

Seismic reflection profiling across the Itoigawa-Shizuoka Tectonic Line: Overall results from a MEXT project in the last 4 years

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The Itoigawa-Shizuoka Tectonic Line (ISTL) in Central Japan is a fault zone with a very high slip rate in Pliocene-Quaternary time. The structure and behavior of the ISTL is highly variable along strike, with a possible boundary of rupture segments around Suwa Lake. In order to reveal the overall structure of ISTL, a research project consisting mainly of seismic-reflection and gravity surveys started in 2005. We report here overall results from the project during the last four years. This project is part of Integrated Research Project for the Itoigawa-Shizuoka Tectonic Line sponsored by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.

In 2005, seismic reflection and gravity surveys were carried out along a 40-km line that crosses the southern part of the ISTL. In 2006 we carried out high-resolution seismic reflection and gravity surveys along 4 lines (3-5 km long each) around Suwa Lake in order to reveal the shallow structure of the segment boundary. In 2007, seismic reflection and gravity surveys were carried out along a 21 km line across Suwa Lake in order to reveal the deeper structure of the segment boundary. In 2008, similar surveys were carried out along a 5 km line and 18 km line near the southern termination of the active portion of the ISTL. The following results can be drawn from these surveys, although part of data obtained so far is still in processing.

(1) The ISTL north of Suwa Lake dips east. Surface geology and available seismic reflection data indicate that the ISTL here (and further north) was originated from a normal fault which borders the western margin of the Northern Fossa Magna Rift Basin of Middle Miocene age. Tectonic landforms indicate that the fault has been reactivated as an oblique-slip (left-slip plus thrust slip) fault since Late Pliocene or Early Quaternary time.

(2) On the other hand, the ISTL around Suwa Lake is a normal fault dipping west. Near Chino south of Suwa, this fault dips also west but the sense of slip becomes almost purely left slip. Deep seismic reflection profiling across the lake, as well as seismic refraction analyses using the same data set, indicates that the west-dipping fault is likely to be the master fault of the ISTL. The middle portion of ISTL from Suwa to Fujimi has no evidence for pre-Pliocene activity, and hence is inferred to have been newly born under the present tectonic regime.

(3) The southern part of the ISTL south of Fujimi dips also west, but a thrust-slip component on it becomes dominant. Near Hakushu and further south, slip on the ISTL has been transferred to the Shimotsuburai-Ichinose Fault (SIF), which is located several kilometers east of the ISTL. Deep seismic reflection and gravity surveys across this portion of the ISTL indicate that the SIF dips west at a low angle and is likely to merge down-dip into the ISTL. Between these two faults is a Miocene volcanic arc complex (the Koma Group), which was accreted onto the Shimanto Belt to the west. Thus, the SIF was originated from a Miocene subduction zone thrust, and has reactivated as a thrust fault in the present-day tectonic regime.