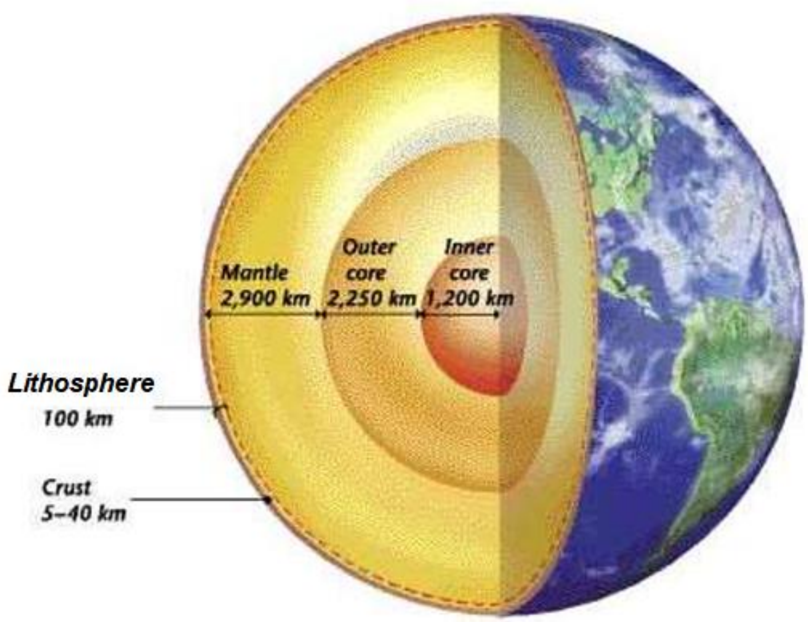
The Great Brake

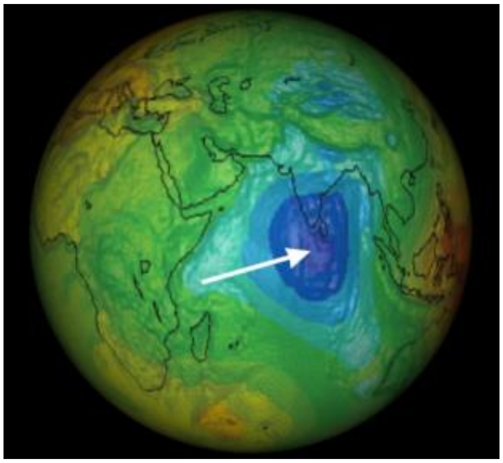
In the Shock Dynamics animation, you may have noticed that some things unfolded quickly near the end. That is due to the Great Brake, when South America's leading edge stopped sliding west at today's Peru/northern Chile coast, causing severe compressive mountain building.

With friction re-established there, South America transferred its mass and westward momentum to the lithosphere, which had a sudden braking effect on the entire global lithosphere.

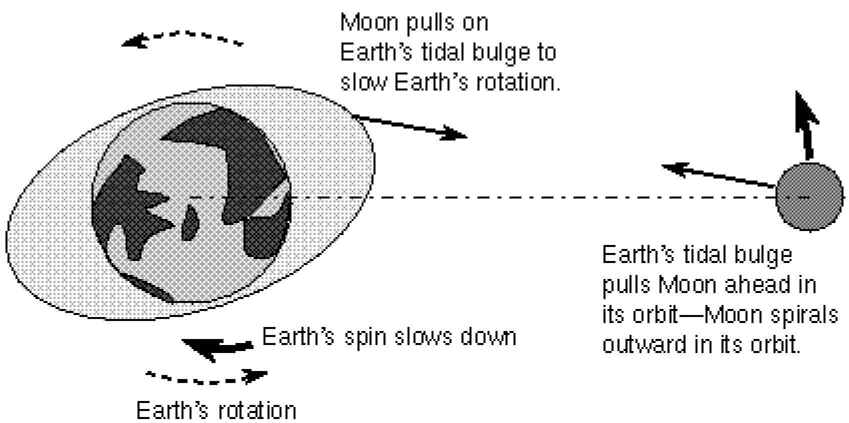
Earth's total mass and angular momentum are enormous. The sudden braking of South America would scarcely be noticed on the whole Earth. But the lithosphere is a thin, mostly solidified shell on Earth's surface. Below it is a more fluid layer, the asthenosphere (the dotted line in the image).



