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Measured vs Calculated WR Geochemical Composition of Deformed Peridotite Xenoliths: Inferences About Metasomatism in Cratonic Mantle

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We have analyzed a suite of exclusively fresh deformed peridotite xenoliths form Udachnaya for geochemical composition of WR and their constituent clinopyroxenes and garnets. Whole–rock trace elements composition of deformed peridotites is enriched in incompatible element. The enrichment degrees range broadly for individual elements. K and Rb abundances are 2-10 times over PM estimates; these for Ba, Th, U, Nb, Ta and La and 1-5 times higher than in PM. The concentration of elements of middle incompatibility (MREE, Zr, and Hf) varies around PM model composition and even slightly depleted in most of the samples. Heavy REE and Y concentrations are lower than that of PM model.

To evaluate the mass-balance of incompatible element we calculated WR trace elements composition of deformed peridotites using modal mineralogy and chemical composition of Gar and Cpx. Comparison displays large difference between calculated and measured WR trace elements composition and concentrations of incompatible elements in calculated data are always lower than that of measured. The most pronounced differences are observed for the hardly incompatible elements (Nb, Ta, Th, U, La, Ce, Rb and Ba). Our modeling shows that REE abundances of only four WR samples out of 20 could be closely reproduced by addition of kimberlite melt to their calculated WR composition. Most of the samples require a metasomatic agent with much lower La/Yb ratio and LREE abundances than in host kimberlites and therefore we try to search the candidate of such melt between incompatible elements enriched OIB. The composition of HIMU type basalts of St. Helena islands are enriched in incompatible elements and calculation shows that they are more appropriate metasomatic agent than kimberlites. However, in most cases, these OIB samples have little lower than necessary La/Yb ratios and the discrepancies are observed in the MREE contents. Ratios between element of similar Kd, which should not fractionate significantly during partial melting and crystallization in measured WR are corresponds to astenosphere derived magmas such as OIB and kimberlites. LIL elements in deformed peridotite composition significantly fractionate from HFSE and LREE of similar incompatibility, first of all by incorporation of Rb and Ba into kelyphitic rims around garnets which could contain over 100 ppm of Rb.

Metasomatism in the lowermost part of continental mantle could be induced via introduction of astenoshperic melt of enriched OIB (HIMU) affinity which could evolve through the fractional crystallization to composition close to kimberlitic. Some peridotite samples later could be affected by introduction of kimberlite melt just before or during emplacement. Grant 11-05-91060-PICS