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Distinctive reflectors in the lower crust and seismic activities in the inner zone of Southwest Japan

Kiyoshi Ito[1], Koji Yoshii[2], Tomotake Ueno[3], Hiroo Wada[4]

[1] Disas. Prev. Res. Inst, Kyoto Univ., [2] RCEP, DPRI, Kyoto Univ., [3] RCEP,DPRI,Kyoto Univ., [4] Kamitakara Obs., Disas. Prev. Res. Inst., Kyoto Univ.

Crustal velocity structures and reflectors in inland zone of Southwest Japan are studied with relation to the seismogenic layers. Velocity structures are derived from seismic refraction and wide-angel reflection surveys along measure lines of 70-250km long. We reanalyzed the Fujihashi - Kamigori profile line conducted in 1988 and other additional observations for the shots, and the Keihoku - Seidann profile line in 1995 after the Hyogo-ken Nanbu earthquake. We also refer to some other data in the northern Kinki district and those in the Atotsugawa fault area in the Chubu district carried out in 2000 and in 2001. We also used the data obtained during the surveys in the source area of the 2000 Tottori-ken Seibu earthquake, in 2002.

Clear later arrivals or reflectors are found in a record section of the survey in the Western Tottori area. The two-way travel times of them are 4.5s, 7-8, 10 and 16-20s. The phases are often seen in many reflection and wide-angle reflection sections in the inland zone. Therefore, we intended to reveal the same kind of reflectors in the northern Kinki district, where seismicity has been well studied.

The travel-time data are reanalyzed to obtain crustal velocity images and reflectors in the middle crust in northern Kinki district by the ray tracing. The upper part of the crustal structure is well constructed by fitting observed travel times to the theoretical ones. For the middle to lower crust, the travel times of the first arrivals are few. Therefore, travel times the first arrivals and reflected waves are used simultaneously to derive a velocity structure. While, seismogenic layers are well determined by dense networks of earthquake observations for about 25years. The upper cutoff of seismicity with depth of 3 to 7km is closely related to the P-velocity boundary of the surface layer with velocity less than 6km/s and basement layer with velocity more than about 6km/s. Below this layer, velocity slightly increases down to a depth of 15-20km. Clear reflection boundaries in the mid-crust and the reflective lower crust were found in the whole study areas at 4-5 and 7-8s of two-way travel times. The top of the reflector seems to be located at the base of the seismogenic layer in the upper crust. The reflector at 7-8s of TWT or at about 20-25km deep is very clear and seems to coincides with the S-wave reflector found by Katao (2001) in the same area The moho reflection is not clear in the area.

The reflector at the base of the seismogenic layer may be related to the break up process of the large inland earthquakes, most of which initiate near the bottom of the seismogenic layer. Shibutani et al.(2001) found high velocity patches near the base of the aftershock area of the 2000 Tottori-ken Seibu earthquake. The reflector may be attributed to the patches. The strain accumulation process is depend on the heterogeneous structure in the lower crust as well as in the upper crust. The reflector in the lower crust may play an important role for the process.