Surface wave tomography of the Isabella slab fragment offshore central California

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Abstract

Continental and oceanic lithosphere, which form in different tectonic environments, are studied in a an amphibious seismic array that crosses the Southern California continental margin. This provides a unique opportunity to directly compare oceanic and continental lithosphere, asthenosphere, and the LAB (Lithosphere-Asthenosphere Boundary) in one study. The complex history of the region experienced subduction of the East Pacific Rise (EPR) spreading center, rotation of the Western Transverse Ranges (WTR), and opening of the Borderlands. Our results will address an active debate to explain high velocities lithospheric anomalies as delamination versus a slab fragment remnant from intersection of the EPR and the coastal subduction zone plate boundaries 30 Ma. We invert Rayleigh wave data obtained from the ALBACORE array and permanent land stations, for 1D and 2D shear wave velocity structure. We divide the study area into several regions: continent, inner Borderland, outer Borderland, and oceanic seafloor. A unique starting Vs model is used for each case including appropriate crust and other layer thicknesses, densities, and P and S velocities which predicts Rayleigh phase velocities and are compared to observed phase velocities in each region. We solve for shear wave velocities with the best fit between observed and predicted phase velocity data in a least square sense. Preliminary results indicate that lithospheric velocities in the oceanic mantle are higher than the continental region by at least 2%. The LAB is observed at 50 ± 20 km beneath 15-35 Ma oceanic seafloor. Asthenospheric low velocities reach a minimum of 4.2 km/s in all regions, but have a steeper positive velocity gradient at the base of the oceanic asthenosphere compared to the continent. Preliminary results from seismic tomography images will be presented with coverage in the central California continental margin showing a remnant slab fragment extending offshore associated the intersection of the EPR with the coastal subduction zone and initiation of the San Andreas fault.