

Seismic reflector above the non-volcanic tremor along the Philippine Sea Plate

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The Philippine Sea plate is subducting beneath the southwestern Japan. Many studies have been done in this area. One of the interesting phenomena at the subduction zone is non-volcanic tremor occurs at the plate boundary (Obara, 2002). Many large earthquakes have occurred at the Nankai Trough region. To know the seismic structure, several seismic explorations using artificial sources have been done at the region. The configuration of the Philippine Sea plate and P-wave structure were estimated by the seismic experiments (e.g, Kodaira et al., 2002; Iidaka et al., 2004; Iwasaki et al., 2016). Igarashi and Iidaka (2017) studied that receiver function analyses to estimate the plate boundary of the Philippine Sea slab and S-wave velocity structure in the crust and uppermost mantle beneath the Japanese Islands. The S-wave velocity structures were estimated using a grid search method between the observed receiver function and synthetic calculation. The P-wave and S-wave seismic structures are compared with the source area of non-volcanic tremor.

It is remarkable characteristic of the seismic experiments in this region that the clear reflected wave around the plate boundary was detected. The clear reflected wave was explained as a reflected wave at the top of the extremely low-velocity layer, which was located at the top of the subducting Philippine Sea slab (e.g, Kodaira et al., 2002; Iidaka et al., 2004). The P-wave velocity values of the thin layer were 3 km/s and 2 km/s in the Nankai and Tokai regions, respectively (Kodaira et al., 2002; Iidaka et al. 2004). Similar strong reflector was also detected at the eastern part of the Kii Peninsula (Iwasaki et al., 2016). The locations of the strong reflectors are compared with the source area of the non-volcanic tremor. In the Nankai region, the depth of the reflector was located at 10 km –30 km (Kodaira et al., 2002). The source area of the tremor is located at the deepest part of the low velocity layer. In the Tokai region, the extremely low velocity layer is located just above the source area of the tremor. Iwasaki et al. (2016) also reported that the strong reflector was located just above the source area of the tremor in the eastern part of the Kii peninsula. At the three areas, the strong reflector was located above the source area of tremor. The seismic structure of the S-wave structure at the tremor area was characterized to be high-velocity mantle wedge and low-velocity oceanic crust (Igarashi and Iidaka, 2017). It is expected that the low velocity layer seems to be related to the dehydration of the oceanic crust.

The non-volcanic tremor had been reported at many subduction zones. Song et al. (2009) reported the ultra low velocity layer in the Mexico subduction zone. The ultra low velocity layer is located at top of the slab. The low velocity layer is located in shallower than tremor area. The extremely low-velocity layer has been reported at several subduction zones. The research of the characteristics of the low-velocity layer is very important to know the source of the non-volcanic tremor.

Keywords: plate boundary, reflector, non-volcanic tremor