

Deep Seismic Reflection Profiling across the Kitakami Lowland, Northeast Japan

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The deep geometry of active faults and the mid-crustal detachment at the base of seismogenic layer is important for understanding active tectonic process and accessing the risk of destructive earthquakes. To investigate the deeper extension of active faults within the seismogenic layer, we conducted a seismic reflection profiling experiment across the western marginal faults of Kitakami Lowland (KL), northeast Japan. The KL is located at the eastern edge of the Miocene rift system of northern Honshu Island. The western marginal faults of KL are commonly recognized as active reverse faults re-activated after crustal stretching during Miocene back arc spreading and subsequent lithospheric cooling. In the seismic reflection survey, four vibrator trucks and 100kg explosives were used. Along an EW oriented 42km-long seismic line with 25-50m geophone spacing, approximately 500 vibrator shots, 15 higher energy vibrator shots up to 100 stationary sweeps at each point, and 2 explosive shots were carried out. Near the western marginal faults of KL, additional high-resolution seismic reflection data were acquired by dense spatial sampling (shot /receiver interval=10m). The seismic reflection profile clearly shows the geometry of west dipping listric faults and the east dipping mid-crustal detachment, suggesting that the deeper extension of the western marginal faults of KL converges on the mid-crustal detachment at the base of seismogenic layer. The high-resolution reflection profile documents the detailed process of reverse reactivation of pre-existing normal faults along the Kitakami fault system.