High-pressure and high-temperature metamorphism of the Starcevo unit (Rhodopes, Bulgaria) and its fast exhumation

Jan Pleuger[1], Thorsten Nagel[2], Neven Georgiev[3], Silke Jahn-Awe[2]
[1]Geologisches Institut, ETH Zürich, Sonneggstraße 5, CH-8092 Zürich
[2]Steinmann-Institut, Universität Bonn, Poppelsdorfer Schloß, D-53115 Bonn
[3]Department of Geology and Palaeontology, University St. Kliment Ohridski, 15 Tzar Osvoboditel Boulevard, 1000 Sofia, Bulgaria

The basement of the Rhodopes in south Bulgaria and northeast Greece is built up mostly of thrust nappes and plutons that were emplaced during a protracted Alpine history. Subduction and accretion processes have lasted at least from the Late Jurassic until the Early Eocene, as evidenced by radiometric ages for the high- to ultrahigh-pressure metamorphism that was experienced by some of the nappes during subduction (Liati 2005).

The Starcevo unit in the Central Rhodopes is a lithologically heterogeneous, eclogite-bearing unit sandwiched between the Arda unit below and the Borovica unit above (Sarov et al. 2004). The Arda and Borovica units do not show evidence of high-pressure (HP) metamorphism. Equilibrium phase diagrams calculated for eclogite samples from the Starcevo unit together with micostructural observations allow to recognize a HP stage followed by a high-temperature (HT) stage. During the HP stage, Omp+Ky+Grt were stable and the P-T conditions were c. 20-25 kbar/600-700 °C. The HT stage is documented by coronas of Pl+Spl+Spr+Crn forming around decomposing Ky. According to the calculated equilibrium phase diagrams, the assemblage Pl+Spl+Spr+Crn is stable above 750 °C. The maximum pressure is constrained by the boundary toward the stability field of Pl+Spl+Opx+Spr+Crn and increases from c. 6 kbar at 800 °C to c. 9 kbar at 900 °C.

We interpret the HT stage to be contemporaneous with migmatisation of the gneisses of the Starcevo and Arda units at c. 37-38 Ma (Ovtcharova et al. 2002). While the kinematics of eclogite exhumation from the HP to the HT stage is unknown, the final exhumation of the Arda and Starcevo units after the HT stage is relatively well constrained by still Priabonian sediments overlying the Arda and Starcevo units in the Eastern Rhodope basin. We interpret this final exhumation to be due to the combined effect of normal faulting between and above the Arda and Starcevo units. The top-to-the-NW Borovica (above the Starcevo unit) and Kardžali (above the Borovica unit) shear zones accommodated exhumation until greenschist-facies conditions were established in the Arda and Starcevo units. Retrogression from higher amphibolite-facies to lower greenschist-facies conditions is also recorded in the the top-to-the-NE Kanarata shear zone between the Arda and Starcevo units. The Kardžali, Borovica, and Kanarata shear zones are cut off by the top-to-the-N Kyuse-Hasanlartepesi fault zone which initiated the formation of the Eastern Rhodopean basin.

References:

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