EXPERIMENTAL STUDY OF SYSTEMS ALKALINE SILICATE MELT – LOW CONCENTRATED WATER-SULPHATE FLUID AT T=1250°C AND P=2 КБАР

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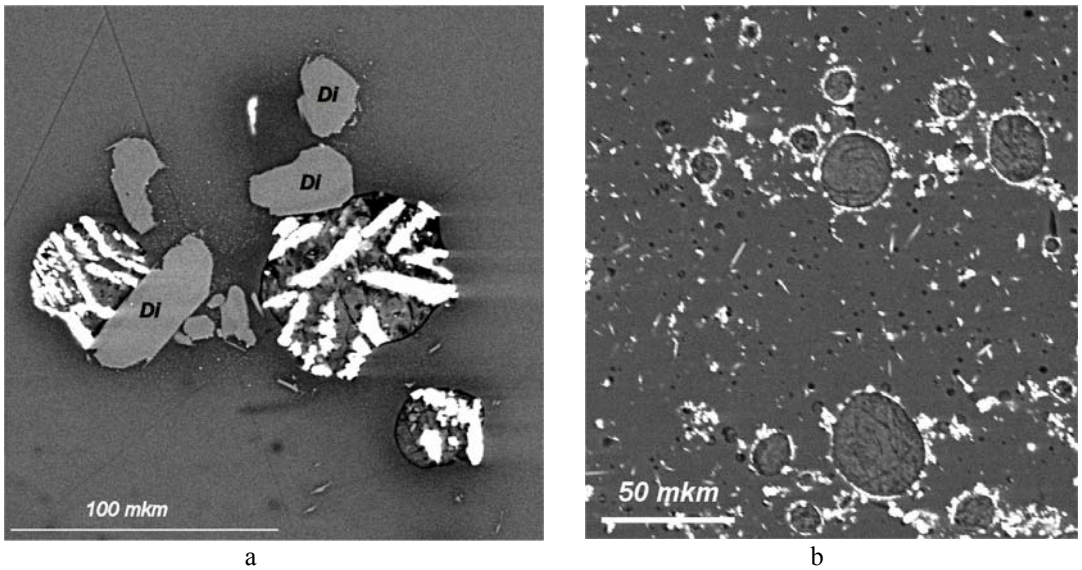
The investigation of process of ore material selective concentration in magmatic systems remains of interest at this time. In previous works on the granite systems example it was shown that the role of hydrothermal solutions in the ore deposits formation is not sufficient effective [1, 2], and important ore-forming role is obtained by heavy salt phases which arise during fluid systems evolution separating as a result of extension of liquid inhomogenuity in them. The study of equilibrium of granite melt with salt melts, fluorides as an example [3], have detected the efficiency of fluoride ore extraction for recovery of ore elements as W and REE from the melts. In our previous works we studied the liquid immiscibility in alkaline silicate-phosphate and silicate-carbonate systems and have determined the extraction of REE and Ti by phosphate melt [4] and extraction of Ba, Sr and at some conditions REE by carbonate melt [5, 6].

In this work the results of study of the system silicate melt – low concentrated water-salt (sulphate) fluid and distribution of ore metals (Ba, Sr, REE) between coexisting phases at T=1250°C and P=2 kbar are presented. The experiments were curried out in the system albite – diopside with the addition of $BaCO_3$ and $SrCO_3$ (or SrO) and albite – nepheline with the addition of CaO, La_2O_3, CeO_2, Y_2O_3, Dy_2O_3 and 1 mol Na_2SO_4 solution in sealed platinum capsules in high gas pressure vessel with subsequent quenching. The experimental aluminosilicate glass was analyzed on an X-ray micro analyzer. Water-salt fluid was collected and analyzed by atomic absorption method (for Na, Sr and Ba), emission method (for Ca and Mg) and ICP-MS method (for REE).

The systems studied are applied to multicomponent systems water – salt of P-Q type (as sulphate is) – silicate [7, 8]. It shows that at magmatic parameters in this systems fluid phase may be heterogeneity with formation of two (or more) phases.

In experimental systems studied containing sulphate fluid during the experiment aluminosilicate glass enriches in Na and becomes poorer in Si and in the less degree in Al, Ca and Mg as compared with initial charge composition. Solution obtained after runs has pH near neutral which connects with decrease of Na concentration and perhaps with some increase of Al and Si concentrations in solution composition.



a b

Fig.1. Sulphate droplets in aluminosilicate matrix experimentally obtained in the system silicate melt – water-sulphate fluid at T=1250°C and P=2 kbar: a – in the system with Ba, Sr; b – in the system with REE. The photographs are made in reflected electrons

In the system silicate melt – water-sulphate fluid at the parameters of experiments it has been observed three phases: aluminosilicate melt, low concentrated water phase and sulphate melt forming the

droplets in the silicate matrix (fig. 1). It evidences that at this parameters fluid was in heterogeneity state.

In the systems containing Ba and Sr the average contents of BaO in glass are 2.97 wt. % and SrO – 2.22 wt. %. There are the diopside crystals in the sample too. In solution Sr content is insignificant (~0.034 wt. %) and Ba does not reveal. In droplets there is a heterogeneity observed. This is reflects in existence of crystal aggregates of Ba and Sr sulphate which are placed in matrix having alkaline composition (sodium sulphate) (fig 1a). Bulk compositions of droplets are characterized by average contents of BaO 14.06 wt. % and SrO - 7.65 wt. %. This is the sulphate phase which is the concentrator of Sr and Ba. The average distribution coefficient sulphate phase/silicate melt for Sr is 3.45 and for Ba – 4.7. The results obtained indicate the efficiency of sulphate ore extraction for recovery from the melt such ore elements as Sr and Ba.

Experimental investigations in the system silicate melt – water-sulphate fluid containing REE shows that neither sulphate phase nor low concentrated water-sulphate fluid don't contain sufficient concentrations of REE, which concentrates in silicate melt as fine-crystalline phase (fig 1b). In solution REE contents are: La – $3.7*10^{-6}$ wt.%, Ce – $2*10^{-6}$ wt.%, Y – $5.6*10^{-7}$ wt.%, Dy – $5.7*10^{-7}$ wt.%. This evidences that sulphate ore extraction is not effective for recovery from the melt such elements as REE.

The results obtained indicate that low concentrated water-sulphate fluid cannot be effective concentrator and transporter of such elements as Sr, Ba and REE. But our experiments show the efficiency of heavy sulphate phase for recovery from the melt such ore elements as Sr and Ba. This confirms that the role of hydrothermal solutions in the ore deposits formation is not sufficient effective, but important ore-forming role is obtained by heavy salt phases arising during extension of liquid inhomogenuity in fluid-magmatic systems.

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