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High resolution seismic reflection profiling across the Torigoe fault, central Japan

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We collected and processed shallow high-resolution seismic reflection data across the Torigoe fault in Niigata sedimenrary basin, in order to resolve shallow structures and to understand structural linkage between active faults and folds recognized at ground surface and deeper, complicated fold and thrust structures. We deployed 200 seismic channels, 10-Hz geophones, and mini-vibrator as a seismic source along about 7-km-long seismic line. Common midpoint stacking by use of initial velocity analysis successfully illuminates subsurface geometries of active fault-related fold to 1-1.5 two-way time. Detailed seismic reflection analyses including refraction and residual statics, migration, deconvolution, and time-space variant bandpass filters, and depth-conversion by use of stacking velocities enable to obtain subsurface depth section of these active structures. The high-resolution depth section shows that upward extension of the west-dipping thrust imaged in the deeper section is consistent with emergent thrust fault defined by middle Pleistocene conglomerates, sand- and mudstone are thrust over younger fluvial sediments. It is of interest that several active fault/fold scarps on the footwall side of the emergent thrust are underlain by west dipping thrusts marked by fault cutoffs recognized by discontinuities of reflectors. These west-dipping thrusts are interpreted to merge into sedimentary layers shallower than 1 km. Gently upward geometries of the footwall strata show that they are upward folded at northward propagation of a right stepping en echelon active anticline to the south. These observations suggest that interactions between adjacent en echelon, lateral propagating active folds strongly controls styles of faulting at structural highest levels, manifested by topographic fault or fold scarps.

Keywords: Torigoe fault, active fault, active fold, seismic reflection profile, Niigata