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Rb-Sr and Sm-Nd whole-rock isotope composition of deformed peridotite xenoliths from kimberlite pipe Udachnaya

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Kimberlite pipe Udachnaya is a well known source of unique fresh mantle xenoliths. Deformed peridotites are compose lowermost layer of lithospheric mantle and experienced most significant metasomatism among the peridotite suite before taken by kimberlite melt. To clarify the nature of metasomatic agent we have studied a suite of deformed peridotite xenoliths for their whole-rock Rb-Sr and Sm-Nd isotope compositions. The chemical composition of those WR samples and their minerals has been studied earlier (Agashev et al. 2013).

The present day Sr isotope ratios of deformed peridotites show radiogenic values (0.7075-0.711) that consistent with their Rb/Sr ratios and negative correlate with amount of CaO in the rock composition indicating Cpx control. 87Sr/86Sr isotope ratios calculated back to the time of kimberlite emplacement (367 Ma) are scatters from depleted to slightly enriched values (0.7032-0.7054) indicating heterogeneity of lithospheric mantle roots before kimberlite emplacement. Initial (367 Ma) Nd isotope composition is less variable being in range of 3.8-5.8 epsilon Nd t units. On the initial (367 Ma) Rb-Sr and Sm-Nd isotope ratios diagram the composition of deformed peridotites scatters from the field of HIMU OIB composition toward radiogenic Sr isotope composition of EM2 (enriched mantle 2) source. Host Udachnaya kimberlites have similar to deformed peridotites isotope composition with slightly lower value of epsilon Nd t.

The ratios between elements of similar geochemical behavior which do not fractionate during partial melting and crystallization also provide the information about source composition like isotope ratios. The ratios between Nb, Th, U, La and Rb can be used as an example. Most of the measured WR have Th/U ratios similar to HIMU basalts and little lower than in host kimberlite, but their Nb/La ratios are more similar to kimberlite although it intersects with that of HIMU OIB.

Overall, the Sr-Nd isotope composition and incompatible elements ratios suggests that metasomatic agent for deformed peridotites could be low-degree melt of OIB-like source with composition intermediate between kimberlite and HIMU OIB. This astenospheric OIB like melt was interacted with lithospheric roots and prepared incompatible elements enriched source for kimberlite melt formation. 11-05-91060-PICS.