Geophysical Research Abstracts
Vol. 16, EGU2014-6804, 2014
EGU General Assembly 2014

UHT overprint of HP rocks? A case study from the Adula nappe complex (Central Alps, N Italy)

Simone Tumiati (1), Stefano Zanchetta (2), Nadia Malaspina (2), and Stefano Poli (1)

(1) Dipartimento di Scienze della Terra, Università di Milano, Milano, Italy (simone.tumiati@unimi.it), (2) DISAT, Università di Milano Bicocca, Milano, Italy

The Adula-Cima Lunga nappe complex is located on the eastern flank of the Lepontine Dome and represents the highest of the Lower Penninic units of the Central Alps. The Adula nappe largely consists of orthogneiss and paragneiss of pre-Mesozoic origin, variably retrogressed eclogites preserved as boudins within paragneiss, minor ultramafic bodies and metasedimentary rocks of presumed Mesozoic age. The higher metamorphic conditions have been estimated for the peridotite lenses in the southern part of the nappe at pressure over 3.0 GPa and temperature of 800-850°C. Garnet lherzolite bodies crop out at three localities, from west to east: Cima di Gagnone, Alpe Arami and Mt. Duria. After the partial subduction of the European distal margin beneath the Africa-Adria margin, the HP rocks were overprinted by an upper amphibolite facies metamorphism that postdates the main phase of nappe stacking. In the southern sector of the Lepontine Dome, adjacent to the Insubric Fault, metamorphic conditions promoted extensive migmatization of both metasedimentary and metagranitoid rocks.
In one single outcrop, at Monte Duria, garnet lherzolites occur in m-sized boudins hosted within partly granulitized amphibole-bearing and k-feldspar gneisses that contain also some decimeter-sized boudins of both mafic and metapelitic eclogites. This rock association is in turn embedded within the migmatitic gneisses that form most of the southern sector of the Adula nappe. Petrographic and chemical analyses indicate that garnet peridotite is composed of olivine (XMg=0.88), orthopyroxene, clinopyroxene and garnet (Py68; $Cr2O_3$ up to 1.45 wt%) with inclusions of Cr-rich spinel (up to Cr/(Al+Cr)=0.55) surrounded by kelyphitic symplectites of opx + cpx/amph + spl. These reaction produced double coronas, one composed of opx (former ol) and one composed of cpx + opx+ spl. In one kelyphite, we observed the uncommon occurrence of ZrO_2 (baddeleyite) and ZrTi2O6 (srilankite). Tiny crystals of these two Zr-bearing phases ($\sim$1 μm) are invariably located in the opx corona after ol. The cpx + opx + spl corona (after grt) contains, instead, zircon. Baddeleyite should have formed through a reaction of the type Mg2SiO4 + ZrSiO4 = $MgSiO_3$ + ZrO_2. ZrO_2 and ZrTi2O6 display a low amount of solid solution. These compositions are consistent with T below 1200°C, but an improvement of the thermodynamic model is needed in order to better constrain the T of the granulitic overprint on the basis of these Zr-bearing phases.
In mafic eclogites, the HP association consists of garnet (Py40Alm37Sp20), omphacite (preserved as inclusion, containing Jd30 and Mg# 0.87), kyanite and minor quartz. Omphacite is almost always replaced by cpx (Jd5) + plag (An55) symplectites. Garnet is surrounded by plag (An33) + opx (En70) symplectites. Kyanite is replaced by plag (An84) + spinel + sapphirine. The spinel-sapphirine Fe-Mg thermometer suggests T of about 850°C due to granulite-facies overprint. We observed sapphirine associated with cpx + opx + plag also in kelyphites after garnet in clinopyroxenites.
In eclogitic metapelites, kyanite is replaced by a corundum + anorthite $\pm$ spinel assemblage. A corundum-rich layer occurs between eclogites and the host gneiss. Cm-sized emerald green zoisite in this layer is replaced by anorthitic plagioclase $\pm$ cpx $\pm$ spinel $\pm$ calcite.
The observed assemblages point to a diffuse granulitization of both the peridotites and the hosting HP rocks of Mt. Duria, suggesting a nearly isothermal decompression from peak-pressure conditions. The surrounding migmatitic gneiss do not display evidence of such granulitic event, having been formed at T<700°C.
The mechanism and timing of emplacement of the garnet peridotite and associated HP-HT rocks in the country migmatites, and whether or not the subduction event is related to the Alpine or to an older orogenic cycle are still a matter of debate.