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Zn isotopes in the Earth's mantle

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Zn is a moderately volatile element which can be used to trace planetary differentiation and volatility-driven processes. The Zn isotope composition of the Bulk Silicate Earth (BSE) is still a matter of debate as igneous processes can fractionate Zn isotopes [1, 2, 3]. This study reports new Zn isotope data for basalts, peridotites and a komatiite in order to better constrain the Zn isotope composition of the BSE and mantle-derived rocks. The measurements were done by MC-ICPMS using a double-spike technique which corrects for chemical and/or instrumental isotope fractionation [4]. The Zn isotope compositions of peridotites are correlated with indices of melt extraction and suggest a $\delta^{66}Zn_{BSE} = 0.27 \pm 0.03$ ‰.

A new non-modal partial melting model was developed to explain the Zn isotope composition of magmatic rocks. Heavy Zn isotopes are enriched in spinel and silicate liquids because Zn in these materials has a lower coordination than in olivine, pyroxene and garnet. As a result, partial melting produces enrichment in heavy Zn isotopes in the liquid relative to the solid residue. This model explains the Zn isotope composition of basaltic lavas but cannot account for the light Zn isotope compositions of depleted peridotites. We propose that the low $\delta^{66}Zn$ of peridotites results from kinetic isotope fractionation during partial melting and melt migration.

[1] Chen et al. (2013), *EPSL*, **369-370**, 34-42. [2] Doucet et al. (2016), *EPSL*, **451**, 232-240. [3] Sossi et al. (2018), *Chem. Geol*, **477**, 73-84. [4] Amet & Fitoussi, *IJMS*, **457**, 116413.