Mantle Wedge Anisotropy at the Plate Edge beneath Northern Taiwan

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Abstract

We analyze the shear wave splitting to investigate the seismic anisotropy in the upper mantle around plate edges beneath northern Taiwan. Both shear waves generated from local deep earthquakes and from distant SKS phases of the Feb. 22, 2006 Mozambique earthquake (Mw=7) were used to derived the anisotropic parameters. The measurements show significant spatial variation in seismic anisotropy across the slab edge. Result obtained from local S waves shows that the mantle wedge beneath northern Taiwan exists a trench-parallel polarization of the leading shear-wave (fast direction), which is consistent with previous observations along the Ryukyu arc to the east. The measured fast directions of SKS phase confirm this feature for stations (WFSB, YHNF, and IGKF) above the mantle wedge. However, it is perpendicular to the one derived from local deep events at ANPB and is comparable with those stations to the south. The ANPB is located right above the edge of the subducted Philippine Sea plate, where the subducted slab is colliding laterally with the continental lithosphere and a minimum slab rollback is expected.

In terms of tomographic images, a relatively low velocity layer lying above the slab has been depicted at least in the upper 70 km and possibly corresponds to the molten mantle associated with the dehydration process along the top of subducted slab. The preferred orientation of the melt might cause seismic anisotropy. In addition, the B-type olivine fabric in the mantle wedge induced by corner flow has been raised to account for the trench-parallel anisotropy. On the other hand, the fast directions to the west of ANPB are subparallel to the orientation of the mountain strike, which is consistent with the results observed in Central and Southern Taiwan. This may be caused by the mountain parallel mantle flow induced by lithospheric collision between the Philippine Sea plate and the Eurasian plate. This unique observation should provide important constraint on the dynamics of subduction zone around the plate edge beneath northern Taiwan.