Geophysical Research Abstracts, Vol. 8, 01883, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01883

Seismic energy partitioning inferred from pseudotachylyte-bearing faults (Gole Larghe Fault, Adamello batholith, Italy)

L. Pittarello (1), G. Di Toro (1), A. Bizzarri (2), J. Hadizadeh (3), G. Pennacchioni (1)

(1) Dipartimento di Geologia, Paleontologia e Geofisica, Padova, ITALY, (2) Istituto Nazionale di Geofisica e Vulcanologia, Bologna, ITALY, (3) Department of Geography & Geosciences, Louisville, Kentucky, USA.

(lidia.pittarello@unipd.it / phone: +39-049-8273941)

Fracture energy is the energy adsorbed on the fault in the breakdown zone during earthquakes. It includes all sinks of energy, as surface energy, plastic deformation of grains and other heat losses. Surface energy E_S is the portion of the fracture energy required for creation of (1) new surfaces in the slip zone, and (2) damage zone in the wall rocks. Partitioning of the earthquake energy between E_S and frictional heat E_H determines the characteristics of an earthquake (e.g. rupture speed, radiated energy). The cataclastic microstructures associated with pseudotachylyte (solidified clast-laden friction-induced melt produced during coseismic slip) might contain information about this partitioning. In this study we determined both E_H and E_S using field and microstructural observations on a selected pseudotachylyte from the Gole Larghe Fault zone (Southern Alps, Italy).

The E_H for unit fault surface area has been estimated by the equation:

E_H = [(1- ϕ) $H + c_P(T_m - T_{hr})$] $\rho\, w$ [J m^{-2}]

where ϕ is the volume ratio between lithic clasts and matrix within the pseudotachylyte (0.2), H is the latent heat of fusion (3.28 10^5 J kg^{-1}); c_p is the specific heat at constant pressure (1180 J kg^{-1} K^{-1}); T_m is the initial melt temperature (1450˚C); T_{hr} is the host rock temperature (250˚C); ρ is the rock density (2700 kg m^{-3}) and $w$is the pseudotachylyte average thickness (5.9 mm), which also includes the friction

melt produced along the main fault and injected in the host rock. From these data we obtained an E_H value of 26.74 MJ m^{-2}.

Surface energy has been estimated by multiplying the newly created surface per unit of fault area by the specific surface energy γgof the rock forming minerals. We considered both the new surface produced in the damage zone (microcracks) and in the slipping zone (plagioclase clasts suspended in the pseudotachylyte matrix have an internal fragmentation that is not found in the host rock). The calculated E_S value is 0.11-0.20 MJ m^{-2}.

It follows that pseudotachylytes might yield information on the energy partitioning between E_S and E_H, and that the surface energy is negligible compared to frictional heat.