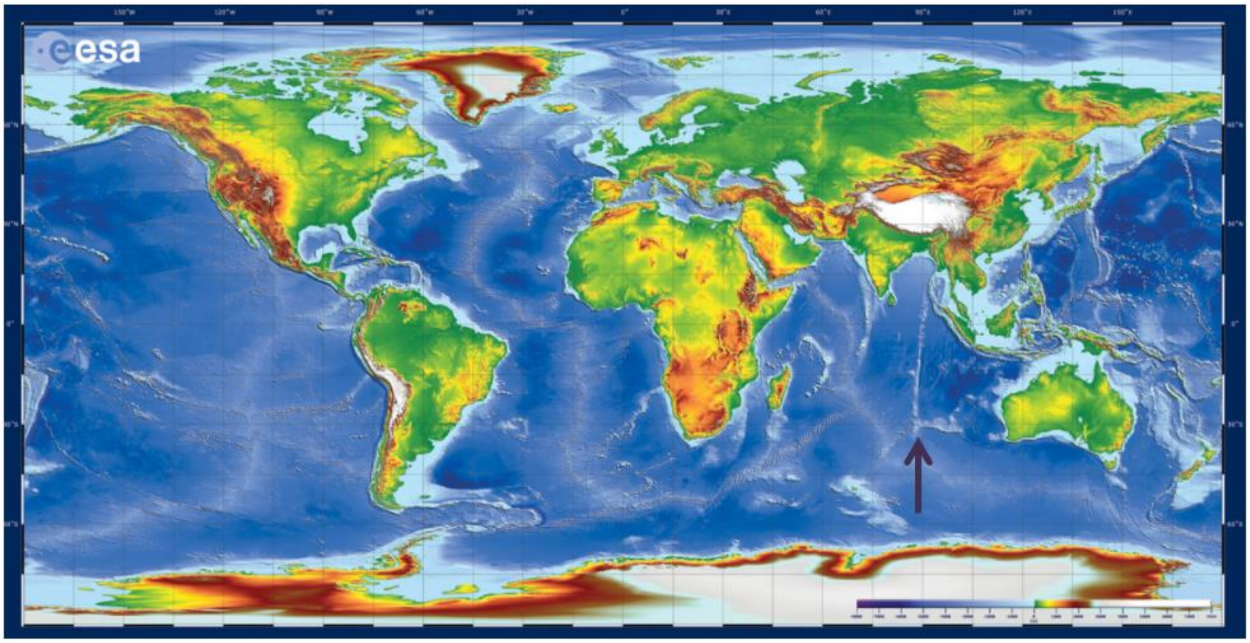
Riding on the asthenosphere, the lithosphere was jolted by South America. The mantle continued rotating eastward 2200 miles before the lithosphere re-engaged with the mantle, causing the deep gravity low that formed beneath the Shock Dynamics impact site to move under the southern tip of India.



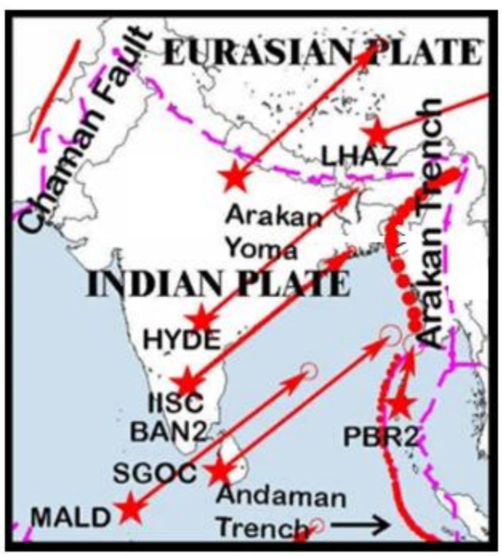
The tidal force between the Earth and Moon provides a constant westward pull on the lithosphere, slowing it in relation to the mantle. That is called differential rotation, and it is the driving force for plate tectonics today.



