Geophysical Research Abstracts
Vol. 19, EGU2017-14929, 2017
EGU General Assembly 2017

Mechanical and microstructural effect of partial melting of continental crust

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We present a set of experiments done in order to investigate the effect of melt on the strength and the microstructures of crustal rocks. Experiments were conducted in a Griggs-type apparatus with a mixture of 90 vol. % quartz and 10 vol. % biotite at 1 GPa confining pressure and a temperature between 700 and 900 °C. In some experiments, 5 vol. % or 10 vol. % of haplogranitic glass (HPG) powder was added to generate melt in the sample. Above the glass temperature transition (GTT), which occurs at 780 °C, HPG viscosity is 4 orders of magnitude lower than that of quartz and thus the sample strength and microstructures should be similar to those of partially molten sample. We performed a comparative study, in which samples were deformed without melt and without HPG, with HPG, but below the GTT, with HPG above the GTT, and finally with melt generated from biotite breakdown reactions. Samples with HPG above GTT and melt from biotite breakdown have the same microstructures and strength. Our data show that melt has two major consequences on the deformation of quartz-biotite aggregates : (1) while deformation is localized through a network of shear bands in experiments without melt and quartz is deformed by dislocation creep, there is no localization of the deformation with HPG or melt and the sample deformed by melt enhanced grain boundary sliding (2) melt reduces the strength of the sample but this weakening is lower than previously suggested if the long term resistance of the samples ($\gamma > 2.5$) instead of peak resistance is taken into account.