

Long-term slow-slip event with high-VP/Vs lower crust of the Eurasian plate in the over-riding plate

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With regard to the Philippine Sea (PHS) plate beneath southwestern Japan, deep low-frequency non-volcanic tremors (LFTs) are observed at depths of approximately 30 km along the strike of the PHS plate from Tokai to the western Shikoku regions (Obara, Science, 2002). Accompanying the LFTs, short-term slow-slip events (S-SSEs) are also observed beneath the Tokai region, eastern Kii peninsula, and Shikoku region. The LFT accompanied with S-SSE is called Episodic tremor and slip (ETS; Rogers and Dragert, 2003). Some studies revealed that the LFTs beneath the southwestern Japan are located along a high-Vp/Vs zone by seismic tomography. Our goal is to investigate the characteristic structure of ETS zone.

Beneath the Tokai region and Bungo channel, long-term slow slip events (L-SSEs) were detected (Ozawa et al., 2002; Hirose et al., GRL, 1999) and no L-SSE was observed elsewhere. We also study the common characteristic structure of the L-SSE zones.

The National Research Institute for Earth Science and Disaster Prevention (NIED) has deployed the high-sensitivity seismograph network of Japan (Hi-net). Plenty arrival time data enable us to clarify the fine-scale 3D Vp and Vs structure beneath the southwestern Japan.

Slow earthquakes (LFT, S-SSE and L-SSE) are distributed along the high-Vp/Vs zone beneath the southwestern Japan and they are considered to be caused by the high pore fluid pressure dehydrated from the oceanic crust of the PHS plate. We found that the ETS may occur at the plate boundary where the PHS plate first encounters the serpentinized wedge mantle of the Eurasian plate. The ETS zone is located in the high-Vp/Vs zone beneath the Tokai and Bungo channel, at the landward end of the high-Vp/Vs beneath the southern Kii peninsula, at the seaward end of the high-Vp/Vs zone beneath the western Shikoku region. The high-Vp/Vs regions extend landward beneath the Tokai and western Shikoku region and Bungo channel. The mantle wedge has high-Vp/Vs zone with 10-30 % serpentinized peridotite exist if there is serpentinized.

High-Vp/Vs zone is extended from the ETS zone to the seaward beneath the Tokai region and Bungo channel along the plate boundary. L-SSEs were observed beneath both regions. In this zone, the lower crust of the Eurasian plate at depths approximately 25-30 km becomes high-Vp/Vs owing to the dehydrated fluid from the subducting PHS plate and L-SSE may be caused by high pore pressure at the plate boundary between the PHS plate and the lower crust of the Eurasian plate. However, no L-SSE was observed beneath the Kii peninsula and western Shikoku region. The high-Vp/Vs lower crust of the Eurasian plate extending from the ETS zone to seaward along the plate boundary is the common characteristic of the L-SSE zone.