The sudden jerk formed the ninety-east ridge. It is an almost straight line 2500 miles long oriented north-south. Long, straight lines are very rare on Earth.

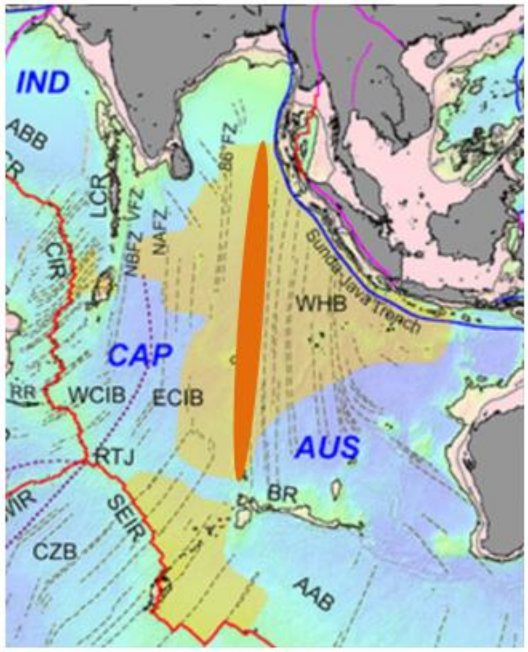


The prevailing Plate Tectonics story for the ninety-east ridge is that the Indian plate passed over a mantle plume to form it. But as you can see, the motion of the Indian plate is northeast, in accordance with the spreading ridge lines southwest of India. So the conventional wisdom is that plate motion must have been different in the past… There is no reason to believe that.



From: Jade, Sridevi, T. S. Shrungeshwara, Kireet Kumar, Pallabee Choudhury, Rakesh K. Dumka, Harsh Bhu. 12 September 2017. India plate angular velocity and contemporary deformation rates from continuous GPS measurements from 1996 to 2015. Scientific Reports, Vol. 7, Article number 11439. DOI: 10.1038/s41598-017-11697-w

The ninety-east ridge (brown) sits entirely in a region called a diffuse plate boundary (light yellow), which is a way to label a wide area of deformation between plates.



In Shock Dynamics, this area was run over twice: first by the block of continental crust moving northeast that ran into Asia, and then by Australia as it rolled away to the southeast. It is no wonder the ninety-east ridge is most likely a tear in the lithosphere due to the sudden braking of South America. Pulling crust apart produces so-called normal faults, such as we see in this seismic profile made east to west across the middle of the ridge.

“Steep faulting of the eastern slope of the Ninetyeast Ridge and its continuity among upper crustal layers are explicit.”

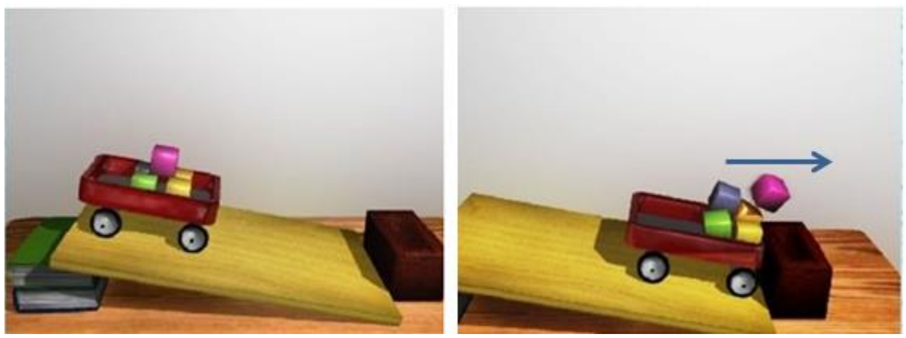
“Eastward faulting terminates at 11°S and continues toward the north on the west side of the ridge.”

