Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37157

Selenium isotope variations in mantle xenoliths from Southern Patagonia

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Orogenic peridotites typically retain a narrow and homogeneous Selenium (Se) isotopic range reflecting the established Bulk Silicate Earth (BSE) value of -0.03 ± 0.07 ‰ [1]. In contrast, subcontinental lithospheric mantle (SCLM) xenoliths can record significantly wider isotopic dispersion. Mantle xenoliths from the Andean back-arc region of southern Patagonia illustrate this difference. Samples spanning three localities in the Deseado Massif (Argentina) and one in Coyhaique (Chile) exhibit a highly fractionated $\delta^{82}Se$ range (-1.46 ‰ to +0.55 ‰) and low Se concentrations (< 55 ng/g).

The studied xenolith suite is predominantly composed of lherzolites, along with one harzburgite and one dunite. Notably, this lithological variation does not appear to control isotopic dispersion; both the harzburgite and dunite fall well within the highly fractionated isotopic ranges defined by the lherzolites at their respective localities and show no correlation with indicators of melt-depletion (e.g., Al_2O_3). This indicates that Se isotope fractionation in these samples is not simply a result of partial melting. Instead, there is a significant variation from light to heavy isotopes observed at each study site, suggesting localized, secondary modifications.

The SCLM beneath southern Patagonia has a well-documented history of complex partial melting and metasomatic overprinting [2-3]. This ongoing investigation evaluates how these processes affect Se, specifically assessing whether the large isotope fractionation observed is driven by fluid/melt-rock interactions and the continuous reworking of mantle sulfides. Given the subduction zone setting and the isotopic similarities between these xenoliths and dehydrated slab materials [4], we aim to determine if subduction-related metasomatism is actively involved. While secondary overprinting (host-magma infiltration and oxidative weathering) must also be carefully assessed, this study tests whether combining Se isotopes with major and trace element geochemistry can provide additional, robust constraints on the recycling of slab-derived components within the Patagonian SCLM.

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