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Thermochronological study of the dip-slip displacement and timing of initiation of the Atera fault

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Fission-track analysis was performed for 5 samples collected from 5 surface outcrops and 6 samples from the Kawaue boring core around the Atera fault, which is a large-scale, left-lateral active fault with dip-slip component of displacement. The results were ~76 Ma of mean zircon fission-track age from SW of the fault, 69 Ma from NE of the fault, ~42 Ma of mean apatite fission-track age from outside of the fault zone and ~22 Ma from inside of the fault zone. Mean track length from U-4 zircon, collected from the fault zone, was only shrunk and the length distribution was apparently bimodal. An interpretation of the distribution was that this sample would have been slowly cooled down from ~300oC, since around 40-60 Ma, derived from some forward calculations with annealing kinetics. In addition, we calculated the excess erosion of the hanging wall (NE of the fault) and true dip displacement of the fault, assuming that the age difference across the fault was caused by dip-slip displacement of the fault and difference of exhumation rate across the fault. The results led us to obtain the following three conclusions. 1. The dip-slip displacement of the Atera fault after 70 Ma is ~1km. 2. The present fracture zone along the fault was widely heated at after 20 Ma but before at least the Quaternary. The displacement is similar to the geomorphologically estimated displacement of basement rocks or topography across the fault. 3. Some minor intrusions or other heating and slow cooling events would have occurred only near U-4 at ~40-60 Ma. Therefore conclusion 1 is consistent with previous studies that indicated the present Atera fault activity restarted after the early Quaternary. Conclusion 2 indicates that the fracture zone already existed at from ~20 Ma to at least the Quaternary and perhaps the ancient fault activity had already initiated.

Keywords: Atera fault, dip-slip displacement, timing of initiation of active fault, fission-track