A tear in the crust allows hot mantle under pressure to push toward the surface. It raised the Ninetyeast Ridge, and a thick layer underplated it. “The crustal thickness of the ridge is ~22 km, indicating that it is greater than an average thickness (7 km) of oceanic crust estimated in the Central

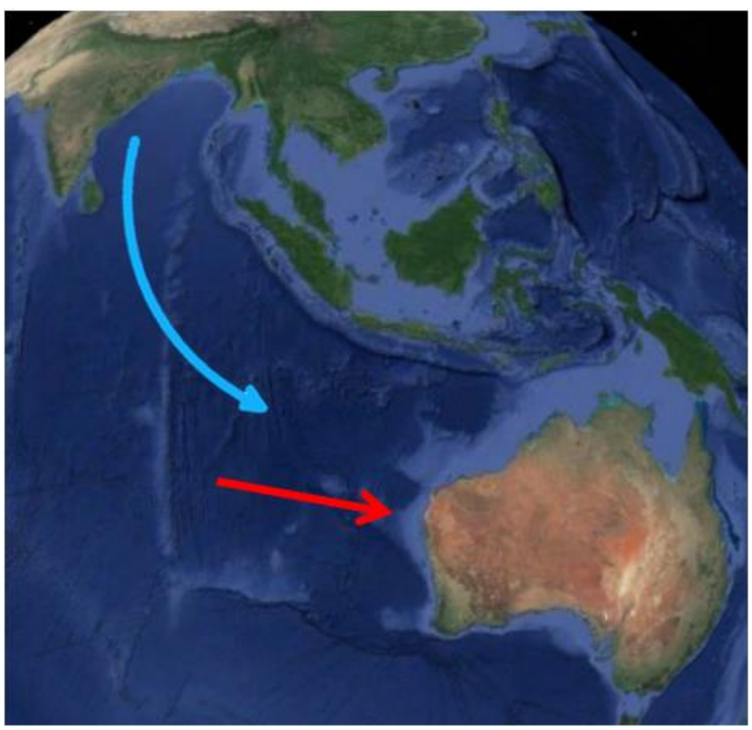
Indian and Wharton Basins. The 15 km of extra crust are accommodated largely in layer 3B [lower crust] and, to a lesser extent, in other layers."

Krishna, K.S., Y. P. Neprochnov, D. Gopala Rao, B. N. Grink. June 2001. Crustal structure and tectonics of the Ninetyeast Ridge from seismic and gravity studies. Tectonics, Vol. 20, No. 3, pp. 416-433.

Earth is rotating about 1,000 miles per hour at the equator, and progressively slower as you move toward the poles. Sudden braking of the lithosphere caused anything riding on it to be flung eastward.

