Seafloor Spreading

Another concept critical to the development of the Theory of Plate Tectonics is *seafloor spreading.* Following the discovery of *magnetic striping* more questions arose. How does this pattern form? Why are stripes symmetrical around the crests of the mid-ocean ridges? What was the significance of these ridges?

A fatal weakness in Wegener's *continental drift theory* was that it could not satisfactorily answer the most fundamental question raised by its critics: What kind of forces could be strong enough to move such large masses of solid rock over such great distances?

To understand the how these "forces" revealed themselves, we need to step back and look at the history of how man began to understand the nature of the ocea floor. As early as the 1600s, navigators began to discover that the floor of the ocean was not the flat and featureless plain most thought it to be. Measurements of the ocean floor significantly advanced in the 19th century. Survey ships laying the early trans-Atlantic cables found evidence of a "middle ground" of underwater mountains in the central Atlantic. Following World War I, echo-sounding devices (primitive sonar systems) began to measure the ocean depth. The records of these investigations revealed that the ocean was more rugged than previously thought. In 1947, the U.S. Atlantis found that the sediment layers on th Atlantic Ocean floor were much thinner than first expected. Scientists had thought that the floor of the Atlantic – like other oceans – was the accumulation of fou billion years of sediments.

In the 1950s oceanic explorations greatly expanded. Data gathered by oceanographers from many countries led to the discovery of a great mountain range on the ocean floor virtually encircling the Earth. Known as the global mid-ocean ridge, this immense submarine mountain chain more than 50,000 kilometers long and in places more that 800 kilometers across zigzags between the continents winding its way around the globe like a seam on a baseball. Though hidden beneath the ocean surface, the global mid-ocean system is the most prominent topographic feature on the surface of the planet.

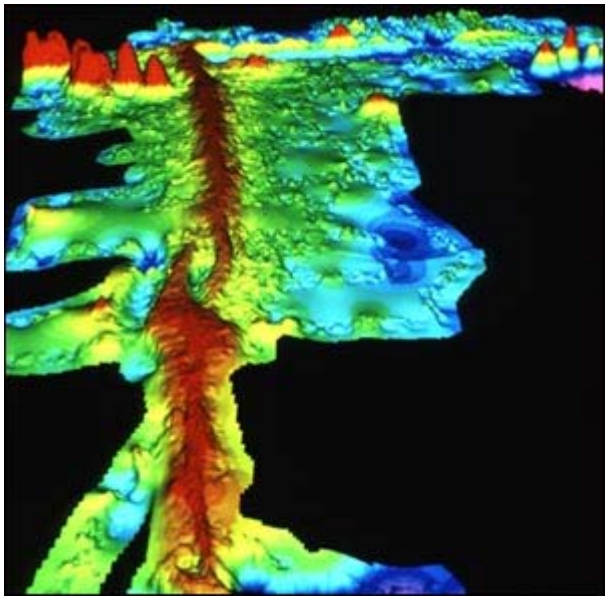
In 1961, scientists began to theorize that mid-ocean ridges mark structurally weak zones where the ocean floor was being ripped in two lengthwise along the ridg crest. New magma from deep with the Earth rises easily through these weak zones and eventually erupts along the crest of the ridges to create new oceanic crust. This process is known as *seafloor spreading.*

But a nagging question remained: how could new crust be made and continuously added along the ridges without increasing the size of the Earth?

The question intrigued Harry H. Hess, a Princeton University geologist, and Robert S. Dietz, a scientist with the U.S. Coast and Geodetic Survey. Dietz and Hes coined the expression *seafloor spreading.* They understood the broad implications of this phenomenon. If the Earth's crust was expanding along the oceanic ridges, it must be shrinking elsewhere. Hess suggested that the new oceanic crust continuously moves away from the ridges' conveyor belt-like motion. Millions of years later, the oceanic crust descends into *oceanic trenches.* As old crust was consumed in the trenches, new magma rose and erupted along the spreading ridges to form new curst. In effect, the ocean basics were perpetually being "recycled" with the creation of new crust and the destruction of old oceanic lithosphere occurring simultaneously. According to Hess, the Atlantic was expanding and the Pacific shrinking.

The continents, which are lighter than the ocean crust, glide over the surface of the Earth in response to the expansion and contraction along oceanic ridges. They are carried along as the ocean floor spreads from the ridges.

Computer-generated topographic map of a segment of the mid-oceanic ridges.



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