GRANITIZATION OF AMPHIBOLITE AT HIGH PARAMETERS

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Amphibolite transformation into granite (granitization process [1]) at filtration of silicon-alkaline fluid through it is experimentally modeled. The runs were performed at t = 750°C, pressure of 5 kbar. The scheme of the run: a charge of the ground synthesized glass of granite composition was put at the bottom of the capsule of 50 mm in length, 5 mm in diameter and with the thickness of the wall of 0.2 mm. Granite was a buffer phase for saturation of fluid by granite components. 1n solution of HCl of the volume of about 0.12 cm^3 was poured into the bottom of the capsule. Then a cylindrical sample of amphibolite of 4.65 ± 0.01 mm in diameter and 10-13 mm in length was inserted into the capsule. A distance between the buffer phase – granite and amphibolite was 15-20 mm. The interaction of granite and amphibolite was realized only through the fluid phase.

A thick-wall microchamber for the solution filtrating through the sample during the run was placed above the amphibolite sample. The capsule was welded and placed into the high-pressure vessel (HPV). At the beginning of the run the pressure in HPV was increased up to 2 kbar at t=25°C . Here the low part of the capsule with the solution was pressed, as a result of which fluid pressure (P_{fl} = 2 kbar) was created. At that very moment the sample itself got the necessary side squeezing (P_{fl} = 2 kbar). That prevented solution filtration between the capsule and the sample. In the upper part of the capsule, in the microchamber, the solution was absent (P_{fl} = 0). Pressure difference along the length of the capsule stimulated fluid filtration through the pore space of amphibolite. The duration time in the regime of the run was 3 days. When the run was over, there was an isobaric quenching up to t=200°C. After that the temperature and pressure decreased simultaneously.

A chemical composition of the initial glass of granite, amphibolite and methods of study of the samples after the runs are similar to the ones in [2].

After the run in amphibolite from the initial minerals only biotite and plagioclase remain. Amphibole decomposes completely; aggregates of ilmenite are fixed in its place. Biotite is represented by large (250-750 мкм), crystals, slightly oriented along pressure gradient. A composition of biotites $K_{0.98}Mg_{1.41}Fe_{1.34}Al_{1.52}Ti_{0.21}Si_{3.02}O_{10}(OH)_2$ differs inconsiderably from the initial ones by a higher content of Ti, more iron number and a higher content of alumina in hexad coordination. Three compositions of plagioclase: An_{30-32} – restites of the initial, and An_{51} и An_{27} – formed in the run are distinguished.

In the low part of amphibolite (in zone of the most intensive effect of the directed flow of the silicon-alkaline fluid) melt is formed (Fig.1). The average composition of this melt - $Na_{0.67}K_{0.32}Ca_{0.13}Fe_{0.08}Mg_{0.03}Al_{1.47}Si_{6.53}O_{16}$ – corresponds to trondhjemite, in the coordinates quartz – albite – orthoclase approaches the eutectic one at P_{H2O} = 1 kbar [3]. A formation of zone of the massive melt $Gl_{eutec.}$ Is explained by the interaction of the alkalized and debasificated part of amphibolite with the fluid phase saturated by granite components.

Besides Gl_{eutec} intergranular (the first dozens of microns) parts of glass (between grains of plagioclase or at the boundary of ilmenite crystals) Gl_1 - $Na_{0.11}K_{0.24}Ca_{0.23}Fe_{0.09}Mg_{0.04}Al_{1.52}Si_{6.57}O_{16}$ can be observed. A melt of such composition is formed at a partial melting of amphibolite at the parameters of the run [4].

A change of a chemical composition of amphibolite along pressure gradient (since some components gain a flow of fluids and others lose it) serves one of the proof of solution filtration through a rock. A determination of the total composition of amphibolite from the area of 800 x 800 mkm along the whole sample has shown the following:

a) CaO content in the sample is less than in the initial amphibolite, i.e.Ca is not accumulated in the transformed rock, but is lost Petrology. with the fluid phase; b) in the part of amphibolite, faced to the fluid flow, a weak alumina loss and silica gain can be observed; c) FeO and MgO are removed from amphibolite by a fluid, FeO being lost quicker than MgO. At a distance of 4-8 mm from the edge of the sample completely transformed into granite, one can see a maximum accumulation of these lost components, their content increases by 1.5-2 times, as compared to their number in the initial amphibolite; d) the lost components are fixed in biotite. Biotite number increases in the zone of the maximum loss of FeO and MgO. This section on the external periphery of feldspatization zone and lightning can be considered as a special zone of «microbasification» (redeposit of the removed FeO and MgO). It is apparent that such zone is formed under the conditions of the restricted bulk of the capsule. Under natural conditions, at multikilometer filtration of fluids, the basic components scatter, here a concentrated front of basification is not observed, what Korzhinskii D.S. pointed out (1952). However, in a number of cases in the surrounding of granitization zones small, conjugated with granitization, manifestations of Fe-Mg-Ca metasomatism: pyroxene – amphibole, amphibole, and garnet -amphibole – pyroxene veins were described [5].

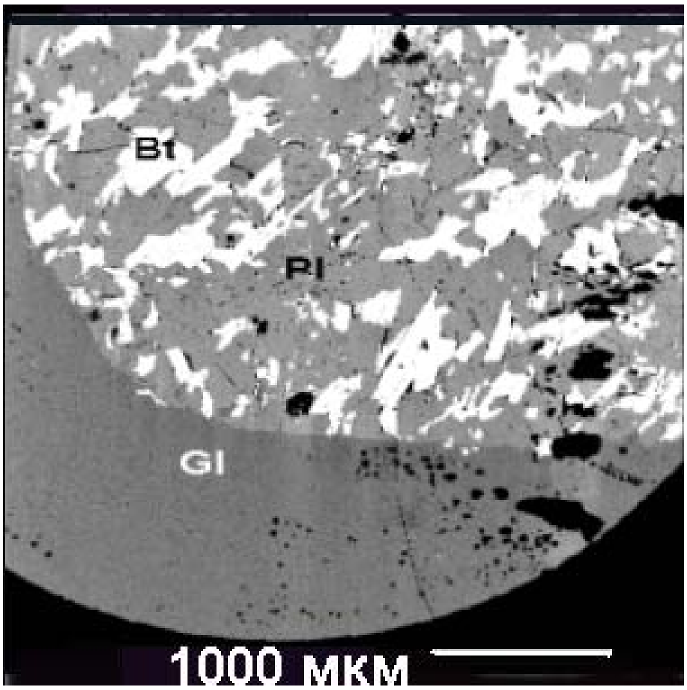

Fig.1. Melt formation over amphibolite rim faced to fluid flow.

We have determined the rate of filtration of the solution through the sample and that of melt motion over the pores of amphibolite as well as a change of amphibolite porosity during the run. It made it possible to give the approximate estimates of the thickness of the transformed rocks both at a metasomatic treatment of a rock (feldspatization and debasification) and a replacement of the enclosing rocks by the melt during different time intervals for different pressure gradients. It is shown that granitization in the regional scales develops only in the preliminarily schistose gneissoid rocks or in the narrow zones of collapse over which migration of granitizing fluids takes place.

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