Zinc isotope fractionation during partial melting of the Earth's upper mantle

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Our understanding of the Zn isotopic variation in terrestial igneous rocks and the fractionation mechanisms remains limited [1]. The terrestrial mantle, and by inference, the bulk silicate Earth (BSE), are previously suggested to have an average δ^{66}Zn value of +0.28 ± 0.05‰ (relative to JMC 3-0749L) primarily based on oceanic basalts [1]. Zn isotope data for mantle peridotites are scarcely reported and whether Zn isotopes are fractionated during parting melting of mantle is still unclear. To address this issue, we make high-presicion Zn isotope analyses on suites of well-characterized peridotites and basalts. The primitive basalts (MgO > 8 wt.%) have homogenous Zn isotopic compostions with an average δ^{66}Zn value of +0.28 ± 0.05‰. By contrast, the peridotites exhibit an overall ~0.9‰ variation (-0.44‰ to +0.44‰), which probably reflects the influence of mantle metasomatism. Eliminating the metasomatised peridotites, the non-metasomatized peridotites have relatively uniform δ^{66}Zn values with an average of +0.17 ± 0.06‰, which is systematically lighter than basalts. This difference indicates Zn isotope fractionation during peridotites melting. Zn isotope analyses on minerals seperated from periotites suggest equilibrium fractionation between olivines and pyroxenes is close to zero, whehres spinels are significantly isotopically heavier than olivines by ~0.1‰. Considering that spinels contain much higher Zn than coexing slicate minerals in peridotites, we propose that prerential consumption of spinel during upper mantle melting accounts for the Zn isotope fractionation between basaslt and peridotite.

[1] Chen, et al. (2013) *Earth. Planet. Sci. Lett.* **369**, 34-42.