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3-D structure of the locked-sliding transition on the plate boundary beneath the southern part of Kii Peninsula

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The Nankai trough region, where the Philippine Sea Plate (PHS) subducts beneath the southwestern Japan arc, is a well-known seismogenic zone of interplate earthquakes. The most recent great earthquakes occurred in 1944 (Tonankai Earthquake, M=7.9) and 1946 (Nankai Earthquake, M=8.0). Detailed crustal and upper mantle structure of the subducting PHS and the overlying southwestern Japan arc are important to constrain the process of earthquake occurrence. A series of active and passive seismic experiments were undertaken in 2004, 2009 and 2010 to obtain a structural image beneath the southern part of Kii Peninsula, southwestern Japan. In November 2004, two active seismic experiments were conducted (Ito et al., 2005; Kurashimo et al., 2005). One was carried out along a 195-km-long seismic line between Shingu and Maizuru (S-M line) in the north-south direction and the other was carried out along a 60-km-long seismic line between Otou and Kumano (O-K line) in the east-west direction. The 2009 passive seismic array observation was carried out along a 60-km-long seismic line between Minabe and Shimokitayama (M-S line) in the east-west direction (Kurashimo et al., 2010). In October of 2010, a deep seismic reflection profiling was conducted along the M-S line (Kurashimo et al., 2011). In order to obtain a three dimensional structural image beneath the southern part of Kii Peninsula, these active and passive seismic dataset are useful. Permanent seismic stations observed the controlled seismic signals as well as natural earthquakes. We combined the seismic array data with permanent seismic station data. The arrival times for the first P- and S waves obtained from local earthquakes and explosive shots were used in a joint inversion for earthquake locations and three-dimensional Vp and Vp/Vs structures, using the iterative damped least-squares algorithm, simul2000 (Thurber and Eberhart-Phillips, 1999). The seismic velocity structure shows that the high Vp zone (>7.5 km/sec) exits below about 25 km depth beneath the western side of the M-S line. This high Vp zone extends to the southward. Deep low frequency tremors are located outside of the high Vp zone and those are located in and around the high Vp/Vs zone.

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Keywords: philippine sea plate, seismic tomography, transition zone, nonvolcanic deep low frequency tremor