Geophysical Research Abstracts
Vol. 13, EGU2011-8963, 2011
EGU General Assembly 2011

Shear-Wave Splitting beneath Northern Sulawesi and the southernmost Philippines – The Sangihe Subduction Zone

Jeanette Di Leo, James Wookey, James Hammond, and J.-Michael Kendall
School of Earth Sciences, University of Bristol, Bristol BS8 1RJ, UK (jd7479@bristol.ac.uk)

Subduction zones have been studied extensively over the past few years with particular focus on seismic anisotropy. One that has not been studied in great detail, however, is the Sangihe Subduction zone in Northern Sulawesi. Here, the Molucca Sea Plate subducts to the west beneath the Eurasian Plate to a depth of around 650 km. Constraints on the mantle flow-field, mantle composition, and state of stress in the area are lacking, but these parameters are nevertheless expected to be reflected in measurable anisotropic fabrics. Here, we present new shear-wave splitting results for both local and teleseismic data for Northern Sulawesi and the southernmost Philippines.

For local-S splitting, we note a change in splitting parameters (delay time and fast direction) around the 410 km discontinuity: Events originating above 410 km show predominantly trench-parallel fast directions. There is little variation in delay time with depth, indicating that the anisotropy is confined to the upper 100 km, i.e. the lithosphere or the crust, and that the mantle wedge is probably isotropic. Potential sources of these trench-parallel anisotropic fabrics are vertically aligned flexural cracks due to deformation in the overriding Eurasian plate or melt-filled cracks associated with active volcanism in the Sangihe Arc.

Fast directions of deeper events are more varied and there is a slight increase in delay times compared to events above 410 km (from a stacked average of 0.53s to 0.65s beneath Sulawesi and from 0.34s to 0.54s beneath the southern Philippines). One possible cause for deeper anisotropic fabrics could be shear layers along the upper surface of the slab due to its down-dip motion and ensuing corner flow in the mantle wedge. Alternatively, this deeper anisotropy might be located in the transition zone; it may be due to the lattice preferred orientation of wadsleyite or a hydrous D-phase in the transition zone.

Delay times for SKS splitting (stacked average: 1.38s) beneath Sulawesi are significantly larger than local-S splitting delay times (stacked average: 0.48s), suggesting there is additional anisotropy in or below the slab not being sampled by local events. SKS fast directions are approximately trench-parallel.

Mechanisms that may combine to explain the observed complex anisotropic fabrics are a stress-field contorted by variations in the morphology and the dip of the slab, trench rollback, or a fossil anisotropy frozen in the subducting lithosphere.