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Formation of the Late Palaeozoic Konya Complex and comparable units in southern Turkey by subduction–accretion processes: Implications for the tectonic development of Tethys in the Eastern Mediterranean region

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ABSTRACT

The southern margin of Eurasia, from the Balkan region eastwards, is widely envisaged as an active continental margin related to northward subduction, at least during Late Carboniferous–Early Cenozoic time. By contrast, the Late Palaeozoic setting of the southern (Gondwana) margin was previously interpreted as an intra-continental marginal basin related to southward subduction beneath the northern margin of Gondwana, or as part of a forearc complex (e.g. forearc basin) related to northward subduction beneath Eurasia. Palaeotethyan evolution is recorded in the Konya Complex (new name), an assemblage of Palaeozoic (Silurian-Carboniferous) meta-sedimentary and meta-igneous rocks that is exposed beneath metamorphosed Upper Permian–Mesozoic shelf-type sediments in central southern Turkey to the north of the Tauride Mountains. The Konya Complex is dominated by large thrust slices of mainly Devonian shallow-water platform carbonates (Bozdağ unit). There is also a melange that is made up of lenticular sheets and blocks of mainly Lower Carboniferous shallow-water limestones, Silurian–Devonian black chert (lydite), pelagic limestones and rare blocks of mid-ocean ridge-type and within plate-type basaltic rocks. The blocks are set in a mainly terrigenous-derived siliciclastic matrix, locally including siliceous tuff. The matrix is interpreted as mainly deep-water turbidites and debris-flow deposits. An overlying, intact volcanic-sedimentary sequence includes chemically enriched extrusives (e.g. trachyandesites) that also exhibit a negative Nb anomaly, suggesting a subduction influence. Dykes crosscutting the carbonate platform units are relatively depleted and also show a subduction influence. Shallow-marine carbonates and terrigenous quartzose sediments of mainly Late Permian age are exposed above the Konya Complex in the west of the area. In contrast, Triassic non-marine, to shallow-marine, clastic sediments unconformably overlie the Konya Complex in the east of the area. Both the Permian and the Triassic sediments pass upwards without a break into a Middle Triassic–Upper Cretaceous platform carbonate succession, which was overthrust by accretionary melange and ophiolites during latest Cretaceous time. The Mesozoic carbonate platform and the underlying Konya Complex experienced polyphase deformation and partial high-temperature/low-pressure metamorphism related to Alpine (Late Cretaceous–Early Cenozoic) closure of Tethys. Comparison of Tauride and Pontide units suggests the deformed Konya Complex Upper Palaeozoic carbonate platform has Gondwanan affinities. We also compare the Complex with other Upper Palaeozoic units in southern Turkey, including the Tekedere unit (Lycian Nappes) and the Karaburun and Chios melanges. All of these units are interpreted to have formed by subduction/accretion processes. Alternative possible settings involve northward subduction, southward subduction, or terrane displacement (strike-slip). Northward subduction beneath Eurasia requires collisional assembly with Gondwana, possibly during the latest Triassic "Cimmerian orogeny" for which there is little evidence. A southward-dipping subduction zone would need to be located some distance outboard of the Gondwana margin as there is little evidence of Upper Palaeozoic arc magmatism in the Tauride platform. Emplacement as an exotic terrane, probably derived from further west in the Balkan region is also possible.

1. Introduction

It is commonly believed that a Palaeotethyan ocean subducted northwards beneath Eurasia during Late Palaeozoic time (Robertson and Dixon, 1984; Dercourt et al., 1993; Ustaömer and Robertson, 1997;

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Okay, 2000; Stampfli, 2000; Dercourt et al., 2000; Stampfli et al., 2001). However, the setting of the southern (Gondwana-related) continental margin of this ocean is controversial and has been explained using several different tectonic models that are tested in this paper. First, the northern margin of Gondwana was passive during the Silurian–Devonian, but switched to an active setting associated with southward subduction during the Carboniferous (Eren and Kurt, 2000). An intra-continental backarc basin opened along this southerly active margin during Early Carboniferous time (Göncüoğlu et al., 2000, 2007). Second, the same southerly region includes two contrasting continental assemblages, one related to Gondwana in the south and another related to Eurasia further north. In this interpretation Gondwanan and Eurasian terranes were amalgamated either during pre-Permian time (Zanchi et al., 2003; Okay et al., 2006), or latest Triassic time (Stampfli 2000; Stampfli and Borel, 2002; Moix et al., 2008).

Palaeozoic ocean-related units are sparse in southern Turkey because they are buried beneath a thick Mesozoic carbonate platform and younger units. Also, they are difficult to interpret since they have been deformed and metamorphosed related to the closure of the Mesozoic Tethyan ocean during latest Cretaceous–Early Cenozoic time (Alpine deformation). However, there are several important exposures of Palaeotethyan units of Late Palaeozoic age, which are the subject of this paper. From east to west, these are the Konya Complex (new name), the Tekedere unit (Lycian Nappes), the Karaburun melange and the Chios melange (see Fig. 1 for locations). We also take account of evidence from several other relevant units that are located generally further south, within the Tauride Mountains.

