Active and passive seismic experiments in the western part of Kii Peninsula, southwestern Japan

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The Nankai trough region, where the Philippine Sea Plate (PHS) subducts beneath SW Japan arc, is a well-known seismogenic zone of interplate earthquakes. In recent years, various types of slow earthquake have been recognized in neighboring regions of the seismogenic zone (e.g., Obara, 2002; Ito and Obara, 2006). A narrow zone of nonvolcanic tremor has been found in SW Japan fore-arc, along strike of the arc (Obara, 2002). The spatial distribution of the tremor is not homogeneous in a narrow belt but concentrated forming clusters. Obara (2002) suggested a dominating factor of tremor is fluids dehydrated from the subducted plate. Seismic reflection characteristics and seismic velocity variations can provide important information on the heterogamous structure around plate interface probably affected by fluid behavior. Seismic structural images in and around the active tremor zone beneath the eastern part of Kii Peninsula have been reported (Iwasaki et al., 2017; Kurashimo et al., 2017; Tsumura et al., 2017). However, little is known about the seismic structure where tremors are inacitive. To investigate the detailed structure in and around the inactive tremor zone, we conducted active and passive seismic experiments in the western part of Kii Peninsula, SW Japan. Ninety portable seismographs were installed on a 90-km-long line nearly parallel to the direction of the subduction of the PHS with approximately 1 km spacing. Each seismograph consisted of a 1.0-Hz 3-component seismometer and an offline recorder, recording at 200 Hz or 250 Hz. Waveforms were continuously recorded during the period from June 20, 2017 to December 20, 2017. During the seismic array observation, the Japan Meteorological Agency located 4,428 earthquakes in a latitude range of 33.4-34.4 N and a longitude range of 135.0-136.0 E. In September of 2017, we also conducted a deep seismic profiling to reveal the geometry of the subducting PHS and the overriding island arc crustal structure. 302 seismometers were deployed on a 60-km-long line in the northwest-southeast direction with about 200 m spacing, on which four explosives shots with charge size of 200 kg were fired as controlled seismic sources. Each recording system consisted of a 4.5-Hz, 3-component seismometer and an offline recorder, recording at 500 Hz. We obtained high signal-to-noise ratio explosion data along the entire length of the profile. The most remarkable feature of the record sections is that high amplitude reflections, probably from the top of the subducting PHS, are recognized. To obtain the detailed structure image, we applied the seismic reflection technique to explosion data. The stacked image shows several features of the deeper part of the crust and the northward dipping plate boundary at 7-12 sec in two way travel time, the latter of which shows the lateral reflectivity variation.

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