Trace elements in garnet - witnesses of peridotite metasomatism

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Trace elements in garnet may provide important information on evolution of orogenic peridotites in deep subduction zones. Garnet peridotites associated with eclogites and diamond-bearing ultrahigh-pressure (UHP) gneisses of the Saxothuringian basement in the north-western Bohemian Massif underwent UHP metamorphism (~4 GPa and 1100°C) and cryptic metasomatism as a consequence of a deep subduction (Kotková *et al.*, 2021). Peridotites contain large garnets (up to ~ 5 mm in diameter) in unequigranular fine-grained matrix composed of olivine, orthopyroxene and clinopyroxene. Garnets are locally consumed by amphibole ± phlogopite corona or by diopside + spinel kelyphite.

Some garnet cores show low trace element contents and flat zoning profiles, except for large garnets (>1 mm in diameter) with HREE decrease to the rim reflecting prograde garnet growth. Primitive mantle-normalized REE patterns feature a steep increase from La_N to Lu_N with no significant Eu anomaly (Fig. 1a). Majority of garnets shows significant enrichment in LREE, U, Th, Pb in their cores, reflecting the initial stage of peridotite metasomatism, followed by a continual decrease of these elements towards the rim (Fig. 1b). Garnet rims with common multiphase solid inclusions (MSI) are characterized by a variable degree of LREE, U, Th, and Pb enrichment (Fig. 1b), which yields an anomalous convex-upward normalized REE pattern from La_N to Sm_N (Fig.1a). These rims crystallized at presence of a metasomatic silicate-carbonate liquid trapped as MSI (Kotková et al. 2021). Contents of HREE, Y, Zr and Hf are unaffected by metasomatism (Fig.1b). Thin outermost rims can show a sudden decrease in HFSE and increase in Y, HREE and Lu/Hf ratios reflecting reequilibration on retrograde path during rapid decompression. The demonstrated garnet formation by metasomatism needs to be considered at interpretation of Lu-Hf geochronological data.

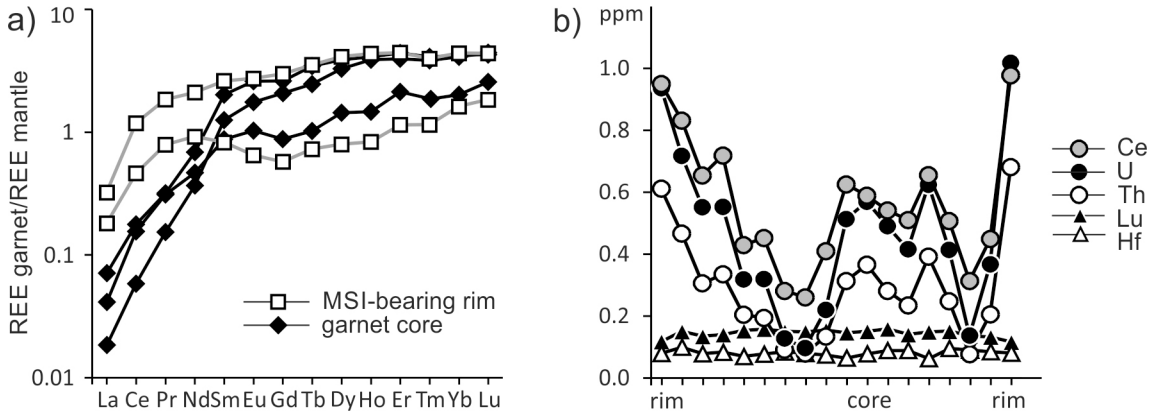

Figure 1- Representative mantle normalized REE patterns in garnet from different samples (a) and trace elements in metasomatic garnet (b).

Kotková, J., Čopjaková, R., Škoda, R., 2021. Multiphase solid inclusions reveal the origin and fate of carbonate-silicate melts in metasomatised peridotite. *Lithos* 398, 106309.