Urban concealed-active-fault investigation in Baku (Azerbaijan) using a ground-penetrating radar

Takao Miyata[1]; Fegan Aliyev[2]; Arif Gasanov[2]

[1] Earth and Planetary, Sci.,Kobe Univ.; [2] none

Two earthquakes (Mw6.2 and Mw6.1) hit the Baku mega-city, Azerbaijan on 25 November, 2000. These earthquakes took 31 lives, and gave great damages of building and infrastructures in Baku. These epicenters were in the Caspian Sea, 25 km to the south-southeast of Baku. However, until now, there is not enough information about the accurate location and activity of active faults in Baku. Accordingly, we have a cooperative research project on the Regenerative study of Urban Infrastructure in Baku, Azerbaijan from the point of disaster prevention (Representative: Shiro Takada) between Azerbaijan and Japan. On August in 2005, we investigated the active faults at seven sites, BK1-BK7, in the urban area of Baku, using a GSSI ground-penetrating radar (GPR) unit and 100 MHz antenna.

Azerbaijan region is essentially characterized by a collision of the Arabian plate against the Eurasian plate [1]. Because the Arabian plate drifts northward at a rate of 3 cm/yr, the Iranian and Anatolian plates are laterally ejected, and the Lesser Caucasus is pushed against the Mesozoic back-arc basins to the north. The western margin of the southern Caspian Sea has the present-day horizontal motion vectors toward NNE, based on the GPS data [2]. The NE-striking fault has a predominant left-lateral strike-slip component, while the NNW-striking fault has a predominant right-lateral strike-slip component due to the northward movement of the Arabian plate. The NNW-striking active fault, found in the Shabandang-Badamdar Mountains near Baku, is one of the right-lateral strike-slip faults in Azerbaijan and Caspian Sea region [3]. It is assumed that the fault has at least the length of 30 km on the land, and further extends to the epicenter of the two earthquakes in the Caspian Sea.

We applied the GPR method for a hidden fault in the urban area of Baku. At all sites, the GPR survey was conducted across a slope and small-scale depression. The length of each survey line is 50 to 300 m. The range of the two-way travel time was used 150 ns, additionally 250 ns for the 100 MHz antenna. The obtained 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. The following results were obtained: (1) Detection of an anomalous reflector was found all at the seven sites. The anomaly is characterized by discontinuity and nearly-vertical, weak (dark) zone of the reflected signal. (2) We have clear GPR imagery showing a discontinuity with an eastward inclination of high angle at two sites (BK1 and BK3). (3) The zone width is 11 -16 m. Judging from the GPR results and observations, the above-noted discontinuity and zone can be interpreted respectively as a fault and fracture zone, saturated water. Secondly, we found a concealed active fault in the urban area of Baku. This is supported from a shallow reflection survey [4]. And it is assumed to run parallel to the NNW-striking active fault in Shabandang-Badamdar Mountains. Therefore this fault information is thought to be very important for disaster prevention in Baku.

References: [1]Philip, H. et al. , 1992, Geophys. J. Int., 110, 141-158; [2]Guliyev, I.S. et al., 2002, Transactions of the Russian Academy of Sciences, Earth Science Section, 383, 174-177 ; [3]Miyata, T. et al., 2006, EGU06, MS4, Vienna, CD-Rom; [4]Takada, S. et al., 2005, 24th Annual Meeting of Japan Society for Natural Disaster Science, 17-18. (J)