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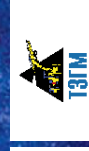
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XII

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«НОВЫЕ ИДЕИ В НАУКАХ О ЗЕМЛЕ»
**XII International
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**Dedicated to
the 70th Anniversary
of VICTORY
in the Great
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WATER-CHLORIDE FLUIDS IN HIGH-TEMPERATURE METASOMATISM OF THE BASIC ROCKS (EXPERIMENTAL DATA)

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In the high-temperature metamorphic complexes which are especially dedicated to the Precambrian Shield the processes of a granitisation or charnockitization expressed in the directed transformation of host rocks from practically unaltered to metagranitoids often are observed. Similar processes take place with the participation of high-concentrated NaCl-KCl fluids which in the process of filtering through the rocks bring some components and actively dissolve and take out others. Considerable experimental data on mechanisms of dissolution of rock-forming minerals, such as quartz, albite, grossular, wollastonite are so far saved up [1 and the bibliography in article]. Information about the interaction of mafic rock-forming minerals with the salt solutions is much less. Interaction of an amphibole with salt solutions of chlorides experimentally is almost not investigated, although field observations show that changes in the composition of this mineral are associated with impact on it of salt fluids.

In this article results of studying the interaction of an amphibole (Hbl, composition is close to average composition of this mineral for metabasites) with NaCl and NaCl+KCl solutions are presented. Experiments were made by the method of quenching at 750-900°C and pressure of 500 and 700 MPa on the high gas pressure installation with internal heating.

As initial material the tschermakite from a metasomatic vein of the Kii Island, White (Be-loye) Sea served. The composition of initial amphibole (wt.%): SiO₂ – 44.05, TiO₂ – 1.09, Al₂O₃ – 15.75, FeO – 12.47, MnO – 0.05, MgO – 11.34, CaO – 11.91, Na₂O – 1.61, K₂O – 0.60, H₂O (as LOI) – 1.11.

System H₂O-NaCl-amphibole, 900°C, P=500 MPa

As a result of interaction of *Hbl* with NaCl solutions (where $X_{\text{NaCl}} = 0.0-0.5$) it was established that амфибол remains stable over the entire range of fluid salinity. In significantly aqueous solutions ($X_{\text{H}_2\text{O}} = 0.9$) along with formation of the small, well-faceted crystals of high-ferrous spinel, there is an insignificant amount of magnesian clinopyroxene. At higher concentration of chloride (and decreasing of $X_{\text{H}_2\text{O}}$) clinopyroxene disappears, and together with spinel high-ferrous amphiboles, ferropargasite and ferrohastingsite are formed. Chlorine is almost not included into composition of both magnesian and ferrous amphibole (less than 0.2 wt. %). At $X_{\text{H}_2\text{O}} < 0.7$ together with the amphibole there are large, to 2 mm, prisms of the chlorine-containing magnesian mica of metal color identical to phlogopite in which potassium is almost completely replaced with sodium (natural analog – aspidolite NaMg₃(Si₃Al)O₁₀(OH)₂).

In all experiences along with mineral reactions incongruent melting of an amphibole is observed. In the melt composition includes 50 wt.% SiO₂ and 23-25 wt.% Al₂O₃, i.e., is formed melt with quartz-corundum normative composition. Only introduction to system of a fluid phase with $X_{\text{NaCl}} > 0.5$ leads to the formation of nepheline-normative melts. Thus, experiments showed that the essential content of NaCl in the fluid will lead to a amphibolization of rocks with formation of pargasite, ferropargasite, ferrohastingsite and to smelting of melts with plagiogranite composition.

Unlike aluminum and silicon, iron and magnesium are almost not taken out by fluids as a part of which high X_{NaCl} are noted. The similar conclusion follows also from work [2]. It should be considered when studying the processes of a granitization and charnockitization occurring with participation of fluids with high concentration of salts [3, 4]. Really, bringing in alkalis, silicon dioxide and alumina can be provided with high salinity fluids, however, the accompanying carrying out from the host rocks of iron, calcium and especially magnesium are unlikely to be associated with the highly NaCl concentrated fluids. The accompanying carrying out of the bases requires radical change of composition of a fluid phase (for example, fluids with high salt component have to be replaced by a strong-acidic fluids).

System H₂O-KCl-amphibole, 750°C, P=750 MPa

If in system amphibole-NaCl-H₂O after experiments amphibole remains as main mineral, already small additives of potassium (KCl) in composition of initial solutions lead to significant change of mineral assemblages after the experiments.

First of all, clinopyroxene remains stable in entire range of salinity of solutions. On composition it is high-magnesian augite with the content of a jadeite component reaching the 15 mol. %. Similarly, presence of KCl at system leads to emergence of biotite with a $X_{Mg} \approx 0.7$ and without chlorine. At low (0.1-0.3) ratios of K/(K+Na) in an initial fluid slight isomorphic substitution of K→Na in biotite is observed, at higher ratios of K/Na in solutions biotite practically doesn't contain sodium. Sometimes at the edges of biotite the rim of a lepidomelan is formed. The plagioclase and potassium feldspar observed in almost all experiments. With a high content of potassium in the initial solution ($K/(K+Na) > 0.5$) amphibole practically disappears, and clinopyroxene, biotite and garnet are stable. On the composition garnet comes nearer to an andradite, i.e. is not characteristic for metabasites.

Melting at the given parameters is observed in experiments at $X_{H_2O} \approx 0.6-0.7$ that corresponds to the data [5]. The appearing melt is presented small balls (the first tens microns). On the composition of the melt – olivine-normative with prevalence of a K-feldspar component, the amount of which is determined by the ratio of K / (K+Na) in an initial fluid.

In most experiments, the initial amphibole (pargasite) doesn't change its iron content, there is almost no chlorine, but the ratio of K/(K+Na) in amphiboles is directly correlated with the corresponding ratio in the fluid. It is shown that the ratio $K/(K+Na) < 0.3$, typical for amphiboles from mafic granulites and metasomatic hornblendites arise at the ratio K/(K+Na) less 0.3 in coexisting fluid.

It is shown that the ratios of K/(K+Na) < 0.3 , characteristic for amphibole from the main granulites and metasomatic amphibolites, arise at the relations of $K/(K+Na) < 0.3$ in the coexisting fluid. The transformations of rocks which are taking place at processes of a charnockitization occur at a little higher ratios of $K/(K+Na) = 0.25-0.40$ in the fluid. Thus, amphibole is a sensitive indicator to a ratio of K / (K+Na) in the composition of the fluid phase.

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