



Alkalic and carbonate components of kimberlites, - their origin

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The standard classification divides kimberlites into two groups: 1) with low K₂O content, and 2) with high K₂O content. The basis to distinguish two groups of kimberlites (Smith, 1983) was their sharp difference in trace element and isotope compositions which predetermined different mantle sources (for the 1st and 2nd groups – weakly depleted and enriched sources, correspondingly). Kimberlites of the Yakutian province are not included in this systematic, despite wide variations of composition, including K₂O content. In terms of isotope composition in Sr-Nd system almost all kimberlites of the province can be regarded as kimberlites of the 1st group.

Within the province it is conventional to distinguish the south diamond-bearing and north poor-diamond kimberlite fields. Specific features in the composition of kimberlites from the north fields as opposed to kimberlites from the south fields are found for such oxides as TiO₂, FeO_{tot}, MnO, Na₂O, K₂O and P₂O₅.

Kimberlites, characterized by relatively high 2O content occur in the south diamond-bearing fields as well. High-K petrochemical type involves diamond-rich kimberlites of the Nakyn field and poor-diamond micaceous kimberlites of Zagadochnaya and Bukovinskaya pipes. We found different correlations between the alkalinity and other characteristics of the composition for the south and north kimberlites. High-Mg kimberlites of the south field as compared with high-Fe varieties turned out to be more carbonatized and contain more K₂O. On the contrary, the kimberlites from the north fields demonstrate a direct dependence between the alkalinity and TiO₂ and FeO_{tot} contents in kimberlites. We believe that the major K₂O source for diamond-bearing kimberlites (pipes of the Nakyn field, Dachnaya pipe of the Malobotuobinsk field) included the assimilated material of hosting sedimentary rocks. Moreover, the contamination of kimberlites of these pipes was accompanied by the carbonatization. The abnormal high REE concentrations and isotope studies indicate that the alkalinity source for micaceous high-Mg kimberlites from pipes of the Daldyn field (Zagadochnaya and other pipes) was initially mantle.

Based on studies of the so-called non-altered kimberlite from the Udachnaya-east pipe number of scientists (Kamenetsky et al, 2004, 2008, 2009) arrived at the conclusion, that Na₂O significance for the origin of kimberlites was earlier underestimated. A "non-altered" kimberlite shows increased Na₂O content (from 0.5 up to 2-3 wt. %) owing to occurrence of such secondary minerals, as zemnokorite, halite, shortite. The superimposed surficial sedimentary-marine source of chlorine-containing mineralization is confirmed by halite occurrence from modern brines, observed in the mine of Udachnaya pipe.

Studies of isotope Sr and Nd systematics for kimberlites of north fields of the Anabar region indicate that the lithosphere metasomatized mantle is responsible for alkaline composition of kimberlites. Studies of isotope Sr composition of phlogopite megacrysts from kimberlites of both north and south fields suggest the asthenosphere source, being the major mantle source for kimberlite too.

The major factor of kimberlite composition variability is the carbonatization. The composition of the surrounding host rocks significantly influences the total amount of carbonates in kimberlites. This fact is a strong argument in favor of sedimentary-marine source in the formation of carbonate component of kimberlites.

A deep mantle origin of the certain part of carbonates indicate that they are an obligatory part of kimberlite rocks. At the same time, we should not identify the carbonate component with carbonatites, which are different both in concentrations of incompatible elements and element ratio, different distribution of trace element composition.

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