

Probing Fault Zone Heterogeneity on the Nojima Fault: Constraints from Zircon Fission-Track Analysis of Borehole and Trench Samples

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We summarize our recent results of the zircon fission-track (FT) thermochronologic analysis of the Nojima fault, which was activated during the 1995 Kobe earthquake (Hyogoken-Nanbu earthquake; M7.2). Rock 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. In the two boreholes that penetrate the fault at depth, zircon FTs were partially annealed in the samples nearby the fault. The age of onset of cooling from the zircon partial annealing zone (ZPAZ) was estimated by the inverse modeling of FT data using the Monte Trax program; i.e., ~4 Ma within ~3 m (in the hanging wall only) from the fault plane in the UG-500, and ~31-38 Ma within ~25 m from the fault in the GSJ-750. On the basis of one-dimensional heat conduction modeling as well as the general positive correlation between the FT annealing and deformation/alteration of borehole rocks, those cooling ages in both boreholes probably represent ancient thermal overprints by heat dispersion or transfer via fluids in the fault zone. Based on the calculation of in-situ heat dispersion, it is likely that the thermal overprints were caused by migration of hot fluids along the fault zone from deep crustal interior. For the fault trench samples, zircon FTs of the 2 – 10 mm thick pseudotachylyte layer were totally annealed and subsequently cooled through ZPAZ at ~56 Ma, which is interpreted as the time of (final stage) of pseudotachylyte formation.