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Tectonic implications of post-30 Ma Pacific and North American relative plate motions

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Abstract Translate

The Pacific plate moved northwest relative to North America since 42 Ma. The rapid half rate of Pacific-Farallon spreading allowed the ridge to approach the continent at about 29 Ma. Extinct spreading ridges that occur offshore along 65% of the margin (Lonsdale, 1991) document that fragments of the subducted Farallon slab became captured by the Pacific plate and assumed its motion prior to the actual subduction of the spreading ridge. This plate-capture process can be used to explain much of the post-29 Ma Cordilleran North America extension, strike slip, and the inland jump of oceanic spreading in the Gulf of California. The Pacific and North American contact zone lengthened with each successive plate capture event, underpinning the parts of western North America directly inland with a strong plate undergoing Pacific relative motion. We suggest that much of the post-29 Ma continental tectonism is the result of the strong traction imposed on the deep part of the continental crust by the gently inclined slab of subducted oceanic lithosphere as it moved to the northwest relative to the overlying continent. The plate-capture hypothesis is distinctly different from theories involving shallow slab gaps. Kinematic problems associated with shallow slab-gap models cause us to question them. This conclusion is consistent with seismic refraction interpretations that suggest there is an inclined layer with high velocities like that of basalt or gabbro at the base of the continental crust beneath much of the Californian margin and the documented reduction of slab-pull forces and density associated with young subducting slabs. Thermal and rheologic modeling suggests that coastal California was a strong zone at all depths allowing it to be

firmly linked to Pacific motion. Our model shows that deformed regions such as the basin and range and borderland provinces developed in predicted weak parts of the crustal section, but they have been incompletely linked to the deep plate across the ductile middle and lower crustal layer.

Details

Subject	Baja California; California; Cenozoic; continental crust; continental margin; Cordilleran Orogeny; crust; East Pacific; Farallon Plate; faults; geotectonic maps; Gulf of California; kinematics; maps; Mexico; movement; North America; North American Cordillera; North American Plate; North Pacific; Northeast Pacific; oceanic crust; orogeny; Pacific Ocean; Pacific Plate; plate tectonics; reconstruction; San Andreas Fault; sea-floor spreading; slabs; spreading centers; strike-slip faults; tectonics; thermomechanical properties; United States