Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11572, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11572
EGU General Assembly 2008

Constraints on the duration of high-strain deformation in the lower crust

A. Camacho, P. Yang and A. Frederiksen

Dept. of Geological Sciences, University of Manitoba, Winnipeg, MB, R3T 2N2, Canada
(camacho@cc.umanitoba.ca / Fax: +1 204 4747623 / Phone: +1 204 4747413)

Understanding the dynamics of orogenic systems requires insights into the transfer and accumulation of stress and strain in rocks buried to great depths ($\geq$40 km). High-strain deformation in the lower crust forms as a consequence of stresses generated by the interaction between the forces that drive and oppose burial, slab flexure, thermal expansion and metamorphic reactions (e.g., Spence, 1986). Knowledge of how fault networks develop in response to stresses in the Earth' s crust and the nature of the processes that govern their effective mechanical behaviour can be achieved by placing quantitative constraints on the duration of the faults that were active during orogenesis. Microscale textures can provide such information. Here we document compositional gradients in Proterozoic ($\sim$1100 Ma) granulite-facies garnet that developed during high-strain deformation at eclogite-facies conditions during the Petermann Orogeny ($\sim$550 Ma). The uptake of Ca in garnet is linked with the release of Ca in plagioclase (the only calcic mineral in the rock) during dynamic neocrystallization of sodic feldspar, which is stable at high-pressure. This process only occurs during high-strain deformation. We can therefore, directly constrain the duration of faulting at eclogite-facies by using the available diffusion data on garnet. Our results indicate that fault movement was short-lived ($<$1 Ma), with wide faults having experienced longer durations of movement than narrow faults.

References

Spence, W., 1986. The 1977 Sumba earthquake series: evidence for slab pull force acting at a subduction zone: Journal of Geophysical Research, 91, 7225-7239.