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Minerals and melt inclusions as keys to understanding magma reservoir processes during formation of volcanic and plutonic mafic-ultramafic complexes in the Maimecha Kotui Province (Polar Siberia)

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Magmatic complexes in the Maimecha Kotui Province (Polar Siberia) attract attention of researchers because they contain ultramafic volcanic rocks - meimechites, being products of crystallization of the ultrabasic deep mantle melts (Sobolev et al., 1991, 2009, 2011; Ryabchikov et al., 2002; Vasiliev, Gora, 2014). Effusive meimechites together with intrusive dunites of the Guli massif form ancient (253-246 Ma) volcanic and plutonic association, in which also pyroxenites and alkaline rocks are situated. Conditions of formation of this association were established with the help of minerals and melt inclusions study.
The cumulative structure of the Guli massif dunites consists of rather large (2-4 mm) olivine crystals and dividing them zones (0.5-0.7 mm), filled with fine grains of clinopyroxenes and ore minerals (magnetite, ilmenite and chromite). The extended forms of well faceted pyroxene crystals testify to their fast growth from melt between cumulative olivines. Thus, crystallization of clinopyroxenes and ore minerals leads to formation between olivines ore pyroxenites, which are presented in the Guli massif by independent bodies.
Analysis of olivine, Cr-spinel and clinopyroxene compositions testify to similarity of conditions of the Guli massif dunites crystallization on the one hand with formation of platinum-bearing Uralian-Alaskan-type mafic–ultramafic complexes and with another - show participation of meimechite magma.
Major element composition of melt inclusions in Cr-spinel has shown that dunites of the Guli massif were crystallized with participation of subalkaline picrite magmatic systems, that are relative to melts, responsible of formation of platinum-bearing mafic-ultramafic complexes and meimechites. Peculiarities of trace and rare-earth elements distribution in melt inclusions in Cr-spinel of dunites are actually similar to inclusions in olivine of meimechites. Overall, data on composition of inclusions directly testify to formation of considered dunites from ultrabasic melt close to meimechite magma. The affinity of melts, forming dunites and meimechites, is confirmed by computer simulations, shown high crystallization temperature of olivines from dunites (1590-1415°) (Simonov et al., 2014, 2015), actually coinciding with data on olivines from meimechite - 1600-1420° (Sobolev et al., 1991, 2009). A part of this ultrabasic melts was crystallized in the magma chambers (with formation of cumulative dunites) and another part – came up to a surface with formation of effusive meimechites.
Presence in Cr-spinels from Guli massif dunites melt inclusions with rather large (up to 50 μm) well faceted olivine crystals, situated in the quenching fine-grained association of minerals (clinopyroxene, feldspar and nepheline), testifies to change of a quiet mode of crystallization by sharp falling of parameters of magma during olivine cumulation in the magma chamber, that resulted in appearance of alkaline rocks.
As a whole, minerals and melt inclusions study testify to formation of volcanic and plutonic complexes in the Maimecha Kotui Province (Polar Siberia) as a result of evolution of primary deep mantle ultrabasic melts (similar by its chemical composition to meimechites) during cumulative processes in the magma chambers.