Role of water on faulting–Restraint of dilatancy hardening by water injection

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In order to investigate the role of water on rock fracturing, laboratory experiments were performed on several rock samples under triaxial conditions with water injection. Change of seismic velocity due to rock deformation and water migration was monitored using difference seismic tomography. Microcracking activity was also monitored using acoustic emission (AE) utilizing a high-speed waveform recording system. In the present study, we focus mainly on relationships between tempo-spatial distribution of microcracking and fluid migration during the deformation process, particularly the nucleation stage of fracturing; from quasi-static to dynamic ruptures. In most cases the ultimate fracture was initiated at the front of water if the rock sample was not fully saturated. Experimental results show also that open fluid system may restrain the dilatancy hardening and weaken the rock sample significantly.

Fig.1 Experimental results of a Andesite sample. a) Initial Vp distribution in the test sample under confining pressure of 5 MPa. b-f) Vp distribution measured at times marked as 1-5 in g). g) Loading history and mean strains. h-j) AE hypocenters and the ultimate fracture plans.