TECTONIC INVERSION OF STRIKE-SLIP BASINS AT RESTRAINING BENDS IN AN EVOLVING TRANSFORM PLATE BOUNDARY: CALIFORNIA CONTINENTAL BORDERLAND

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Many large fault-bounded uplifts in the California Continental Borderland were former sedimentary basins. Four observations common to Borderland restraining bends lead to a simple model for the tectonic evolution of these inverted basins. First, the strike of the principal displacement zone (PDZ) in the major restraining bend parallels the Miocene Pacific–North America (PAC-NOAM) relative motion vector. Clockwise rotation of these trends mirrors the clockwise rotation of the relative plate motion vector through Neogene time. Second, major faults within the restraining bend pop-up have very steep to vertical dips, typical of strike-slip faults formed along an evolving transform fault even where prominent low-angle normal faults associated with Miocene transtension exist. Third, Miocene extensional basins are structurally inverted to form the pop-up; the location of greatest uplift often correlates to the deepest part of the former basin. The elongate narrow outline of these former rift basins are typical of strike-slip basins formed during transtension with the greatest subsidence located adjacent to the active strike-slip PDZ. Volcanism resulted from extreme extension and crustal thinning of some rift basins, as in a classic pull-apart rhombochasm. Volcanic and metamorphic basement rocks are squeezed upward in the restraining bend during tectonic inversion with mechanisms that may be similar to basement-involved transtension. Fourth, the overall right-stepping en echelon character of major right-slip faults in the Borderland is consistent with transform faults linking Miocene pull-apart basins (nascent spreading centers) formed during transtension, like the modern Gulf of California. The change in relative plate motion vector, rotating clockwise from about N60°W to N40°W at present, was the ultimate cause of restraining bend formation and tectonic inversion of original transtensional basins. Careful timing of rifting and onset of tectonic inversion may provide a high-resolution mapping of a time-transgressive PAC-NOAM plate boundary evolution in southern California. From such analysis, local tectonic stress/strain effects may be separated from regional and global plate boundary processes.
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