Zinc isotope fractionation in upper mantle: New insights from ultra-refractory mantle xenoliths in an oceanic intraplate setting

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To investigate metal fractionation in mantle differentiation processes, Zn stable isotopes in peridotites have a great potential as sensitive tracer of mantle partial melting, metasomatism and mineral segregation. Yet, Zn isotope data on mantle peridotites remain scarce and exclusively originating from continental settings (e.g. cratonic, off-cratonic and orogenic).

Here we report for the first time whole rock (WR) Zn elemental and isotopic compositions for 26 ultra-refractory spinel harzburgite (URSH) xenoliths from the Kerguelen Archipelago, an oceanic intraplate environment (South Indian Ocean). Selected samples are fresh (LOI≤4.6), show no or little evidence of metasomatism and are interpretated as residues from high degrees of melt extraction (~30%) as pointed out by low clinopyroxene contents (<2.8%) and high $Mg\#_{WR}$ (0.92-0.93) [1].

Zn concentrations (Zn_{WR}) and Zn isotope compositions ($\delta^{66}Zn_{WR}$ relative to JMC-Lyon 03-70491) were obtained on an Agilent 7700x and a Nu Plasma II, respectively. The URSH have homogenous Zn_{WR} with an average of 41±6ppm (2SD). This is in good agreement with a residual origin, especially as their relatively low Zn_{WR} are similar to those obtained on continental peridotites (30-48ppm) [2]. $\delta^{66}Zn_{WR}$ values range from +0.13±0.04‰ to +0.36±0.03‰ (2SD), overlapping the isotopic fields defined by both fertile and residual unmetasomatized peridotites from previous studies (+0.10 to +0.34‰) [2,3]. However, Kerguelen URSH show a distinct trend, not correlated with partial melting markers (e.g. Mg#) and thus suggesting a distinct metal fractionation between peridotites from continental and oceanic settings.

[1] Wasilewski *et al.* (2017) *Lithos* 272, 336-349. [2] Doucet *et al.* (2016) *EPSL* 451, 232-240. [3] Wang *et al.* (2017) *GCA* 198, 151-167.