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Mantle wedge-fluids interactions during the Variscan subduction: the case of chlorite peridotites from the Ulten Zone, Italy.

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Numbers of small lens-shaped peridotitic bodies are included within high-grade Grt-Ky gneisses and migmatites basement rocks belonging to the Upper Austroalpine domain, Tonale nappe, Ulten zone, Nonsberg area, Eastern-central Italian Alps. They represent a portion of the Adriatic subcontinental mantle wedge, which underwent metasomatic enrichments (i.e. C-O-H fluid influx) during the subduction of a crustal slab.

Seven mineral associations have been described (Morten, 1993; Morten and Trommsdorff, 2003) and related to a complex metamorphic P-T evolution from high-T spinel peridotites to relatively low-T garnet peridotites. The observed mineral assemblages sequence, resulting from the metamorphic transition from spinel- to garnet + amphibole-bearing peridotites, is: I) Ol + Opx + Cpx + Spl $\pm$ Amph; II) Ol + Opx + Cpx+ Grt + Spl + Amph: III) Ol + Opx + Cpx + + Grt + Amph; IV) Ol + Opx + Cpx + Grt + Amph $\pm$ Spl; V) Ol + Opx + Grt + Amph $\pm$ Spl; VI) Ol + Opx + Amph + Spl; VII) Ol + Opx + Amph + Chl. The transition from Spl-peridotites to Grt ($\pm$ Amph)-peridotites is interpreted as the result of the incorporation of mantle-wedge portions in a downgoing continental slab. The Chl-peridotites are thought to represent the latest stage of the P-T evolution.

They carry porphyroclastic, with rare olivine and orthopyroxene porphyroclasts, to tabular or mosaic equigranular texture. They are formed of olivine (Fo 88-90), orthopyroxene (En 88-90), amphibole (edenitic and pargasitic horneblendes), spinel [Cr/(Cr + Al) 0.25-0.50], associated to tremolite and spinel relicts [Cr/ (Cr + Al) 0.65-0.75] included in chlorite porphyroblasts. Some domains are spinel-free and chlorite

is the stable aluminous phase. Chlorite (clinochlore – penninite) is present in different textural sites: i) isolated and oriented crystals in the matrix; ii) flakes gathered in clusters; iii) porphyroblasts with included spinel relicts. Whole-rock major element composition reflects different degrees of fertility. Trace element compositions suggest interaction with foreign metasomatic fluids and/or melts agents. LREE (La_N/Yb_N 2.48-9.63) and LILE enrichments are likely due to interaction with fluids with crustal signature whereas some samples showing negative Nb-Ta and positive Pb anomalies suggest a possible interaction with alkaline siliceous melts.

Calculated equilibrium temperatures range from 700 to 780˚C with H_2O activity varying from 0.4 to 0.7. The lack of clinopyroxene and garnet in the Chl-peridotites mineral assemblages precludes any pressure estimation. However, the coexistence of chlorite and amphibole implies an upper pressure limit of 2.2 GPa as shown in experimentally-derived petrogenetic grids for hydrous peridotites (Schmidt & Poli, 1998).

On the basis of the above evidence, we suggest that Chl-bearing peridotites have re-equilibrated at lower pressures than the Chl-free ones. This re-equilibration may have occurred during a relatively early stage of the Nonsberg peridotites exhumation process concomitantly with a significant input of C-O-H metasomatic fluids.