The Moho discontinuity and the Philippine Sea Plate beneath Southwest Japan derived from receiver function analysis

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In this study, we imaged S wave velocity discontinuities using P-to-S converted waves in receiver functions (RF) to investigate the relation between the aseismic Philippine Sea (PHS) plate and the lower crust and the upper mantle beneath the Chugoku district. We used teleseismic events that occurred in the epicentral distances of 30 - 80 degrees. We analyzed three-component waveforms recorded at 40 temporary stations operated by the Group for the Joint Seismic Observation in Southwestern Japan and 37 permanent stations by NIED (Hi-net), JMA, University of Tokyo and Kyoto University. The stations were distributed in a cross-shaped array. One of the lines of the array was about 260 km long in the N25W-S25E direction (N-S profile), and the other was about 140 km long in the N70E-S70W direction (E-W profile). The two lines intersected at the source region of the 2000 Western Tottori Earthquake (Mw 6.6) with each other. The observation was carried out from 2002 to 2004.

We estimated arrival directions of the P wave and its coda by polarization analysis (Park et al., 1987) to check whether the arrival directions were different from the theoretical back azimuths. We calculated RFs by deconvolving the vertical component seismogram from the radial component seismogram using a multi taper method (Park and Levin, 2000). The deconvolution essentially removed the P waves from the RFs except for the direct arrival, and leaved conversions and reverberations of P-to-S types generated at S wave velocity discontinuities. We produced images of the P-to-S converted waves along the N-S and E-W profiles. The results show two clear discontinuities to be considered to correspond to the Moho discontinuity and the PHS plate. They are consistent with the results of Shiomi et al. (2004) and Yamautch et al. (2003).

The upper surface of the seismic PHS plate has been derived from hypocentral distributions beneath the Southwest Japan (e.g., Miyoshi and Isibashi, 2004, Nakamura et al., 1997). These results did not illustrate the surface of the PHS plate beneath the Chugoku district, since no earthquakes occur in the mantle of this region. However, it has suggested that the aseismic PHS plate exists beneath the region (e.g., Nakanishi, 1980). Recently, Doi et al. (2002) and Nishida et al. (2002) found a reflector located deeper than 50 km in the source region of the 2000 Western Tottori Earthquake. In the previous study (Ueno et al., 2004), we found two surfaces of the P-to-S converted waves beneath the source region. The shallow one was considered to correspond to the Moho discontinuity and the other might correspond to deep reflector of P waves. In this study, we extend the target region from the source area of the 2000 Tottori earthquake to the central part of the Chugoku and Shikoku districts, and discuss the relationship between the deep surface and the aseismic PHS plate beneath the central part of Southwest Japan.