

Paleoseismology of the Atotsugawa fault system; implication on the displacement per seismic event and slip rates for the Holocene

Ryosuke Doke[1]; Akira Takeuchi[1]; Muren Kan[1]

[1] Grad. Sch. Sci. Eng., Univ.Toyama

The Atotsugawa fault system constitutes a NE-SW trending dextral strike slip Atotsugawa and Ushikubi faults. It is one of the major active fault zones in the Chubu mountainous region, north-central Japan. The fault system is located in the northern margin of Niigata-Kobe Tectonic Zone, where the strain rate observed by GPS is higher than that of the surrounding area. From the results of geomorphological and geological investigation of the Atotsugawa and Ushikubi faults, new concepts about the activity of the Atotsugawa fault system occurred. The results are as follows:

(1) The results of radiocarbon dating of the outcrop in Sako indicate that the faulting event occurred after 100 \pm 30 yrBP in the eastern part of the Atotsugawa fault. During the latest event of the Atotsugawa fault, which was marked by the 1858 Hietsu earthquake, the entire fault was displaced. The vertical displacement was less than 3 m in Sako. In Higashiurushiyama, the vertical displacement was 2.4-2.6 m, and 4.9-5.1 m horizontally. From the displacements, the faulting length is estimated to be 60-69 km, with a magnitude of 7.8-7.9.

(2) Average displacement per seismic event of the Atotsugawa fault in the last 10,000 years (with 5 events) is about 5.6 m horizontally and about 2.9 m vertically. However, the displacement of event 2 (estimated at 600-2500 calBP) and event 5 (estimated at 9500-10700 cal BP) were bigger than that of the other events. Therefore, the characteristic earthquake model does not fit with the Atotsugawa fault, because of the fluctuation of coseismic displacement. A possible cause of such fluctuation is the interaction among seismic events between the Atotsugawa and the Ushikubi faults.

(3) Slip rates for the late Pleistocene and later have been re-evaluated along the Atotsugawa and Ushikubi faults with the references of river terraces. The horizontal slip rates of the Atotsugawa fault were newly determined as 2.1-2.4 m/ky in Higashiurushiyama and 1.7-2.5 m/ky in Sangawara. The vertical slip rates of the Atotsugawa fault are 1.1-1.2 m/ky in Higashiurushiyama and 0.9 m/ky in Makido. The horizontal slip rate of the Ushikubi fault, which is 0.7-1.9 m/ky in Kamishirakimine, and 0.5-1.4 m/ky in Mizunashi is smaller than that of the Atotsugawa fault.

(4) Using slip rates and total displacement estimated from offset of major rivers, the initiation of the present style of activity in the Atotsugawa fault system is estimated at early Quaternary. Moreover, the vertical displacement of the Atotsugawa fault has been accelerated recently, as viewed from the recent slip rate and accumulative displacement.