

Pseudotachylyte dating by zircon fission-track thermochronology

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Frictional heating during earthquake-causing fracturing events literally melt the rocks within the fault, i.e. pseudotachylyte. The fission-track (FT) method is a novel rock-dating technique that allows to precisely date such thermal events. Murakami et al (submitted) performed a new series of laboratory annealing experiments on zircon FTs. As a result, surface FTs almost faded and only very few tracks remained visible in samples heated at 912 degree for 3.9 seconds and 858 degree 10.4 seconds. This result suggested that FTs in zircon should be annealed at these temperature-duration conditions while melting pseudotachylytes (i.e. at 1000 degree for 5 seconds). The zircon FT annealing is therefore available for the dating of pseudotachylytes. This study demonstrated that within the Nojima Fault and the Asuke Shear Zone there are surfaces that show geological evidence of past earthquakes.

The Nojima fault was activated during the 1995 Kobe earthquake (M 7.2), which caused great damage and loss of life in Kobe city and the northwest area of Awaji Island, Japan. Otsuki et al. (2003) found pseudotachylyte layers in the fault, in which the detail of physical process during seismic slip was recorded. We carefully separated zircons from about 2-10 mm wide pseudotachylyte layers collected at the Hirabayashi trench of the fault and analyzed them by FT method. The measured ages of the layers (about 56 Ma) were significantly younger than those of surrounding Ryoke granitic rocks (about 74 Ma). The results suggest that the Nojima fault was already initiated at about 56 Ma.

Asuke Shear Zone is located in Aichi Prefecture, Japan. Sakamaki and Takagi (2002) reported pseudotachylyte layers associated mainly with cataclasite along the shear zone. We analyzed zircons separated from a 11cm wide layer by FT and U-Pb method. FT ages of the pseudotachylyte are about 53 Ma, significantly younger than those of surrounding host rock (about 74 Ma). In addition, another important aspect is that the FT age was significantly younger than U-Pb age of the pseudotachylyte layer while host rock has indistinguishable ages between the two methods.