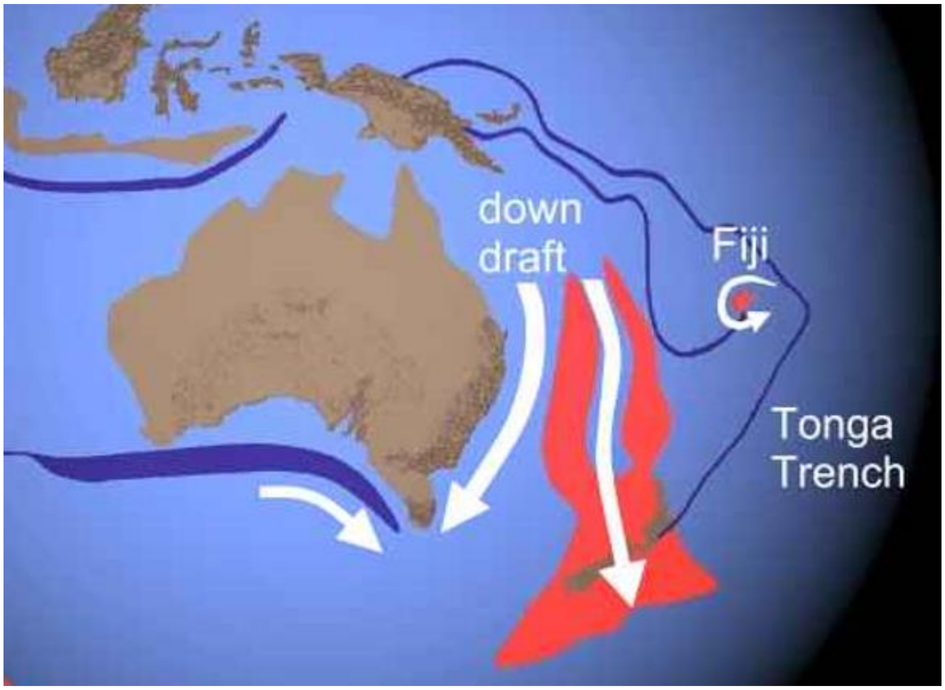


That includes Australia, which slid eastward (red arrow) after rolling away from India.



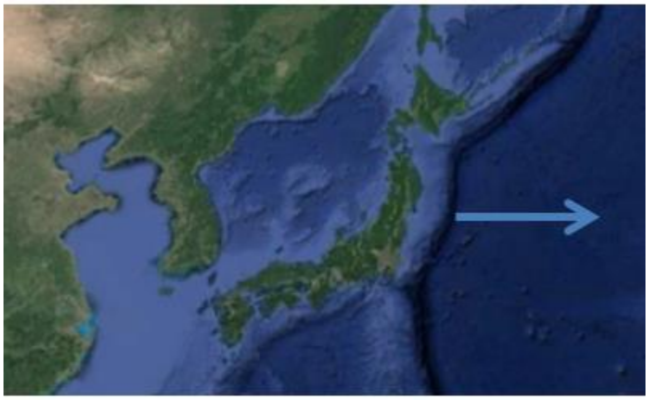
The east-moving crustal wave was accelerated. The northern end of the Tonga Trench went farther than the southern end because Earth rotates faster near the equator than near the poles.

