

The Southern California plate boundary, the San Andreas fault, is traceable as a dipping structure throughout the lithosphere

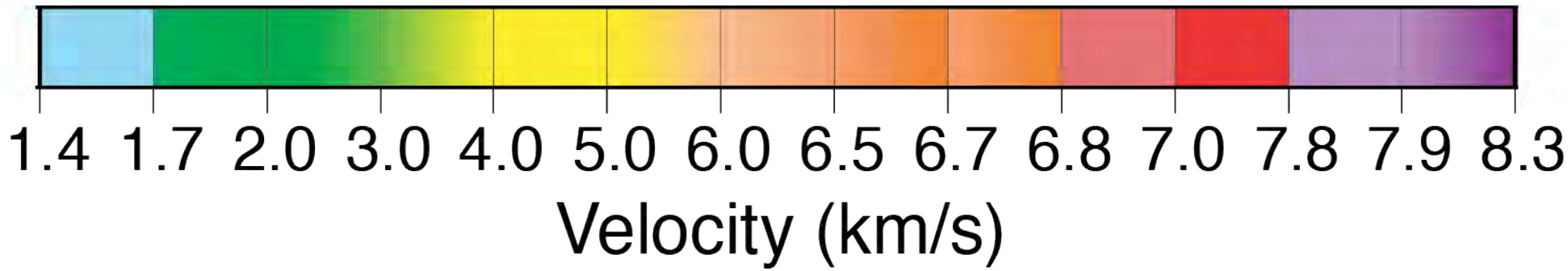
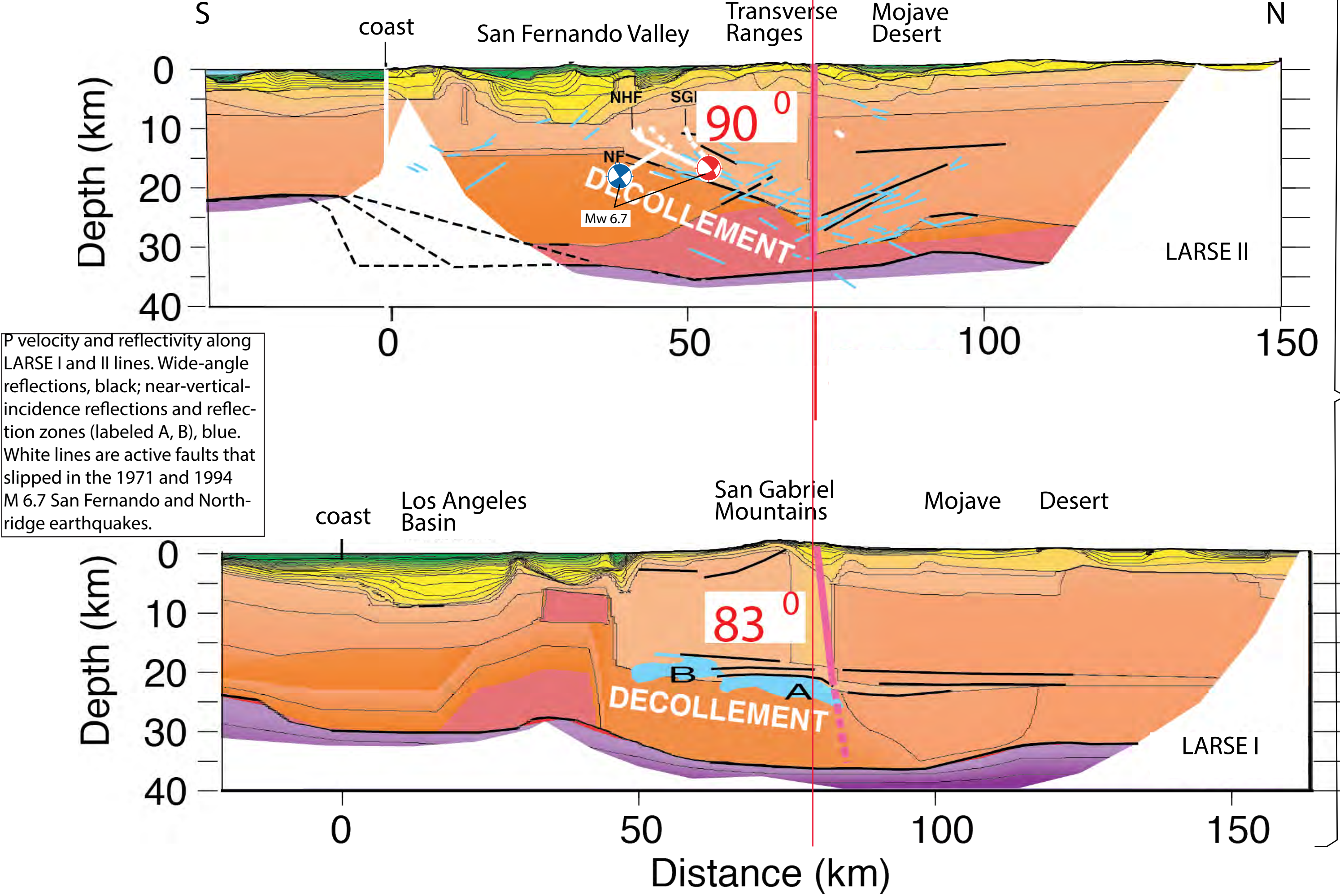
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The predicted strong ground motions in Southern California for a Shakeout Scenario rupture on the San Andreas Fault were reported by Jones et al. (2008). These predictions were updated for a similar rupture but with a northeast dipping fault plane (Fuis et al., 2017). SCEC will soon calculate changes from the 2008 Scenario rupture for a dynamic rupture along this same dipping San Andreas fault (SAF). The motivation for this poster is to highlight the geophysical evidence for the dipping geometry of the southern San Andreas fault.

