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P-T METAMORPHIC PATH OF GARNET-KYANITE-BEARING SCHISTS: CHEPELARE FORMATION, CENTRAL RHODOPE, BULGARIA

M. Georgieva[1,2], A. Mogessie[2], C. Hauzenberger[2], A. Proyer[2] & Z. Cherneva[1]

[1]Geological Institute
Bulgarian Academy of Sciences, Acad. G. Bontchev Str., bl. 24, 1113 Sofia, Bulgaria
[2]Institute of Mineralogy and Petrology
University of Graz, Universitätsplatz 2, A-8010 Graz, Austria

In the tectonic evolution of the Rhodope massif two successive compressional and extensional events which occured during the Alpine time are distinguished. Both stages resulted from the collision between Eurasian and African plates in early Cretaceous time. During the compressional stage, the rocks have been subjected to regional metamorphism and a system of large-scale south verging thrusts emerged. The extensional stage began with tectonic erosion of the anomalous thickened crust and continued with the formation of detachment fault system. The later has been connected with a development of granitic and migmatitic domes and imposed graben depressions filled with sediments of Palaeogene age. The Late Cretaceous-Tertiary extensional system in the Central Rhodopes area consists of two plates: an upper plate (Asenitsa unit) that has been affected by amphibolite facies metamorphism (550°C / 13 kbar); and a lower plate (Arda unit) that has been affected by migmatization (620–680°C / 4–8 kbar). The Arda unit migmatites were exhumed during the Oligocene (35–34 Ma) and formed the core of the Central Rhodopian Dome [1].

This work presents new petrologic data and preliminarily P-T estimations on garnet-kyanite-bearing schists from Chepelare formation, Central Rhodope.

Chepelare formation crops out in the N periphery of the Central Rhodopian Dome (CRD), in the vicinity of the town of Chepelare. It consists of medium- to coarse grained biotite gneisses, banded two mica gneisses with garnet porphyroblasts, micaschists with garnet and kyanite porphyroblasts, amphibolites, fine-grained aplitic gneisses, and fine- to coarse-grained marbles in an irregular alternation. According to the latest tectonic subdivision of the CRD, it occupies the uppermost levels of Arda 1 tectonic unit.

Within the Chepelare formation garnet-kyanite schists form layers and lenses with irregular form and shapes with thickness up to 900 m [2]. Matrix mineral assemblage consists of Grt, Ky, Bt, Qtz, Pl ± Phen, Sil, Chl and accessory zircon, apatite, ilmenite, pyrite, graphite, rutile. Garnet and kyanite have variable proportions and form large porphyroblasts.

The analysed garnet porphyroblasts (3–4 mm) are almandine type (X_{Fe} 0.58–0.60, X_{Mg} 0.28–0.30, X_{Ca} 0.11–0.12, X_{Mn} 0–0.01). Garnets are found as largely unzoned grains only with variably developed Mn-enriched rim as resorption during retrogression or around large inclusions. Grain boundaries are corroded and grain shapes are elongated to the foliation. Inclusions of St, Ky, Pl, Bt, Chl and Qtz, are found near the garnet rim. Accessory rutile, ilmenite, ± zircon, xenotime, pyrite, apatite, allanite are widespread within the garnet.

Kyanite elongated to the foliation grains, includes rounded Qtz. Si content in phengites range from 6.54 to 6.59. Staurolite was found only as inclusion in Grt, in association with Pl, Bt, Qtz, Rt and Ilm. Its absence in matrix assemblage suggests temperatures higher than St-stability field - 700°C [3].

Thermobarometric calculations have been performed using PET and TWQ software. Different calibrations of Grt-Bt and Grt-St geothermometers and GASP and GRAIL geobarometers were used. Reequilibration of garnet rim and diffusion changes in some of the inclusions made the exact determination of peak metamorphic conditions difficult. Preliminary geothermometric and geobarometric results characterise changing metamorphic conditions: from 600–650°C / 7–8 kbar for garnet inclusions assemblage to 700–750°C / 9–10 kbar for the matrix. These results are consistent with the presence of Ky inclusions in garnet, consumption of staurolite and complete homogenisation of garnet composition.

Because of strong retrogression of the rock, it is possible that some P-T to be underestimated, taking in mind that recently mineralogical evidence for UHP from garnet-kyanite-bearing schists have been reported - maximum P of 6.8 GPa [4].

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