# PROCESSES OF Ta, Nb, Zr Hf CONCENTRATION CONNECTED WITH THE GRANITOIDE MAGMATISM ON THE BASE OF EXPERIMENTAL RESEARCH

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Problems of connection mineral deposits with intrusions and a source of ore material are actual during the lifetime of existence of geology. In the present state the line of attack of the problem is evident owing to acceptance of aqua-salt phase (fluid melts) function in the mineral formation processes, which perform the effective extraction of ore components. For rare metal granites and syenites the investigation of the associated fluorine-bearing model system is of chef interest.

Phase relations in the liquidus part of the system $NaAlSiO_4$-$KAlSiO_4$-$SiO_2$-$H_2O$ with the substitution by fluorine the part of oxygen have been experimentally studied (1). All experiments were performed at the same temperature 800°C and pressure 1 kbar at the hydrothermal apparatus (of Tuttle's bomb type) during 3-4 days. Partitioning of Ta, Nb, Zr and Hf between immiscibile silicate and aluminofluorine melts in the system are determined. Partitioning experiments were carried out with the 12 compositions: K-, K-Na- and Na- ones correspond closely with suitable model granites, Na-Al- composition conforms to peraluminous granites, Li-bearing compositions correspond Li-F granites, nepheline normative composition is symbolised by Ne.

The comparison these data with the peculiarities of the nature objects was made. Based on the experimental data, boundaries of immiscibility area have been refined in peralcaline, peraluminous and quartz-normative parts of the system. It is shown, that immiscibility field is extended over nepheline normative part of the system. In the equilibrium aluminosilicate and aluminofluorine melts Ta, Nb, Zr and Hf are concentrated in the first one. Data confirm leading significance of crystalline differentiation in concentration the elements at issue. The separation of aluminofluorine melt srtengthened this effect.

Partition coefficient silicate/fluid melt decrease essentially with leading Li into the system [2], in particularly for Zr and Hf (for Hf the partition coefficient is close to 1). Besides Li, variation of relationship between K and Na, the saturation of the system by $SiO_2$, its agpaitic coefficient, replacement of the fluorine part by carbon dioxide**,** have effect on the partition coefficient values. The tendency of the changes are not the same, up to opposite for elements with closely related properties, because of values its relations vary (geochemical indicators). Experimental results provide an explanation well-known regularities of a decrease of Zr/Hf and Nb/Ta ratio in the latest phases of granite complexes; accumulation of Nb and Zr in the Na-rich granite, Ta and Hf - in the granite of K-Na profile, the lack of concentration Zr (by contrast to Nb and Ta) at the final differentiates of Li-F granites. In the nepheline normative area the experimental data conform with the most general features of Nb and Ta geochemistry. Nb are concentrated mainly in nepheline syenites, and Ta - in granites. Nb plays the large role in peralcaline rocks, whereas detectable concentration of Ta are typical only for peraluminous rocks.

Experimental data give not evidence of possible concentration of discussed elements in postmagmatic processes. However with carbon dioxide introduction to the system partition coefficients of Nb for agpaitic nepfeline normative composition decrease governed by natural regularities, while they increase in all quartz-normative compositions (fig.). It is precisely with agpaitic nepfeline syenites carbonatites with commercially useful concentration Nb are associated.

Data for distribution Ba and P are also obtained. Geochemistry of Ba in magmatic processes the one hand, and Nb, Ta, Zr, Hf on the other hand, - in many respects are directly opposite. The same is true of its distribution between silicate and fluorine melts. A well-known Ba clarke lowering in leucocratic granites and alaskites can be explained by as its dissipation in the form of isomorphous impurity (admixture) to the feldspars in the early stage of crystalline differentiation, as its extraction to the fluorine liquid with the partition coefficients is close to 0.03–0.15. At the same time the partition coefficient is more than 1 in the Na part of the system, what is in accordance with increasing of Ba contents in plagiogranites. In the Li-bearing part of the system partition coefficients of P and Ba - elements, which aren't characteristic for Li-F granites, decrease abruptly to 0.02–0.05. They essentially fully separate with fluorine melt. In the nepheline normative parts of the system partition coefficients of Ba > 1, what is in accordance with increasing of Ba contents in nepheline syenites.

1. Gramenitskiy E.N., Shchekina T.I. Phase relationships in the liquidus part of a granitic system containing fluorine // Geochemistry International, 1994, v. 31, N1, P.52-70.
2. Shchekina T.I., Gramenitskiy E.N. The genetic connection of rare-metal deposits with granites according to experimental data // Abstracts of EUG 9 Union Symposia. Strasbourg: Terra Nova, 1997. V.9. № 1. P.530.