Is the Pacific splitting in two?

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26 January 2008

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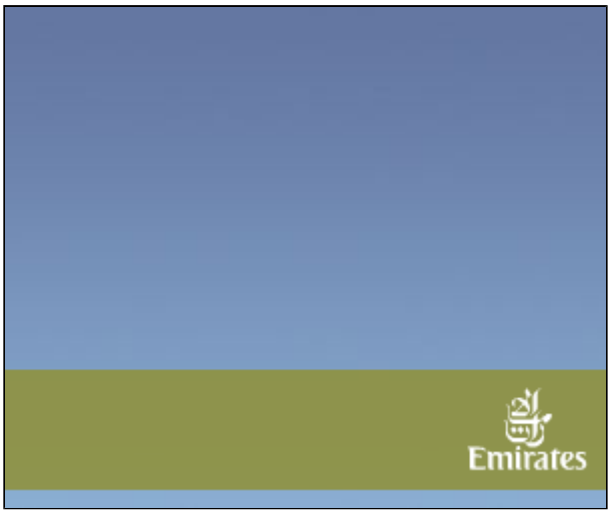
Michael Reilly

MOSES may have parted the Red Sea, but that was nothing compared to this feat. The world's biggest tectonic plate under the Pacific seems to be tearing apart, forming a new mid-ocean ridge and two distinct plates.

Enlarge image
Spinning plates

Muriel Gerbault and Valerie Clouard of the University of Chile in Santiago believe this is happening because the northern half of the plate has been moving west at a faster rate than the southern half for the past 7 million years.

North of the equator, the plate is moving relatively quickly toward the Mariana trench, where the ocean crust is disappearing into a subduction zone. Meanwhile, in the southern hemisphere, the Tonga trench is consuming crust more slowly, and is itself migrating in the opposite direction to the Pacific plate. Both of these factors have slowed the movement of the southern half of the plate by as much as a centimetre per year compared with the northern part.



As evidence for their theory, the researchers point to the existence of several archipelagos in the south Pacific - running from Samoa to Easter Island - including the Pitcairn and Cook islands, and French Polynesia. (see Map). Gerbault and Clouard think they formed when molten mantle erupted through cracks in the tearing plate (*Earth and Planetary Science Letters*, vol 265, p 195) - an idea that has reignited a decades-old debate over whether plates pulling apart can trigger volcanic activity. Most geologists think that these volcanic islands were created by "hotspots", large plumes of mantle material that can punch through the middle of tectonic plates that don't need to be weakened first. Island chains like the Hawaiian archipelago, the Canaries, and Iceland are also thought to have formed this way.

To back up their theory, the team built a model of the strain patterns across the Pacific plate using data from the ocean trenches and GPS readings of movement in the plate. Their model predicted a line where the crust was likely to tear and form volcanic islands and it matched the position of existing islands.

Norman Sleep of Stanford University in California thinks the researchers' claim for a new plate boundary is interesting, but has some doubts about the mechanism they use to make their case. Like many other geologists, he believes that strain on the Pacific plate on its own would not be enough to prompt hot mantle to well up. There are several places on Earth where oceanic crust is being stretched, but with very little volcanic activity, he says. "Ocean spreading ridges in the Indian and Arctic Oceans are notably very magma-starved." According to the geological "standard model", a plume of buoyant mantle beneath the region must also be involved for magma to rise to the surface in the volumes it has.

Gerbault admits that a plume could be influencing the formation of islands, but found that when they included this information in a second model, the island chains formed in a different place.

Whether a plume is involved or not, if things continue apace, Gerbault says the tearing could create a new mid-ocean ridge, and a new plate boundary. If they are right, between 5 and 20 million years from now the Pacific will effectively be divided in two.

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Printed on Mon Mar 31 21:34:32 BST 2008