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Testing alternative tectono-stratigraphic interpretations of the Late Palaeozoic-Early Mesozoic Karakaya Complex in NW Turkey: support for an accretionary origin related to northward subduction of Palaeotethys

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The mainly Permian-Triassic rocks of the Karakaya Complex exposed E-W across Turkey are critical to reconstruction of Tethys in the E Mediterranean region. Their origin remains controversial with both stratigraphic layer-cake and accretionary-type settings being advocated. Suggested tectonic settings range from back-arc rift, to accretionary prism- related to either northward or southward subduction. To test alternatives we have studied the contact relations and the internal fabric of each of the main litho-tectonic units making up the Karakaya Complex and related "basement" in nine outcrop areas across NW Turkey, also taking account of existing chemical and dating evidence. Our results show that the Karakaya Complex was assembled by regional-scale thrust faulting without evidence of layer cake-type stratigraphical contacts, or even of deformed sedimentary contacts separating the major lithotectonic units. In several areas (e.g. Havran) the outcrops of meta-siliciclastic sediments of presumed Palaeozoic-age (∼Kalabak Unit) are locally cut by Early-Mid Devonian granites. These outcrops represent one or more high-level crustal imbricates made up of basement rocks together with depositionally overlying U. Triassic siliciclastic rocks. Evidence from structurally lower, high pressure-low temperature Karakaya rocks (∼Nilüfer Unit) reveals an imbricated, mainly volcaniclastic-carbonate sequence. Both these relatively high-grade Karakaya rocks and the structurally overlying, lower-grade Karakaya rocks (i.e. Çal and Ortaoba units) are interpreted as tectonically emplaced accretionary melange rather than sedimentary "olistostromes". MOR-type basalts (Ortaoba Unit) are locally overlain by red ribbon radiolarites that then pass upwards into feldspar-rich siliciclastics. Triassic oceanic crust and oceanic siliceous sediments were overlain by terrigenous turbidites derived from the north (Sakarya continent), followed by tectonic accretion at a subduction trench bordering the southern margin of Eurasia. Other volcanic units (∼Çal and ∼Nilüfer) are of typical within-plate type, characteristic of seamount or rift settings but outside the range of compositions of Large Igneous Province (LIP) magmatic rocks. The ∼Nilüfer Unit is interpreted as mainly the flanking facies of Triassic intra-oceanic volcanic seamounts; this material preferentially accreted, whereas the seamount core material mainly subducted. In contrast, the traditional Çal Unit is subdivided into two (related) parts. One part reflects U. Permian rifting, probably of the Tauride continental margin to the south, as suggested by the widespread presence of terrigenous sediments stratigraphically beneath U. Permian platform carbonates. The other part (type Çal) records intra-plate-type volcanism, probably as marginal seamounts within adjacent oceanic crust. In our tectonic model, the Karakaya Complex relates to Triassic northward subduction of Palaeotethys (Late Palaeozoic?), while Triassic oceanic crust simultaneously formed adjacent to Gondwana (∼Tauride continent). Older Palaeotethyan oceanic crust subducted northwards beneath the S Eurasian margin, represented by Peri-Gondwanan terrane(s) (e.g. Central Sakarya basement) that accreted to Eurasia prior to late Carboniferous time. Upper Permian neritic carbonates and volcanics relate to rifting of the Tauride continent to the south (∼Çal Unit). Large (plume-related?) oceanic seamounts (∼Nilüfer Unit) erupted within the Triassic ocean. The seamounts and rifted continental fragment(s) drifted northwards across remnant Palaeotethys and accreted to the southern, active margin of Eurasia, represented by the Sakarya basement. The Karakaya accretionary prism was finally obducted northwards over U. Triassic deltaic to deeper-marine cover sediments of the Sakarya basement during latest Triassic (Norian) time, culminating in crustal-scale intercalation of accretionary and basement/cover material. The probable cause was collision of one, or several, large oceanic seamounts. This model is broadly applicable for >1500 km E-W across Turkey into Iran and has implications elsewhere.