Linking the NE Anatolian and Lesser Caucasus ophiolites: evidence for large-scale obduction of oceanic crust and implications for the formation of the Lesser Caucasus-Pontides Arc

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In the Lesser Caucasus and NE Anatolia, three domains are distinguished from south to north: (1) Gondwanian-derived continental terranes represented by the South Armenian Block (SAB) and the Tauride–Anatolide Platform (TAP), (2) scattered outcrops of Mesozoic ophiolites, obducted during the Upper Cretaceous times, marking the northern Neotethys suture, and (3) the Eurasian plate, represented by the Eastern Pontides and the Somkheto-Karabagh Arc. At several locations along the northern Neotethyan suture, slivers of preserved unmetamorphized relics of now-disappeared Northern Neotethys oceanic domain (ophiolite bodies) are obducted over the northern edge of the passive SAB and TAP margins to the south. There is evidence for thrusting of the suture zone ophiolites towards the north; however, we ascribe this to retro-thrusting and accretion onto the active Eurasian margin during the latter stages of obduction. Geodynamic reconstructions of the Lesser Caucasus feature two north-dipping subduction zones: (1) one under the Eurasian margin and (2) farther south, an intra-oceanic subduction leading to ophiolite emplacement above the northern margin of SAB. We extend our model for the Lesser Caucasus to NE Anatolia by proposing that the ophiolites of these zones originate from the same oceanic domain, emplaced during a common obduction event. This would correspond to the obduction of non-metamorphic oceanic domain along a lateral distance of more than 500 km and overthrust up to 80 km of passive continental margin. We infer that the missing volcanic arc, formed above the intra-oceanic subduction, was dragged under the obducting ophiolite through scaling by faulting and tectonic erosion. In this scenario part of the blueschists of Stepanavan, the garnet amphibolites of Amasia and the metamorphic arc complex of Erzincan correspond to this missing volcanic arc. Distal outcrops of this exceptional object were preserved from latter collision, concentrated along the suture zones.

Keywords: Lesser Caucasus; NE Anatolia; Tethys; ophiolite; obduction

1. Introduction

During the Mesozoic, the southern margin of the Eurasian continent was involved in the closure of Palaeo-Tethys and the opening of Neotethys oceans. Later, from the Jurassic to the Eocene, subductions, obductions, micro-plate accretions and ultimately continent–continent collision occurred between Eurasia and Arabia, and resulted in the closure of Neotethys.

In order to better understand the different phases linked with the opening and closing of the Tethyan Ocean leading to the current structure of the Lesser Caucasus and the Eastern Pontides (Figure 1), it is important to identify the different units involved in the Tethyan suture s.l. and their corresponding geodynamic context including the lateral continuation of the structures. The evolution of northern Neotethys can be deduced from the structural, geochemical and geochronological studies of preserved oceanic crust domains obducted (ophiolites) in the Lesser Caucasus and in NE Anatolia and of the metamorphic rocks beneath these ophiolites. These studies yield key time and palaeogeographic data from the East Mediterranean area to the NW Himalayan belt (Barrier & Vrielynck, 2008; Dercourt et al., 1986; Galoyan, Rolland, Sosson, Corsini, & Melkonyan, 2009; Hafkenscheid, Wortel, & Spakman, 2006; Hässig et al., 2013; Okay & Tüysüz, 1999; Ricou, 1994; Ricou et al., 1985; Robertson, 2004; Rolland, Galoyan, Sosson, Melkonian, & Avagyan, 2010; Şengör & Yılmaz, 1981; Sosson et al., 2010; Stampfli, Borel, Cavazza, Mosar, & Ziegler, 2001). Supra-subduction zone (SSZ) ophiolites provide chronologic constraints related to oceanic crust formation by repetitive extension in a fore- and/or back-arc context, linked to the behavior of an intra-oceanic subduction, by the dating of related magmatic rocks. The study of these remarkable objects also contributes to understand oceanic closure, particularly ophiolite emplacement processes, by the dating of metamorphic rocks underlying the preserved (non-metamorphic) ophiolites and post-accretionary sedimentary series unconformably overlying the suture zone. Datings undertaken along the Ankara–Erzincan–Sevan-Akera suture.