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Eastward Dipping Structure of the Northern Itoigawa-Shizuoka Tectonic Line from Integrated Data Processing

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The Itoigawa-Shizuoka Tectonic Line (ISTL), 250 km running with NS direction in Central Japan, is a major tectonic boundary separating the NE and SW Japan arcs. The northern segment of the ISTL coincides with the western rim of the northern Fossa Magna basin (NFMB) formed in a Miocene rift system at the final stage of the opening of the Sea of Japan (ca. 17 Ma). Under a compressive stress regime starting in the late Neogene, the northern to central part of the ISTL has behaved as an active fault system with a large slip rates (4-9 mm/yr).
So far, several seismic reflection experiments provided structural images in the northern part of the ISTL. In the present study, we performed an integrated analysis combining reflection processing and refraction/wide-angle reflection modelling. Intensive analysis using refraction tomography and ray-tracing technique was applied for 2002 seismic experiment data acquired from the NFMB to the Komoro Basin (KB), which provided a detailed uppermost crustal structure across the ISTL. The uppermost ISTL is recognized as a boundary of very low sedimentary package. The ISTL active fault dips eastward with an angle of 25 degrees in its uppermost part, but flattens at a depth of 3-4 km with a horizontal extent of 10-12 km (Sato et al., 2004, Iwasaki et al., 2007). The NFMB is filled with 4-5 km thick Miocene sediments of 1.6-5.2 km/s. Beneath the CUZ, the crystalline basement is situated at a very shallow depth of 1-1.5 km forming a domed structure. Reprocessing of the reflection data indicates a series of seismic events in the eastern part of the profile, dipping to the east with an angle of 20-30 degrees, which were not mapped well in the previous studies. The refraction data (first arrival times) are also well explained by a model in which such ESE dipping structural trends. So, this result suggests another scenario for the deformation process associated with the ISTL since the time of the back arc spreading of the Sea of Japan.
The wide-angle data in 1991, collected just north of the 2002 seismic line, were also reanalyzed. The uppermost structure quite similar to that for the 2002 seismic line explain complicated travel time behaviour very well, indicating the low angle dipping structure of the ISTL was very reliable. The velocity of the crystalline basement becomes slightly low west of the northern ISTL, beneath which the velocity reversal exists, probably dominated by the magmatic activity in this area.
Reanalysis of seismic reflection data across the Matsumoto Basin confirmed the former interpretation of reflection image (Ikeda et al., (2004)). New technique of CRS stacking provided very clear image of eastward dipping structure of the East Boundary Fault of the Matsumoto Basin (thrust fault) with an angle of about 30 degree. The Gofukuji Fault (strike slip fault) is imaged by a vertical fault. These two faults are merged together at a very shallow depth of about 2 km from the ground surface, forming an eastward dipping plane further east.
From these results, the northern part of the ISTL is characterized by a east dipping strucutre with a low angle of about 30 degrees.

Keywords: Itoigawa-Shizuoka Tectonic Line, fault, structure, seismic reflection method, refraction/wide-angle reflection method