Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28736

Molybdenum isotopes in intraplate basalts record the heterogeneity of Earth's deep mantle

MR. WEI FANG, LI-QUN DAI AND ZI-FU ZHAO
University of Science and Technology of China

Existing Mo isotope data show that intraplate basalts have highly variable Mo isotopes, but their origin remains unclear. We synthesize Mo isotope and other geochemical data for global intraplate basalts, which provide insights into Mo recycling in Earth's deep mantle. Global intraplate basalts display highly variable δ^{98}Mo values of −0.84‰ to 0.10‰, suggesting mantle Mo isotopic heterogeneity. Most of the basalts have low δ^{98}Mo values and high Ce/Mo ratios that are similar to those of the oceanic eclogites, indicating that recycled dehydrated oceanic crustal components were involved in their mantle sources. However, some intraplate basalts have heavy Mo isotopes. This reveals that slab components at shallow depths were dragged by the downgoing slab and have carried heavy Mo isotopes into the deep mantle. Significantly, high δ^{98}Mo values of these basalts are also associated with low Ce/Mo ratios, high fluid-mobile element contents, and depleted radiogenic Sr-Nd isotopes. Given that recycled basaltic oceanic crust and sediment are generally efficiently dehydrated during subduction and sequester light Mo isotopes, subducted serpentinised lithospheric mantle is a plausible candidate to transfer heavy Mo isotopes into the deep mantle. Thus, Mo isotope systematics of intraplate basalts record complex geochemical fluxes from subducting slab to the deep mantle. Our study highlights the effectiveness of Mo isotopes as indicators for geochemical heterogeneity of Earth's deep mantle.