Subsurface high-resolution fault imaging from the Kamishiro fault in Lake Aoki obtained by acoustic exploration, central Japan

Tsuyoshi Haraguchi[1]; Yuichi Yoshinaga[2]; Shinji Toda[3]

[1] Geosci.,Osaka City Univ.; [2] Biology & Geosciences Sci,Osaka City Univ; [3] Active Fault Research Center, GSJ/AIST

To visualize 3D inland geologic structure associated with active faulting, one uses high-cost multiple seismic reflection profiles. Here we fortunately face an unusual case: a large lake across one of the most active faults allows us to use acoustic exploration to visualize the subsurface deformation as the 3D high-resolution images. We investigated the Kamishiro fault, which is a northern part of the Itoigawa-Shizuoka tectonic line active fault system (ISTL), to reveal its Holocene activity. Lake Aoki, which is a natural dam reservoir bonded by an old landslide mass located in the city of Omachi, Nagano Prefecture, hides a 30-meter-high N-S striking fault scarp. On the lake, we employed a 10-KHz acoustic sonar equipment which maximum resolution for the images is 5 cm and which maximum depth of acoustic penetration is 20 m. We cruised the 51 transverse lines which interval and length are 25 m and 900 m on average. The entire profile set covers ˜1.5 km x 1.5 km area and provides us not only the detailed fault traces ever mapped but also multiple paleoseismic event horizons in the deformed lacustrine strata. We found three major fault traces (F1, F2, and F3 from west to east), one of which (F2) corresponds to the previously mapped the N-S striking fault scarp that separates the major basin (west) and shallow sub-basin (east). A newly identified fault (F1) coincides with a steep sub-lake cliff that bounds the western margin of the major basin. These two faults (F1 and F2) are bifurcated from the north coast of the lake to the south and bear the major basin as a pull-apart basin structure. On the sub-basin, strata under a 500-meter-long topographic bulge also show evidence of the recent reverse faulting. Such an imaged complex fault system that strike-slip faults and a reverse fault coexist would cast a new view over the common knowledge of tectonic frame work for the future earthquake potential on the ISTL.