Low-Ni olivines in silica-undersaturated ultrapotassic igneous rocks as evidence for carbonate metasomatism in the mantle

E. AMMANNATI[1*], D.E. JACOB[2], R. AVANZINELLI[1], S.F. FOLEY[2] AND S. CONTICELLI[1,3]

[1] Dipartimento di Scienze della Terra, Università di Firenze, Via G. La Pira, 4, I-50121, Firenze, Italy (*correspondence: edoardo.ammannati@unifi.it)

[2] ARC Centre of Excellence for Core to Crust Fluid Systems & Dept. of Earth and Planetary Sciences, Macquarie University, Sydney NSW 2109, Australia

[3]U.O.S. Firenze, Istituto di Geoscienze e Georisorse, C.N.R.,Via G. La Pira, 4, I-50121, Firenze, Italy.

Major and trace elements in forsteritic olivines from mafic igneous rocks are a valuable tool to infer on mantle mineralogy and on metasomatic processes that affect the source of magmas prior to melting. This line of research 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 olivines from the Plio-Quaternary potassic to ultrapotassic magmatism of the Italian Peninsula. Samples belong to two major petrographic groups, silica-saturated and -undersaturated rocks. The analysed olivines display a markedly bimodal distribution of trace elements between the two groups. Olivines from the silica-saturated samples have remarkably high Ni (up to 5'000 ppm) and Cr, and low Ca and Mn/Fe. 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). Results are presented within a wide frame of available litterature data.

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, *ii)* partition coefficients are well within the range ($Kd_{Ni}^{ol\text{-}liq}$ 10-20) of medium-Mg melts (4-8 wt.% MgO), and *iii)* trace elements of olivines from the silica-undersaturated samples are compatible with a metasomatic reaction in the presence of excess Ca, which would stabilise olivine and clinopyroxene at the expenses of orthopyroxene [3].

[1] Sobolev *et al*. (2007), *Science* **316**, 412-417. [2] Foley *et al*. (2013), *EPSL* **363**, 181-191. [3] Ammannati *et al*. (2016), *EPSL* under revision.