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Detailed 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 subducts beneath the SW Japan arc, is a well-known seismogenic zone of interplate earthquakes. A detailed crustal and upper mantle structure of the subducting Philippine Sea Plate and the overlying SW Japan arc is inevitably important to constrain the physical process of earthquake occurrence. Recently a narrow zone of nonvolcanic tremor has been found in the SW Japan fore-arc, along strike of the arc (Obara, 2002). The epicentral distribution of tremor corresponds to the locked-sliding transition zone. The spatial distribution of the tremor is not homogeneous in a narrow belt but is spatially clustered. Knowledge of lithospheric structure is necessary for an understanding of tremor. However, little is known about the deeper part of the plate boundary, especially the transition zone on the subducting plate. To reveal the detailed structure of the transition zone on the subducting plate, we conducted a deep seismic profiling in the southern part of Kii Peninsula, southwestern Japan. In this experiment, 290 seismometers were deployed on a 60-km-long line in the east-west direction with about 200 m spacing, on which five explosives shots were fired as controlled seismic sources. Charge size of the shots is 200 kg. Each seismograph system consisted of a 4.5 Hz, vertical component seismometer and a single channel data recorder, recording at 250 Hz. We obtained high signal-to-noise ratio data along the entire length of the profile. The most remarkable feature of the record sections is that extremely high amplitude reflections, which are interpreted as a reflected wave from the top of the subducting Philippine Sea plate, can be recognized. To obtain the detailed structure image of the transition zone on the subducting plate, the data recoded on the EW-line were processed using seismic reflection technique. The stacked image shows several features of the deeper part of the crust including the subducting plate boundary at 10-11 sec in two way travel time. Seismic reflection image also shows the lateral variation of the reflectivity along the top of the subducting Philippine Sea Plate.

Keywords: Non-volcanic tremor, transition zone, plate boundary, reflector