

Selenium isotope and Se–Te elemental systematics of the Pacific–Antarctic ridge basalts

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Selenium and tellurium are volatile and chalcophile elements [1]. The Se–Te abundances (~80 and 11 ng g⁻¹, respectively) and near-chondritic ratios in the primitive mantle (~7.9 vs ~8.5 in CI chondrites [1]) have been attributed to addition of late-accreted materials after core formation [2,3]. However, lherzolites that are used to estimate the primitive mantle Se–Te signature are generally affected by secondary metasomatic processes involving addition of Se–Te-rich base metal sulfides [4]. Besides, Se–Te systematics of the southern Mid-Atlantic Ridge basalts show that the mantle sources of normal- and enriched-type mid-ocean ridge basalts (MORBs) have distinct (non-chondritic) Se/Te ratios (~18–27 [5]). Selenium isotope systematics may provide further constraints on the origin and evolution of these elements in the mantle. A chondritic Se isotope composition (–0.21 ± 0.31‰; difference in ⁸²Se/⁷⁶Se relative to NIST SRM3149 [6,7]) would be expected for the upper mantle if the Se budget was dominated by late-accreted materials and no subsequent Se isotope fractionation occurred during magmatic processes [5,8]. Basalts from a variety of geodynamic settings with different Se/Te ratios (~3–65) show similar yet distinctly heavier Se isotope composition (0.23 ± 0.14‰; n = 4 [9]) compared to chondrites. It remains unknown if these basalts are representative of their mantle source. Here, we present the first Se isotope and new Se–Te abundance data on MORB glasses from the Pacific–Antarctic ridge (n = 27). These MORBs show rather uniform Se isotope compositions that are resolvably lighter than all previously published data for mantle-derived rocks and melts [9,10,11]. The lack of measurable Se isotopic fractionation during sulfide–silicate fractionation suggests that these MORB values can represent the depleted mantle signature. We further address the reason for Se isotopic differences among mantle reservoirs and provide constraints on the origin of Se–Te in the mantle.

[1] Lodders (2003) *Astrophys. J.* **591**, 1220–1247; [2] Wang & Becker (2013) *Nature* **499**, 328–331; [3] Rose-Weston et al. (2009) *GCA* **73**, 4598–4615; [4] König et al. (2014) *EPSL* **385**, 110–121; [5] Lissner et al. (2014) *GCA* **144**, 379–402; [6] Vollstaedt et al. (2016) *EPSL* **450**, 372–380; [7] Labidi et al. (2018) *EPSL* **481**, 212–222; [8] Brenan (2015) *EPSL* **422**, 45–57; [9] Yierpan et al. (2018) *G-cubed* **19**, 516–533; [10] Kurzawa et al. (2017) *Chem. Geol.* **466**, 219–228; [11] Rouxel et al. (2002) *GCA* **66**, 3191–3199.