P-WAVE VELOCITY STRUCTURE AND SEISMIC REFLECTORS IN RELATION TO SEISMIC ACTIVITY IN THE KINKI DISTRICT

Kiyoshi Ito[1]; Issei Hirose[1]; Takuo Shibutani[1]; Shiro Ohmi[1]; Yasuhiro Umeda[2]

[1] DPRI, Kyoto Univ.; [2] DPRI Kyoto Univ.

Seismic activity in the Kinki District is studied in relation to the crust and upper mantle structure. Relationship between the seismicity and crustal velocity structure has been revealed such as that most of the earthquakes in the crust occur only in a layer with P-wave velocity of 6km/s. Besides, seismic reflectors in the lower crust is supposed to play an important role for occurrence of large earthquakes. Thus crustal structures are important to derive process of the earthquake occurrence as well as to determine the hypocenters and green functions for calculation of theoretical wave forms.

Seismic surveys of the crust and the upper mantle structure have been conducted under the special project for earthquake disaster mitigation in urban areas (DAIDAITOKU). In 2004, the deep seismic profilings were carried out in the Kinki district southwest Japan. Seismic refraction and wide-angle-reflection surveys were carried out along the Shingu-Maiduru line of about 240km. From the results with other explosion seismic surveys in the Kinki district, the followings are obtained for the relationship between seismicity and structures of the crust and the upper mantle:

1) The Philippine Sea (PHS) plate is well defined from the seismic surveys and it lays even beneath the northern Kinki district, though no earthquakes occur in it to the north of Osaka.

2) Two clear parallel reflectors about 10km apart, relating to PHS, are identified on the Pacific to the area of Osaka. The two reflectors seem to join in the area of Osaka at depth of about 60km.

3) The lower reflector coincident with the upper boundary of mantle earthquakes. The upper reflector is shallower than the lower one by 8-10km.

4) The dip of PHS determined from the reflectors is about 15 degrees on the Pacific and 20 degrees in the inland area.

5) The reflectors are very clear in the range of about 25km from the coast of Kii Peninsula towards inland.

6) Low frequency earthquakes occur at the intersection of the inland Moho with PHS.

7) The lower crust is reflective with many northward dipping reflectors. In particular, some of them seem to continue to the active faults in a shape of detachment.

8) A very clear reflector is located at the base of the seismogenic layer in the crust.

9) Another clear reflector at depth of about 25km is well observed in the northern Kinki district. The reflector is coincident with the S-wave reflector found from earthquakes.

10) Shallow structure including surface layer is well corresponded to the geological features: the surface layer with velocity less than about 6km/s is shallow from the Arima-Takatsuki Tectonic Line (ATL) to the Median Tectonic Line (MTL).

11) The depth of the Moho is about 32km from refracted waves, though Moho reflection is not clear in the single-fold reflection section.

12) A graben-like structure with depth of about 1.5 km was found at ATL from detailed reflection survey.

13) Another reflectors of 60-90km were also found beneath northern Kinki district. This seems to be the same reflector found in the area of the 2000 western Tottori earthquake.

The obtained structure of the crust and the upper mantle leads to a model of earthquake generation, in which strain concentrates in the lower mantle due to the plate motion. Fluid or gas plays an additional role to the occurrence of large events. Thus combined refraction and reflection surveys are effective to reveal the process of large earthquakes in both plate boundary and inland regions, providing detailed image of the crust and upper mantle.