Structural variation of the incoming Philippine Sea plate along the Nankai Trough off Shikoku

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The next large-thrust earthquake along the Nankai Trough, southwest Japan is concerned to occur within this century. Nonvolcanic deep low-frequency tremors and very low-frequency (VLF) earthquakes considered as one of indicators of the future large-thrust earthquakes are observed around the down-dip limit of the coseismic rupture zone of the last Tonankai and Nankai earthquakes [Obara, 2002]. However the activity of the nonvolcanic deep low-frequency tremors and VLF earthquakes is not homogeneous, and the belt-like tremor zone is divided into several segments bounded by gaps [Obara, 2010]. One of the causes of these low-frequency seismic phenomena is considered to be fluid generated by dehydration processes from the subducting slab. To investigate the relation between the formation process of the Philippine Sea plate and the occurrence of the low-frequency seismic phenomena as well as large-thrust earthquakes, it is important to investigate structural variation in the incoming Philippine Sea plate, including its fluid content.
In 2014, we conducted the seismic refraction and reflection survey in the northern margin of the Shikoku Basin, where the Philippine Sea plate is subducting beneath the Eurasia plate at the Nankai Trough. We conducted a 360km long seismic profile about 50-60km seaward of the deformation front along the Nankai Trough. 35 OBSs were deployed along the profile with the interval of 10km. A tuned airgun array shot with a total volume of 7800 cu. in. every 200m. Moreover, high-resolution multichannel seismic reflection survey is conducted along the same profile by using a 192-channel, 1.2km-long hydrophone streamer and an airgun array of 380 cu. in. volume shot by every 37.5m.
In the time-migrated reflection section, variation in the configuration of the basement reflection can be recognized as the structural boundary off the cape Muroto. The result of first-arrival tomography based on the wide-angle OBS data shows dramatic change in P-wave velocity just beneath the basement corresponding with the structural boundary observed along the reflection section as mentioned above. The structural boundary may be related to the boundary of the plate age proposed by magnetic lineation [Okino, 2015]. From the northeast of the structural boundary, it seems that the undulation cycle of the basement configuration is remarkably similar to the cycle pattern of frequency distribution of tremor along the tremor belt-like zone beneath the Shikoku Island shown by Obara [2010]. Similar undulation cycle of the basement configuration is also recognized in the reflection section previously acquired along trough axis just landward of the seismic profile of this study. Such incoming Philippine Sea plate with the dramatic structural variation is subducting beneath the southwestern Japan, and may have the possibility of any effects on the occurrence of the low-frequency seismic phenomena.
We will show the structural variation in the Vp/Vs ratio that is a sensitive to the presence of fluid by using PS converted wave observed by OBSs.
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