Subsurface fault geometry from Chino to Hakushu in the ISTL active fault system, based on detailed analysis of tectonic landforms

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Research Group for ISTL Tectonic Landforms has conducted detailed mapping of active fault traces and precise measuring of displacement amounts since 2005, in order to improve segmentation and net slip distribution of the fault system. In 2007-2008, we have focused on the section from Chino to Hakushu in the central to southern portion of the fault zone. Here we summarize all the tectonic geomorphic observations in (a)-(f), to discuss subsurface fault geometry and slip direction, as well as slip rates.

(a) We identified left-lateral strike-slip faults from the NE margin of the Suwa basin to Kanazawadai via Sakamuro (named F1) with left-lateral slip rates of 5-10 mm/yr. (b) No active tectonic landform has been identified between Kanazawadai and Fujimigaoka along the Miyakawa River and its southeastern extention. (c) We detected left-lateral strike-slip faults and reverse faults in and on the tectonic bulges from Oike to Yokobuki via Kanazawa, Osawa, Misayamagodo, and Wakamiya (named F2), with left-lateral slip rates of more than 3.5-5.0 mm/yr and general vertical slip rates of less than 1.0 mm/yr. We obtained three drilling cores in a tectonic swamp at Misayamagodo for estimating slip rates precisely. (d) We identified left-lateral strike-slip faults between Fujimigaoka and Tsukue (named F3). (e) We found left-lateral strike-slip faults between Senno and Shimotsutaki (named F4) with left-lateral slip rates of 1.5-5.5 mm/yr. (f) We identified west-dipping thrust fault in the northern part of Hakushu (named F5). In the southern part, we also detected left-lateral strike-slip faults in addition to west-dipping thrust fault (named F6). Vertical slip rates of F5 and F6 are estimated to be 0.2-0.8 mm/yr.

We estimated the dip of F1 and F4 to be high-angle, based on the linear geometry of the fault traces. We can explain geomorphic processes of the tectonic bulges related to F2 when we assume that the subsurface high-angle strike-skip faults have branched upward near the ground surface to push upward unconsolidated deposits between the branched fault planes. This indicates that no other fault is needed to explain the existence of the tectonic bulges. The left-lateral slip rate of F2 is as high as those of F1 and F4. This is consistent to the observation (b). F3 is also estimated as one of the branched fault. F4 doesn't continue to the southeastern area. Instead, F5 and F6 have accommodated the regional compressional stress mainly by east-vergent thrust faulting.

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