



## Genetic code of subsolidus garnet and its role in deciphering of Siberian craton metasomatic history

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Mantle xenolith from Udachnaya kimberlite (Russia) made up of two domains: (i) megacrystalline (porphyroclastic) garnet orthopyroxenite, and (ii) equigranular lherzolite. At the former part it preserves orthopyroxene crystals 2 to 6 cm long with abundant (16 vol.%) elongated garnet grains in the host and along its grain boundaries. The latter one consists of small olivine, orthopyroxene, garnet and rare clinopyroxene grains. Minerals relationships in orthopyroxenite part suppose the garnet to have been exsolved from Ca-Al rich enstatite. In consistency with the CMAS system and integrated chemical composition a precursor pyroxene was equilibrated at  $P \sim 2$  GPa within T range of  $>1100$  C. Major-element chemistry of precursor pyroxene and, thus, monomineralic protolith denotes its affinity to harzburgites, especially those rich in silica. The latter are considered to be connected with fractionation during upward transport of initial high-P melting residues at accretion of cratonic nuclei (Doucet et al., 2012). The instability of Ca-Tschermak component in pyroxene and diffusion of Ca and Al control the formation of a garnet; wide spacing between lamellae implies for diffusion rates low enough for gradual garnet growth taken place during cooling down to  $\sim 900$  C. Strain-induced partial re-crystallization followed by chemical re-equilibration of mineral assemblages occurred at  $\sim 4.9$  GPa and  $930 \pm 50$  C. The evaluated P-T evolution may have been prior to or during consolidation and stabilization of the Siberian craton, when the lithosphere grew thicker and colder. Similar scenario was considered in application to garnet peridotite genesis from the Lashaine (Gibson et al., 2013) and Monastery (Dawson, 2004), Tanzanian and Kaapvaal cratons, respectively, where mantle rocks are known as unusually rich in Opx. REE compositions of garnet both from the orthopyroxenite and lherzolite domains of the specimen show evident resemblance with those of hypothetical pre-metasomatic garnet, for which positive slope within HREE and strong depletion in LREE reflect composition of a protolith that experienced a major melt extraction event (Stachel et al., 2004). Subsequent evolution of the subsolidus garnet claims its interaction with an extremely fractionated metasomatic agent that inputs mainly LREE together with comparatively little MREE, what might be attributed here to an interaction of rock with carbonatitic (or protokimberlitic) melt. The work was supported by the grant of the President of the Russian Federation MK-2231.2017.5. Stachel, T., Aulbach, S., Brey, G.P., Harris, J.W., Leost, I., Tappert, R., Viljoen, K.S. (2004). The trace element composition of silicate inclusions in diamonds: a review. *Lithos* 77, 1–19. Gibson, S.A., McMahon, S.C., Day, J.A., Dawson, J. B. (2013). Highly-refractory lithospheric mantle beneath the Tanzanian Craton: evidence from Lashaine pre-metasomatic garnet-bearing peridotites. *J. Petrol.* 54, 1503–1546. Dawson, J.B. (2004). A fertile harzburgite-garnet lherzolite transition: possible inferences for the roles of strain and metasomatism in upper mantle peridotites. *Lithos* 77, 553–569. Doucet, L.S., Ionov, D.A., Golovin, A.V., Pokhilenko, N.P. (2012). Depth, degrees and tectonic settings of mantle melting during craton formation: inferences from major and trace element compositions of spinel harzburgite xenoliths from the Udachnaya kimberlite, central Siberia. *Earth Planet. Sci. Letters*, 359–360, 206–218.