Zircon fission-track thermochronology of the Nojima fault zone

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Fission track (FT) thermochronologic analysis was performed on zircon separates from rocks in and around the Nojima fault, which was activated during the 1995 Kobe earthquake. Samples were collected from the University Group 500 m (UG-500) borehole, Geological Survey of Japan 750 m (GSJ-750) borehole, the fault trench at Hirabayashi, and nearby outcrops. Zircon FT ages from the UG-500 borehole record ~2 Ma cooling age in the zircon partial annealing zone (ZPAZ) for samples within ~25 m distance the fault plane, whereas those of the GSJ-750 borehole record ~30 - 40 Ma cooling ages within the same fault zone width. On the basis of one-dimensional heat conduction modeling as well as the consistency between the degree of FT annealing and the degree of deformation/alteration of borehole rocks, these cooling ages in both boreholes are interpreted as consequences of ancient thermal overprints by heat transfer or dispersion via fluids in the fault zone. For the fault trench samples, zircon FTs of the 2 – 10 mm thick pseudotachylyte layer were totally reset (or remained reset) and subsequently cooled at ~56 Ma, which is interpreted as the time of final cooling through ZPAZ immediately after the pseudotachylyte formation. It is, therefore, suggested that the present Nojima fault system was reactivated in the Middle Quaternary from an ancient fault initiated at ~56 Ma at mid-crustal depths.

In this presentation, we also refer the updated review of the zircon fission-track thermochronology developed by the Kyoto Univeristy geochronology group, as well as our recent applications of the technique to other fault settings including the ancient seismogenic zone formed by the plate subduction.