Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03265, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03265
EGU General Assembly 2008

Microstructural characterisation of pseudotachylytes in quartzitic rocks by electron microscopy – preliminary results

M. Bestmann (1), J. Götze (2), H. de Wall (1) and M. Göken (3)

(1) Geozentrum Nordbayern, University Erlangen, Germany, (2) Institut für Mineralogie, University Freiberg, Germany (3) Institut für Werkstoffwissenschaften, University Erlangen, Germany, (michel@geol.uni-erlangen.de / Phone: +49-9131-8529026)

Characterisation of microstructures in natural frictional fault zones is essential for interpreting and modelling of fossil earthquake structures and the understanding of the rheology of such zones. Despite a wealth of data about seismic fault zones there is an ongoing discussion about the possibility of frictional melting of quartzitic rocks.

In quartzitic rocks (with 5-10 vol % muscovite) of the "Schneeberg Zug"- (Austroalpine Unit, Southern Tyrol, Italy) pseudotachylyte zones of 0.5-2 mm in thickness have been observed. They typically occur in fault and injection vein association and are oriented subparallel or locally at a high angle to the foliation of the cretaceous HT/HP fabric of the quartzitic host-rock. As they intrude cataclasites, locally present at the contact to the host rock, the pseudotachylytes represent a late event of the associated brittle deformation. These contacts are sharp and the brittle deformation caused strong grain refinement (grain size 0.5-3 μm) of the original 100-300 μm sized quartz grains. EBSD, SEM and TEM analyses reveal a combination of crystal plasticity, microcracking, grain boundary sliding and annealing as prevailing deformation mechanism. Together with deformation lamellae these low temperature plasticity microstructures in quartz reveal ambient host-rock conditions in the range of 250˚C. In contrast to the mainly quartzitic host the pseudotachylyte zones contain a fine-grained matrix of quartz and K-feldspar. K-feldspar can be related to the break down of muscovite. Relicts of deformed and non-deformed quartz clasts (grain size 50-500 μm) of the host rock float in the matrix of the pseudotachylyte. Flow banding and flow structures, sometimes defining eye-shaped flow folds, are characteristic. Glass as the most unequivocal evidence that frictional melting has occurred was not found. Also devitrification (crystallization of glass) is not obvious. Instead spherical microlites and spherulites (quartz and/or K-feldspar) in the pseudotachylyte matrix are indicative features of melting and crystallization. Spectacular corrosion structures at the pseudotachylyte/host rock contact give the most convincing evidence of the presence of a high temperature melt. Cathodoluminescence (CL) analysis reveals bright rims around quartz clasts in the matrix, interpreted as melt/clast interaction. CL colour/intensity variation across the zoned pseudotachylyte zones and their injection veins can be referred to local change in composition of melts with time due to contrasting cooling rates and crystallization in different position of the pseudotachylyte veins and/or due to multiple pulses of friction-induced melts and the possible influence of fluids.