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Triassic Collision Between the Sakarya and Istanbul Zones, and Remarks on the Existence of Intra-Pontide Ocean in NW Turkey

E. Bozkurt (1), J. A. Winchester (2), M. Satir (3), and Q. G. Crowley (4)

(1) Middle East Technical University, Department of Geological Engineering, Universiteler Mahallesi, Dumlupınar Bulvari No: 1, Çankaya, TR-06800 Ankara, Turkey, (2) Earth Science & Geography, School of Physical and Geographical Sciences, Keele University, Staffs ST5 5BG, UK, (3) Institute für Geowissenschaften, Universitat Tübingen, Wilhelmstrasse 56, D-72074 Tübingen, Germany, (4) Department of Geology, Trinity College, College Green, Dublin 2, Ireland

Two important controversial issues about Tethyan evolution in northwest Turkey are: (i) the existence and evolution of a Cretaceous Intra-Pontide ocean and location of its suture: the metamorphosed ultramafic-mafic rocks exposed in both the Armutlu Peninsula and the Almacik Mountains, which have long been considered by some to be the remnants of this ocean; (ii) the timing of the juxtaposition of the Sakarya and Istanbul zones, with Palaeocene-Lutetian, Coniacian-Santonian, Turonian, pre-Senonian, Early Cretaceous and pre-Santonian all being suggested. Here, we present both field and isotopic data from two localities on opposite sides of the North Anatolian Fault: the Sunnice Massif in the Istanbul Zone and the Almacik Mountains in the Sakarya Zone.

The lowest structural levels of the Istanbul Block in NW Turkey are exposed in the Sunnice Massif and comprise the Ediacaran greenschist-facies calc-alkaline bimodal Yellice metavolcanics, intruded by the Dirgine granitoid. However, ages obtained from the underlying amphibolite-facies ultramafic gneisses, hitherto termed the Cele 'meta-ophiolite' (hornblende gneisses of island arc meta-tholeiitic and transitional to calc-alkaline metagabbroic compositions), and previously thought to be part of the İstanbul Block basement, indicate a Permian age of formation. The junction between the Cele gneisses and the overlying basement to the İstanbul Block is tectonic, which we term the Istanbul Block Basal Thrust (IBBT). Equivalent rocks to the Cele gneisses occur in the Almacik Mountains south of the North Anatolian Fault (adjacent to the Sakarya Continent) where high amphibolite facies, alternating ultramafic (harzburgitic and websteritic) and mafic (metagabbroic) gneisses of similar compositions and age are exposed. Isotopic dating has suggested that both the Cele and Almacik gneisses formed during the Permian and underwent late Triassic metamorphism. We attribute the Triassic metamorphism to compression of the Sakarya Block and its fringing active continental margin during a Cimmerian collision, marking the closure of Palaeotethys. The absence of this metamorphic event from the currently overlying Istanbul Block basement suggests that while the two rock groups converged in the Late Triassic, metamorphism barely affected the overriding İstanbul Block rocks.

The absence of ophiolitic sheeted dyke or pillow basalts and the dominantly calc-alkaline geochemistry of both the Cele and Almacik gneisses, suggests that they formed lower crustal basement of Permian age to an active continental margin formed on the north side of the Sakarya microcontinent, with south-dipping subduction of Palaeotethys. Late Triassic uplift as a late result of the collision with the Istanbul Block and overthrusting of the latter indicates a change of subduction polarity. Subsequent extension in the Jurassic produced subsidence, allowing deposition of lower Jurassic (late Berriasian-Valanginian age) molasse unconformably upon the rocks of the Istanbul Zone, Sünnice Massif and Almacik Mountains, which must thus have been juxtaposed and eroded before this time, much earlier than previous suggestions.

Because these rocks have proved to be much older (late Proterozoic–Early Palaeozoic in the Armutlu Peninsula and Permian in the Almacik Mountains and Cele gneisses, the two latter overlain by the same Jurassic sediments, there is scant supporting evidence left for a Cretaceous Intra-Pontide ocean in the western Pontides.