This poster describes the subsurface structure of the SAF as it penetrates both the crust and upper mantle, or collectively, the lithosphere. The structure in the crust is similar to that described in SCEC CFM 7.0, and the dip of the SAF in the crust appears to project to depth more or less along the north side of the well-known upper-mantle body of high P-wave velocity (e.g., Kohler et al., 2003). The projection is not planar but is in the same sense, i.e., northward or southward, as the crustal dips (Fuis et al., 2012). It makes sense that the SAF would remain a discontinuity throughout the lithosphere, as it is the plate boundary.

Throughout the San Bernardino Mountains, the dip of the SAF is moderately northward as documented by multiple data sets. In the east, the base of seismicity is offset 10 km upward on the north at a location that is approximately 10 km north and 10 km down from the modern trace of the SAF; the interpreted dip of the SAF here is, thus, ~45 degrees (Fuis et al., 2012). In the San Bernardino area, a prominent magnetic anomaly between the modern trace of the SAF and an older trace (Mill Creek fault) indicates a northeastward dip of 37-45 degrees. This dip is consistent with modeling of ambient seismic noise (Barak et al., 2015). In Cajon Pass, scientific drilling encountered at 3.5-km depth anomalously thick, young, and hydrothermally altered breccia, leading Forand et al. (2017) to interpret the presence of the SAF just below the bottom of the drillhole. The interpreted dip of the SAF here is 45-50 degrees northeast.

Just west of Cajon Pass, in the eastern San Gabriel Mountains, modeling of a magnetic anomaly from northeast dipping igneous and metamorphic layers requires the SAF, which bounds these layers on the northeast, to dip approximately 67 degrees northeast. This dip is supported by the termination of seismicity in the Pacific plate (Cucamonga thrust fault) approximately 8 km northeast of the current trace of the SAF (Fuis et al., 2012). To the northwest in the San Gabriel Mountains, both LARSE seismic-imaging transects require the SAF to be vertical or steep (Fuis et al., 2001, 2003). Finally, in the Big Bend of the SAF at the south end of the Great Valley, gravity requires a dip of 55 degrees southwestward, and this is confirmed by the termination of seismicity in the North American plate (Pleito thrust system) southwestward of the current trace of the SAF (Fuis et al., 2012).