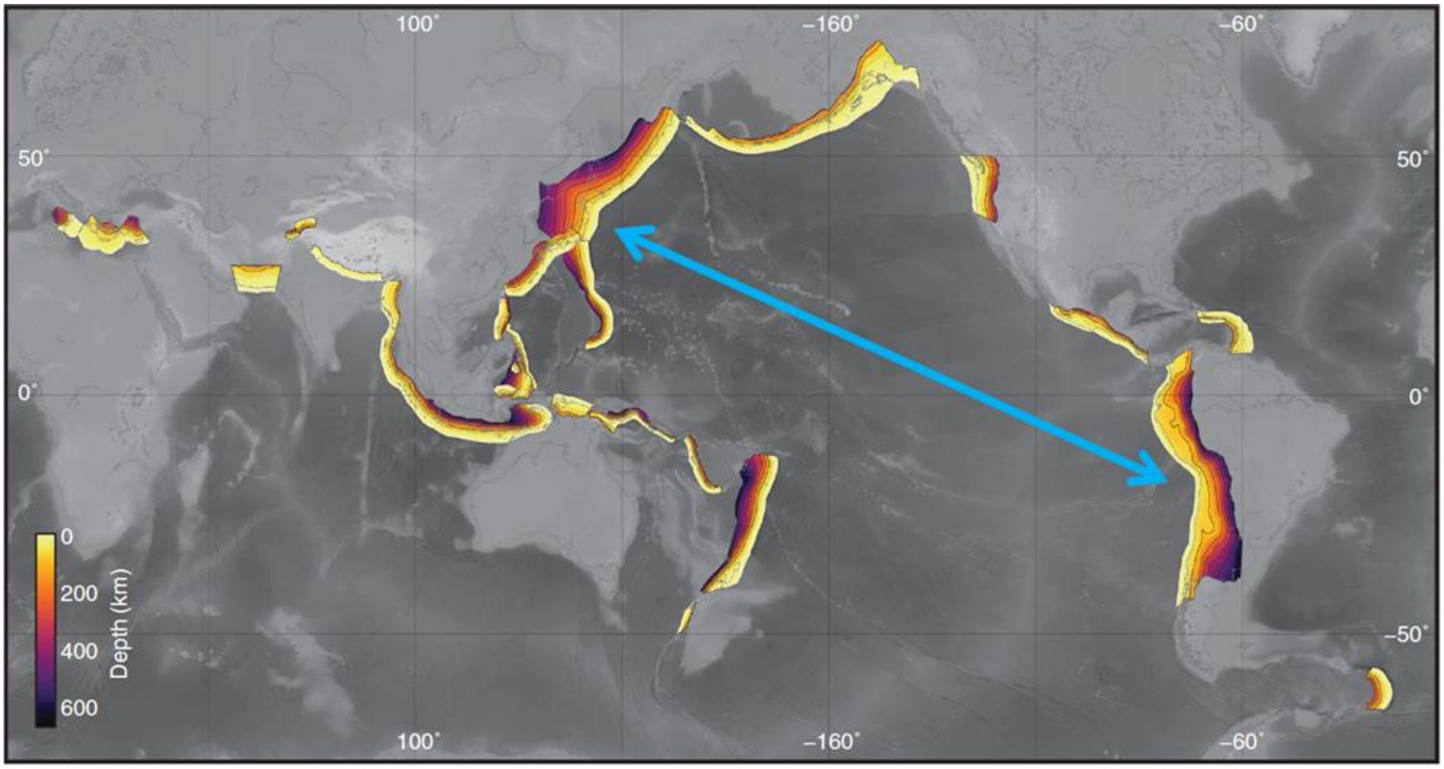
As the northern end of the crustal wave was flung forward beyond Australia, a turbulent eddy, or downdraft, formed in the oceanic crust east of Australia.



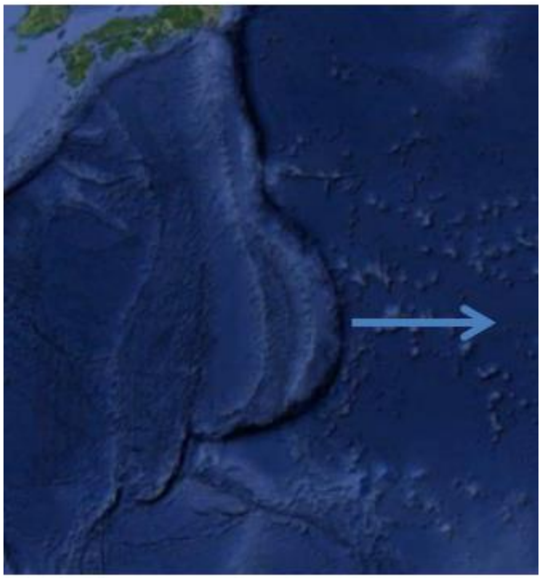
The collision that raised the Himalayas pushed China to the east, separating coastal crust from Korea northward. It also anchored Asia to the lithosphere with deep mountain-chain roots in the upper mantle. When the sudden braking occurred, several things happened at once:

Japan was thrown to the east with such force that the depth of its subducted trench is comparable to South America's.

