

Controls on the high PGE content of primary mantle spinel

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The bulk rock platinum group element (PGE) budget of mantle peridotite is controlled primarily by volumetrically insignificant (<0.1 modal %) sulphide [1]. The remaining 5% of the mantle PGE budget is distributed between the 99.9 modal % of the silicate minerals and spinel which dominate the mineralogy of the upper mantle. Within these phases osmium is disproportionately concentrated in primary spinel, with Os concentrations consistently an order of magnitude higher than co-existing olivine, orthopyroxene and spinel [2] [3]. Unlike chromite, which can induce the precipitation of platinum group minerals and sulphides through a localized perturbation of fO_2 [4] found as inclusions within the margins of chromite grains, primary spinel does not appear to contain discrete PGE-rich phases [5]. To date the source of high Os concentrations in primary spinel remains equivocal, although experimental evidence derived from chromite suggests that Os, Ir, Ru and Rh partition preferentially into the chromite crystal lattice as opposed to co-existing silicate phases (e.g., [6]).

Here we present the results of a systematic study to determine the location of PGE within primary spinel from a Kilbourne Hole peridotite xenolith. As spinel itself is an opaque mineral 50 randomly chosen chromian-spinel grains were examined by SEM to visually check for sulfide grains included within the spinel. The same grains were then analysed by laser ablation ICP MS and the time resolved data of several analyses examined for peaks in PGE abundances that may indicate the presence of sub-micron platinum group minerals. Finally, aggregates of spinel grains were leached and finally dissolved in inverse aqua regia in a high pressure asher at 300 to 320 °C determine whether the PGE is hosted in sub micron sulphides that can be liberated by a HBr leach, or are hosted within the chromian-spinel crystal matrix, as predicted by experimental methods.

[1] Hart and Ravizza (1996) *Geophys. Mon.*, vol. 95. AGU, Washington. pp. 123–134 [2] Harvey et al (2010) *Geochim Cosmochim Acta* 74, 293-320. [3] Harvey et al (2011) 75, 5574-5596 [4] Finnigan et al (2008) [5] Ferraris and Lorand (2008) *Earth Planet Sci Lett* 276, 167-174. [6] Pagé et al (2012) *Chem Geol* 302-303, 3-15.