Seismic reflection profiling across the source fault of the 2003 Northern Miyagi earthquake , NE Japan

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The Northern Miyagi earthquake (Mj 6.4) on July 26, 2003,was a shallow crustal earthquake produced by high-angle reverse faulting. By dense array of temporal seismic stations, the geometry of source fault was well constrained by the distribution of aftershocks. To construct realistic geologic model for this fault system from deep to shallower part, seismic reflection profiling was carried out across the northern part of the source fault of this earthquake. The common-mid point seismic reflection data were acquired using a vibrator truck for 12-km-long seismic line. The interval of shot and receiver points were 25 m. The obtained seismic profile portrays the Miocene half-graben bounded by west-dipping fault with 55 degrees. The portion close to the fault scarp of the normal fault shows poor and chaotic pattern of reflection and consists of thick conglomerate deposited as talus and footwall fans. Together with the data of gravity anomaly, the maximum thickness of the basin fill probably reaches 3 km. From regional geology, this basin bounding normal fault forms the eastern edge of the northern Honshu rift system and was produced by rapid extension during 17-15 Ma. The displacement of the Pliocene strata along this fault indicates that reverse faulting occurred after late Pliocene. The deeper extension of the fault revealed by seismic profiling coincides with the linear array of the aftershock distribution. The hypocentral distribution of the aftershocks shows concentration on the plain dipping 50 degrees to the west with listric geometry. The geometry of rift basin on the hanging wall accords well to the deep fault geometry revealed by hypocentral distribution aftershocks. Thus, the basin inversion has been performed using the same fault also in the deeper portion. The 2003 Northern Miyagi earthquake was produced by fault reactivation of Miocene normal fault.