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Seismic survey using artificial sources at Nobi fault system, central Japan - advanced analysis

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The structure of active fault in deep region has important information for investigating generation mechanism of inland earthquakes and forecasting strong ground motion by the earthquake. In the last fiscal year, we conducted seismic reflection survey using artificial sources (Vibroseis) at Nobi fault system, central Japan in order to investigate the seismic structure beneath the fault system. The strike-slip Nobi fault system, about 80 km long, activated at the 1891 Nobi earthquake (M 8.0). Seismic data were processed, then, using CMP method and the depth converted seismic reflection profiles were obtained. We found some reflection planes around the fault down to the depth of about 10km. The results were reported at 2010 joint meeting in the last year. In this presentation, we applied advanced analysis methods, CRS-MDRS (Common Reflection Surface - Multi-Dip Reflection Surfaces) method and 'Fresnel-volume' migration, in order to make clearer the distribution of reflection planes in and around the fault.

The outlines of the seismic survey were as follows. We set two survey lines; the one was an NE-SW line of about 30 km length crossing the central part of the Nobi fault system (northern line), the other was an E-W line of about 22 km length, beside the southern part of the fault system (southern line). Four large size vibrator trucks vibrate the ground along the survey lines and we tried to image subsurface seismic structures down to the depth of about 20 km. Total vibrating sites were 105 in the northern survey line and 93 in the southern survey line. The sweep signals of 6 - 40 Hz were recorded by geophones and digital telemetry systems (JGI GDAPS4) arranged along the survey lines at about 50 m interval. Geophones and off-line recorders (JGI MS2000) were also used in a small part of the survey line. Total seismic receiving sites were 684 and 453 in the northern and southern survey lines, respectively.

Distribution of reflection planes became to be clear due to the advanced analysis. In the northern survey line, wavy reflection planes are recognized in the depth of about 2 - 3 km which should be correspond to the anticline and syncline structures we confirm on the ground surface. There are reflection planes in the depth of 8 - 11 km in the southwest and northeast region, respectively. The planes seem to be disconnected in the region under the surface fault. In addition, the reflection plane was found in the depth of 14km in the southwest region, which was obscure before applying the advanced analysis. Whereas, in the region of the depth of 3 - 8 km, reflection planes are hardly found. In the southern survey line, reflection plane descending to the west was detected clearly down to the depth of 10km. It is indicated that the reflection plane extends to a buried thrust fault plane where the seismicity is active and the hypocenters are distributed in planar shape. In addition, we found the reflection plane descending to the east in the west part of the survey line, which seems to correspond to the syncline structure confirmed in the northern area of the survey line.

Keywords: Nobi fault system, Seismic survey, Seismic reflection method, Vibroseis, Common Reflection Surface method, 'Fresnel-volume' migration