

Behavior and geometry of complicated strike-slip fault system-A case of Atotsugawa fault system, central Japan

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The Atotsugawa fault system (AFS) is composed mainly of three strike-slip faults, the Atotsugawa fault (AGF), Ushikubi fault (UKF) and the Mozumi-Sukenobe fault (MSF), which are located along the northern margin of the Hida Highland with ENE-WSW direction. The AFS is a complicated strike-slip structure in north-central Japan, characterized by high seismicity of micro-earthquakes along the fault traces (e.g., Ito and Wada, 2002), is the most active zone of right-lateral strike-slip faults in north-central Japan. In 1858 A.D., a big earthquake, named Ansei Hietsu Earthquake, occurred along the AGF with a magnitude of 7.0-7.1 (Usami, 1987), caused serious damages along the fault and around the Toyama Plain. As an inland earthquake generation system, the AFS is an important existence for earthquake assessment in the central Japan.

To reveal characteristics of faulting behavior and history, and relationship of dislocation and geometry of the fault system, we carried out multidisciplinary studies on the fault system, and achieved some interesting features of the faults of AFS. Geological and geomorphological studies clarified detailed geometry of the AFS: The two main faults, the AGF and the UKF parallel with each other and formed a rectangular block between the two faults. On the surface, the AGF extends almost continuously whereas the UKF shows right step en echelon sense. And the another member of the AFS, the MSF branches from the eastern end of the AGF and towards the UKF, so the active characteristic of the MSF is subordinate to the AGF. This geometric feature may indicate reorganization of local stress field near the fault system.

We carried out seismo-geological studies and summarized the previous studies on the fault system in three sites. One is in the central portion of the master AGF (Atotsugawa fault excavation research group, 1989; Awata and Tsukuda, 1993), one is at the end, and another is on the branching MSF. Trenching surveys on the eastern portion of the AGF revealed the faulting history of the AGF within recent 22,000 years. The results demonstrated a maximum recurrence interval of 3,000 years of the fault, which is similar to that of the central portion of the AGF, an interval of about 2,500 years that calculated by previous studies. This might indicate a uniform behavior in the seismogenic zone of the main AGF, despite the apparent segmentation by seismicity and creep motion in the shallower AGF. Another geo-slicing survey at MSF depicted a scarce interval of 13,500 years. Two simultaneous events on both the AGF and the MSF occurred in 1858 A.D. (Ansei Hietsu Earthquake), and at about 17,300 years ago, suggesting an intermittent cooperation between the master and branch faults of the AFS, and it is related to the geometric relationship of the two faults.