



Evolution of the Bolivian Megakink in the Nazca Slab beneath South America

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The Peru-Chile trench off the western coast of South America marks the trace of active subduction of the Nazca Plate beneath the overriding South American Plate. The Bolivian Orocline recorded the evolution of the trench as a result of rollback of the subducting slab, and continues at depth into a giant kink that plunges orthogonally through the transition zone. The variations in the steepness of subduction, especially the existence of flat slab subduction regions, influence the volcanic gap in the Andean Volcanic Belt. Although the subduction geometry in the upper mantle is widely studied and well understood, little is known about the subducted lithosphere in the lower mantle. Local seismicity and tomography both show a kink that accounts for approximately 10% along-strike shortening of the subducted slab through the mantle transition zone, which is consistent with the 10% horizontal shortening expected at 600-700 km depth because of the planet's spherical geometry. The along-strike shortening is a mechanism to accommodate the reducing lateral space as the lithosphere descends into the spherical Earth. The kink may translate to a stagnation point in the rollback process, which could hence define the Bolivian Orocline. There is a crucial link between subduction structures in the deeper mantle, crustal deformation and the tectonic evolution of South America.