2. Regional geology and definition of terms

The Konya Complex forms part of the Afyon-Bolkardağ zone, as shown on Figs. 1 and 2a (Göncüoğlu et al., 1996–1997;Okay and Tüysüz, 2003). We introduce the term Konya Complex to take account of the complicated internal structural relationships of the Silurian-Carboniferous rocks exposed west of the city of Konya, which cannot be treated simply as a conventional stratigraphic unit. As discussed below, the Konya Complex has been described as including olistostromes with olistoliths, but is here reinterpreted as a melange terrane overall (see e.g. Raymod, 1984). An olistostrome is traditionally defined as a sedimentary unit in which detached blocks (olistoliths) are emplaced within a sedimentary matrix by mass-flow processes. Melange is considered as a non-genetic term for a pervasively mixed unit comprising exotic blocks of one or more lithologies with or without a sedimentary matrix. In this sense, melange can form by sedimentary or tectonic processes, and thus includes olistostromes.

The time scale of Gradstein et al. (2004) is used throughout this paper.

The locations of places and topographic features in the Konya area that are mentioned below are shown in Fig. 2b.

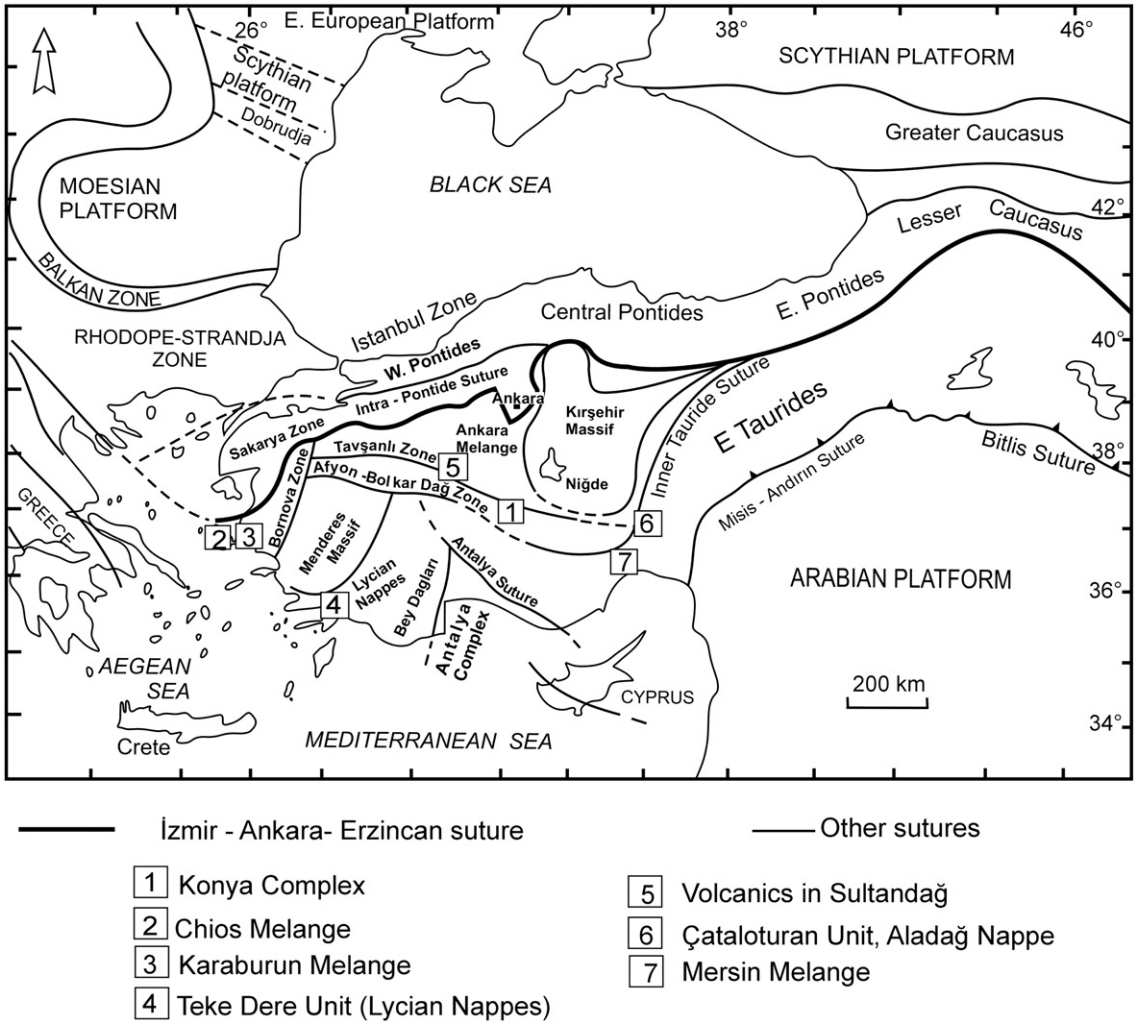

Fig. 1. Outline tectonic map of Turkey showing the locations of the Konya Complex together with other comparable units that are discussed in this paper. The tectonic zones are modified from Okay and Tüysüz (2003).