Paleoseismicity and Structure of the Gero fault constituting the Atera Fault System

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The Atera fault system runs NW-SE for about 70 km in the eastern part of Southwest Japan. Its activity is among the highest in this area. The fault system mainly consists of left-lateral strike-slip faults with NE-side-up reverse component. The 7 km long Gero fault, the target of this study, is located in the north-central part of the fault system between Gero town and northern Kashimo village through Butai-toge pass. Distinctive fault topography of systematically deflected stream channels, fault saddles, and fault scarplets along the Gero fault indicates its recent activity (Tsukuda et al., 1993; Yasue and Hirouchi, 2001). However, there is little information on the timing and magnitude of past earthquakes as well as the slip rate of Gero fault. We studied the Late Quaternary activity of the Gero fault through geomorphological, geological, trenching, and GPR (ground penetrating radar) surveys.

Geomorphological and Geological survey: The Gero fault offsets a Holocene lower terrace surface by 1.3 m on the left bank of Norimasa river. Displaced talus deposit crops out along a conjugate fault of the Gero fault at Norimasa with vertical fault plane of N12E to N22W strike. The conjugate fault plane accompanies 10 cm thick layer of fault gouge. The fault plane crops out at Norimasa, Hatsuya-toge pass, and Mimayano. The above evidence clearly indicates the Late Quaternary activity of the Gero fault.

Trenching survey: We excavated a trench in a swamp in trees on the western bank of the Takehara river. Layers of humic sand/ silt/ clay and fluvial gravels were exposed on trench walls with patches of Kikai-Akahoya tephra (K-Ah) near the bottom of the humic deposits. The Gero fault cut through these layers to form a linear depression on its NE side. From the structural evidence along the fault plane, we recognize at least three faulting events, two of which postdata the age of K-Ah tephra. The uppermost termination of the fault plane is covered only by the most recent A-horizone. This may indicate the last event have occurred within several hundred years.

Structure: Around the trench, micro-topography produced by recent faulting is very well preserved for the land-use as a woodlot. Detailed digital mapping of the topography was carried out using a total station. The map shows the arrangement of fault scarplets and other linear features in right-stepping en echelon with a few to 10 meter steps. The predominant strike of the linear features is between N60W and N70W, which deviate counterclockwise by 10 to 20 from the general strike of the Gero fault. The surface expression is in right-stepping en echelon arrangement formed along the master strand of the Gero fault. According to the GPR profiles, the humic deposits that appeared on trench walls are distributed along the linear features and the thickness is about 6 m.

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