

Onshore-offshore deep seismic profiling across the Toyama basin: 2014 Kahoku-Tonami seismic survey

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We show preliminary results and interpretation of newly obtained deep seismic reflection profiling across Toyama sedimentary basin beneath Tonami Plain, to illuminate crustal architecture and deep to shallow structures of active faults in this region. We deployed 25 m interval offline seismic recorders covering 15 km long onshore seismic line extending from the Kureha Hills to the shoreline and connected with 2.5 km long bay cable. In addition, we deployed denser, 12.5-m-interval off-line recorders across the Tonami plain to the eastern flank of the Hodatsu Mountains to the west to illuminate shallow high-resolution structures and recent activity of blind thrust structures. Seismic signals enhanced by 25-m-interval shots using four vibroseis trucks were recorded by these onshore and offshore recorders simultaneously. Refraction tomography by use of shot records of 100-150 sweeps at about 5 km intervals suggests that P-wave velocity structure traced by the top of Vp 5 km/sec, presumably correlated with top of the pre Neogene granitic basement rocks appears located 5 km below the sea level beneath the Tonami Plain and delineates significant amount of subsidence of this region during Neogene, equivalent to the Toyama trough located to the north. Deep seismic reflection profile indicates that thick basin-fill beneath the Tonami Plain are strongly faulted and folded by moderately dipping thrust faults located both near topographic domain boundaries and underneath flat-lying alluvial plain. Architectures of folded sedimentary units suggest most of these structures are reactivated normal faults originally formed associated with Miocene extension tectonics. These structural characters of sedimentary basin are similar to other sedimentary basins extensively distributed in backarc regions, such as Niigata basin and northern Fossa magna basin. High-resolution seismic reflection profile indicates recent activity of these reactivated structures. Other important contribution from this experiment include that coastal plain along the Sea of Japan beneath the western portion of the seismic line is underlain by previously unrecognized, east-facing monocline and east-dipping thrust faults. In conclusion, these survey results provide great contribution to construct seismic source fault models for Tsunami and seismic hazard estimation.

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