

Fluid-mediated slab-mantle interaction during (U)HP and HT metamorphism of garnet peridotites and their hosting crustal rocks (Monte Duria, Central Alps, N Italy)

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The Adula-Cima Lunga nappe represents the highest of the Lower Penninic units of the Central Alps. It consists of orthogneiss and paragneiss of pre-Mesozoic origin hosting lenses of metacarbonates, partly retrogressed eclogites and garnet/chlorite peridotites. The garnet peridotite bodies cropping out in the southern area of the nappe complex (Alpe Arami, Cima di Gagnone and Monte Duria) record the highest metamorphic conditions ($P > 3.0$ GPa, $T = 800-850^{\circ}\text{C}$). In the study area garnet peridotite lenses are in contact with biotite-bearing migmatites or hosted in amphibole-bearing migmatites and K-feldspar gneisses.

Petrographic and mineralogical data indicate a previously unknown HT stage during peridotite and eclogite exhumation. Peridotites show orthopyroxene with symplectites of tiny crystals of baddeleyite (ZrO_2) and zircon (ZrTi₂O₆), whereas only zircon was found in the symplectites after garnet.

Bulk rock analyses of peridotites show REE content 3 to 5 times lower than PM but with a clear selective enrichment in LREE (spoon-like pattern), and with a Eu positive anomaly. The same “spoon like” pattern in the LREE field is displayed also by eclogites, shifted to values 2 to 5 times higher than PM. Due to the similarities of the REE patterns of peridotite and eclogite and the occurrence of the Eu positive anomaly in most of the peridotite analyses that points to a contamination by a “basaltic” source, we suggest that eclogites are the source of the metasomatic agent that enriched the original garnet peridotite.

The Monte Duria area thus represents a natural laboratory where it is possible to study “in situ” the mantle-crust interaction. Metasomatic agents and processes, relationships between UHP-UHT metamorphism and metasomatism, and mechanisms of emplacement of mantle rocks into crustal slab can be here addressed and framed in the context of the well known geological background of the Alps.