The seismological structure about fault zone extending to the lower crust in the northern Kinki district, southwestern Japan

*Shinya Kato[1], Yoshihisa Iio[1], Takuo Shibutani[1], Hiroshi Katao[1], Masayo Sawada[1], Kazuhide Tomisaka[1]

1. Disater Prevention Research Institute, Kyoto University

The “water-weakened lower crust model” has been proposed to explain the mechanism of stress concentration on faults of inland earthquakes (Iio et al. 2002). According to this model, it is necessary that heterogeneous structure caused by the fluid exists locally in the deeper part of fault zones in the lower crust, but it has not been clearly confirmed in previous researches. This is because we do not resolve the heterogeneous structure due to fluid in the deeper part of fault zones in the lower crust. In order to solve this problem, in this study, we tried to image the heterogeneous structure in the lower crust in detail.

We conducted S-wave reflection analysis to detect the horizontal distribution of the heterogeneous structure (reflector), and receiver function analysis to estimate the structure beneath the reflector, in the northern Kinki district, southwestern Japan. As a result of the S-wave reflection analysis, it is found that the reflector exists on the north side of the Arima-Takatsuki fault zone and does not exist on the south side of it. We consider that the distribution of the reflector is related to the Arima-Takatsuki fault zone. From a result of the receiver function analysis, it is found that reflector is a thin layer with low S-wave velocity.

It is concluded that the thin layer with low S-wave velocity exists in the lower crust of the northern Kinki region. As the origin of it, it is possible to consider fluid dehydrated from the Philippine Sea slab subducting beneath the Arima-Takatsuki fault zone. In the vicinity of the Arima-Takatsuki fault zone, it is known that fluid that seems to originate in the mantle springs out (Kazahaya et al. (2014)). In the lower crust, pores between minerals exist independently (Yoshino et al. 2002), and fractures caused by faulting is thought to be necessary for fluid movement (Mibe et al. (2000)). Furthermore, since the spatial distribution of the reflector is related to the Arima-Takatsuki fault zone, we consider that the reflector in the lower crust indicates that fluid exists in fractures caused by faulting. This result supports the water-weakened lower crust model.

Keywords: S-wave reflection analysis, receiver function analysis, lower crust, fault zone, fluid

