



Kinematics of Palaeogene low-angle extensional faults along the eastern border of the Central Rhodopes (Bulgaria)

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The Central Rhodope crystalline basement in the eastern flank of the Central Rhodopean Dome is a pile of Alpine high-grade metamorphic units. The structurally lowest of these units were migmatized in the Late Eocene, probably due to decompression induced by northwest-vergent orogen-parallel and north- to northeast-vergent hinterland-directed extensional shearing. Extensional shearing in the Central Rhodopes took place at various crustal levels (Kandarata, Borovica, and Kardžali Shear Zones) and thus under various metamorphic conditions. Final stages of the extension resulted in the formation of the East Rhodope Basin which, in this part of the basin, initiated with the Kyuse-Hasanlartepesi low-angle normal fault. A generalized section through the Kyuse-Hasanlartepesi Fault comprises, from bottom to top, lower-greenschist-facies mylonites to ultramylonites, foliated fine-grained cataclasites, and unfoliated cataclasites and breccia. A brittle fault surface is at the top of these fault rocks. The parallelism between the brittle fault surface and the mylonitic foliation, the coincidence in the orientation of the mylonitic stretching lineation with the slickenfibres lineation of the cataclasites, and the overall top-to-the-north(-northwest) displacement sense for both ductile and brittle faulting indicate that the kinematics of the fault zone remained constant during the evolution from ductile to brittle faulting. The observed relationship between ductile and brittle fault rocks reflects the progressive juxtaposition of relatively cold brittle fault rocks with relatively hot mylonitic rocks during ongoing exhumation of the footwall of a detachment fault. Existing geochronological and stratigraphic data from the basement and the overlying volcano-sedimentary succession allow to date the activity of this fault between 35 and 32 Ma. The average exhumation and cooling rates for the exhumation of the migmatites of the Arda 1 and Starcevo Units from a depth > 23 km to surface as constrained by available petrological P-T data and radiometric and stratigraphic ages were c. 6.5-10.8 km/Ma and 182-246 °C/Ma. Only after c. 32 Ma, the further subsidence of the East Rhodope Basin was accommodated along steeply dipping normal faults which widely overprinted the Kyuse-Hasanlartepesi Fault. Where the Kyuse-Hasanlartepesi Fault is still exposed, its corrugated geometry controls the distribution of the onlapping sedimentary units and is thus interpreted as a primary feature.