The Neotethys suture in the eastern Bulgarian Rhodopes

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Following a tectonic scheme proposed by Janák et al. (2011; Journal of Metamorphic Geology 29, 317-332) and Pleuger et al. (2011; Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 162, 171-192), the Rhodopes are composed of four nappe complexes, from bottom to top the Lower, Middle, and Upper Allochthon and the Circum-Rhodope Belt. Rocks derived from Adria and/or Pelagonia (Lower Allochthon) are separated from rocks of European origin (Upper Allochthon) by lithologically variegated thrust sheets containing sporadic occurrences of ophiolites (Middle Allochthon). These ophiolites typically yield magmatic protolith ages of c. 160 Ma and were metamorphosed under amphibolite- to eclogite-facies conditions. They represent Neotethyan lithosphere subducted below Europe in the Late Cretaceous to Palaeogene whereas the Circum-Rhodope Belt contains ophiolites of the same protolith age but with lower metamorphic grade (greenschist facies at most) and was obducted onto the former European margin in the Jurassic. We present LA-ICP-MS U-Pb zircon and additional geochemical data from the Luda Reka Unit in the Bulgarian Eastern Rhodopes. This unit consists mostly of amphibolite, metagabbro, and metadiorite that yielded two protolith ages of 163.5±2.6 Ma and 154.2±1.0 Ma. The trace element patterns resemble those of typical back-arc basalts and lower oceanic crustal cumulates. Initial epsilon Nd values of six samples calculated to 154 Ma were +10.8 ±0.8 (2σ; n = 6), in agreement with average basalts derived from depleted ambient mantle. A pegmatite crosscutting the Luda Reka Unit yielded a magmatic age of 52.04±1.1 Ma. Such pegmatites are widespread in the Luda Reka Unit (Middle Allochthon) suggesting that emplacement of this unit over the Bjala Reka Orthogneiss Unit in the Bjala Reka Orthogneiss Unit where such pegmatites are lacking happened only after c. 52 Ma. The Bjala Reka Orthogneiss Unit forms the footwall of the top-to-the-SSW Bjala Reka Detachment that became active in the Late Eocene. Where the Luda Reka Unit is lacking, the Bjala Reka Orthogneiss Unit is overlain by rocks that were collectively described as "Low-grade Mesozoic Unit" (e.g. Bonev & Stampfli 2008; Lithos 100, 210-233). Based on peak temperatures determined by Raman spectroscopy of organic matter, two tectonic units can be distinguished in the “Low-grade Mesozoic Unit”. The temperature peak was at c. 530 °C in the Mandrica Unit below and at c. 285 °C in the Maglenica Unit above. For the Mandrica Unit, minimum peak pressures of c. 1.4 GPa
were obtained by Raman spectroscopy of quartz inclusions in garnet, indicating that this unit underwent subduction-related metamorphism. Because of this marked difference in peak metamorphic grade, we attribute only the anchimetamorphic Maglenica Unit to the Circum-Rhodope Belt while the high-pressure Mandrica Unit probably represents the Upper Allochthon. Both units are presently separated by the top-to-the-NW Mandrica Detachment that was active before the Bjala Reka Detachment. Our new findings show that the easternmost Rhodopes expose a condensed section through all four nappe complexes, notably including the Neotethys suture.