



Evidence of mantle metasomatism in garnet peridotites from V. Grib kimberlite pipe (Arkhangelsk region, Russia)

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We have studied 26 samples of garnet peridotite xenoliths from V.Grib pipe and 17 of them are phlogopite bearing. Studied peridotites have features of two types of modal metasomatism: low-temperature ([U+02C2] 1100 C°) and high-temperature ([U+02C3] 1100 C°).

Low-temperature modal metasomatism: 17 samples contain modal phlogopite, which is present in the form of tabular grains (to 3 mm in size) and rims around pyrope grains. Chemical composition of minerals from phlogopite-garnet peridotites and phlogopite free peridotites is distinctly different. Olivine, garnet, orthopyroxene and clinopyroxene have higher concentration of FeO relative to these minerals in phlogopite free peridotites. Occurrence of phlogopite in peridotites indicates the influence of melt enriched in K₂O, H₂O, FeO and other incompatible elements. Two types of phlogopite have difference in chemical composition that indicates two different sources.

High-temperature modal metasomatism: Reconstructed V.Grib pipe peridotite whole-rocks composition and high Mg# of peridotite olivines indicates that these samples are residues after 30-40 % partial melting of primitive mantle. At those high degree of partial melting all clinopyroxene and probably all garnet should be exhausted from residue. Character of REE patterns in garnets and clinopyroxenes indicates that the most garnets and all clinopyroxene in studied peridotites are of metasomatic origin. We used the method of geochemical modeling of fractional crystallization to establish the source's composition for garnets and clinopyroxenes. For geochemical modeling we used the composition of tholeiitic basalts, picrites and carbonatites which occurred in Arkhangelsk diamondiferous province (ADP) and have emplacement ages similar to that of kimberlites. Modeling result indicates that garnets could be crystallized from alkali picrite and tholeite basalts compositions. Peridotites containing garnets equilibrated with picritic melt have a different position in lithospheric mantle section from that of peridotites with tholeiitic originated garnets. Two geochemically distinct types of clinopyroxenes could be the products of crystallization of tholeite basalts (type 1) and carbonatites (type 2).

Overall, the lithospheric mantle beneath V. Grib kimberlite pipe experienced a complex history including multiply metasomatic events. Metasomatic agents parental to peridotitic garnets and clinopyroxenes are similar in composition to basalts and carbonatites located within the ADP indicating that magmatic events within the province are interconnected.