to match up like puzzle pieces. He also noticed that matching fossils could be found on different continents. He formed the *theory of continental drift* based on this evidence. His theory states that the continents used to be one supercontinent called "Pangaea." Over millions of years, the continents broke up and moved to their current positions.

Misconception 2: ***Are plate tectonics and continental drift the same?***

Plate tectonics and continental drift are not the same. Continental drift was an earlier theory that does not explain how and why the continents moved. The theory of plate tectonics was developed later and explains how and why continents move.

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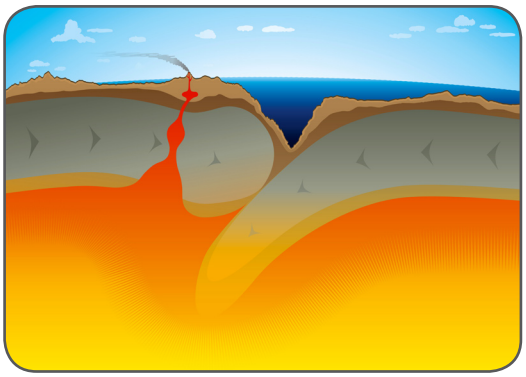
Unfortunately, Wegener's theory was largely ignored because it did not explain how or why continents moved. It was not until seafloor spreading was discovered that his theory was validated.

How did the discovery of seafloor spreading validate the theory of continental drift?

In the mid-1900s, scientists discovered that the rock near oceanic mountain ridges was much younger than the rock further away. They also realized that ridges were volcanic and were constantly forming new rock. This showed that the seafloor was actually spreading away from the ridges.

It was also discovered that rock on the ocean floor was "subducted" in certain places. In these areas the rock would melt and disappear back into Earth's mantle. This resulted in a lot of volcanic activity and frequent earthquakes.



In subduction zones, one plate moves under another plate, and parts of the subducted crust melt.

These two discoveries led to the realization that the Earth's crust is made of *tectonic plates*. These plates are constantly moving over, against, or past one another. Tectonic plate movement causes volcanic activity, earthquakes, and mountain formation. Because the continents are part of tectonic plates, tectonic plate movement also explains the movement of the continents. These new discoveries, combined with Wegener's earlier theory of continental drift, became known as the *theory of plate tectonics*.

Misconception 3: ***The theory of plate tectonics is still just a theory. Doesn't that mean that it might not be true?***

Scientific theories are not the same as the "theories" we think about in everyday life. Theories are not guesses; they are supported by a large body of evidence and explain fundamental processes in the world. For example, consider the theory of gravity. This theory is not a guess; it is supported by a vast number of observations, and it explains and predicts how the force of gravity affects matter in nearly every context. Likewise, the theory of plate tectonics explains and predicts fundamental processes in the world and is supported by an enormous amount of evidence.

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