Geophysical Research Abstracts, Vol. 8, 02633, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02633

Stable isotopic evidence of multi-scale fluid flow in the shear zone network of the Mont Blanc Massif

M. Rossi (1,2), Y. Rolland (3), S.F Cox (4) and O. Vidal (2)

(1) Physics of Geological processes, University of Oslo, Norway (mrossi@ujf-grenoble.fr)

(2) Laboratoire de Géodynamique des Chaînes Alpines, Observatoire des Sciences de l'Univers de Grenoble, France.

(3) Géosciences Azur, CNRS UMR 6526, Nice, France.

(4) Department of Earth and Marine Sciences and Research School of Earth Sciences, The Australian National University, Canberra, Australia.

Carbon, oxygen and hydrogen isotope data from quartz, chlorite and calcite veins associated with shear zones are used to examine crustal-scale to local-scale fluid redistribution during the development of a shear zone network in the Mont Blanc massif, late during the Alpine orogeny. Carbon isotope compositions of vein calcite associated with shear zone development fall into three compositional groups: type A) δ^{13}C = -4.10 to +3.90 ‰ from shear zones cross-cutting the Helvetic sedimentary cover, type B) δ^{13}C = -6.72 to -2.77 ‰ for those cross-cutting most ofthe Mont Blanc granite, and type C) δ^{13}C = -8.82 to -10.75 ‰ in shear zones associated with intense alteration in shear zones in both the sedimentary cover and the Mont Blanc granite. The lowest δ^{13}C veins are associated with intense Mg-metasomatism which is interpreted to result from the infiltration of deep-seated fluids which had equilibrated with carbonaceous matter. Structural relationships and the crustal scale setting of the Mont Blanc massif suggest that the shear zones which host flow of the low δ^{13}C, magnesian metasomatising fluids are closely related to the emplacement of the Penninic Front and tapped fluid from deep-crustal and mantle sources. At the margins of the MBM, type B δ^{13}C values in carbonates suggest mixing between the deep-seated fluids and shallower crustal fluids which had equilibrated the Helvetic nappes cover sequence above the Mont Blanc massif. Oxygen isotopic compositions of vein quartz and calcite are similar as those of undeformed host-rocks ($\delta^{18}O_{qtz}$ = +19.73 to +27.21 ‰

and $\delta^{18}O_{cc}$ = +17.28 to +23.97 ‰ in the sedimentary cover and $\delta^{18}O_{qtz}$ = +9.10 to +11.75 ‰ and $\delta^{18}O_{cc}$ = +8.05 and +9.09 ‰ in the Mont Blanc granite), indicating buffering of $\delta^{18}O$ composition of fluids by the host-rock or formation of Alpine structures in a relatively closed-system.