Cu isotope heterogeneity in lithospheric mantle metasomes

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The Cu-isotope composition of asthenospheric mantle, as inferred from MORB & OIB, is relatively homogeneous (~0 ± 0.2‰), suggesting that high-T mantle processes do not fractionate $^{65}Cu/^{63}Cu$. Yet, $\delta^{65}Cu$ of Type I (Cr- & Mg-rich) orogenic peridotites and lithospheric mantle xenoliths range from -0.68 to +1.82‰, which has been attributed to mantle metasomatism [1]. We are investigating this hypothesis via a suite of Type II (Fe & Al-rich) clinopyroxenites, wehrlites and amphibolites from the Geronimo Volcanic Field (GVF) of SE Arizona, USA. The rocks are interpreted as examples of enriched metasomes within the lithospheric mantle, which formed as cumulates from basaltic melts; as such, they may retain a record of the percolating melts and metasomatic fluids inferred from the cryptically metasomatized (i.e. LREE-enriched) orogenic peridotites reported by [1]. New geothermometric analyses, based on Al partitioning between olivine and spinel, yield temperatures of 983˚ – 1187˚C, suggesting the xenoliths were derived from somewhere near the top of the lithospheric mantle. Whole rock analyses (HF dissolution) of the Type II xenoliths range from +0.14 to +1.44‰. Host basalts are isotopically light (-0.23 to -1.30‰) compared with the entrained xenoliths, so interaction with the host basalt is not responsible for the compositional variation in the xenoliths. Readily leachable Cu, assumed to be hosted in sulfides, exhibits a wider range of values -0.39 to 3.88‰, indicating considerable isotopic heterogeneity within individual samples. However, isotopic variations do not correlate with sulphide type, as the majority of sulfide grains, across all petrographic types, are pyrrhotite or Ni-poor mono-sulfide solution (MSS). Work is ongoing to identify the origin of the within-sample heterogeneity.

[1] Liu et al. (2015) *EPSL* **427**, 95-103.