



Evidence for slab-derived melts/fluids-mantle interaction during HP and HT metamorphism of garnet peridotites of Monte Duria (Central Alps, N Italy): clues for a hidden pre-Alpine age in the southern Adula Nappe complex

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The Monte Duria area is located in the southern part of the Adula Nappe complex on the north-eastern side of the Como Lake (N Italy). Garnet/chlorite peridotites were found within Bt-rich migmatites or in direct contact with migmatitic Amp+Pl gneiss containing boudins of variably granulitised eclogites. The contact between mafic and ultramafic rocks is marked by the occurrence of a tremolitic metasomatic rim which likely represents a former clinopyroxenite layer produced at high pressures by a melt-peridotite interaction and subsequently retrogressed under amphibolite facies conditions. The occurrence of leucosomes and HT deformation structures in eclogites provides evidence for the partial melting at HP conditions through the reaction $\text{Phen} + \text{Cpx} + \text{SiO}_2 = \text{Grt} + \text{Ky} + \text{melt}$. Moreover, the HP assemblage $\text{Grt} + \text{Ky} + \text{Omp} + \text{Kf}$ recognized in eclogites suggests the reaction $\text{Phen} + \text{Omp} + \text{SiO}_2 = \text{Grt} + \text{Jd} + \text{Kf} + \text{Ky} + \text{melt}$ indicating again that melting occurred at HP conditions. Thus, we suggest that eclogites could represent the source of the melt which interacted with the associated peridotites. Petrographic and mineral chemical data indicate that peridotites and associated eclogites experienced a HT stage postdating the HP metamorphic peak recorded by these rocks. In garnet peridotites P-T estimates on symplectitic assemblages replacing HP minerals yielded conditions of 0.8-1.2 GPa and 850 °C. The same HT conditions have been also determined for the granulitisation stage of eclogites.

Bulk rock analyses of peridotites show REE contents slightly lower than the DM, but a LREE enrichment conferring a spoon shape REE pattern suggests that these rocks have been affected by a metasomatic event assisted by slab-derived melts. Garnet peridotites and eclogites also show enrichment in fluid-mobile elements indicating that a subsequent fluid-assisted metasomatic event has affected both mafic and ultramafic rocks under amphibolite facies conditions.

Sm-Nd whole-rock and mineral isotope systematics were applied to garnet peridotites and eclogites in order to constrain the age of the HP metamorphism. Results yield ages at 34 ± 4.0 Ma and 24.6 ± 5.0 with a 2σ error. The age at 34 ± 4 Ma is comparable to U-Pb ages (Herman et al., 2006) for initial stages of decompression of garnet peridotites of Mt. Duria. The age at 24.6 ± 5 Ma could represent the chemical/isotopic re-equilibration of HP assemblages during the late stages of the post-collisional crustal anatexis in the Central Alps. LA-ICP-MS U-Pb rutile geochronology performed on eclogites yielded discordant ages. The lower intercept at ≈ 44 Ma suggests that rutile may have partially registered an Alpine event, but older ages indicate that the inheritance of older metamorphic events, as reported from other areas of the Adula nappe (Herwartz et al., 2011), has not been completely obliterated.

These preliminary results suggest that the time of the HP stage recorded by peridotites and associated eclogites may conceal a pre-Alpine age and further studies are needed.

References:

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