1.2.P02

Li-isotopic signatures of peridotite xenoliths and isotopic fractionation at high temperature between olivine and pyroxenes

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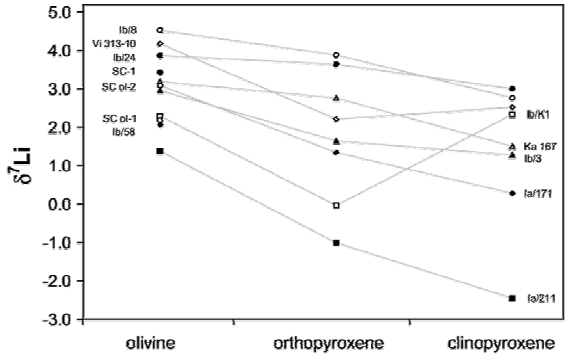
We determined Li-isotopes on olivine, clinopyroxene and orthopyroxene from spinel- and garnet-peridotites from San Carlos (Arizona), Vitim (Siberia), Dreiser Weiher (Eifel, Germany) and Kapfenstein (Austria). These samples represent parts of the upper mantle with varying partial melting, metamorphic and metasomatic histories. In isotopic studies of mantle xenoliths, mineral surface contamination can be a serious problem. It is generally solved by careful handpicking and subsequent acid leaching. We found that ultrasonic cleaning with Milli-Q water (18 MΩ cm) was sufficient to remove all surficial lithium.

δ^7Li-values range from +1.4 to +4.5‰ in olivines, from –1.0 to +3.9‰ in orthopyroxenes and from –2.4 to +3.0‰ in clinopyroxenes. Olivines in mildly depleted lherzolites (Eifel, Vitim, San Carlos) are isotopically the heaviest (δ^7Li +3.4 - +4.5‰). A metasomatised amphibole bearing lherzolite from the Eifel gave the lightest value (1.4‰). Olivines have similar δ^7Li-values to that of MORB while the pyroxenes are isotopically lighter. Except for one sample, all samples depict the same relationship, whereby olivine has the heaviest δ^7Li-value, followed by orthopyroxene and clinopyroxene to lighter values (Fig).

The differences in $\Delta\delta^7\text{Li} = [\delta^7\text{Li}^{ol} - (\delta^{7cpx})]$ apparently depend on temperature. $\Delta\delta^7$Li is about 3.5 for low temperature (~950°C) and 1.5 for high temperature (~1150°C) xenoliths. We therefore suggest Li isotope fractionation to occur at high, magmatic temperatures.



Systematic difference of δ^7Li-values between olivines, ortho- and clinopyroxenes (1‰ mean 2σ).

1.2.P03

Metasomatic phenomena and Li-Be-B characteristics of mantle xenoliths from Harrat Uwayrid, Saudi Arabia

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Harrat Uwayrid is a late Miocene to Quaternary volcanic field, located in the northwestern part of the Arabian plate and related to the formation of the Red Sea. Mantle xenoliths from this field can be classified into different groups: spinel peridotites, spinel websterites, spl-ol clinopyroxenites and cpx-bearing orthopyroxenites. Some of these rocks contain additional pargasite in textural equilibrium with the other phases. Most of these xenoliths show evidence for a late metasomatic overprint in the form of intergranular glass containing microphenocrysts of olivine (ol2), clinopyroxene (cpx2) and spinel (spl2), and/or the formation of brown secondary pargasite (prg). One olivine websterite has 'primary' Ba-rich phlogopite (11 wt% BaO) and pargasite (0.8 wt% BaO), both in textural equilibrium with ol, opx and cpx. The formation of phl and prg is attributed to an earlier phase of metamorphism followed by recrystallization. Afterwards, an infiltrating melt reacted with phl resulting in the formation of Ba-rich feldspar (30-35 wt% BaO) and Ba-rich glass (4.6 wt% BaO) containing microphenocrysts of ol2, cpx2 and spl2.

The abundances of Li, Be and B in the minerals of the xenoliths were studied by SIMS. The partitioning of these elements among the primary minerals (ol, cpx, opx) is virtually independent of xenolith equilibration temperature. The abundances of Li, Be and B in the various primary minerals depend on the degree of initial depletion and later metasomatic re-enrichment experienced by each xenolith. Primary cpx is characterized by 0.5–4.6 µg/g Li, 0.02–0.39 µg/g Be and 0.02–1.3 µg/g B. Primary opx has 0.65–3.52 µg/g Li, 0.007–0.117 µg/g Be and 0.02–1.73 µg/g B, while olivine contains 1.2–4.2 µg/g Li, 0.000-0.015 µg/g Be and 0.02–0.77 µg/g B.

Ba-rich phlogopite in the olivine websterite contains 1.0–3.3 µg/g Li, 1.2–1.6 µg/g Be and 2.0–9.3 µg/g B. Pargasite grains were too small to be analyzed. Glass could be analyzed in a number of xenoliths and contains 0.03–1.7 µg/g Li, 0.25–2.2 µg/g Be and 0.3–3.2 µg/g B. Secondary pargasite is characterized by 0.15–2.4 µg/g Li, 0.1–1.2 µg/g Be and 0.0–2.0 µg/g B. The partitioning of the three low atomic mass elements between olivine, cpx and opx will be discussed using the data of this and other studies [1-3].

References

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[3] Woodland AB, Seitz H-M, Yaxley GM (2004) *Lithos*: in press