# Plate tectonics may take a break

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Plate tectonics, the geologic process responsible for creating the Earth's continents, mountain ranges, and ocean basins, may be an on-again, off-again affair. Scientists have assumed that the shifting of crustal plates has been slow but continuous over most of the Earth's history, but a new study from researchers at the Carnegie Institution suggests that plate tectonics may have ground to a halt at least once in our planet's history—and may do so again.

A key aspect of plate tectonic theory is that on geologic time scales ocean basins are transient features, opening and closing as plates shift. Basins are consumed by a process called subduction, where oceanic plates descend into the Earth's mantle. Subduction zones are the sites of oceanic trenches, high earthquake activity, and most of the world's major volcanoes.

Writing in the January 4 issue of Science, Paul Silver of the Carnegie Institution's Department of Terrestrial Magnetism and former postdoctoral fellow Mark Behn (now at Woods Hole Oceanographic Institution) point out that most of today's subduction zones are located in the Pacific Ocean basin. If the Pacific basin were to close, as it is predicted to do about in 350 million years when the westward-moving Americas collide with Eurasia, then most of the planet's subduction zones would disappear with it.

This would effectively stop plate tectonics unless new subduction zones start up, but subduction initiation is poorly understood. "The collision of India and Africa with Eurasia between 30 and 50 million years ago closed an ocean basin known as Tethys," says Silver. "But no new subduction zones have initiated south of either India or Africa to compensate for the loss of subduction by this ocean closure."

Silver and Behn also present geochemical evidence from ancient igneous rocks indicating that around one billion years ago there was a lull in the type of volcanic activity normally associated with subduction. This idea fits with other geologic evidence for the closure of a Pacific-type ocean basin at that time, welding the continents into a single "supercontinent" (known to geologists as Rodinia) and possibly snuffing out subduction for a while. Rodinia eventually split apart when subduction and plate tectonics resumed.

Plate tectonics is driven by heat flowing from the Earth's interior, and a stoppage would slow the rate of the Earth's cooling, just as clamping a lid on a soup pot would slow the soup's cooling. By periodically clamping the lid on heat flow, intermittent plate tectonics may explain why the Earth has lost heat slower than current models predict. And the buildup of heat beneath stagnant plates may explain the occurrence of certain igneous rocks in the middle of continents away from their normal locations in subduction zones.

Source: Carnegie Institution

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