

Origin of distinct later phases of slab earthquakes beneath southwest Japan

Takayuki Miyoshi[1]; Katsuhiko Ishibashi[2]

[1] Earth and Planetary Sci., Kobe Univ.; [2] RCUSS, Kobe Univ.

<http://www-seis.planet.sci.kobe-u.ac.jp/>

The subducting Philippine Sea (PHS) plate reaches depths of about 30-70 km beneath the region from Ise Bay to western Shikoku, southwest Japan (Miyoshi and Ishibashi, 2004). Due to shallow focal depths of slab earthquakes, many distinct later phases have been observed after initial P and S waves in their seismograms.

We analyzed the NIED's Hi-net seismograms of slab earthquakes during the period from October, 2000 to May, 2005 with depths of 30-60km beneath southwest Japan. In this paper, we focus on slab earthquakes at depths around 30 to 40 km beneath the Lake Biwa region.

In the case of Sept. 4, 2002 earthquake (M4.3; H=38.5km), four distinct P later phases and three remarkable S later phases arrived after initial P and S waves, respectively (denoted by P1, P2, P3, P4 and P5 phases and S1, S2, S3 and S4 phases). To understand the origin of these phases, we calculated ray paths and theoretical travel-times by using 2-D ray tracing method. Assuming the seismic wave velocity structure in the subducted PHS plate and continental crust beneath the Lake Biwa region (cf. Hori et al, 1985), observed arrival times were compared with calculation. As a conclusion, we interpreted the origin of these phases as follows: Concerning P waves, P1 is Pn, head wave traveling through the uppermost mantle below the earthquake occurrence layer; P2 is Pg, direct wave; P3 is pPcP, reflection of upgoing P wave at free surface and at Conrad discontinuity; P4 is pPmP, reflection of upgoing P wave at free surface and at Moho discontinuity; P5 is sPmP. As for S waves, S1 is Sn; S2 is Sg; S3 is sScS; S4 is sSmS.

We estimated a preliminary crustal structure beneath the Lake Biwa region. The earthquake occurrence layer, corresponding to an oceanic crust, exists at the depth range of 30-40 km above a high velocity layer. The Moho depth beneath the Lake Biwa region is about 40km, deeper than that to the west of Lake Biwa. This result is consistent with Hori et al.(1985) and earlier studies. This earthquake occurred not within the mantle but within the oceanic crust.

Acknowledgements: We used Hi-net waveform data by NIED and JMA's hypocenter database. We also used USGS open-program of 2-D ray tracing (Luetgert, 1992) and WIN system (Urabe and Tsukada, 1992). We are grateful to them for providing valuable data and tools.