

## Development of direct dating methods of fault gouges focused on the latest fault slip event

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We started a research project to develop methods to determine the age of the latest fault slip event using fault gouges. The methods would be used for evaluation of activities of faults without overlying sediments. In order to estimate the latest fault slip event, it is necessary to use fault gouges which have been experienced age resetting (AR) by frictional heating. Near-ground surface fault gouges have been sometimes dated to be older than the true age because the gouges have not been completely reset at the AR temperature. Therefore, we investigate fault gouges at deep depth (300-1,500m) to compare the latest fault slip event with known recent historical earthquakes.

This study includes the following 1)-3): 1) AR condition check: We conduct a deep borehole observation through the target fault damage zone to measure physical temperature, pressure and geological conditions in which the sample expecting a reliable dating can be acquired. We are now drilling a deep borehole with multiple depths through the Nojima Fault ruptured during the 1995 Hyogo-ken Nanbu earthquake to understand conditions of AR. 2) Luminescence and electron spin resonance (ESR) dating: We apply the luminescence and ESR dating techniques to estimate precisely determination of the age of the latest fault event. 3) Friction test: Rotary-shear high-velocity friction tests using natural fault gouge under water-pressure conditions are expected to clarify frictional behavior of faulting and AR conditions. Combining results from 1)-3), integrated analysis on fault activity will be performed. Our goal of this study is to establish the dating methods of fault gouges for precise determination of the age of the latest fault slip event.

Keywords: fault gouge, fault activity, dating, deep borehole drilling, high-velocity friction test, fault damage zone