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Tertiary exhumation processes and related kinematic record in the northern Aegean: evidence from the Eastern Rhodope-Thrace (Bulgaria-Greece) and the Biga Peninsula (NW Turkey)

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Since the first recognition of metamorphic core complexes of cordilleran-type in the Cyclades, the Aegean region is now considered as a natural laboratory for studying processes of crustal extension and exhumation of metamorphic rocks. This contribution presents a regional kinematic study of exhumed basement rocks in the northernmost part of the Aegean region (eastern Rhodope and Thrace of Bulgaria and Greece, and Biga Peninsula of northwest Turkey).

The regional-scale tectonic pattern of the eastern Rhodope and Thrace is dominated by late Alpine metamorphic culminations, namely the Kesebir-Kardamos and the Byala reka-Kechros domes. In the the Biga Peninsula of northwest Turkey, the high-to medium-grade basement rocks are represented by the Kazdag Massif, the Çamlica and Kemer micaschists. In all places, shear structures associated with stretching lineations in mylonitic metamorphic tectonites were systematically measured. Kinematic analysis demonstrates regionally consistent (1) NE–SW extension direction in the core of the Kesebir-Kardamos dome, with top-to-the NE ductile then brittle shear sense in the north, and (2) NNE–SSW direction with top-to-the SSW shear sense in the core of the Byala reka-Kechros dome. The same pattern is shown in the corresponding parts of these domes in northern Greece. In the northern Biga Peninsula, NE-directed ductile to semi-brittle extension characterizes the metamorphic strip of the Kemer micaschists. Further south, the Alakeçi mylonitic zone, bounding the northern flank of the Kazdag Massif presents evidence of down dip top-to-the NNE extension, assisting exhumation

of this part of the massif. To the south, the Selale detachment accommodates top-to-the SSW extensional exhumation of its southern flank. Overall, the basement rocks in the Biga Peninsula present a NNE–SSW to NE–SW extension direction. In all the studied areas, the ductile fabrics have been progressively overprinted by semi-brittle structures and finally brittle faults. Similarly, the shearing took place in decreasing metamorphic conditions from amphibolite to greenschist-facies.

This kinematic framework, combined with stratigraphic ages (syn- and post-tectonic sedimentary basin fill) and regional geochronology (metamorphic/cooling ages in the basement rocks, crystallization ages of magmatic rocks) provide constraints for the timing of the extensional deformation in the region. The latter took place from the latest Paleocene to Miocene. Following and/or coeval with the late phase of Cretaceous crustal thickening in the region, the NE–SW oriented extension in the northernmost Aegean commenced earlier to the north (Paleocene-Eocene, e.g. the Kesebir-Kardamos dome, the Kemer micaschists). This syn-orogenic extension relates to the subduction-collision history coeval with the closure of the Vardar Ocean. Then, it was followed by a late Oligocene-Miocene Aegean post-orogenic back-arc extension which evolved further south (e.g. southern flank of the Kazdag massif, the Thasos metamorphic core complex, the Strymon Valley detachment), and related to the roll-back of the remnant oceanic slab in the Mediterranean region. Southward migration of extension in the north Aegean region with an overall maintained kinematic direction, as well as the associated time equivalent magmatism accounts for the sequential retreat of the subduction boundary along the Eurasian plate margin from the Oligo-Miocene to Present. Moreover, regional-scale correlations of the studied areas in the northern Aegean suggest that they were kinematically coupled during the Tertiary extension and related tectonics.