Seismic reflection profiling and across the surface rupture associated with the 2004 Mid-Niigata Prefecture earthquake

Naoko Kato[1]; Hiroshi Sato[2]; Tomoo Echigo[3]; Masaaki Tateishi[4]; Sumiko Ogino[5]; Shin'ichi Sakai[6]; Hajime Kato[7]; Shigeru Toda[8]; Shin Koshiya[9]; Tanio Ito[10]; Tsuyoshi Toyoshima[11]; Toshifumi Imaizumi[12]; Shintaro Abe[13]

[1] ERI; [2] ERI, Univ. Tokyo; [3] Graduate School of Science, The University of Tokyo; [4] Dept. Geol., Niigata Univ.; [5] EPRC,ERI,Tokyo Univ.; [6] Earthquake Research Institute, Univ. of Tokyo; [7] Education and Human Sci., Univ. of Yamanashi; [8] Earth Sci., AUE; [9] Civil and Environmental Eng., Iwate Univ.; [10] Dept. Earth Sciences, Fac. Sci., Chiba Univ.; [11] Grad. Sch. Sci. & Tech., Niigata Univ.; [12] Geography Sci., Tohoku Univ.; [13] CRIEPI

The Mid-Niigata Prefecture earthquake in 2004 (Mj 6.8) generated the surface ruptures along the eastern rim of the Uonuma Hills. To reveal the relationship between a the seismogenic source fault and the surface ruptures, shallow, high-resolution seismic reflection profiling was undertaken across the surface ruptures and active faults.

High-resolution common mid-point (CMP) seismic reflection data were acquired using a mini-vibrator (IVI, T-15000) and shot interval of 10 m. The sweep signals (10-100Hz) were recorded with 10 Hz geophones deployed at 10 m intervals and a digital telemetry system (JGI G-DAPS4). The seismic data were processed using conventional CMP-reflection methods.

The resultant depth converted seismic section portrays an emergent thrust beneath the surface ruptures associated with the Mid-Niigata Prefecture earthquake. Based on the geologic structure, this emergent thrust corresponds to the northern extension of the Muikamachi fault. 2D model of the fault geometry is estimated based on the aftershock distribution and shallow reflection profile. The development of the main geologic structure is well explained by the forward modeling using a balanced cross-section method. Thus the fault system generated the main shock shows high angle (60) below 5 km in depth and low angle (30) at the shallower part.