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The Eastern Pelagonian metamorphic core complex: insight from the 40Ar/39Ar dating of white micas

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The Pelagonian Zone in continental Greece is the westernmost unit of the Internal Hellenides that constitutes a pre-alpine crystalline block in-between two oceanic domains, the Pindos in the west and the Vardar zone in the east. We present petrographic, structural and geochronological evidence for a metamorphic core complex in eastern Pelagonian. The denuded metamorphic dome extends about 20 x 15 km with the long axis striking NNW-SSE. A shallow-dipping foliation defines the structural dome. The mineralogy of the lithologies (gneiss, impure marbles and amphibolites) show metamorphic conditions that decrease from upper-amphibolite in the core to greenschist metamorphic conditions in the flanks of the dome, reflecting structural depth and thus erosion of the dome. Aligned micas and amphiboles and elongated quartz and feldspar define a prominent lineation trending SW-NE. Asymmetric structures in the XZ finite strain plane of rocks show two regional senses of shear: (i) everywhere, top-to-the-SW sense of shear (direction: 252°±30; plunge: 8°±25) associated with strain gradients from protomylonite to ultramylonite and recumbent, isoclinal and occasional sheath folds; (ii) top-to-the-E sense of shear (direction: 88°±24; plunge: 11°±12) in narrow (0.1 to 100 m) low-angle shear zones on the eastern flanks of subdomes.

The 40Ar/39Ar step-heating dating technique has been applied to micas from orthogneisses from the core to the flanks of the dome to constrain its thermal and structural evolution. The micas have been separated with acoustical shockwave produced in the SELFRAG apparatus, with the advantage to liberate morphologically intact grains. The liberated grains were sieved at different grain-sizes (between 100 and 300 μm) depending on the micro-textures observed in thin-sections. Results show "plateau"-ages at ca. 100-120 Ma and at ca. 80 Ma. Interestingly, the 100-160 μm fraction of white micas in a mylonitic orthogneiss yielded slightly younger ages than the 160-300 μm fraction, arguing for neo-crystallization age during deformation of the smaller grain fraction and a more retentive apparent age with multiple diffusion domains for the larger. Micro-textures confirm an early generation of mica fish (>160 μm) arranged between c-type shear bands representing a later generation of micas. These new ages are consistent with ages published on the southern Pelagonian, demonstrating major tectonic and metamorphic activity during early Cretaceous times.