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Restoring the Central Anatolian Crystalline Complex to its late Cretaceous configuration

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The Anatolian region recorded the closure history of the Neotethyan Ocean(s) situated between the converging African and Eurasian continents during late Mesozoic – Cenozoic times. The location of the former northern Neo-Tethyan ocean is marked today by the presence of an ophiolitic mélange forming the Izmir-Ankara-Erzincan Suture Zone (IAESZ). South of the IAESZ, the Central Anatolian Crystalline Complex (CACC) is the largest metamorphic domain exposed in Turkey, which mainly consists of metamorphic rocks, ophiolites and magmatic intrusions. This crystalline domain experienced a complex tectonic history involving late Cretaceous obduction of ophiolitic nappes onto Paleozoic-Mesozoic sedimentary units, development of a regional Barrovian metamorphism, and widespread magmatic intrusions. However, no consensus has been reached so far about a unique geodynamic scenario to explain in which setting the CACC evolved during the late Cretaceous.

We present here a multi-scale and multi-disciplinary study of the tectono-metamorphic evolution of the CACC, and integrates the obtained results with data from the literature in order to propose a plausible tectonic model for the evolution of the CACC in the late Cretaceous. The tectono-metamorphic history of the central Anatolian metamorphic rocks has been investigated through detailed microstructural, metamorphic and geochronological analysis, together with local and regional mapping of ductile structures and metamorphic field gradients. An extended set of paleomagnetic data from the central Anatolian granitoids provides constraints for restoring the large-scale geometry of the CACC into its late Cretaceous configuration.

The main results of this study revealed that during the late Cretaceous the CACC consisted of a NNE-SSW elongated and narrow dome-shaped antiformal structure (∼500x150km). In this configuration, regional Barrovian metamorphism was accompanied with a top-to-the-SSW ductile crustal flow in the deeper part of the antiform, while shallower levels were synchronously affected by a WNW-ESE directed exhumation. Post-tectonic magmatism affected the western side of the antiform in three successive magmatic events showing a chemical evolution from calc-alkaline in the west to alkaline in the east (i.e. from an external to a more internal position in the antiform). This magmatic trend together with published geochemical data from the central Anatolian plutonic rocks, has been recognized as a typical evolution of a magmatic arc in a supra-subduction environment. Therefore, the contemporaneous L/MP-HT metamorphic CACC and the subduction-related HP-LT Tavşanlı Zone most likely formed a paired metamorphic belt. Moreover, at the plate tectonic scale, the contemporaneous northward subduction below the Pontides along an EW-trending suture together with the newly established eastward subduction of a NNE-SSW trending subduction system below the CACC suggests the presence of a Trench-Trench-Trench (TTT) type triple junction at the intersection of these two subduction zones. Finally, during the Paleogene, the collision of the NNE-SSW-oriented antiformal structure with the central Pontides led to the break-up of the CACC into three distinctive domains as exposed today.