Geophysical Research Abstracts
Vol. 15, EGU2013-3272-1, 2013
EGU General Assembly 2013


# Effect of water on the frictional behavior of cohesive rocks during earthquakes

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While it is widely recognized that fluids control earthquakes nucleation and evolution, their effects on coseismic sliding friction is only conjectured. To shed light on these effects, more than 100 high velocity friction experiments were conducted on carbonate- (Carrara marble, porosity $<1\%$) and silicate- (basalt, porosity $\sim 2.3\%$) bearing rocks in the presence of pressurized water, room-humidity and, for dry samples, under vacuum ($10^{-4}$ mbar). Experiments were performed with a rotary shear apparatus (SHIVA, Slow to HIgh Velocity friction Apparatus) on hollow cylinders (50/30 mm ext/int diameter) at velocities of 1–6.5 m/s, displacements from 0.005 to 12 meters, normal stresses up to 40 MPa and fluid pressure up to 15 MPa. Contrary to common believe based on theoretical argumentations, we show that frictional melt of a silicate-bearing rock develops even in the presence of water. In silicate-bearing rocks, the weakening mechanism (melting of the asperities) is hindered in the presence of water; conversely, in carbonate-bearing rocks the weakening mechanism (brittle failure of the asperities), is favoured. These opposite behaviors highlight the importance of host-rock composition in controlling dynamic (frictional) weakening in the presence of water. Cohesive carbonate-bearing rocks are more prone to slip in the presence of water, whereas the presence of water might delay or inhibit the rupture nucleation and propagation in cohesive silicate-bearing rocks.