Melt-peridotite reactions in the lowermost continental crust: evidence from the Ivrea-Verbano Zone (Italian Alps)

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Understanding the emplacement and evolution mechanisms of mantle-derived melts into the lower continental crust is crucial to shed light on the debate dealing with the growth of the continental crust. Deep magma chambers are most likely the dominant sources of evolved magmas rising at intermediate and shallow crustal levels to give rise to granitoid bodies. However, only a few mafic-ultramafic magmatic sequences were used as natural laboratories to investigate the emplacement of mantle-derived melts in the lower continental crust. The Ivrea-Verbano Zone from Italian Alps is a lower continental crust section that mostly consists of a km-scale thick gabbro body of Lower Permian age (Ivrea Mafic Complex) that intruded a granulite to amphibolite facies basement in response to post-collisional transtensional regime. In the deepest sectors of the Ivrea Mafic Complex, some peridotite-pyroxenite sequences considered of magmatic origin are exposed. We present here a petrological-geochemical investigation of the peridotites from the largest ultramafic sequence of the Ivrea Mafic Complex, which is locally referred to as Rocca d'Argimonia.

The Rocca d'Argimonia peridotites are dunites, harzburgites, and minor clinopyroxene-poor lherzolites, and include accessory amounts of spinel, Ca-amphibole (titanian pargasite) and Fe-Ni-sulfides. The harzburgites and the lherzolites are characterized by poikilitic orthopyroxenes including partially dissolved olivine grains associated with accessory spinel. Hornblende gabbronorite dykes locally crosscut the peridotites and show mm-scale, orthopyroxenite to hornblende websterite reaction zones along the contact with host rocks. Olivine from the Rocca d'Argimonia peridotites has forsterite decreasing from 90 to 85 mol% with increasing modal orthopyroxene/olivine ratio. The forsterite proportion is also negatively correlated with olivine $\delta^{18}O$, which ranges from +5.5‰ to +6.8‰. We propose that the Rocca d'Argimonia peridotites formed by reaction of a melt-poor olivine-rich crystal mush with migrating basaltic melts that retained a substantial continental crust component.