Fluid in the lower crust estimated by a high-resolution reflection analysis in the northern Kinki district, southwestern Japan

*加藤 慎也[1]、飯尾 能久[1]、片尾 浩[1]、澤田 麻沙代[1]、冨阪 和秀[1]、三浦 勉[1]、米田 格[1]
*Shinya Kato[1], Yoshihisa Iio[1], Hiroshi Katao[1], Masayo Sawada[1], Kazuhide Tomisaka[1], Tsutomu Miura[1], Itaru Yoneda[1]

1. 京都大学防災研究所
1. Disater Prevention Research Institute, Kyoto University

We conducted a high-resolution reflection analysis by using data from 168 seismic stations with an average spacing of about 5 km in the northern Kinki district, southwestern Japan. We used 168 points of seismometers. 61 points of those are permanent stations and 107 points of those are temporary stations. Temporary stations are next-generation seismometry system called the “Manten system”.
This area is a part of Niigata–Kobe tectonic zone (NKTZ) identified as a zone with high strain rates. Iio et al.(2002) proposed the water-weakened lower crust model, which explains that strain rates are high in the NKTZ. This model indicates that strain concentration is arisen in the NKTZ by water upwelling from subduction plates.
Katao et al. (2007) conducted a reflection analysis and estimated the distribution of S wave reflection points using data observed at 10 permanent stations. They found a planar distribution of the S wave reflection points at a depth of 20 –30 km. But, the detailed shape of S wave reflector was unknown. Aoki et al. (2016) conducted a high-resolution analysis by using data from 128 seismic stations with an average spacing of about 5 km, and they found that the S wave reflector is dipping to the north and that isolated intraplate deep low-frequency earthquakes (DLFs) occurred near the edge of the S wave reflector. They think that the reflector is the fluid path and isolated intraplate DLFs are related to fluid.
Aoki et al. (2006) conducted the reflection analysis, assuming the homogeneous horizontal structure, but S wave reflector is dipping. If the true reflector is dipping, reflecting points of seismic waves and the location of S wave reflector differ from the case supposing the homogeneous horizontal structure. Hence, the purpose of this study is to detect the accurate location of S wave reflector. This study modifies the method using Aoki et al. (2016) to detect accurate locations of S-wave reflectors.
As a result of analysis, we obtained more highly-detailed results than Aoki et al. (2016). We confirmed S-wave reflector reported by Katao et al. (2007) and Aoki et al. (2016), and detected the accurate location of S wave reflectors. We found the new S-wave reflector at the area where Aoki et al. (2016) could not make imaging. This new S-wave reflector exists on the east side from the S-wave reflector reported by Katao et al. (2007) and Aoki et al. (2016). After this, we call the S-wave reflector reported by Katao et al. (2007) and Aoki et al. (2016) the reflector W, and the new S-wave reflector the reflector E. The north edge of the reflector E and W is located near different epicentral areas of DLFs. The reflector W exits along the Kyoto Nishiyama fault zone. It appears that the position of this reflector W moves to the northwest direction along the Kyoto Nishiyama fault zone as it is deepened. The reflector E exits along the Hanaore fault zone and Biwako Seigan fault zone. It appears that the position of this reflector E moves to the northwest direction along these fault zones. It is imaged as different S-wave reflectors in deeper region, but these reflectors are united in shallower region. Epicenters of DLFs are located immediately above the edge of the reflector E, and the high $^{3}He/^{4}He$ ration are detected around the epicenter (Umeda et al., 2007). The result of tomography in this region indicates the existence of fluid by dehydration from Philippine Sea Plate in the lower crust (Nakajima and Hasegawa. (2006)). According to previous studies, the crustal fluid by dehydration from Philippine Sea Plate exists near these epicenters and we infer from these results that this crustal fluid arouses DLFs and forms the S wave reflector. The result inferred the

existence of fluid under the active fault in the lower crust is in accordance with the consideration of the water-weakened lower crust model proposed by Iio et al. (2002).

キーワード：反射法、下部地殻、流体、新潟–神戸歪集中帯、深部低周波地震、満点システム
Keywords: Reflection analysis, Lower crust, Fluid, Niigata-Kobe Tectonic Zone, Deep low-frequency earthquakes, Manten system