The geochemical features of the garnets from peridotites of Udachnaya pipe (Yakutia)

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Iintroduction

Study of mantle xenoliths from the kimberlite pipes allows to get an important information about the origin and transformations of the lithosphere substance. The most deep-seated rocks of the lithospheric mantle are deformed peridotites, having the features of recrystallization and structures of the flow. These rocks undergo significant transformations and enrichment with different components under the effect of asthenospheric melts penetrating by the cracks and faults [1]. The most depleted rocks which are not affected by the enrichment processes are supposed to be the megacrystalline dunites [2].

Methods and samples

The garnets from 5 deformed lherzolites (mineral composition: olivine, orthopyroxene, clinopyroxene, garnet), and 20 megacrystalline harzburgite-dunites (mineral composition: olivine, garnet, sometimes chromite, orthopyroxene) from the kimberlite pipe Udachnaya (Yakutia) were analyzed by the LAM-ICPMS.

Results and Conclusion

The chondrite normalized [3] REE patterns of garnets from deformed lherzolites are mostly characterized by smooth increasing of LREE values with gradation in the field of HREE. The distribution curves of REE in garnets of megacrystalline dunites have highly sinusoidal character. The very big difference in REE values is seen in the width of dunite field. It shows the different degree and time of their enrichment.

The most of distribution curves for garnets of megacrystalline dunites have the peaks at the LREE and MREE showing increased Ce (7 samples), Pr (4 samples), Nd (7 samples), Sm (2 samples) concentrations proving early enrichment. The sharp sinusoidality of REE distribution curves, early enrichment with the LREE prove that some garnets of studied dunites were not in the equilibrium with the melt. In general these garnets could be formed as a result of transformation of earlier chromites [4], which is confirmed by the increased Cr-concentration in them (for example, garnet UV167/09 contains 11.84 wt.% Cr_2O_3), either as a result of exsolution of primary Al, Cr-containing orthopyroxene, presenting in garzburgites.

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Composition evolution of peridotites of Siberian craton lithosphere roots: harzdurgite→lherzolite→wehrlite

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Peculiarities of chemical composition and geochemical features of extremely fresh xenolith of unique mantle peridotites from Udacnaya kimberlite pipe were studied. The studied xenoliths were formed at the P-T conditions corresponding to the diamond stability field. A studied collection includes some varieties of megacrystalline Cr-pyrope harzburgites [1,2], metasomatized depleted peridotites [3]; c) fresh sheared Cr-pyrope lherzolites [4].

Obtained results show that ultra depleted peridotites: Cr-pyrope dunites and harzburgites including their diamondiferous varieties were secondary enriched in different scale by two different types of metasomatic agents. The first of them had a geochemical features close to those of carbonatitic melts. Increase of Ca in system caused a transformation of initial paragenesis ol+en+low-Ca knorringite-rich Cr-pyrope to ol+Cr-cpx+high-Ca uvarivite-rich pyrope (up to 76% Ca-comp.). This process caused enrichment of initially depleted peridotites in LREE and Ca.

The second type of metasomatic agent had definitely basanitic composition, and it caused secondary enrichment of initial ultra depleted peridotites by Si, Ti, Al, Fe, Ca, Na, K, incjmpatible and HREE, and obviously this process was synchronous to the kimberlite melt generation. CPX and magnesian ilmenite were a prohibited phases in initial ultra depleted peridotites, and in some the most enriched peridotites their amounts are up to 20 and 5 vol.%, correspondingly.

Sheared pyrope peridotites have a multistage character of a composition evolution including: a) initial depletion as a result of extraction from them melts of high degree of partial melting; b) enrichment by agent with high content of incompatible elements that caused significant increase of La/Yb ratio; c) enrichment by basanitic components synchronous to process of kimberlite formation [5].

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