The Theory of Plate Tectonics

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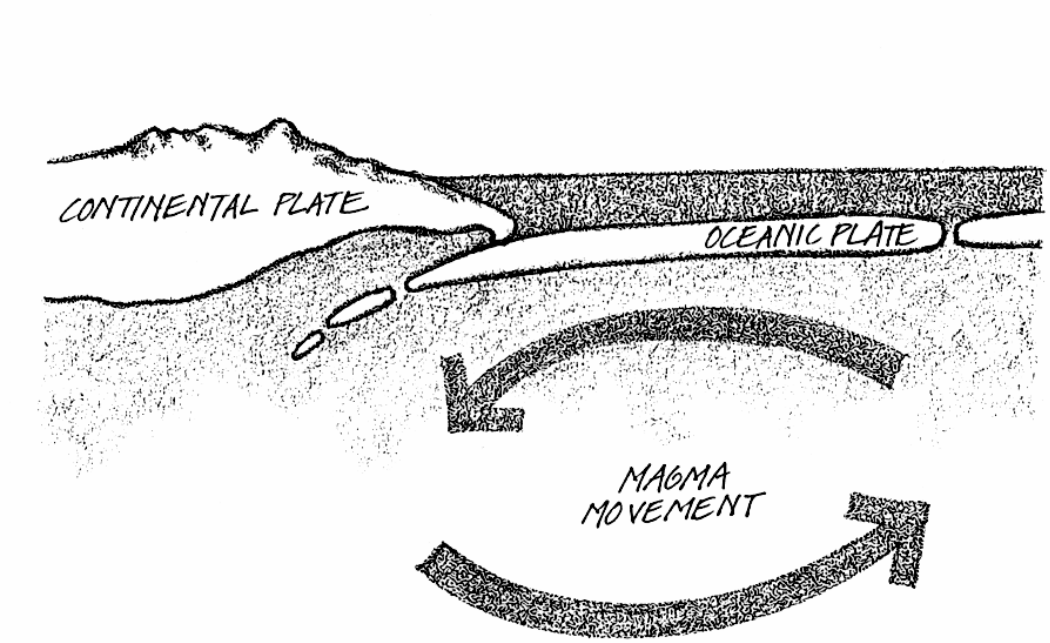

Plate tectonics, possibly the most important geological theory ever developed, incorporated the earlier theory of continental drift, espoused by German meteorologist and lecturer Alfred Wegener in the early 20th century. Although the scientific community of the time ridiculed Wegener and flatly rejected his theory, current-day geologists, geophysicists, and oceanographers live by much of what he had to say about our planet.

The word tectonics derives from the Greek tektonikos, meaning "pertaining to construction."

Dr. Robert D. Ballard, associate scientist at Woods Hole Oceanographic Institution, wrote in Exploring Our Living Planet in 1983: "Plate tectonics not only vindicated Wegener, it transformed geology as profoundly as the theories of evolution and relativity transformed biology and physics."

The word tectonics derives from the Greek tektonikos, meaning "pertaining to construction." In geology, tectonics concerns the formation and structure of the earth's crust.

The theory of plate tectonics--formulated by American, Canadian, and British geophysicists--attributes earthquakes, volcanoes, the mountain-building process, and related geophysical phenomena to movement and interaction of the rigid plates forming the earth's crust.

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According to the theory, the earth's surface layer, or lithosphere, consists of seven large and 18 smaller plates that move and interact in various ways. Along their boundaries, they converge, diverge, and slip past one another, creating the earth's seismic and volcanic activities. These plates lie atop a layer of partly molten rock called the asthenosphere. The plates can carry both continents and oceans, or exclusively one or the other. The Pacific Plate, for example, is entirely oceanic.

Continental plates are composed mainly of granite, while oceanic plates are mostly basalt, which is considerably heavier. Essentially, the continents are lighter and more buoyant; hence, they float higher on the earth's mantle than the ocean's crust does.

When plates converge, one slips under the other and is said to be subducted. At depths from 185 to 435 miles beneath the earth's surface, the subducted parts of the plate melt and become part of the molten mantle. As new plate material is being formed continuously, and the excess is melted into magma, the earth's rocky crust is constantly recycled.

If both converging plates have oceanic edges, either one might slip beneath the other. But when a plate carrying a continent converges on an oceanic plate, the more buoyant continental plate always slides over the heavier basaltic oceanic plate.

When two continental plates converge, however, neither can subduct. Instead, the two interact to create mountain ranges.
Consequently, all subducted plates are oceanic, which keeps the ocean floor in a constant state of change; whereas, the continents change ever so slowly in geologic time.

After Wegener's death in 1930, geological research and technology progressed rapidly, and new discoveries lent credence to much of what his theory of continental drift embodied. Further research and findings over the past 40 years advanced the theory of plate tectonics and allowed scientists to unlock some of the mysteries enshrouding the formation of continents and oceans.

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