MAGMATIC REPLACEMENT OF AMPHIBOLITE AT HIGH PARAMETERS. EXPERIMENTAL STUDY

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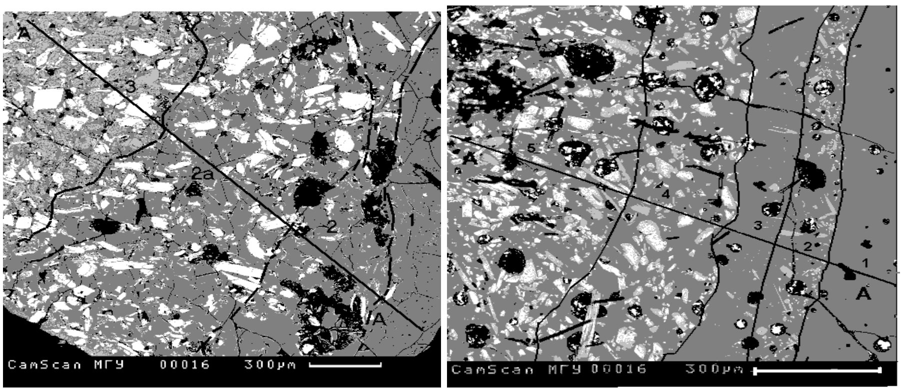
This study was supported by the Russian Fundamental Research Foundation (Project No 00-05-64036)
Herald DGGGMS RAS № 5 (15)'2000 v.2
URL: *http://www.scgis.ru/russian/cp1251/h_dgggms/5-2000/magm34.eng*

Granite formation by D.S. Korzhinskii can occur at interaction of trasmagmatic solutions with a high content of silica and alkalies for the enclosing rocks. As the simplest model of granitization of metamorphic rocks we studied amphibolite interaction with the preliminarily synthesized glass of gaplogranite composition at Tand P in the presence of aqueous fluid.

The runs were held at high gas pressure vessel with the internal heating by quenching technique. The initial materials were fine-ground /mkm/ amphibolite characterizing rocks of the basic composition of the Tavajarvinskii complex of Nothern Karelia and preliminarily synthesized gaplogranite. Hornblende, plagioclase and biotite, as well as sphen, magnetite mainly enter amphibolite composition. Amphibolite change of 200-300 mg was ground and densely packed into the capsule, then H_2O was added of 0.04-0.05 ml in quantity and granite charge of 100-200 mg, which was also densely packed there. The capsule was welded and kept in the regime of the runs for 3-5 days. After the run the sample was studied with the help of the microprobe "Camscan" in the laboratory of the microanalysis of the petrology department of the Moscow University and on the "Camebax", IEM. The determination of the total composition was made from the area of 0.1-0.25 mm^2 in each zone.

After the runs the samples 1D (800°C) and 9D (950°C) represented a dense partially melted rock, dark - grey, not fully coloured. The part of the sample where amphibolite was placed was dark- grey, but where the initial synthetic granite was put, there was formed a colourless, transparent glass, slightly coloured into grey in the vicinity of the contact.



800°C 950°C

Fig. 1. Photomicrographs of the samples 1D and 9D

In the sample 1D the basic minerals in the contact zone were represented by amphibole and biotite. In the third zone together with amphibole and biotite plagioclase appears which alkalinity increases from Pl_{35} to Pl_{48} while removing from the contact. In the sample 9D in zone 1 (fig.1a) after homogeneous granite glass a layer of fine crystals of orthopyroxene with the iron content of f=27% appears. It is a narrow zone of 50-70 mkm (zone 2). Towards amphibolite the zone practically disappears, being replaced by the narrow band of 50-70 mkm of the quenching glass. Then (in zone 4) among the glass large up to 100 mkm zonal crystals of amphibole and biotite appear. A bit further across the section crystals of clinopyroxenes can be seen. Approximately in 500 mkm from the contact beginning zonal crystals of plagioclases with Ca enrichement of the edge zones of crystals from Pl_{31} to Pl_{54} occur.

In a general case the run products show the two processes: partial melting of amphibolite and diffusional interaction of the melted granite with amphibolite in the contact zone. In that part of the samples where amphibolite was placed especially at 800°C practically no marked gain or loss of the components can be observed. Here a partial melting of the rock can be seen: a melt of the acidic composition while preserving amphibole and biotite is formed, amphibole is enriched by silica, plagioclase is preserved, at T=950°C clinopyroxene is formed. In the contact zones with the partial melting amphibolite interaction with granite melt with the gain - loss of the components takes place. As a result of this, plagioclase disappears, it is possible, that newly-formed biotite appear. At T=950°C orthopyroxene is formed in the contact. The initial amphiboles refer to edenite hornblende. At a partial melting of amfibolite at

800°C hornblende preserves, at T=950°C it transforms into ferro-pargaside hornblende. Due to the diffusion of the components, caused by the interaction of amphibolite with the granite melt in contract zones amphibole transforms into edenite at 800°C and ferro-pargasite at 950°C. By a chemical composition biotite in the samples does not differ essentially. Clinopyrocxenes in the contact contain less Fe and somewhat more Al than the pyroxenes of the sample edge at a practically identical content of Mg.

A variable number of the quenching glass (from to 100 - 24 mass%) can be seen in all zones of one and the other sample. In glass composition of the initial granite the presence of ions of Ca, Mg, Fe in the very edge parts of the sample is fixed. Here a drop of alcali concentration can be seen. While recalculating chemical compositions of the quenching glasses in that or another sample for normative compositions it is obtained that at 800°C quenching glasses in contact zone represent trondhjemite, at 950°C - granites, at partial melting of the samples granodiorites are formed. It is apparent, recrystallization of the quenching glass is to take place in accordance with the normative compositions. In such a case the experimental column formed at 800°C will look as below:

recryst. melt min. in the run	Q+Ort+ +Pl_{10}	Q+Ort+$Pl_{17\text{-}35}$+Am+ Bt	Q+Ort+$Pl_{17\text{-}35}$ + + Am+ Bt	Q+Ort+$Pl_{35\text{-}50}$ +Am + Bt
rock	granite	migmatite of the trondhjemite		partially melt amphibolite

The experimental column is comparable with the natural columns formed at feldspatization and the initial stage of melting of amphibolites: zones 1 and 2 can characterize “occurrence of drops of leucocrate composition in the rear zones of feldspatized rocks”. The next two columns 3-4 represent migmatites close to trondhjemites by composition. Zone 5 represents enclosing rocks, in our case - amphibolite subjected to partial melting.

At recrystallization of quenching glasses obtained at 950°C the experimental column looks as follows:

recryst. melt minerals in the run	Q+Ort+ +$Pl_{до\ 10}$	Q+Ort+ Pl_{10}+Opx	Q+Ort+ +$Pl_{10\text{-}20}$	Q+Ort+$Pl_{10\text{-}20}$+ + Am+ Bt	Q+Ort+Pl_{25}+ +Am + Bt
rock	charnokite		leucocrate zone	migmatite of granite composition	partially melt amphibolite

The similar zoning is close to that pointed out at granitoid formation of charnokite series.

A comparison of the results of the runs with the natural objects is sure to be of a conventional character, since natural processes under lab conditions are not reproduced. Together with that, the results of the runs show that at a magmatic replacement of metamorphic rocks as well as at metasomatism, zoning of a magmatic replacement is formed. Depending on temperaure mineral composition of such zoning can be represented either by amphibole assemblage with biotite, typical for granitized amphibolites, or by the formation of the assemblages with orthopyroxene, typical for charnokite complexes.