

Plate Tectonics

The Continental Drift Hypothesis

.....**Read to Learn**.....

Pangaea

Nearly 100 years ago, a scientist named Alfred Wegener (VAY guh nuhr) began an investigation. He wanted to know if Earth's continents had always been in the same place, or if they had moved. Wegener proposed that *all the continents were once part of a supercontinent called **Pangaea*** (pan JEE uh). Over time, Pangaea broke apart, and the continents slowly drifted to their present locations. Wegener proposed the hypothesis of continental drift. *The **continental drift hypothesis** suggested that continents are in constant motion on the surface of Earth.*

Wegener looked at the coastlines of continents that are now separated by oceans. He saw similarities in their shapes. For instance, Africa and South America seemed to fit together like the pieces of a puzzle, as shown below.



Evidence That Continents Move

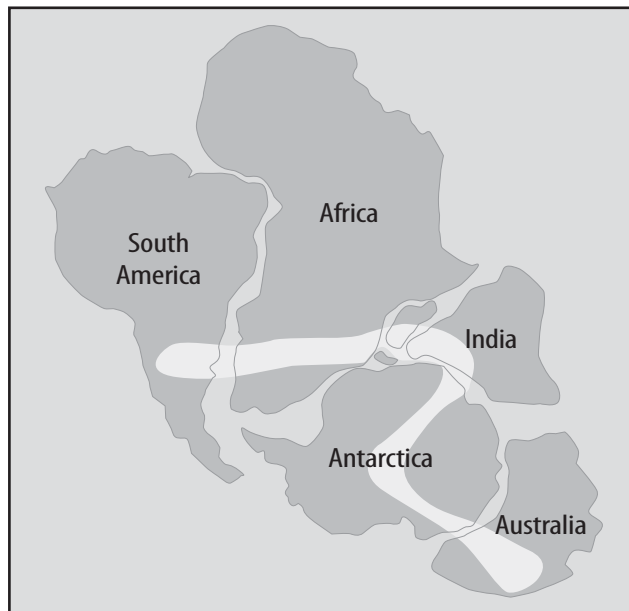
Wegener knew that he needed evidence to support his hypothesis of continental drift. The most obvious evidence was how the continents fit together like pieces of a puzzle. But other scientists were doubtful of his hypothesis. Wegener needed more evidence.

Fossil Clues

There are many animals and plants that live only on one continent. For example, lions live in Africa but not in South America. Because oceans separate the continents, animals cannot travel from one continent to another by natural means. However, fossils of similar organisms have been discovered on several continents that are now separated by oceans.

Fossils of a plant called *Glossopteris* (glahs AHP tur us) have been discovered in rocks from South America, Africa, India, Antarctica, and Australia. Today these continents are far apart and separated by oceans. The plant's seeds could not have traveled across the oceans.

The figure below shows how some of the continents were joined as part of Pangaea 250 million years ago. The lighter area on the map shows where *Glossopteris* fossils have been found. Notice that the plant once grew in parts of five continents—South America, Africa, India, Antarctica, and Australia. Because these plants grew in a swampy environment, this region, including Antarctica, was different from how it is today. Most of Antarctica is covered in ice sheets. No swampy environments are found there now.

