

## Highly siderophile element and Os isotope constraints on pyroxenite genesis by melt-rock reaction

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Highly siderophile elements (HSE) and Os isotopes have been useful tools for the study of Earth accretion, core formation and mantle differentiation, because of their range in compatibility and their siderophile and chalcophile geochemical behaviour. Recent studies have shown that HSE may be more susceptible to redistribution during igneous processes than previously thought. Reliable estimates of the HSE and Os isotopic composition of primitive mantle model compositions are required to evaluate the influence of core formation and late accretion processes. Because such primitive mantle estimates rely to a large extent on compositions of fertile lherzolites, a good understanding of the influence of refertilization on the HSE budget of lherzolites is required.

Pyroxenite layers, which occur as a minor volumetric fraction in mantle-derived rocks from ultramafic massifs and xenoliths, have been linked to the refertilization process as either deformed slices of subducted oceanic crust; lithospheric high pressure cumulates that crystallized from migrating melt or reaction products of infiltrating melt and preexisting pyroxenite. Understanding the genesis of pyroxenite layers in ultramafic massifs and the distribution of HSE during their emplacement may thus be important for a comprehensive understanding of the redistribution of the HSE and their budget in mantle rocks.

Here we report HSE and Os isotopic data on a variety of pyroxenites from the Totalp ultramafic massif, eastern Switzerland. The Totalp massif consists of spinel lherzolites, interlayered with spinel and spinel-garnet websterites and clinopyroxenites. Rapid uplift prior to emplacement on the Jurassic Piedmont-Liguria ocean floor prevented equilibration in the shallower mantle and allows study of deep, presumably oceanic lithospheric mantle.

Pyroxenites from the Totalp massif show suprachondritic Pd/Ir and Re/Ir, and radiogenic initial  $^{187}\text{Os}/^{188}\text{Os}$  (160 Ma) of 0.1329 to 1.17. Two distinct types of fractionated CI chondrite normalized HSE patterns can be identified. Type A patterns, found primarily in websterites, have a positive Pd anomaly relative to Pt and Re. Type B patterns occur in spinel and spinel-garnet clinopyroxenites and websterites, and have HSE patterns that show increasing enrichment from Pt to Re.

The HSE distributions are inconsistent with in situ melting of subducted oceanic crust, as melting models using typical basalt HSE concentrations and partition coefficients applicable under upper mantle conditions fail to reproduce the observed HSE patterns. The Pt, Pd and Re enrichments of type A patterns can be reproduced by adding sulfide from small-degree fractional melts derived from a depleted mantle source to Re-Pd-Pt depleted residual harzburgites. The type B HSE patterns characterized by high Re/Pd can be replicated in a similar way, using melts that formed by larger degrees of melting. Totalp pyroxenites may thus represent precipitates from migrating mafic melt added to residual peridotite.

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