

The ratio of Ta and Nb in fluorine-rich granitic melts

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The ratio of clark contents of niobium and tantalum Nb / Ta in the acidic rocks is approximately equal to 7. In most differentiated varieties Li-F granites it reaches a value of 0.5, corresponding to a significant predominance of tantalum. Such ratio of these metals observed in the apical parts of the rare-metal granite massifs and in the marginal areas of subvolcanic ongonites.

Increasing the amount of tantalum with respect to niobium in the final portion of the magmatic melt is possible in: 1) crystallization differentiation, 2) the interaction of silicate melt and aqueous fluid, and 3) the distribution of these metals between immiscible silicate and salt aluminofluoride melts.

Region of silicate and salt melts coexistence experimentally established in the system Si-Al-Na-Li-HFO at $T = 700-800^{\circ}\text{S}$ and $P = 1$ kbar. The composition of the aluminosilicate melt immiscibility region varies from quartz to nepheline-normative with $Ka=(\text{Na}+\text{Li})/\text{Al}=0.6-1.3$. Aluminofluoride melt occupies an intermediate position between the cryolite (Na_3AlF_6) and hyolithids ($\text{Na}_5\text{Al}_3\text{F}_{14}$) and contains in small quantities Li, Si, and water. Under equilibrium conditions, the fluorine content in the aluminosilicate melt vary from 4 wt.% in acidic melts to 15 and above wt.% in nepheline-normative aluminosilicate melts.

In conditions of equilibrium coexistence of the two melts tantalum and niobium have statistically significant differences in the values of the partition coefficients between these phases. Tantalum more efficiently accumulated in the silicate melt than niobium.

On the basis of the distribution of tantalum and niobium between two melts and data on their distribution between the aqueous fluid and the silicate melt, as well as tantalite and columbite solubility in silicate melts at temperatures 700-800°C shown that all three processes lead to reducing the ratio Nb / Ta in the final portion of the magma. The greatest impact on reducing the value Nb / Ta, apparently, has a melt crystallization differentiation and the formation of the immiscible salt melt.