Crustal structure under the eastern flank of the Kanto Mountains from refraction/wide-angle reflection analysis

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In 2003, a refraction/wide-angle reflection profiling was carried out in the eastern flank of the Kanto Mountains as a part of Special Project for Earthquake Disaster Mitigation in Urban Areas. The about 140km-long seismic line was laid out in a north-south direction from Kiryu city, Gumma prefecture to Odawara city, Kanagawa prefecture. Dynamite shots with 200-300kg charges at 9 locations and vibroseis shots at 6 locations were used as the seismic sources. This paper reports the crustal structure beneath the eastern flank of the Kanto Mountains revealed by the refraction/wide-angle reflection analysis of the data.

This line is divided into four parts, northwestern part of the Kanto Plain, the Kanto Mountains, Tanzawa Mountain and Ashigara Plain. The southern part of the line is located at the collision zone between the Honshu arc and the Izu-Bonin arc associated with the subduction of the Philippine Sea Plate. The purposes of this seismic experiment are elucidating the depth and the configuration of the Philippine Sea Plate, the configuration of the fault zones, such as Kan'nawa-Kodu-Matsuda fault zone, and velocity structure of the sedimentary layer and the crust beneath the western part of the Kanto Plain.

U-D 10Hz geophones were deployed at about 50m spacing for data acquisition. Signals were recorded with the digital telemetry system in the about 55km line from the northern part of Kiryu city to Fukaya city and in the about 16km line from Minami-Ashigara city to the western part of the Hatano Basin. Stand-alone seismographs were set in the about 85km line at the middle of the seismic line. The total number of stations for dynamite shots is 2518 and that for vibroseis shots is 1278 or 621.

In the record sections, first breaks of refractions (apparent velocity almost equal to 6.0km/s) can be picked in the broad area, except for some of the record sections from vibroseis shots. And also in some of the dynamite shots, reflection waves from the crust and the upper boundary of the plate can be seen.

A velocity structure beneath this line by forward ray tracing shows the large velocity variation and heterogeneity in the sedimentary layer. The velocity of sedimentary layer beneath the Ashigara Plain is about 3km/s. There is a thick sedimentary layer (about 2km at a maximum) beneath from the northern flank of the Kanto Mountains to the northwestern part of the Kanto Plain with a velocity of 2.0-2.5km/s. On the other hand, the uppermost velocity beneath the Kanto Mountains and Tanzawa Mountain is larger than 4.0km/s. We cannot find the velocity variation corresponding to tectonics in deeper part although there is a tendency that velocity of southern part is lower than that of northern part. We also cannot determine the velocity structure deeper than about 5km accurately because of insufficient ray coverage. From the analysis with reflection travel times, some clear reflection boundaries were revealed beneath the Kanto Mountains. The depth of the Philippine Sea Plate was determined to be about 9km at the southern tip of the line, and about 20km at the middle. In the record section of northernmost dynamite shot, we can see the refraction wave which presumably traveled within the plate whose velocity was determined to be about 7km/s. This is almost comparable to the velocity of the lower crust of the Izu-Bonin arc revealed by the seismic reflection-refraction experiment at 32N (Takahashi et al. 1998).