USSINGITE SYNTHESIS UNDER HYDROTHERMAL CONDITIONS (PRELIMINARY DATA)

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Ussingite ($Na_2AlSi_3O_8[OH]$) is widespread mineral of Lovozersky alkaline massif and can serve as the indicator of a fluid regime of mineralogenesis. Runs on ussingite synthesis were carried out on the capsule method on hydrothermal installations with external heating and cold seal, and also in autoclaves. Accuracy of temperature control was ±5°C, pressure ±50 bar. As starting applied mixes of albite and ussingite in which albite gel and amorphous SiO_2 were added in ratio: (Ab):(Uss):(gel Ab):SiO_2=1:1:8:3. The composition of a fluid was set by solutions of sodium hydroxide with concentration from 2 up to 30 wt. %. Experiments were carried out at temperatures 300 - 500°C and pressures 0.75 - 1.0 kbar. Duration of runs was 22-45 days. The analysis of run products carried out by X-ray and microprobe methods.

The following reaction of ussingite synthesis was studied:

$NaAlSi_3O_8$ (albite) + NaOH (aq) ⇔ $Na_2AlSi_3O_8$ [OH]) (ussingite)

The following conclusions can be draw due to the results of investigation:

1. Ussingite is stable relative to albite at temperatures 300 - 400°C at concentration of sodium hydroxide not less than 10 wt. %. With increasing of NaOH concentration up to 15 wt. % (and more) desilication process of ussingite with formation of analcime and then cancrinite occurs. However at natural conditions, at a high ratio of rock/fluid (≥50), that promotes formation of high-content SiO_2 hydrothermal solutions, ussingite can be stable at higher concentration of NaOH. Thus, ussingite finds in natural paragenesis indicate that minimally possible concentration of sodium hydroxide in solution was not less than 10 wt. %;

2. The field of ussingite synthesis is limited by temperature 400°C, at higher temperatures at concentration of sodium hydroxide up to 10-12 wt. % albite is stable, increasing of concentration of NaOH up to 15 wt. % at 450°C lead to analcime synthesis and at 500°C (P=1.5 kbar) - an unknown phase with approximate composition $Na_2AlSi_2O_6$ [OH] synthesis.

3. At 300-400°C ussingite is stable up to concentration of NaOH 12 wt. %. With increasing of concentration of sodium hydroxide up to 16 wt.% desilication of ussingite with formation of analcime occurs, at concentration of NaOH more then 20 wt. % cancrinite is formed.

4. X-ray data researches have shown that albite, synthesized in experiments concern to structurally order. Apparently, the alkaline solution and SiO_2 superfluity promotes synthesis of the ordered forms of albite. Cell parameters of synthesized ussingites are similar with presented in card file PDF-2. Synthesized cancrinites according to X-ray dates are close to hydroxyl-cancrinites of Lovozersky massif.

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