

Halogen Composition of the Proto-Iceland Plume Source Mantle

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Constraining the halogen composition of the primitive undegassed deep mantle reservoir is an important step in improving our understanding of the whole-Earth halogen geochemical cycle. The 62-58ma Baffin island picrites; the initial products of the Iceland plume, record the highest measured terrestrial ³He/⁴He values (~50Ra) [1,2], making them ideal candidates to assess the halogen composition of the primitive undegassed mantle.

We present new elemental halogen and chlorine isotope ($\delta^{37}\text{Cl}$) compositions of olivine-hosted melt inclusions from Baffin Island picrites with uniformly high ³He/⁴He signatures. The most primary and unenriched melt inclusions yield a $\delta^{37}\text{Cl}$ composition of $-0.21 \pm 0.32\%$ for the primitive source mantle, which is comparable to carbonaceous chondrites [3]. Samples with more enriched compositions, i.e., higher La/Yb and more radiogenic Sr, are more variable and extend to higher halogen concentrations and more positively fractionated chlorine isotope compositions, tracing the addition of recycled material to the Baffin Island source mantle. Thus chlorine isotopes, like radiogenic isotopes, appear to be decoupled from He isotope systematics.

The halogen composition of undegassed deep mantle represents an important end-member which will compliment current datasets of more processed OIB source mantle domains. This will ultimately contribute to a more robust understanding of the whole-Earth halogen budget.

[1] Stuart F. *et al.* (2003) *Nature* **424**, 57-59 [2] Starkey N. *et al.* (2009) *Earth Planet. Sci.* **277**, 91-100 [3] Sharp *et al.* (2013) *Geochim.Cosmochim. Acta* **107**, 189-204