

Shapovalov Yu.B., Suk N.I. Concentration of Mo, Pb, Cu, Zn in granite-halide systems.

All the experiments were carried out by the unified technique on gas bombs at T=960 and 950°C and P=1 kbar. The first series of experiments was run in the granite system containing fluorides (Na₂SiF₆, CaSiF₆

and CaF₂ 20 wt% each) and ore oxides (MoO₃, PbO₂, ZnO). The samples of the latter contained equal percent amounts of the metals (molybdenum, lead, zinc) in the starting composition. The distribution of ore metals between equilibrium granite and fluoride melt phases has been studied.

The average compositions of the obtained phases in comparison with the starting compositions are given in Table 1.

Table 1. Starting (I) and average compositions (in wt% of the metals) of the silicate (II) and fluoride (III) phases obtained experimentally at T=960°C, P=1 kbar in the granite system with the additions of fluorides (20wt%); given in brackets is the number of analyses.

Metal	Na ₂ SiF ₆			CaSiF ₆			CaF ₂		
	I(1)	II(7)	III(23)	I(1)	II(9)	III(15)	I(1)	II(22)	III(13)
Si	56.80	66.58	2.28	60.92	70.22	14.40	49.23	58.77	4.23
Al	11.60	11.43	8.39	12.39	14.48	9.20	11.43	14.08	1.22
Fe	1.15	1.38	1.83	1.23	1.13	5.51	1.14	1.87	0.23
Mg	0.77	0.28	5.83	0.82	0.19	2.09	0.81	0.59	0.55
Ca	1.28	0.27	17.83	8.90	0.86	16.78	22.80	5.45	90.77
Na	18.08	11.38	35.45	4.72	4.58	3.59	4.37	6.57	0.80
K	3.78	4.14	1.86	4.03	4.59	1.90	3.77	4.44	0.33
Zn	2.18	1.89	2.03	2.33	1.86	6.34	2.15	2.74	0.35
Mo	2.18	1.23	14.72	2.33	0.85	28.35	2.15	2.50	1.34
Pb	2.18	1.43	9.78	2.33	1.24	11.84	2.15	2.99	0.18

Table 2. Compositions of layered phases in the silicate-chloride systems (wt%) at T=950°C and P=1 kbar (I- silicate phase, II- chloride phase).

N		Si	Ti	Al	Fe	Mg	Ca	Na	K	Cl	Pb	Cu	Zn
1	I	62.54	0.21	16.12	0.74	0.69	0.99	16.66	0.71	0.67	0.06	0.03	0.58
	II	0.14	0.03	0.04	0.05	0.09	0.06	47.06	2.14	48.72	0.25	0.38	1.04
2	I	64.16	0.25	14.18	1.08	1.00	0.88	15.55	0.97	1.03	0.09	0.03	0.78
	II	0.12	0.01	0.05	0.04	0.06	0.13	47.97	1.82	48.34	0.35	0.41	0.70
3	I	69.87	0.27	10.29	1.48	1.30	0.08	0.65	14.66	0.54	0.04	0.14	0.68
	II	0.49	0.02	0.04	0.06	0.07	0.00	3.26	44.11	50.94	0.33	0.10	0.58
4	I	65.55	0.27	12.90	1.03	0.83	0.24	0.38	17.02	0.98	0.07	0.05	0.68
	II	0.38	0.02	0.04	0.09	0.04	0.00	4.87	39.40	51.80	0.26	0.30	2.80
5	I	64.30	0.28	13.26	1.34	1.00	0.83	15.06	1.21	1.35	0.15	0.03	1.19
	II	0.13	0.01	0.01	0.08	0.15	0.26	41.05	4.65	50.38	0.35	0.79	2.14
6	I	66.56	0.29	12.54	1.12	1.07	0.72	1.03	14.95	0.60	0.14	0.01	0.97
	II	0.18	0.00	0.01	0.04	0.09	0.00	6.03	39.48	51.92	0.21	0.18	1.87

The salt components used showed different ability to extract ore metals from granite melts. Sodium fluoride did not extract molybdenum, lead, and zinc. The melts corresponding to this fluoride with low silicon, aluminum, alkali metals content when separating with the following crystallization of fluorite did not concentrate ore metals. The salt melts Na₂SiF₆ and CaSiF₆, by contrast, were effective extractants of ore metals. It was

proved experimentally that molybdenum, lead and zinc have different liability to fluoride extraction.

Molybdenum is most easily extracted by fluoride melts. Its concentration in experiments with Na₂SiF₆ and CaSiF₆ was 14.72 and 28.35 wt% in the salt phase and 1.23 and 0.85 wt% in the silicate phase, respectively. In this respect molybdenum is similar to tungsten whose content under the same conditions (when added

to the granite melt $\text{Na}_2\text{SiF}_6 + \text{LiF}$) was 11.90 wt% in the salt phase and 0.10 wt% in the silicate phase.

Table 1 shows that lead is pretty well, although to a lesser degree than molybdenum, extracted by fluoride melts (9.78 and 11.84 at%). The experiments performed showed the principle difference of molybdenum and lead from zinc which in the system with sodium fluorosilicate is not extracted by the fluoride melt. Zinc content (2.03 at%) there remains the same as in the starting and newly formed silicate melts (2.18 and 1.89 at%). Salt extraction of zinc was observed in experiments with calcium fluorosilicate but in this system is also much lower than that of molybdenum and lead.

The second series of experiments was run to study the chloride extraction of lead, copper, and zinc in magmatic systems granite-chloride (NaCl , KCl). The study on the distribution of these ore metals between immiscible silicate and chloride phases showed their preferential extraction by the salt melt of both sodium and potassium composition (Table 2).

The above experiments show a special role of chlorine as a factor of the effective migration of ore metals and prove the possible role of chloride salt melts in the extraction and concentration of lead, copper, and zinc in granite systems.

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