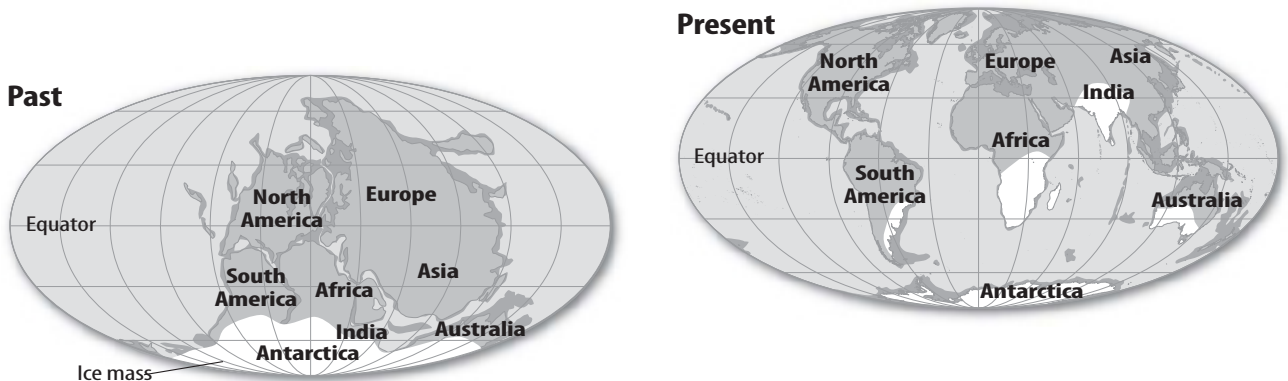


Climate Clues

Other fossil evidence supported continental drift. Coal beds are in Antarctica, a polar climate today. Yet coal formed from fossilized plants that lived long ago in warm, wet climates. This meant that Antarctica must have been warmer and wetter when these plants were alive. Is it possible that Antarctica was at one time closer to the equator? Did Antarctica move to a colder climate near the South Pole?

Another climate clue used by Wegener to support continental drift came from glaciers. When Wegener pieced Pangaea together, he proposed that South America, Africa, India, and Australia were located closer to the South Pole 250 million years ago. He suggested that a large ice sheet covered much of the continents, as shown below. When the ice sheet melted as Pangaea spread apart, it left rock and sediment behind. Wegener studied the similarities of these sediments.

Wegener also studied glacial grooves. Glacial grooves are deep scratches in rocks made as ice sheets move across the land. Wegener found glacial grooves on many different continents. By studying these grooves, he was able to determine the direction that the ice sheet moved across the joined continents.

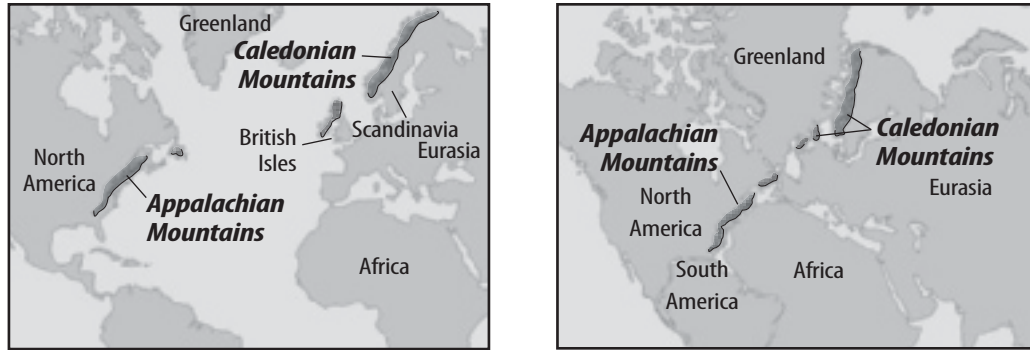


Rock Clues

Some of the evidence used by Wegener to support his idea of continental drift came from rock formations on different continents. The rock formations and mountain ranges seemed to have formed in the same way at the same time. Today geologists know that there were large-scale volcanic eruptions on the western coast of Africa and on the eastern coast of South America hundreds of millions of years ago. Geologists have studied rocks from these eruptions. They found that the volcanic rocks from both continents were identical in chemistry and age.

Mountain Chains More evidence came from the rocks that make up two mountain chains in Europe and North America. Locate the Caledonian mountain range and the Appalachian Mountains in the figure below on the left. The Caledonian mountain range is in northern Europe, and the Appalachian Mountains are in eastern North America.

Mountain Ranges



Rock Types Rocks in these two mountain chains are similar in age and structure. Both are also composed of the same rock types. If you could place North America and Europe next to each other, these mountain chains would meet. They would form one long, continuous mountain belt, shown in the figure above on the right.

What was missing?

Wegener supported his continental drift hypothesis until his death in 1930. Wegener's ideas were not widely accepted until nearly 40 years later. Why were scientists skeptical of Wegener's hypothesis?

Continental drift is a slow process. Wegener could not measure how fast the continents moved. Wegener also could not explain what forces caused the continents to move. The mantle under the continents and seafloor was made of solid rock. How could continents push their way through solid rock? Wegener needed more scientific evidence to prove his hypothesis.

The evidence for drifting continents was hidden on the seafloor. During Wegener's lifetime, scientists did not have the tools to determine what happened beneath the oceans. Wegener also could not have known what the seafloor looked like. The evidence needed to prove continental drift was not discovered until long after Wegener's death.