2009 Portland GSA Annual Meeting (18-21 October 2009)

Paper No. 13-2

Presentation Time: 8:20 AM-8:35 AM

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 transpression. 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 N60oW to N40oW 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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