Particle size and fracture energy of gouge from the Taiwan Chelungpu-fault Drilling Project (TCDP) Hole-A

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Abstract

It is common to observe the grain-size reduction associated with the development of fault gouge within seismogenic faults. Also, the major displacement along mature faults usually occurred within the fault gouge. Thus, understanding the properties of fault gouge provides insights into the mechanism of earthquake rupture. Slip-weakening model can be used to explain the relationship between energy budget and physical processes of earthquake slip. Based on the model, the energy released during an earthquake is partitioned into the fracture energy (E_G), frictional heat (E_H), and radiation energy (E_R). Although radiation energy and fracture energy only occupy the small portion of total energy, their relative magnitude is the main factor to controlling earthquake rupture dynamics, expressed by radiation efficiency $\eta_R = E_R / (E_R + E_G)$. Fracture energy is defined as the energy at rupture tips that is required to form a rupture surface and produce a breakdown in strength. This study will report the fracture energy estimated from the grain-size distribution of fault gouge on the retrieved cores of Taiwan Chelungpu-fault Drilling Project (TCDP), Hole-A.

TCDP retrieved cores from two holes in the Dakeng area since 2004. Continuous cores of Hole-A between 430 and 2003m provide a good opportunity to obtain in-situ fault gouge samples. We collected images from thin sections of fault gouge samples under optical microscope and scanning electron microscope and further analyzed their

grain-size distribution with image-process software. Based on the grain-size distribution of samples, we estimated fracture energy from the surface area of grains.