P-wave azimuthal anisotropy tomography of Kanto: Implications for the structure of the Philippine Sea slab

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We reported abnormal anisotropy structure of the PHS slab beneath Kanto (Ishise et al., 2019 JpGU) and propose some possible causes of the structure. However, we were not able to reach a final conclusion. Therefore, we used a seismic profile imaging shallow structure of the PHS slab (Sato et al., 2005) to interpret the reported abnormal structure.

First, vertical cross sections of isotropic and anisotropic structures were compared with the seismic profile. As a result, anisotropy direction in the upper plate was found to be parallel to the strike direction of accretionary complex that forms the basement of Kanto. Since the anisotropic properties are due to the accretionary layer structure, the bottom of the upper plate was determined by tracing the basement of the anisotropic region parallel to the strike direction of the accretionary complex structure.

Next, directional property of anisotropy were examined in an area deeper than the bottom of the upper plate and three characteristic anisotropy directions were found: (1) NW-SE, (2) NNE-SSW, (3) WNW-ESE directions.

(1) The NW-SE anisotropy is distributed just beneath the bottom of the upper plate, suggesting that NW-SE anisotropy would exist in the oceanic crust of the PHS slab. The direction of the anisotropy is parallel to the strike direction of the trough axis. So, the anisotropy can be explained by bending-related faulting at the trench (e.g., Ranero et al., 2003).

(2) The NNE-SSW anisotropy is found in the distinct high-velocity anomaly region below the oceanic crust of the PHS slab. Therefore, it is considered that the PHS slab mantle has NNE-SSW anisotropy. It is known that there are intraslab earthquakes in which the strike direction of the fault is parallel to the anisotropy direction. The similarity in direction suggests the existence of a large structure characterized by the strike in the NNE-SSW direction.

(3) The WNW-ESE anisotropy is found in the low-velocity anomaly region just beneath the basement of the upper plates. Although low-velocity anomalies are widely distributed just beneath the upper plate, the low-velocity anomaly with WNW-ESE anisotropy is discriminated from the oceanic crust of the PHS slab in terms of anisotropy direction. Since the anisotropy direction is parallel to the relative plate motion between the Okhotsuk and the PAC plates, we interpret that the WNW-ESE anisotropy as deformation of mantle minerals due to the plate motion.

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