

Grain size segregation in a fault gouge

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The structures and textures of fault gouge are believed to provide with rich information on the coseismic slip dynamics of faults. In Chelungpu fault gouge, where the coseismic slip was accommodated in 1999 Chichi earthquake, grain-size segregation is found [Boulier et al. *G³* 10, Q03016 (2009)]. This could be an evidence for gouge-fluidization, because grain-size segregation is believed to require sufficient porosity in granular matter. Grain-size segregation is also found in a laboratory friction experiment with large displacement (~12m) and under intermediate normal stress (~2MPa)[Ujii and Tsutsumi *GRL* 37, L24310 (2010)]. Here we wish to know whether grain-size segregation occurs as a result of gouge fluidization. To this end, we perform numerical simulation on a simple model of fault gouge, and show that grain size segregation occurs under a condition that may be relevant to faults gouge: the pressure of 1 MPa, the sliding velocity of 1 m/s, and the duration of 0.1 sec. Segregation occurs irrespective of gravitation and it is controlled by nonlinear velocity gradient. More importantly, we find that segregation occurs even if the granular matter possess yield stress, and therefore segregation itself does not imply gouge-fluidization.

Keywords: segregation, fault gouge, nonlinear velocity gradient