Dating of garnet-bearing leucosome from NW Rila Mountain, Bulgaria

Датиране на гранатсъдържаща левкосома от СЗ Рила, България

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Field associations of high pressure and high temperature metamorphic mineral assemblages are often considered as recording subduction related burial at considerable depth and consequent process of decompression due to their later exhumation. High-temperature incongruent melting of metapelitic rocks produces garnet and other water-free peritectic minerals together with melt, while water-assisted congruent melting results in migmatites free of peritectic minerals. The later type is common in the Rhodope metamorphic complex and refers to Cenozoic amphibolite facies regional metamorphism. Recent studies consider finds of garnet-bearing migmatites in the Bulgarian and Greek Rhodope and report results of mid-Mesozoic HP granulite facies melting that followed an UHP event (Cherneva et al., 2014 and reference therein).

The high-grade basement of NW Rila Mountain comprises the northwestern most coherent part of the Rhodope Metamorphic Complex, a pile of Alpine synmetamorphic nappes. NW Rila Mountain area is composed of several lithotectonic units. From bottom to top these are: Malyovitsa, Kabul, Polich, Lakatishka and Verila Lithotectonic Units (see for further descriptions of the units Gorinova, Georgiev, 2015). *The Kabul Unit* is migmatized variegated section of garnet bearing amphibolites, schists, orthogneisses, marbles, metaultrabasites. The garnet bearing amphibolites have protholith ages of ca. 540 Ma and Early Cretaceous metamorphic overprint at ~100 Ma (Gorinova et al., 2014). The unit contains also relicts of Lower Triassic (~235 Ma) eclogites (Miladinova et al., 2013). The P-T estimates of three successive metamorphic mineral assemblages from the metapelites (Kolcheva, Cherneva, 1999) show a clockwise decompression P-T path from 620–650 °C/7–8 kbar to 460–500 °C/1–2 kbar due to a process of regional extension. A similar path of isothermal decompression from supposed granulite to greenschist facies is obtained by Machev (2002) for metabasites. Below we present geochronological data for a new find of garnet-bearing leucosome in metapelites from the Kabul Unit. The studied rock is found in the upper part of the Iliina River valley (N 42°5'25.60", E 23°22'46.80"). The garnet-bearing leucosome forms discordant patches (pockets) or veins oriented parallel to the regional metamorphic foliation in garnet-sillimanite metapelites and rarely in the garnet-bearing amphibolites. Depending on the particular structural position such garnet-bearing leucosomes appear in Kabul complex as: 1) discordant and shapeless patches and pockets in the metapelite substratum and thus, representing most probably *in situ* granulite facies melts; 2) different in thickness veins of garnet-bearing melt occurring parallel to the foliation in garnet-sillimanite metapelites representing portions of leucosome transported for a small distance from the source; 3) veins of garnet-bearing leucosome oriented parallel to the foliation of other rocks in the same unit suggesting melt extracted from the metapelite substratum and injected into other rock varieties. In our study we focus on the first case.

Thin-sections of metapelite and garnet-bearing leucosome were used for petrographic observations. U-Th-Pb zircon dating of leucosome is accomplished by LA-ICP-MS in the Geological Institute of BAS using zircon grains in thin-sections and zircon separates. The selection of analytical spots (30 μm) is based on CL and BSE images.

The metapelite comprises fractured and strongly resorbed garnet porphyroblasts (≤1.5 mm) and kyanite relics in a matrix of prismatic to fibrolitic sillimanite, white mica, quartz, minor biotite, and chlorite. Plagioclase, zircon and monazite are found as inclusions in garnet and in the matrix. Quartz and plagioclase in the matrix form lense-like aggregates of unclear orientation. Retrograde changes led to crystallization of biotite followed by chlorite in fractured garnet. The general features of metapelite sample indicate decompression from kyanite to sillimanite stability field. The

leucosome is granoblastic, and inequigranular, composed of plagioclase, quartz, garnet and minor biotite, chlorite and white mica. Subhedral to euhedral garnet grains (≤2 mm) contain inclusions of plagioclase, apatite, and rutile, the later rarely rimed by opaque mineral (probably ilmenite). Biotite, chlorite with opaque mineral parallel to its cleavage planes, and scarce white mica flakes mark retrogressive changes of garnet in fractures and along grain rims. The felsic matrix around garnets comprises polygonal plagioclase forming foam-structure and amoeboid quartz aggregates with slight undulose extinction. The presence of garnet in leucosome suggests HT dry melting of metapelite at temperature not lower than 750–800 °C (Vielzeuf, Holloway, 1988).

Zircon grains are rounded short-prismatic to isometric. CL images show dominant sector zoning which had wiped out older and unclear oscillatory zoning in some of the zircons. Such internal structures are found in zircons of high-grade metamorphic origin (Corfu et al., 2003). Scarce zircon cores are inappropriate for dating containing inclusions of other minerals and thin rims (<10 μm) of strong CL brightness in some grains. The results of *in situ* dating in the thin-sections yield 270–287 Ma for zircon inclusions in garnet and wide variation from 166 to 297 Ma for zircon grains in the quartz-feldspar matrix. Similarly, zircon separates show ages from 229 to 286 Ma. The probability plot based on concordant results display three groups of ages with frequency peaks of 284.8, 266.2 and 238.5 Ma. The first two clusters of ages most probably represent ages of inherited cores while the third cluster could either represent the age of the granulite facies melt or mixed magmatic and metamorphic ages. However, the age similarity with the eclogite from the same unit (~235 Ma) points rather to the first assumption. Hence, the granulite facies melts must be interpreted as belonging to as by the same tectono-metamorphic event and thus to the closure of the Paleotethys Ocean.

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