

Geologic structure of southern part of Uonuma Hills, Chuetsu, Japan: shallow seismic reflection profile in Itsukamachi

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The main shock of the 2004 Niigata Chuetsu earthquake (M 6.8) was generated by faulting along the west-dipping, high-angle-reverse fault beneath the central part of the Uonuma Hills (e.g. Hirata et al., 2005). The distribution of aftershocks is concordant with the geologic structure in the Uonuma hills, namely southern end of the aftershock area coincidence with the end of the Higashiyama anticlinorium. In the focal area, the Muikamachi fault bounding the eastern edge of the Uonuma hills shows low angle (less than 30 degrees) in the shallow part and continues to the deeper high-angle source-fault (Kato et al., 2005; Sato et al., 2006). On the other hand, in the south of the focal area, the Uonuma Hills shows simple asymmetric anticline and the Muikamachi fault in the eastern edge is estimated to have relative high-angle, simple geometry than in the north (Sato and Kato, 2005). However, actual subsurface geometry of the Muikamachi fault in the south of focal area is poorly understood. To reveal the subsurface geometry of this fault, high-resolution seismic profiling was undertaken in October 2005 across the Muikamachi fault. A 3.6-km-long seismic line is located along the River Oppori-gawa in Itsukamachi across the Muikamachi fault. With 3 km gap, the seismic line connected the Tamugiyama seismic line (JNOC, 1988). Seismic source was a mini-vibrator (IVI T15000). Shot and receiver intervals are 10 m. Seismic signals were recorded by JGI, G-daps 4 recorder using fixed 360-ch. Sweep frequency were 10 to 100 Hz and number of sweeps were ten or five at a shot point. The seismic records were processed by Common Mid-point method using a seismic software (JGI, Super X).

Seismic section portrays the subsurface image down to 1 second (Two way travel time). West-dipping fault is interpreted at the eastern edge of the Uonuma Hills by the abrupt termination of horizontal reflectors in the Muikamachi basin. The surface trace of this fault coincidence with the surface trace estimated by tectonic geomorphology (Watanabe et al., 2001). In the basin fill of the Muikamachi basin some discontinuities are identified by the pattern of reflectors. The most prominent one located at 250 m below the surface is interpreted as the base of the Uonuma Group. The vertical offset of the base horizon of the Uonuma Group is estimated as 420 m, following the above-mentioned interpretation. Together with the JNOC Tamugiyama seismic line, the main geologic structure of the Uonuma Hills are revealed. The estimated fault geometry is simple without showing a large bed as it is estimated Sato and Kato (2005).