Larikova T.L., Zaraisky G.P. Experimental modeling of coronitic textures

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In the Early-Proterozoic garbbro-norites of the Belomorian Complex, coronas of clinopyroxene and garnet form at the contacts of orthopyroxene and olivine with plagioclase. An increase of P_{H2O} and cooling results in amphibolization of the coronas and their transformation to garnet amphibolites (Larikova, 2000). Reaction Opx+Pl→Cpx+Grt+Qtz is well studied experimentally as a reaction of eclogite formation (e.g. Green, Ringwood, 1967). However, until now there were no successful attempts to experimentally model the coronitic textures. In order to support the hypothesis on the simultaneous formation of the coronitic textures (by the mechanism of diffusion bi-metasomatism), two experiments were performed on the exoclave high-pressure apparatus. The first experiment with H_2O is described by Larikova and Zaraisky (2000).
Table 1.

The second experiment was carried out in gold ampoule of 5 mm in diameter. Finely grained powders of pyroxene (enstatite; in order to exclude iron) and plagioclase (NAn = 51). Their initial contact was marked by Pt ring. The run duration was two weeks at T = 700°C and P = 5 kbar in presence of 0.1 M NaCl. After quenching, pH and composition of a solution was analyzed. As a result, the following column between primary En and Pl was observed (Fig. 1, Table 1):

En ← Ged+En ← Tr ← Ged+Fo ← Chl+Fo → Prg → Cpx → Grt(Grs)+An

PH	7.65	
SiO_2	5.95*10-3 mol/l	0.358 mg/ml
Al	0.00299 mol/l	0.081 mg/ml

The pure Pl zone is not preserved in the column, since plagioclase is strongly dissolved and replaced, despite the presence of NaCl. Garnet (grossular) crystals were found on walls of the ampoule. The column begins immediately from the garnet zone. The presence of amphiboles (gedrite, tremolite, pargasite) is related to higher water activity in the experiment in comparison to the natural coronas, where hornblende is secondary. The chlorite (clinochlore) contains the Pt ring, that means that it was formed after the initial boundary of Pl and En.

A composition of all the zones gradually changes to enstatite. In the each zone, Al and Ca contents decrease, while Mg content increases. That is a result of the contrary diffusion of Al and Ca from Pl and Mg from En. In the tremolite zone, a maximum of the Ca content is found. This maximum is similar to that in the central portions of the natural drusitic coronas (Larikova, 2000). A presence of such maximum can correspond to the perfect mobile behavior of Ca. In contrast to the natural coronas, in the central portion of the column, forterite forms between plagioclase and pyroxene. That points to intergranular desilication during the experiment, which is proved by analyses of a solution.

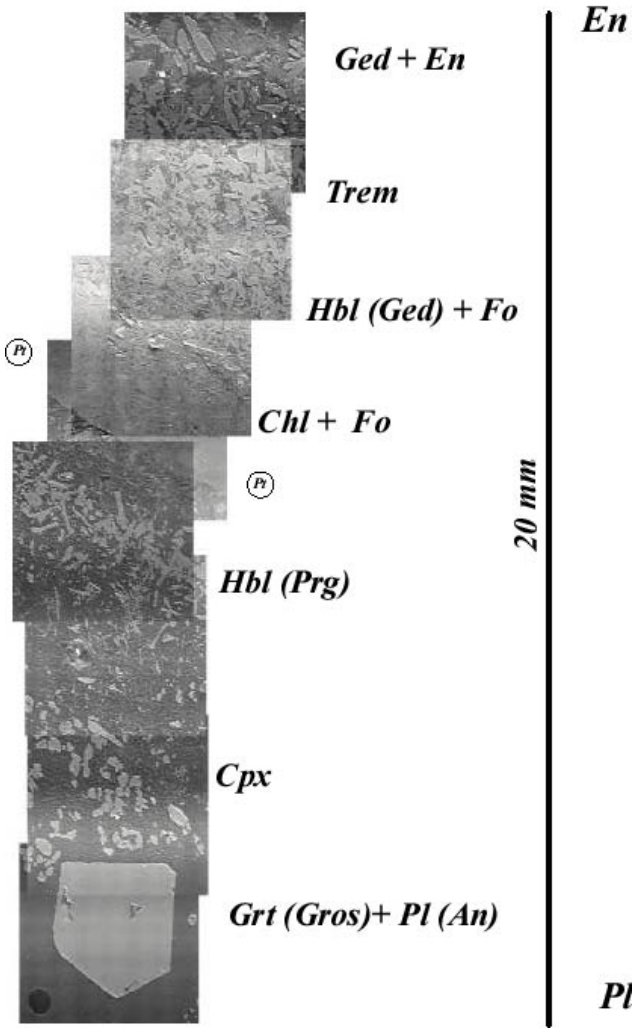

Fig. 1. Experimental coronitic texture.

An appreciably high concentration of Al in the solution can be observed. That corresponds to its significant transfer into the apoenstatite portion of the column with the formation of alumina-bearing minerals (gedrite, chlorite, tremolite). Alumina in the column migrates further than calcium. A transport of elements during the column growth occurred in pore solution, probably, as chlorides. Thus, experimental results closely reproduce the natural coronas. They persuasively imply a formation of the coronitic textures by the mechanism of diffusion bi-metasomatism with mass-transfer through the aqueous fluid.

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References:

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