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Experimental study of paragenesis of ultramafic lamprophyres: aillikites from Southwestern Siberia.

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Occurrences of alkali not diamondiferous ultramafic lamprhophyres, which recently were found on southwest edge of Siberian craton [Kargin et al., 2016], are very informative and may help us to understand origin mechanisms and evolutions of such rocks, their connections to other ultramafic types, so comprehensive study of this case are important. Especially, experimental works on nature samples might model the system, which have been done in this work.

In this paper the results of experimental study of natural sample of aillikites from Irkeneeva-Chadobets trough are presented. This sample represented collection of rocks from Ilbokich uplifts, where the rocks form dykes. The rocks are classified, according classification scheme [Tappe et al.,2005], as aillikites. Aillikites are characterized by porphyritic an/or globular texture, enriched in magmatic carbonates (up to 25 wt.% of CO_2 whole rock composition), olivine macro- and/or phenocrysts, and rarely pyroxene phenocrysts. Mineral compositions are presented in groundmass: carbonates, phlogopites, clinopyroxenes, spinel, ilmenite, rutile, perovskite, Ti-garnets, K-feldspar. Aillikites characterized higher concentrations of CO_2 than kimberlites and differ from lamproite by lower alkali content.

Variety of minerals, their composition and morphology indicates multi-stage evolution, which can be distinguished to magmatic and late magmatic stages, on which many autometasomatic processes occurred. The studied rocks are rich in volatile substances and late-stage processes strongly effect on paragenesis, which makes the determination of solid minerals difficult, but it is very important to unders–tand the mechanism of origin. To solve this problem, melting experiments have been made. Thermodynamic parameters of anticipated first phase were rough estimated using monomineral olivine thermometer [Smirnova et al., 2017]. That estimations and literature data [Tappe et al., 2006] suggested that the pressure - near 5 GPa and temperature varies from 1200 up to 1400C.

The experiments were conducted under 5 and 4 GPa and temperatures 1000 – 1500C with the high-pressure toroidal “anvil-with-hole” apparatus. For experiments least altered and not containing macro- and phenocrysts samples were chosen. Natural samples were crushed into powder and stored in platinum capsules. The time of the experiment was from 3 to 10 hours under predetermined pressure and temperature.

As a result of the experiments, the following conclusions were made: we found that two types of paragenesis are characteristic: (1) under high-pressure and low-temperature clinohumite + Ti-garnet + clinopyroxene + carbonate, and (2) olivine + clinopyroxene + mica + carbonate $\pm$ Ti-garnet $\pm$ Ti-phase. Ti and F play important role in forming process, namely in the stabilization of phases such as Ti-clinohumite/olivine/Ti-garnet/F-mica. Our experiments confirm that studied aillikites from Southwestern Siberia can be formed under estimated conditions. Apparently the most important differences between aillikites’ magmas and kimberlites and lamproites can be associated with various influence of activities F, Ti and CO_2.

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