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The Sb Isotope Composition of Bulk Silicate Earth and the Upper Continental Crust

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Recently, the fractionation of Sb isotopes has become an emerging tool, e.g. for deciphering the mechanisms of- and conditions during ore formation or the characterization of near-surface Sb cycling. However, the Sb isotope composition of the continental crust, the Sb source for many of these processes, is yet poorly constrained. Here, we investigated 22 glacial diamictite composites, which have previously been characterized for their isotopic and chemical composition [1,2], along with additional sedimentary and igneous rocks for their Sb isotope composition. The aim is to determine the Sb isotope signatures of bulk silicate Earth (BSE) the upper continental crust (UCC), and to further constrain Sb isotope fractionation during deep and near-surface Sb cycling.

Mafic and ultramafic igneous rocks show a narrow range of delta^{123}Sb (~0.0 ±0.15‰) that may be considered as the best estimate for BSE. Differentiated (Intermediate and acidic) magmatic rocks and the diamictites, spanning an age range from Mesoarchean to Paleozoic, show identical Sb isotope compositions (within uncertainties), however, the latter display significantly larger variability. These findings indicates that UCC and BSE have very similar Sb isotope signatures. However, as indicated by the Sb isotopic variability of sediments and previous weathering studies [3], near-surface processes can result in significant Sb isotope fractionation that may, as a result of crustal recycling, generate significant Sb isotopic variability in the UCC and, likewise, in ore deposits.

[1] Gaschnig et al. (2016) GCA, 186, 316–343
[2] Bindeman et al. (2024) Chem. Geol. 670, 122458
[3] Kaufmann et al (2024) Chem Geol. 662, 122253