Progress Report
2008 SCEC project #08060: "Lithospheric Anisotropy in Southern California from Receiver Functions"
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Receiver functions calculated for long-operating seismic stations in southern California located in the San Gabriel Mountains (MWC, CHF) and adjacent Inner Borderland (RPV) reveal a regional S-wave low-velocity zone at the base of the crust (**Fig. 1**). Converted phases from the top of the SW-LVZ and the Moho have large variations in amplitude and polarity reversals on both the radial and transverse components. These data characteristics are similar to those observed at station PKD located in the Salinian terrane near Parkfield, central California (*Ozacar & Zandt*, 2008). The broad similarity of data on widely separated stations supports an origin primarily from a sub-horizontal layer of hexagonal anisotropy with a dipping symmetry axis, rather than sets of similarly dipping planar interfaces, or local effects. Although, in some cases, localized dip or offset on interfaces probably contributes to complexity in the data (*Yan and Clayton*, 2007).

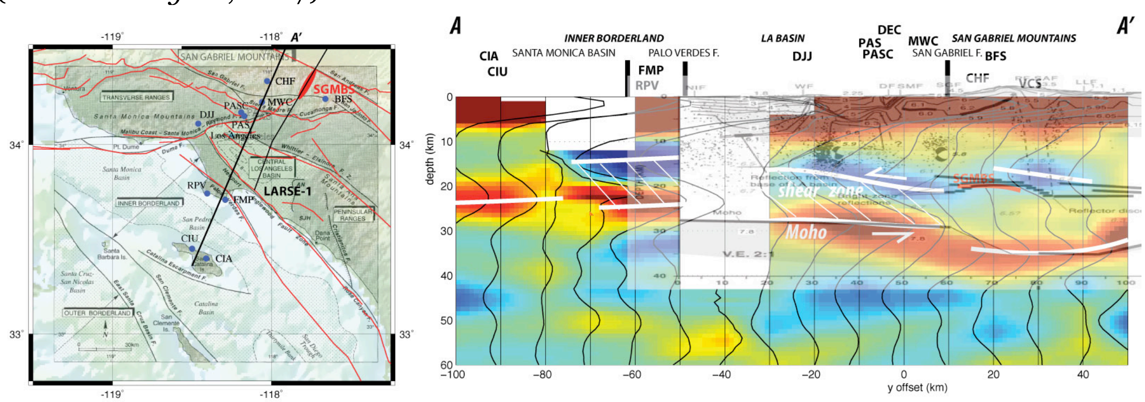

Figure 1. Receiver function (RF) common-conversion-point (CCP) stack for cross-section A-A'. In the RF stack blue highlights negative polarity arrivals indicating top of a low-velocity zone (LVZ) and red highlights positive polarity indicating Moho. Interpretation of a shear zone (in white) in the lower crustal low-velocity zone is based on presence of anisotropy leading to large tangential energy on the RFs. Note the excellent agreement in Moho depth between the RF and the overlay (black) of the interpretation by *Ryberg and Fuis* [1998] of LARSE-1 seismic reflection/refraction data along a parallel transect. The lower crustal anisotropy layer is interpreted as a fossilized fabric in underplated schist.

With partial funding from SCEC-2008, Neighborhood Algorithm searches for depth and dip of interfaces, and trend and plunge of anisotropy symmetry axis (*Frederiksen et al*, 2003) have been completed for several of these stations. As in the case of our previous study with data from station PKD, we found the best fitting models for MWC require a 6-km-thick, high Vp/Vs layer at the base of the crust with slow axis hexagonal anisotropy > 15% with an orientation consistent with ENE dipping (~45 degree) rock fabric. Very similar anisotropy models are recovered for other nearby stations with similar data characteristics.

The orientation of the anisotropy is consistent with a fossilized S-C fabric in an underplated schist body created from NE-SW oriented sense of shear that existed along this segment of coastal California during past subduction (**Fig. 2**) (*Saleeby*, 2003), or during its extensional collapse (*Crouch and Suppe*, 1993). Under MWC the top of the anisotropic layer is at ~20 km, the approximate depth of the San Gabriel Mountain Bright Spot (SGMBS) observed in LARSE I reflection data ~20 km to the east (Fig. 1).

Ryberg and Fuis (1998) interpreted the SGMBS as a possible "master" decollement for active thrust faults in the area. A possible explanation for this apparent contradiction in the age of the structures is that the SGMBS is a young feature that was localized at the top of an older and thicker regional detachment zone.

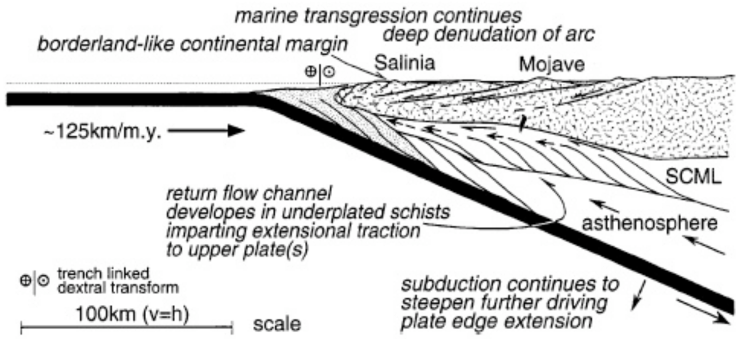

Figure 2. Generalized cross-section in the region of the Mojave-Salinia segment of the batholithic belt showing how re-steepening of the Laramide slab induced regional extension in the upper plate leading to orogenic collapse and disruption of the arc batholith crust and underplating with schists. The orientation of subduction at this time was NNE to NE. From (*Saleeby*, 2003).

References

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