The subsolidus segregation of leucocratic bands – a possible mechanism for formation of banded structures in metamorphic rocks

Субсолидусна сегрегация на левкократни ивици – възможен механизъм за образуване на ивичестата текстура в метаморфните скали

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Introduction

Metamorphic layering (alternation of leucocratic and mafic layers) is a widespread structural feature of metamorphic rocks of different grade of metamorphism. In many cases it is related to the primary inhomogeneous parent rocks, i.e originally banded rocks. The formation and growth of bands of different composition within an unbanded massive rock such as granites is a debatable process. It can results from melting and formation of banded leucosome (migmatization of the rocks); from subsolidus segregation; from mylonitization (mylonite banding). The first two processes are closed-system processes. To examine the possible way of formation of banded structure we investigate the rocks croping out close to the check point “Ilinden” at the Bulgarian-Greece boundary.

Petrology

The investigated rocks are strongly banded former equigranular granites and they are described as “banded migmatites” belonging to the Slashten lithotectonic unit (Sarov et al., 2008). The leucocratic bands are up to 5–7 cm thick and they have sharp contacts with the melanocratic parts of the rocks. The mineral composition of both lithologies is similar – quartz, biotite, plagioclase, potassium feldspar, white mica. The mafic bands contain more biotite and epidote whereas the white mica is concentrated only in the leucocratic bands. In some cases the epidote has features of magmatic origin. The character of deformation of minerals is also similar – chessboard pattern in quartz and dynamic recrystallization, submagmatic fracturing of feldspars and recrystallization with subgrain rotation.

Compared to the bulk chemical composition of the rocks, the leucocratic veins are slightly enriched with SiO_2 and vastly with Na_2O, K_2O and Ba. They are strongly depleted in TiO_2, Fe_2O_3, MnO, MgO, CaO, Y, Zr. In contrast to them the melanocratic bands are enriched with TiO_2, Fe_2O_3, MnO, MgO, CaO Y, Zr, Nb, La, Ce and depleted in K_2O, Na_2O, Ba, Sr, Rb. The ratio of geometrical mean of chemical components (in leucocratic + mafic bands/whole rock) shows slight deviation around line, representing ratio = 1.

Conclusion

The field, petrological and geochemical data support the idea for segregation of leucocratic bands in the rocks croping out close to the check point “Ilinden” under solid-state conditions. It occurs under high differential stress by model proposed by Robin (1979). A basic assumption of this model is that among rocks which contain quartz and different amount of mica, competency increases as the proportion of mica decreases. In particular, a greater percentage of mica causes the diffusion path of silica to be wider.

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