Constraining the Crustal Conveyor: EarthScope Imaging of Mendocino Triple Junction Tectonics

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It has long been recognized that the San Andreas plate boundary through central and northern California forms and evolves as a response to the migration of the Mendocino triple junction (MTJ). The general concept of faults developing and eventually coalescing into a primary plate boundary structure after MTJ passage serves as the framework for most tectonic and geodetic analyses of the fault system. What has been less well understood or quantified is specifically how the fault systems form, what drives fault localization, and how the concomitant crustal evolution plays a role in the plate boundary development. In the Mendocino Crustal Conveyor (MCC) model, Furlong and Govers [1999] proposed that crustal deformation, transient crustal thickening and thinning, and the associated topographic, heat flow, and seismic character of the crust are a consequence of viscous coupling within the evolving slab window. This model matched the general patterns of crustal structure and kinematics available in the pre-EarthScope era, but the spatial distribution of data precluded placing quantitative constraints on the process. The substantial augmentation of broadband seismic stations and geodetic data for northern California through a combination of EarthScope (Transportable Array (TA) and PBO-CGPS) and PI-driven research now allows us to test, calibrate, and refine the MCC model, specifically: (1) the crustal thickening at and north of the MTJ, predicted by MCC processes, (2) the ~ E-W extent of MCC deformation is delineated by the GPS data and RF analysis to occur primarily through the core of the northern Coast Ranges, (3) seismic observations and the GPS data imply that the upper crust is only a minor participant in the MCC crustal thinning that occurs approximately 200 km south of the MTJ (i.e. ~ 4-5 million years after MTJ passage), and (4) development of the precursor faults to the San Andreas plate boundary structure appears to be driven by the combination of MCC crustal deformation and the development of localized shear within the MTJ-formed slab window.

References

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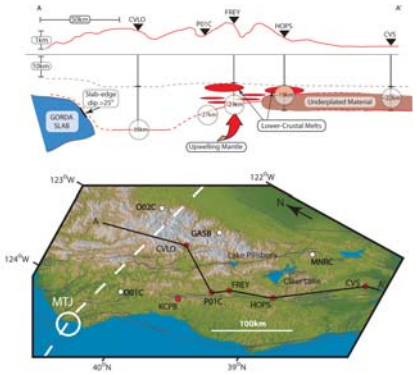

Figure 1. Summary cartoon from Hayes & Furlong (2007), describing the variation in crustal structure across the Coast Ranges of northern California as inferred from receiver function analysis at CVLO, P01C, FREY, HOPS and CVS. **Figure 2.** Tectonic setting of the Mendocino triple junction (MTJ) region. **Figure 3.** Crustal displacement field in vicinity of the Mendocino triple junction (MTJ).