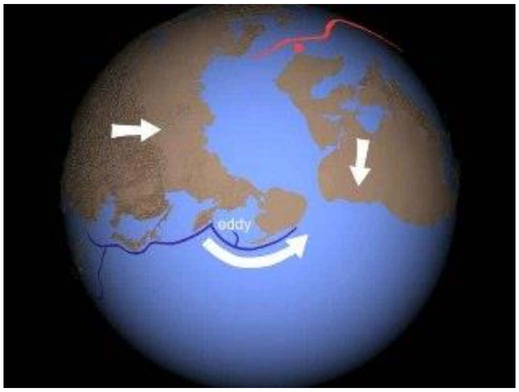




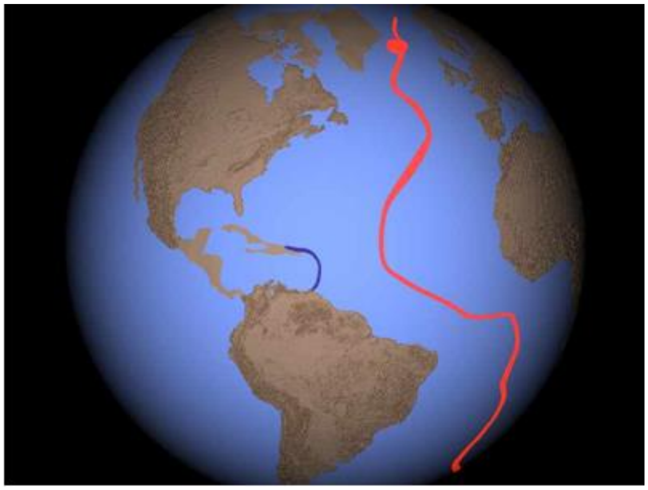
On the seafloor, the crustal wave bulged eastward, forming the Mariana Trench.



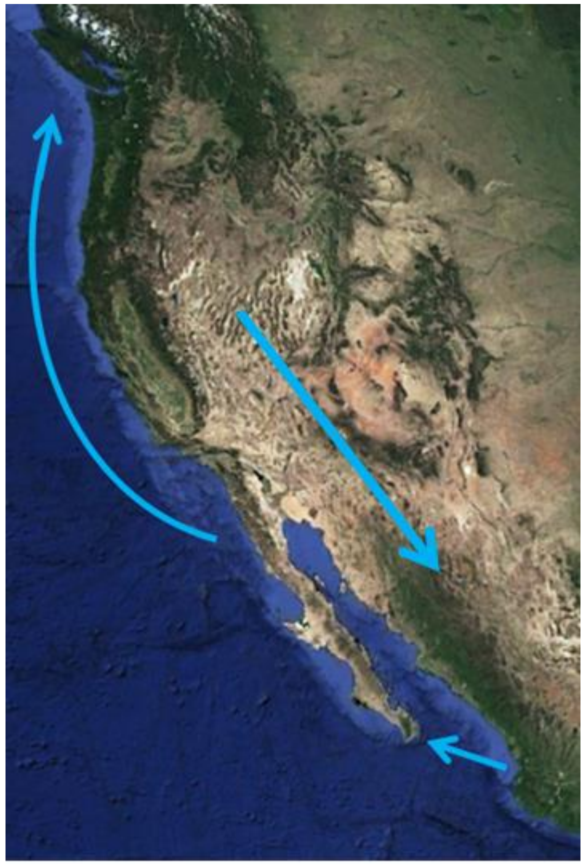
The Siberian peninsula swung eastward, spinning Alaska off of it and pulling the Kamchatka Peninsula away from the Asian coast.



When South America abruptly stopped, North America continued to slide west until Central America, Cuba and the Antilles unfolded between them.



With South America stopped and North America still moving west, the Central America link pulled on North America, causing it to rotate counterclockwise slightly. A strip of crust on the west coast did not rotate with the rest of North America. It reaches from Washington State through the San Andreas Fault to the tip of Baja California.



No other geology theory can explain all these surface features on Earth so elegantly.

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