AOGS 2005

Concealed Active Fault Study in Urban Areas Using Ground-Penetrating Radar Imaging Techniques

TAKAO MIYATA

Department of Earth and Planetary Sciences, Kobe University,
miyata@kobe-u.ac.jp/ Fax: +81- 78-803-5784

The Mj 7.3 Hyogo-ken Nanbu (Kobe) Earthquake hit a Japanese mega-city on 17 January, 1995. Although the surface ruptures accompanied with this earthquake appeared on the northern Awaji Island, these did not appear obviously in the urban area of Kobe, at which was suffered from the severe damages of the 7th degrees of seismic intensity. But on the Kobe side, it made clear that the earthquake faults moved right-laterally about 30 km in length, based on some observations and analyses after the earthquake. Furthermore, on the Kobe side, some concealed active faults were discovered from the reflection seismic surveys. Accordingly I have investigated the concealed active faults at two sites of Kobe and Ashiya with Ground-Penetrating Radar (GPR) in order to characterize the subsurface fault structure.

For this study, a SIR-2 system (GSSI) with 100 and 35 MHz frequency antennas was used. Using the RADAN software, the GPR data were processed to accentuate geologic features by high pass filtering, low pass filtering and migration. The time profile changed to a depth profile by the wide-angle measurement.

We made the following observations based on the GPR imagery: (1) Detection of an anomalous reflector was found in all survey sites across the concealed active fault. The anomaly is characterized by discontinuities of multiple sub-horizontal reflectors with either a reflector-break-mode or a reflector-bending-mode. (2) The reflector-break-mode shows often a zone of weak reflected signals. Its width is 8-15 m. (3) The width of a reflector-bend-mode is estimated at 10-15m. (4) The vertical offset of the reflector-bend-mode can be estimated at 0.8-1.0m. (5) The thickening of sediments is generally observed in the synclinal bend.

Judging from the GPR results and the geological observations, the zone of the reflector-break-mode is interpreted as a fracture zone of the fault, while the structures of the reflector-bend-mode are interpreted as flexures of subsurface sediments, overlying the concealed active fault. We can discuss about the vertical displacement of the concealed active fault, based on the reflector-bend-mode on the GPR imagery. Therefore, the GPR imaging techniques are very useful for understanding the accurate location and activity of the concealed active fault.