Depth varying Deformation within the Nazca Slab from Seismic Anisotropy

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The Andean subduction zone is an excellent place to study deformation within a subducting slab as a function of depth, owing to the varying and well-resolved geometry of the subducting Nazca slab beneath South America. A number of previous studies have looked into the anisotropy in the region using receiver-side shear wave splitting techniques (e.g. SKS). However, only a handful have used the source-side technique (direct teleseismic S waves), which can isolate the slab and sub-slab component and thus provide a better depth constraint on the source of anisotropy. Here we combine the results of the source-side shear-wave splitting technique with the latest regional P-wave tomography model (SAM5_P_2019) in order to isolate intra-slab ray paths and determine the spatial distribution of anisotropy within the Nazca slab. We observe that in the upper mantle, the intra-slab anisotropy appears strongest where the slab is most contorted. This suggests that subduction-related slab deformation is capable of generating anisotropy through the development of new olivine LPO fabrics. We identify a second source of anisotropy ($\delta t \sim 1s$) within the subducting slab at lower mantle depths (660-800km). The surrounding mantle and transition zone appear largely isotropic, with deep anisotropy concentrated within the slab as it deforms while entering the higher viscosity lower mantle. Given the depth and widespread nature of the observed deep anisotropy, the likely source is inferred to be LPO development of bridgmanite within the slab.