EXPERIMENTAL INVESTIGATIONS OF FLUID FILTRATION THROUGH AMPHIBOLITES AT HIGH PARAMETERS

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Precambrian rocks of tonalite - trondhjemite - granite series (TTG) are a considerable part of the ancient continental crust. In these rocks blocks and xenolites of amphibolites changed in a different degree, two-pyroxene crystalloschists and other types of metabasites are often present. It gives all grounds to assume that the initial metabasites were transformed into (TTG) melts. Different hypotheses of formation of such melts from metabasites exist: their partial melting, contamination by intruding (TTG) melts and etc. One can assume that transformation of metabasites into granitoids might occur at filtration through their silicon-alkali bearing fluid. Thus, this paper represents the *results* of the experiments on filtration of silicon-alkali saturated solution through amphibolites. Fluid filtration through porous space of amphibolites was attained due to pressure decay along the length of capsule *grad P*. The scheme of the runs is described in detail in [1].

From the experimental data at given *grad P* the fluid number, filtrating through amphibolites is determined, constituting $n \times 10^{-9} \div n \times 10^{-8}$ g/s and solution filtration rate – $n \times 10^{-10} \div n \times 10^{-9}$ m/s.

As a result of the reproduced fluid filtration through the rock there take place the following changes of the mineral composition of amphibolites:

a) biotite reorientation takes place, directed along fluid flow filtration;

b) a change (most often increase) of iron number of dark-coloured minerals occurs, as well as decrease of alkalinity of plagioclases up to andesite, new formation of magnetite and ilmenite;

c) subeutectic melts - granites and trondhjemites – are formed at the edge of amphibolites, faced to a fluid flow. First of all, drops of newly-formed melt replace plagioclase, then amphibole and biotite. Replacement front by amphibolites melt shifts towards fluids' motion;

d) accessory minerals, such as apatite, rutile, titanomagnetite, zircon can be preserved in the melt.

In a general case to calculate fluid filtration rate through rocks Darci law is used as a relationship $x / \tau = k \; grad \; P / \mu \; \phi$ (1), where μ - is rock permeability. The following values were taken in the calculations: amphibolites porosity $\phi = 0.01$, viscosity μ =9.5 x 10 Pa c [2, 3], *grad P* = 2 x 10^{-4} Pa/m, rates of growth of metamorphic isograds (in other words, rates of filtration of fluid-thermal flows, causing metamorphism) $x / \tau = 10^2 – 10^3$ m/million years according to data [4-5].

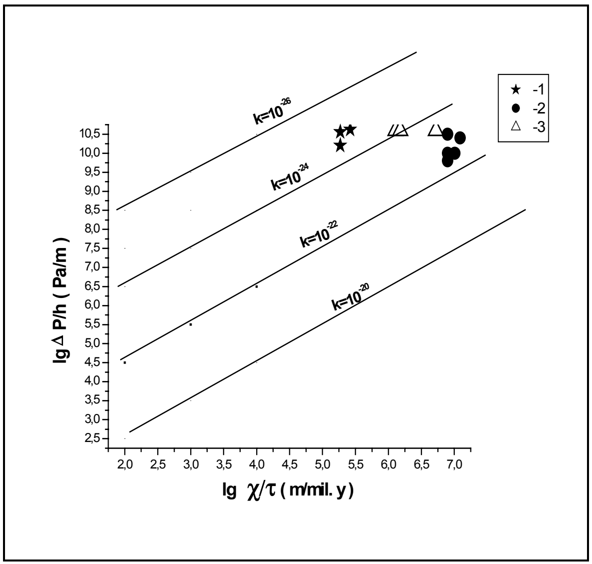

Fig.1. Relationship x / τ (m /mil. y.)- grad P (Pa/m). Lines of equal permeability k, determined from the Darci equation, are shown. The notations: 1–solution filtration rate in amphibolites ST88, 2-S28, 3- S524 under the assumption ϕ=0.01

Within the coordinates filtration rate-pressure gradient (in logarithmic units) Fig.1 shows by solid lines permeability values of rocks, calculated from (1). The signs in Fig.1 reflect filtration rate of the solution through three different amphibolites at values *grad P*, given in the runs, at assumption ϕ = 0.01. As seen from Fig. 1, the data of the runs get into the interval of permeability $k \sim 10^{-24} - 10^{-25}$ m^2, i.e. one can accept that the considered rocks have the indicated permeability. One should emphasize that permeability *k* is calculated according to (1), then the values of amphibolites permeability, obtained and determined from Fig. 1, will be close, i.e. a small number of the melt, being formed at a partial melting of amphibolites under the parameters of the runs does not principally change these rocks' permeability.

Rates of transformation of rocks at granitization processes in natural conditions are estimated as 10 – 10^4 m/ million years. As seen from Fig.1, under such rates of rock transformation and under the condition *grad P* = 10^4 Pa/m rocks must have permeability $k = 10^{-21}$ m÷ 10^{-17} m^2. Rocks, having permeability $k < 10^{-23}$ m^2 are extremely weakly or quite impermeable for the fluids in those cases when a difference of densities of the enclosing rock and a fluid filtering through it, is to be a moving force *(grad P)*. It was possible to reproduce amphibolites granitization only due to the created extremely high *grad P* what allowed us to filter the solution through dense, partially melted rocks and estimate their permeability.

Thus, it becomes evident that a regional development of granitization processes at metamorphism must be connected with zones of enhanced permeability of rocks for metamorphing granitizing fluids. Massif, nonschisted, i.e., weakly permeable for fluids metabasite rocks are almost not subjected to granitization even under the conditions of metamorphism granulite facies, being preserved among granitized formations in the form of blocks or xenoliths.

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