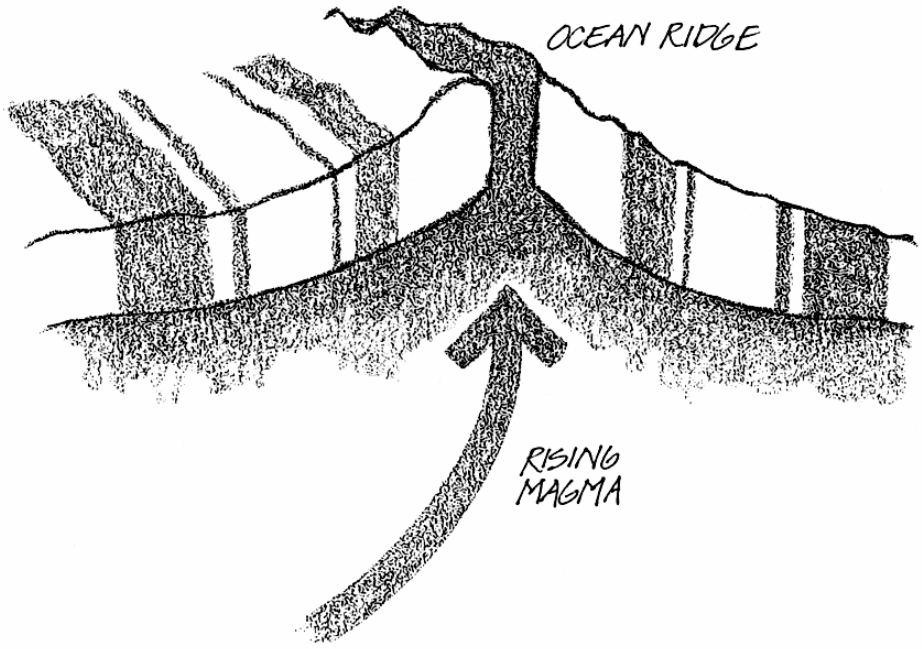
Plate Tectonics at Work

by Kenn Oberrecht



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Imagine the earth's surface as a mosaic of tiles--irregular in shape and size--set in a mortar that remains hot and soft, allowing the tiles to move toward and away from one another. This is a simplification of the notion with which scientists were coming to grips during the 1950s and 1960s, as they were formulating the theory of plate tectonics.

New technology and discoveries following World War II posed some questions that caused geologists and geophysicists to begin rethinking the whole concept of moveable continents. During this time, scientists discovered the earth's largest geological feature: the Mid-Ocean Ridge, a continuous range of volcanic mountains uplifting from the ocean floor to a height of 12,000 feet. The 1,200-mile-wide range extends 46,000 miles through the world's oceans.

Harry H. Hess, a Princeton geologist, theorized in 1960 that the ocean floor itself moves, and he offered persuasive arguments to support his theory of seafloor spreading. He and other scientists, with the aid of oil-exploration equipment aboard the research vessel Glomar Challenger, found that the sea floor did indeed spread outward from mid-ocean ridges and took the continents with it.

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The 1953 invention by British physicist P.M.S. Blackett of the astatic magnetometer enabled scientists to detect even the weakest magnetic fields in rocks--a great aid in determining geologic age, which unlocked many of earth's mysteries, but created a few as well. For example, geologists found rocks on land that were determined to be 3.8 billion years old, yet the oldest rocks on the ocean floor are only 200 million years old.

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When Hess theorized that the excess oceanic crust material was disappearing in deep ocean trenches, he might have also shed light on the age disparity between rocks found on land and in the sea.
Remember, ocean-floor plates consist largely of heavy basalt. As an oceanic plate moves and converges with a lighter, granitic continental plate, the edge of the former slides under the latter, or subducts. The subducted material gradually sinks, melts, and becomes part of the earth's magma.

As oceanic plates age, they compress and become denser and heavier. So when two oceanic plates converge, the older slab slides beneath the younger, lighter, more buoyant one. So older oceanic crustal material is being continuously recycled, leaving nothing on the ocean floor older than 200 million years.

These are the kinds of discoveries and thinking that ultimately led to the development of the theory of plate tectonics. In just a few decades, we have greatly changed our view of and notions about our planet and the sciences that attempt to explain its existence and development.

As Dr. Robert D. Ballard of the Woods Hole Oceanographic Institution wrote, the drifting of continents "did not just rearrange the map; plate movement also helped ice ages come and go, seas rise and fall, and deserts spread and retreat. It even shaped life itself."

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