‘Depleted pyroxenite’ domain in the Galápagos mantle, the result of crustal processing?

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Low-K tholeiites erupted from volcanoes in eastern and north-eastern Galápagos are more isotopically depleted and have lower concentrations of strongly-incompatible trace elements than those from other parts of the archipelago. This is explained by the presence of thinner lithosphere in the eastern archipelago allowing greater adiabtic decompression melting of more refractory mantle material [1]. Additionally, Os isotopic data provides compelling evidence that the Low-K tholeiites have interacted with altered oceanic crust during crystal fractionation [2]. Despite the homogeneity of melting processes suggested by radiogenic isotopes and incompatible trace elements, significant variations exist in the Ni, Ca and Mn contents of olivine phenocrysts in the Low-K tholeiites and cannot be explained by one single model. Here we explore several separate hypotheses to explain the variations in olivine minor element concentrations in the basalts. These are:

1. Presence of a pyroxenitic component [3].
2. Variations in the melting parameters e.g. pressure and tempterature of mantle melting.
3. Interaction with altered oceanic crust as indicated by Os isotope data.
4. Mixing between primitive and evolved magmas, resulting in the crystallisation of high-Ni olivines.
5. Variations in the magmatic storage conditions. This should control the proportion of olivine and pyroxene crystallising from the magma.

Using newly-acquired high-precision in-situ trace-element analyses, previously determined Os and Pb isotope ratios, and the results from mantle melting and AFC models we investigate the effects of these processes on olivine chemistry of Galápagos basalts. In particular, we focus on the relative controls of mantle lithology and post melt generation processes on the minor element compositions of olivine phenocrysts from Low-K tholeiites in eastern and north-eastern Galápagos and islands in the south of the archipelago that are thought to contain melts from an ancient subducted oceanic crust.

[1] Gibson, S. A. *et al.* (2012) *Geochem. Geophys. Geosyst.* **13**, Q09007. [2] Gibson, S. A. *et al.* (2016) *EPSL.* [3] Vidito, C. *et al.* (2013) *Geochem. Geophys. Geosyst.* **14,** 4214–4240.