Geophysical Research Abstracts, Vol. 8, 04313, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04313

Multistage re-equilibration during fast exhumation of the UHPM Brossasco-Iscasca Unit (BIU), Dora-Maira Massif (Western Alps)

C. Groppo (1), D. Castelli (1,2), B. Lombardo (2), R. Compagnoni (1,2)

(1) Department of Mineralogical and Petrological Sciences, University of Torino, Italy, (2) C.N.R., Institute of Geosciences and Georesources, Torino, Italy

(chiara.groppo@unito.it)

The exhumation $P-T$ path of the UHP BIU was reconstructed combining microstructural observations, conventional thermobarometry and pseudosection analysis applied to eclogite and metapelite samples.

The eclogite consists of the peak assemblage omphacite (Omph), garnet (Grt), phengite (Phe) and quartz (Qtz). A porphyroblastic blue-green hornblende (Hbl) statically overgrows the eclogitic foliation defined by the Phe flakes. Both Omph and Phe are partially replaced by fine-grained symplectites, consisting of clinopyroxene (Cpx) + albite (Ab) and biotite (Bt) + oligoclase (Pl), respectively. Metapelite consists of pre-Alpine porphyroblastic Grt_I, Alpine idioblastic Grt_{II}, Phe, kyanite (Ky), Qtz aggregates after former coesite (Cs) and fine-grained paragonite (Pa) aggregates after jadeite (Jd). Late chloritoid (Ctd) and staurolite (St) idioblasts, randomly growing across the main Alpine UHP Phe foliation defined, are also present in the rock matrix.

Different $P-T$ pseudosections were calculated in the NKCFMASH (eclogite) and MnNKFMASH (metapelite) systems in order to model peak and exhumation conditions. Peak parageneses consist of Omph (X_{Jd}=0.55), Grt (X_{Grs}=0.30-0.32), Phe (Si=3.55 a.p.f.u.), Rt and Cs in eclogite and Jd, Grt (X_{Prp}=0.20), Phe (Si=3.51 a.p.f.u.), Ky, Rt and Cs in metapelite. Peak conditions of P=37.7 kbar at T=732˚C and P=40 kbar at T=745˚C, i.e. within the diamond stability field, were estimated for eclogite and metapelite, respectively.

The BIU decompressional history can be summarized by the following stages:

1. an early decompression from 37.7 kbar to 27.1 kbar accompanied by a T decrease of about 80˚C: during this part of the $P-T$ path the eclogite peak assemblage was stable, but cation exchanges were active, resulting in a significant zoning of Omph, Grt and Phe;

2. in the eclogite, at $P \approx$27 kbar, i.e. approximately at the Cs-Qtz transition, porphyroblastic Phe ceased to re-equilibrate and a new generation of fine-grained Phe crystallized. At this time, both Grt and Omph continued to re-equilibrate in response to T and P decrease;

3. in the eclogite, at about 14 kbar and 630˚C, Omph and Grt thin rims, characterized by abrupt decrease in X_{Jd} and by abrupt increases in X_{Grs} and X_{Alm}, developed. At the same time, porphyroblastic Hbl started to grow and Phe started to be replaced by a Bt + Pl symplectite;

4. at pressures just below 14 kbar metamorphic reactions in the eclogite ceased to be continuous and became discontinuous. Evidence for discontinuous reactions is the development of the Cpx + Ab symplectite after Omph;

5. the metapelite exhumation path is strongly constrained at T=580-590˚C and P=10.0-10.6 kbar by the St and Ctd compositions and the absence of Bt and Ab.

A Rb-Sr Phe-based isochron from the eclogite sample gives an age of about 36 Ma for the peak metamorphic event (Di Vincenzo et al., submitted to J.Petrol.), in agreement with the 35.1$\pm$0.9 Ma age reported by Rubatto & Hermann (2001) for the UHP peak of a calc-silicate nodule included in a BIU marble. The major retrogressive event, marked by the beginning of the discontinuous reactions in eclogite and by the growth of late Ctd at the expenses of St in the metapelite, coincides with the retrograde event dated at 32.8$\pm$0.9 Ma by Rubatto & Hermann (2001). This exhumation stage, occurring at P lower than 14 kbar, also represents the most important retrograde event in the country orthogneisses.

The calculated $P-T$ paths combined with geochronological data confirm that the BIU experienced a very fast exhumation from 38-40 to 10 kbar (i.e. from $\sim$125 to $\sim$35 km depth) at an exhumation rate of $\sim$2.9 cm/yr, which compares well with the 3.2 cm/yr rate obtained by Rubatto & Hermann (2001).

References

Di Vincenzo G.F., Tonarini S., Lombardo B. & Castelli D., A ^{40}Ar-^{39}Ar and Rb-Sr investigation on white micas from the UHP Brossasco-Isasca Unit (Dora Maira Massif, Italy): implications for dating UHP white mica, submitted to J. Petrol.

Rubatto, D. & Hermann, J., 2001, Exhumation as fast as subduction?, Geology, v. 16, p. 577-588