

# [Free report on principles of plate tectonics](https://assignbuster.com/free-report-on-principles-of-plate-tectonics/)

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## The theory of plate tectonics describes the wide­scale movements of the lithosphere of

the earth. The model is based on the ideas of continental drift, which first gained acceptance in
the early 1900s. The geoscientific community granted the theory even more validity after the
notion of seafloor spreading appeared in the late 1950s. Basically, the lithosphere is not whole
but instead is separated into either seven or eight major plates, depending on the definition that
you use. Every meeting point between plates has its own relative movement, either transform,
convergent or divergent. Volcanic activity, mountain creation and earthquakes all occur along
these edges, and the plates move laterally relative to one another between zero and 100
millimeters annually (Read and Watson).

## Tectonic plates have the ability to move because the lithosphere is stronger than the

underlying asthenosphere. Variations in mantle density lead to convection, and when the plates
move, it is the result of seafloor movement away from the edge, leading to alterations in
gravitational forces, and a downward suction at the subduction zones. The forces that the
earth’s rotation, in combination with the solar and lunar tidal forces, also have an effect on the
movement of the plates. However, researchers still debate the relative significance of each
factor.

## Scientists did not always accept the reality of continental drift. As late as the ealry 1900s,

geologists made the assumption that the major features of the earth were fixed, and that the
majority of geological features like mountain ranges or basin development were attributed to
vertical movement in the crust. The explanation for this was a contracting planet losing heat over

## As early as 1596, researchers observed that the opposing coasts of the Atlantic Ocean

have shapes that look as though they fit together at one point (Kious and Tilling). Many theories
came out to explain that oddity, but the overweening assumption of a solid, stable crust made it
difficult to absorb these proposals. However, the discovery of the heating properties of
radioactivity in 1895 prompted a new examination of the age of the planet. In previous estimates,
the cooling rate had been set for the radiation of a black body, or an ideal physical body that
absorbs all electromagnetic radiation, no matter the angle of incidence or frequency. Knowing
that the radioactivity could well have provided a new source of heat, the planet could be much
older than a few million years, and the core might still be hot enough to have remained liquid.

## In 1912, Alfred Wegener presented a theory of continental drift to the German Geological

Society on the basis of the research of several theorists in the 1800s as well as his own work.
Eduard Suess had posited the existence of the supercontinent Gondwana in 1858, and Roberto
Mantovani had proposed the joining of all of the continents into Pangaea in 1889. Both of these
earlier researchers suggested that thermal expansion had led to volcanic activity that broke the
continent apart, and the continents had drifted apart through further growth of the rip­zones,
which is where the major oceans now lie. This inspired Mantovani to suggest the Expanding

## Earth theory which later was seen to be flawed (Scalera and Lavecchia). Frank Bursley Taylor

suggested in 1908 that the continents were pulled toward the equator by an increase in lunar
gravity during the Cretaceous, making the Alps and Himalayas form. Wegener, though, was the
first to formally publish the assertion that the continents had drifted away from one another.

## However, the fact that he was unable to explain the physical forces causing the drift left his

theory still wanting.

## Today, evidence for continental movements on tectonic plates is widespread. Similar

animal and plant fossils appear around different continental shores, implying that they once
shared a connection. For example, the Mesosaurus, a freshwater reptile, appears in fossil form
on both the coasts of Brazil and South Africa. The Lystrosaurus, a land reptile, appears in fossil
form in rocks in Antarctica, Africa and South America, all from about the same time frame. Some
earthworm families still appear in both Africa and South America.

## Another piece of evidence of continental drift is the obvious similarity between the facing

sides of Africa and South America. However, those shapes will not always stay complementary.

## The processes of ridge­push and slab pull are just two physical forces that will continue to push

those continents apart, rotating them away from one another.

## The widespread incidence of permo­carboniferous glacial sediments in Arabia,

Madagascar, Africa, South America, Antarctica, Australia and India was one of the most
significant pieces of evidence for the larger theory of continental drift. The continuous nature of
glaciers, inferred from tillite deposits and glacial striations, suggested that Gondwana had
actually once been a supercontinent. The striations implied a glacial flow toward the poles from
the equator, at least in terms of modern cartography, supporting the idea that the planet’s
southern continents had once been in very different places and contiguous with one another
(Wegener).

## However, the fact that Wegener was not even a geologist, along with the fact that he was

missing a driving force to explain the movement, meant that continental drift was still a long way
had shown that the floating masses sitting on a rotating planet would gather at the equator.

## Second, masses floating within a fluid substratum, such as icebergs, should have a balance

between the forces of gravity and buoyancy, which was not the case throughout the planet.

## Finally, some of the planet’s crust had hardened while others were still fluid, and the whole

surface should have solidified. Because these conditions meant that the contemporary
assumptions about continental drift had failed, researchers still refused to accept the theory until
geophysicist Jack Oliver provided the first convincing seismologic evidence of tectonics that
contained and recast the theory.

## Beginning in 1965, a series of scientific breakthroughs established plate tectonics as the

most viable way to explain the movement of the continents. In 1965, Tuzo Wilson added the
notion of the transform faults to the model. This explained the operation of faults in such a way
as to make plate movement logical. That same year, the Royal Society of London held a
continental drift symposium which officially began the acceptance of the theory within the
scientific community. One of the presentations at the symposium covered the calculations that
show how the continents on the edges of the Atlantic Ocean would fit to bring the ocean to a
close. The next year, Wilson published a paper referring to previous plate tectonic structures,
introducing what researchers would call the Wilson Cycle. In 1967, rival proposals were
published suggesting the existence of six and 12 plates, respectively.

## Currently, geologists know that two types of crust exist, continental and oceanic

crust. The continental variety is lighter by nature and has a different composition, but both types
rest above a “ plastic” mantle with much greater depth. At the spreading centers, oceanic crust
appears, and this process, coinciding with subduction, causes chaos in the plate system,
leading to places with isostatic imbalance. The theory of plate tectonics is currently the best
explanation that exists for the drift of the continents.

## Scientists now believe that tectonic motion first ensued about three billion years ago

(Zhao). To gauge the movements of the continents, researchers use different types of
quantitative and semi­quantitative information. Magnetic stripe patterns show relative plate
movements going all the way back into the Jurassic period. The tracks of hotspots provide more
absolute data, but they only go back to the Cretaceous period. Older proposals rely on
paleomagnetic pole data, but the fact that these only constrain latitude and rotation means that
these constructions are not far wrong. Researchers combine poles with different ages within a
particular plate to generate polar wandering paths to compare movement of different plates over
time. The distribution of various types of sedimentary rock, fossil evidence of faunal habitation
and the positioning of orogenic belts takes the case for tectonic movement even further.

## Current theory suggests that the supercontinent Columbia or Nuna formed about 2 billion

years ago, breaking up about 500 million years later (Zhao). About a billion years ago, rodinia is
suggested to have formed, containing most of the planet’s land, breaking into eight continents
about 600 million years ago. They reassembled into Pangaea but then broke into Laurasia, which
became Eurasia and North America, and Gondwana, which turned into the other continents.

## When two major plates collided, the Himalayas are assumed to have appeared. Before that, they

sat under the Tethys Ocean. Today, satellites and ground stations keep an eye on plate
movements, with an eye toward predicting coming earthquakes and other disruptions.

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