

Low-Ni olivine from silica-undersaturated ultrapotassic rocks as evidence for carbonate metasomatism in the mantle

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Major and trace elements in forsteritic olivine from mafic igneous rocks have been shown to be a valuable tool to infer on mantle mineralogy and on metasomatic processes that affect the mantle-source of magmas prior to melting. The deviation of some trace elements (e.g. Ni, Co, Ca) and of their ratios to major elements (Fe, Mg) from the concentrations in olivine from Middle Ocean Ridge Basalts (MORB), has been used to assess the contribution of an olivine-free mantle source to the origin of some Ocean Island Basalts (OIB)[1] and subduction-related lamproitic rocks [2].

Here we present a comprehensive dataset of major and trace elements in high-Mg olivine from the Plio-Quaternary alkaline magmatism of the Italian Peninsula. Samples have been selected from the two major petrographic groups, silica-saturated and -undersaturated rocks, based on their primitive character and the presence of olivine. Through modelling of Ni-Fe-Mg partitioning between melt-olivine pairs, we show that *i*) bulk rocks approximate the composition of parental melts in equilibrium with olivine cores, and *ii*) partition coefficients are well within the range (Kd_{Ni}^{ol-liq} 10-20) of medium-Mg melts (4-8 wt.% MgO).

Such olivine crystals display a range of trace elements contents which encompasses the whole spectrum of olivine worldwide. Olivines from the silica-saturated samples have remarkably high Ni (up to 5'000 ppm) and Cr, and low Ca and Mn/Fe, suggesting contribution from a mantle source that has undergone silica- and K-rich metasomatism, causing olivine consumption in favour of orthopyroxene [2]. Conversely, olivine from the silica-undersaturated rocks have variably high Ca (up to 4'000 ppm) and Mn/Fe, and sistematically low contents of compatible elements (e.g. Ni below 2'000 ppm). This is compatible with a metasomatic reaction in the presence of excess Ca, that would stabilize olivine and clinopyroxene at the expenses of orthopyroxene.

[1] Sobolev *et al.* (2007), *Science* **316**, 412-417. [2] Foley *et al.* (2013), *EPSL* **363**, 181-191.