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The influence of Middle Paleozoic Yakutian plume on the geochemical modification of Siberian craton lithosphere

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The most promising for diamond potential the Middle Paleozoic kimberlite magmatism on Siberian Craton was due to upwelling of the Yakutian deep plume [Ernst, Buchan, 1997], that resulted to extensive event of the fluid and magma transfer in upper mantle. The plume approached to the base of rigid continental plate produced asthenospheric melts parental to Cr-poor megacrysts and high-temperature deformed peridotites. The melts realized simultaneous magmatic substitution of matter in the upper part of asthenospheric layer and in lower lithosphere [Solovjeva et al., 2008].

The distributions of incompatible trace elements in Grt megacrysts and Grt from high-temperature deformed Grt lherzolites of coarse-porphyroclastic type agree with magmatic trend with maxima of HFSE against REE. Grt from deformed peridotites of fine-porphyroclastic type show the sinusoidal REE curves and minima HFSE against REE. The latter rocks are thought to be lower lithosphere slices trapped by plume. The obtained data fit the model of reworking of asthenosphere and the lowermost lithosphere by the plume melts and agree with the mechanism of percolative fractional melt crystallization [Burgess & Harte, 2004; Harte et al., 1993]. The material of the plume source is belived to be been enriched in majorite and silicate-perovskite in transition zone and lower mantle.

Trace elements distribution in garnet and clinopyroxene grains from low-temperature coarse-grained Grt and Sp-Grt peridotites suggests that lithospheric mantle located above the infiltration zone of asthenospheric melts was "washing out" by redox fluids deriving from chambers of asthenospheric liquids [Solovjeva, 2007]. It is verified by sharp depletion of garnet and clinopyroxene in incompatible trace elements from xenoliths with the most low logfO_2 calculated by method of Gudmundsson & Wood [1995] (content Fe+3 in garnet). There are pale-green and colorless olivine in rocks with most low contents of incompatible trace elements.

On the contrary, Grt and Cpx from coarse-grained peridotites with most high logfO_2 and containing orange and brownish-pink olivine display the most high content of incompatible trace elements. It seems that pale-green, colorless olivines changed the hue due to reduction of Fe3+ by redox fluids at early stage of kimberlite-forming cycle. The reduced character of fluids may be explained by the development of an advanced hydrogen front in asthenospheric melts. These fluids vigorously extracted incompatible trace elements from rocks and minerals. They were also responsible for the development of the metasomatic reactions at oxidized geochemical barriers and the growth of the metasomatic minerals: phlogopite + Cr-diopside + cromite $\pm$ sulfides $\pm$ graphite [Solovjeva et al., 1997]. The native graphite formed in metasomatites at the same stage. Diamonds are thought to be formed due to oxidation reactions of the redox fluids under the corresponding P – T conditions.