Source variability and crustal contamination of the Baffin Island picrites – coupled Sr isotope and trace element study of individual melt inclusions

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Baffin Island picrites are among the most primitive post-Archean magmas erupted and are thought to have escaped major melt-modifying processes en route to the surface. Recent whole rock geochemical studies show remarkable coherence between radiogenic and He isotopes that infer varying contributions from mantle reservoirs ranging from a high ^{3}He primordial endmember, through "primitive-enriched" material to depleted MORB source mantle [1]. Early-formed olivine-hosted melt inclusions (MIs) may sample undiluted melt fractions from these components prior to melt aggregation and mixing. Sr isotope and trace element measurements of single MIs [2] may thus provide a higher resolution picture of these source contributions. 30 individual olivine-hosted MIs from 5 picrites reveal substantial Sr isotope variations (0.7031-0.7103), which contrast the narrow range of the host picrites (0.7031-0.7037). REE fractionation of MIs [$(La/Sm)_N$ 0.36-2.38] is comparable to the picrites [$(La/Sm)_N$ 0.57-1.09], but $(Rb/Sr)_N$ of the MIs extend to more extreme values (0.1-9.19 vs. 0.04-0.12). Mixing of mantle-derived melts fails to reproduce such elemental and isotopic variations. This suggests, that the Baffin Island MIs witness an overprint of crust that masks the source variations. We derive a model involving interaction of magma with various crustal endmembers to produce a complex spectrum of MI isotopic compositions. This agrees with the model based on trace elements [3]. The extensive nature and complexity of this high level interaction of olivine-hosted MIs suggests that caution should be applied to the interpretation of Sr and Pb isotope variations in oceanic magmas as being solely of mantle origin.

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[2] Harlou, R., et al. (2005) *GCA*, 69/10S, A380.
[3] Yaxley, G., et al. (2004) *Contrib Mineral Petrol*, 148. 426-442.