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Barian mica in multiphase solid inclusions from orogenic garnet peridotites as indicator of composition of subduction-zone fluids

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Chemical composition of barian mica in multiphase solid inclusions (MSI) enclosed in garnet from mantle-derived UHP garnet peridotite (Saxothurian basement of the northern Bohemian Massif) has been used to describe its crystallization medium. Barian mica in MSI from lherzolite forms anhedral grains, which are intimately intergrown with other associated minerals (amphibole, magnesite, dolomite, spinel and graphite). In harzburgite, barian mica commonly occurs at the rim of MSI around central dolomite. Its chemical composition corresponds to Ba-rich phlogopite to kinoshitalite. Beside Ba (0.24-0.67 apfu) and K (0.22-0.59 apfu), minor Na (0.1-1.0 wt. % Na_2O) and Sr ($\leq$ 0.27 wt. % SrO) fill the interlayer site. Micas are enriched not only in Mg (1.83-2.48 apfu with X_{Mg} ratio $\sim$ 0.85-0.95) but also in Cr (0.03-0.43 apfu), which along with minor Fe (0.11-0.36 apfu) and Ti (0-0.11 apfu) and traces of Ni (0.1-0.3 wt. % NiO) enters octahedral sites. All barian micas are characterized by high Cl (0.04-0.34 apfu) and very low F ($\leq$0.03 apfu). Substitution vector involving Ba in the I-site and describing observed chemical variability can be expressed as $BaFe^{IV}AlClK_{-1}Mg_{-1}Si_{-1}(OH)_{-1}$. Minor amount of Cr and ^{VI}Al enters octahedral sites following substitution trend $^{VI}(Cr,Al)_2^{VI}(Mg,Fe)_{-3}$ towards chromphyllite and muscovite. Chemistry of the barian mica from MSI studied (high Cr, X_{Mg}, Cl > F, low Mn, Ti) differs from the composition of other trioctahedral barian micas described typically from crustal magmatic (potassic and alkaline) or metamorphosed rocks (marbles, skarns, Fe,Mn deposits) enriched in barium.

Textural relations and chemical composition indicates crystallization of barian mica together with other minerals in MSI from fluids trapped during garnet growth. The unusual chemical composition of barian mica reflects mixing of two distinct sources. The internal source represents the host peridotite and garnet, providing Mg, Fe, Al, Cr, (+Ni). Externally sourced, crustal-derived subduction-zone fluids supplied Ba (+Sr), K and Cl > F. At UHP-UHT conditions recorded by the associated diamond-bearing metasediments (c. 5 GPa at $\geq$ 1100°C), located above the second critical point in pelitic system, solute-rich supercritical fluids with properties of hydrous melt are produced. These are efficient carriers of elements into the suprasubduction mantle peridotite. UHP peridotites can thus represent another typical environment, still overlooked, that allows formation of Ba-rich phlogopite to kinoshitalite. Its presence and chemical composition itself provide evidence for mantle metasomatism by crustal-derived fluids in subduction zone setting.

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