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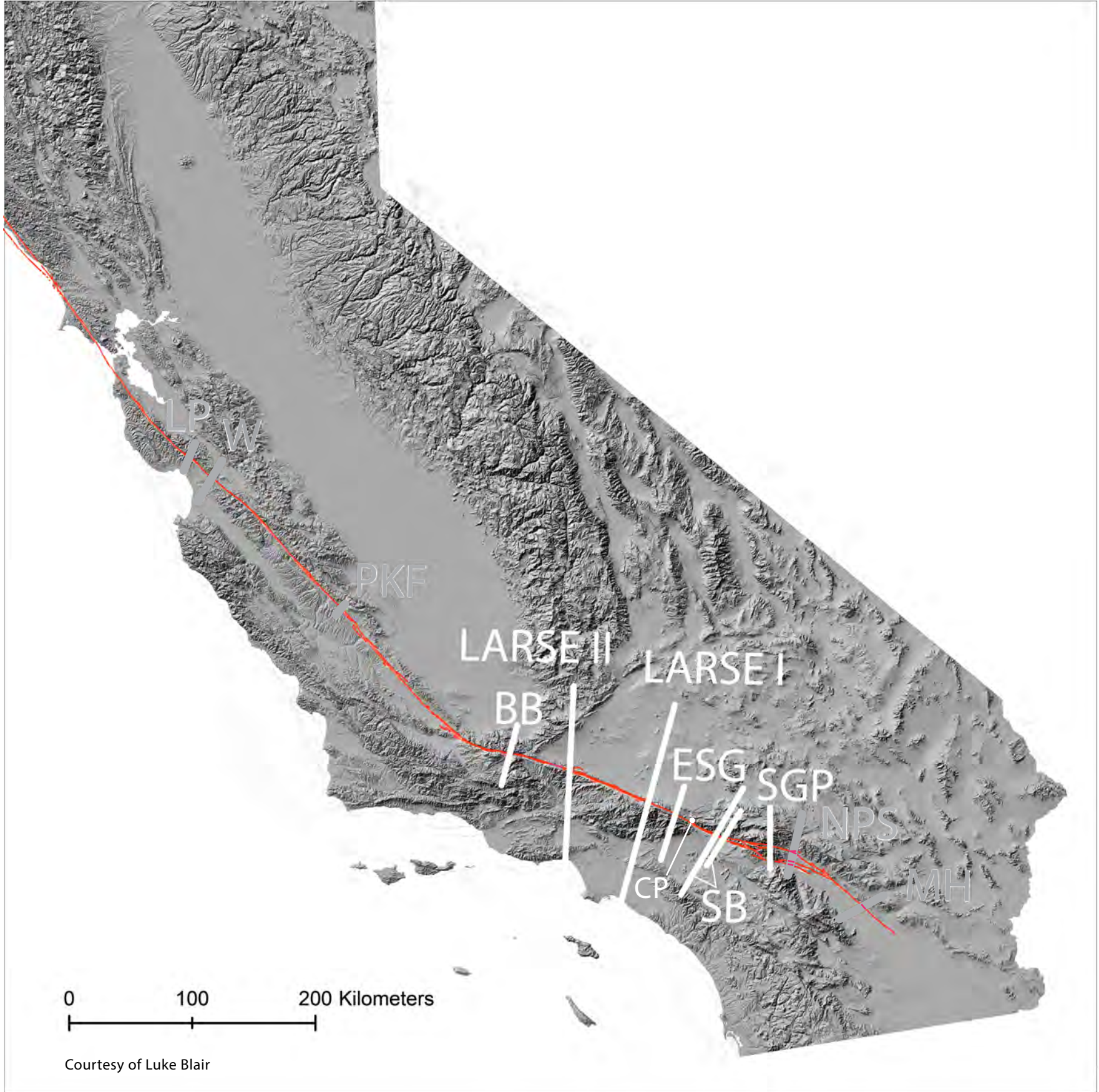
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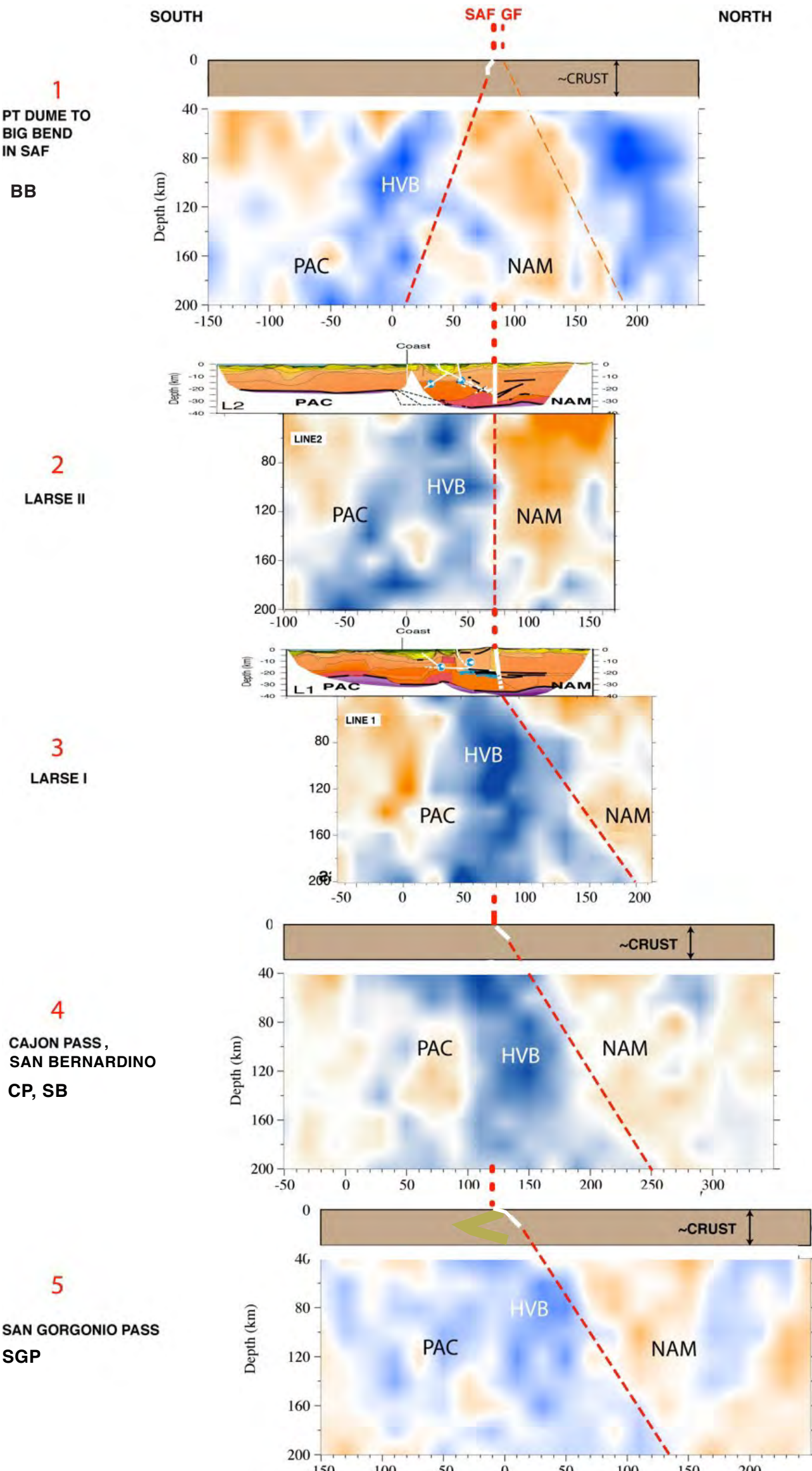
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Deep structure



Constrained parts of the SAF are shown as white lines. The crust is shown in brown except for the LARSE transects, where the full crust is imaged. Projections of the constrained crustal segments of the SAF to depth are shown as dashed red lines. These projections line up along the north side of the well known upper-mantle body of relatively high P-velocity (HVB) (Kohler et al., 2003). Higher such velocities are represented by progressively darker shades of blue, up to 3% relatively higher velocity. GF is Garlock f.; NAM is North American plate; PAC is Pacific plate.