The mantle metasomatism assotiated with kimberlite magmatism, the Grib kimberlite pipe, Arkhangelsk diamond province, Russia

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Here we present major (EMPA) and trace element (SIMS, LA-ICP-MS) data for garnet and clinopyroxene from mantle-derived xenoliths of coarse and sheared garnet peridotite [1, 2] and clinopyroxene-phlogopite metasomatic rocks from the Grib kimberlite, the Arkhangelsk diamond province, Russia, and provide new insights into the metasomatic processes that occur within the subcontinental lithospheric mantle (SCLM) during the kimberlite melts generation and ascent.

The obtained data allowed us to reconstruct the following sequence of metasomatic events associated with the generation of the Grib kimberlite:

1. Ascent of high-temperature asthenospheric or mantle plume material resulted in a partial melting of a carbonated peridotite and led to the generation of high-temperature REE-enriched proto-kimberlite melts containing significant amounts of carbonate, Fe-Ti and K-H_2O. These proto-kimberlite melts started to interact with the surrounding mantle rocks during its evolution and ascent, and caused metasomatic modification of both coarse and sheared peridotites at the base of SCLM (T and P estimates are 1220°C and 70 kbar).

2. Further evolution of proto-kimberlite melts during the ascent and the interaction with the surrounding mantle (e.g. mantle-rock assimilation and/or percolative fractional crystallization) led to changes in the kimberlite composition from REE-enriched carbonate-dominated to carbonate-rich ultramafic silicate magmas with lower REE contents.

3. During the ascent, carbonate-rich ultramafic silicate kimberlite melts progressively metasomatised sorrounding SCLM from garnet-phlogopite peridotite through garnet-phlogopite peridotite to clinopyroxene-phlogopite rocks under T and P estimated as 830°C and 40 kbar. At this stage, the fractionated of Fe-Ti-bearing megacrysts occurred.

[1] Kargin et al. (2016) *Lithos*, **262**, 442-455. [2] Kargin et al. in press, *GSF,* doi:10.1016/j.gsf.2016.03.001