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Petrology andTrace Element Budgets of High-pressure Peridotites Indicate Subduction Dehydration of Serpentinized Mantle (Cima di Gagnone, Central Alps, Switzerland)

Marco Scambelluri (1), Thomas Pettke (2), Elisabetta Rampone (1), Marguerite Godard (3), and Eric Reusser (4)

(1) University of Genova, Dipartimento di Scienze delle Terra, Ambiente e Vita, Genova, Italy (marco.scambelluri@dipteris.unige.it), (2) Institute of GeologicalSciences, University of Bern, Bern, Switzerland, (3) Geosciences Montpellier, Universite Montpellier 2, Montpellier, France, (4) ETH Zurich, Insitut fur Geochemie un Petrologie, Zurich, Switzerland

At Cima di Gagnone, garnet peridotite and chlorite harzburgite lenses within pelitic schists and gneisses correspond to eclogite-facies breakdown products of hydrated peridotites and are suitable for studying dehydration of serpentinized mantle.Thermobarometry and pseudosection modelling yield peak temperatures of 750-850 C and pressures below GPa.The minimum temperature recorded by the garnet peridotite corresponds to the maximum conditions experienced by the chlorite harzburgite, suggesting that these rocks recrystallized cofacially at 800 C. Alternatively, they might have decoupled during subduction, as achieved in tectonically active plate interface boundaries. The major and rare earth element (REE) variability of the peridotites was mostly acquired during pre-subduction mantle evolution as a result of partial melting and reactive melt flow.The ultramafic suite is also characterized by fluid-mobile element enrichments (B, Pb, As, Sb, Cs, Li, U, Be), which confirm derivation from variably serpentinized protoliths. Similarity in the U, Pb, B, Li and Sr contents of the Gagnone peridotites to present-day oceanic serpentinites suggests that these elements were partly taken up during initial serpentinization by seawater-derived fluids. Positive Be, As and Sb anomalies suggest involvement of fluids equilibrated with crustal (metasedimentary) reservoirs during subsequent subduction metamorphism and peridotite entrainment in (meta)sediments. Fluid-mobile element enrichment characterizes all peak eclogitic minerals, implying that multiple hydration events and element influx pre-dated the eclogite-facies dehydration. Peak anhydrous minerals retain B, Li, As and Sb concentrations exceeding primitive mantle values and may introduce geochemical anomalies into the Earth's mantle.The relatively low contents of large ion lithophile elements and light REE in the Gagnone peridotites with respect to much higher enrichments shown by metasomatized garnet peridotite pods hosted in migmatites (Ulten Zone, Eastern Alps) suggest that the crustal rocks at Gagnone did not experience partial melting. The Gagnone garnet peridotite, despite showing evidence
for chlorite dehydration, retains significant amounts of fluid-mobile elements documenting that no partial melting occurred upon chlorite breakdown.We propose that the Gagnone ultramafic rocks represent a prime example of multi-stage peridotite hydration and subsequent dehydration in a plate interface setting.