Along-trough variation in the seismic structure of the incoming Philippine Sea plate just seaward of the Nankai Trough

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Rupture of large-thrust earthquakes along the Nankai Trough is known by always initiating from off the Kii Peninsula. The segmentation boundary between the 1944 Tonankai (Mw=8.1) and the 1946 Nankai (Mw=8.4) earthquake rupture is locate on the Kii channel, off the Kii Peninsula. Activity of the nonvolcanic deep low-frequency tremors and very low-frequency earthquakes observed around the down-dip limit of the coseismic rupture zone of the last Tonankai and Nankai earthquakes is not homogeneous, and the belt-like tremor zone is divided into several segments bounded by gaps [Obara, 2010]. Largest gap is recognized around the Kii channel between the Shikoku Island and Kii Peninsula.
Our recent integrated result of first-arrival tomography based on the 2012 and 2014 wide-angle OBS data shows dramatic along-trough variation in P-wave velocity just beneath the basement of the incoming Philippine Sea plate. Variations in P-wave velocity from ~4km/s to more than 5km/s can be recognized south off the Cape Muroto, Shikoku Island and the Shima Peninsula, about 50-60km and 20km seaward of the deformation front, respectively. Such dramatic velocity change correspond with the structural boundary observed as variation in the configuration of the basement reflection in the time-migrated section, and the boundary of the plate age of about 20-21.5Ma proposed based on magnetic lineation by Okino [2015]. Similar along-trough structural variation in the incoming Philippine Sea plate can be recognized along two seismic profiles across the central Shikoku Basin far south from the trough axis [Nishizawa et al., 2011]. Furukawa et al. [this meeting] also find out the similar structural change around the eastern margin of the northern Shikoku Basin along several seismic profiles across the Izu-Ogasawara arc [Takahashi et al., 2015]. The low P-wave velocity of the oceanic layer 2 formed at backarc region is concerned to be related to high porosities and arc-related mineralogies [e.g. Dunn and Martinez, 2011]. Seismic velocities decrease in the oceanic crust may also indicate high water contents, which may be one of the causes of the low-frequency seismic phenomena around the down-dip limit of the Nankai Trough subduction seismogenic zone. This structural characteristic is thought to continue northwards to the subducting Philippine Sea plate beneath the southwest Japan, and may cause the segmentation of an earthquake rupture, and heterogeneous activity of the nonvolcanic deep low-frequency tremors and very low-frequency earthquakes.
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