The Eldivan ophiolite and volcanic rocks in the İzmir–Ankara–Erzincan suture zone, Northern Turkey: Geochronology, whole-rock geochemical and Nd–Sr–Pb isotope characteristics

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Gabbros and dolerite dikes of the Eldivan ophiolite and basaltic volcanic rocks of the ophiolitic mélangé in the central part of the İzmir–Ankara–Erzincan (IAE) suture zone were investigated for their ⁴⁰Ar/³⁹Ar age and whole-rock-major-trace element and Sr–Nd–Pb isotope compositions. Based on geological and geochemical characteristics basaltic volcanic rocks in the ophiolitic mélangé are subdivided into two groups (Groups I and II) with ocean island basaltal or enriched mid-ocean ridge basalts characteristics, respectively. Gabbros and dolerite dikes of the Eldivan ophiolite (Groups III and IV) have instead geochemical compositions indicative of a subduction-related environment. The volcanic rocks of Group I have ⁸⁷Sr/⁸⁶Sr(i) between 0.7037 and 0.7044, ƐNd(i)–DM of −4.5 to −5.6, and ²⁰⁶Pb/²⁰⁴Pb(i) ranging between 18.35 and 18.75. Group II volcanic rocks have higher ⁸⁷Sr/⁸⁶Sr(i) values (0.7049–0.7055), ƐNd(i)–DM ranging between −5.4 and −6.0, and ²⁰⁶Pb/²⁰⁴Pb(i) between 18.14 and 18.62. The Nd isotopic signatures and ²⁰⁶Pb/²⁰⁴Pb(i) values of the volcanic rocks of both groups point to a different source with respect to those of the Eldivan ophiolite. The low ²⁰⁶Pb/²⁰⁴Pb(i) values relative to the ophiolitic rocks seem to exclude a significant contribution from a HIMU reservoir, whereas the ²⁰⁷Pb/²⁰⁴Pb(i) values slightly above the NHRL might indicate some contribution from an EM2-type reservoir. Gabbros (Group III) of the Eldivan ophiolite and dolerite dikes (Group IV) cross-cutting the ultramafic part of the ophiolite show ⁸⁷Sr/⁸⁶Sr(i) between 0.7037 and 0.7053, ƐNd(i)–DM from −2 to −3.6 and ²⁰⁶Pb/²⁰⁴Pb(i) between 18.10 and 18.80. The gabbros yield ca. 150 Ma ⁴⁰Ar/³⁹Ar amphibole–plateau ages, which, together with the geochemical data, indicate that they were produced above subducted oceanic lithosphere in the IAE ocean domain in Late Jurassic times. Therefore, the Eldivan ophiolite in the IAE suture zone constitutes a link between the Hellenide–Dinaride ophiolite belts to the west and the Armenian–Iranian ophiolites to the east.

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1. Introduction

Ophiolitic mélangés yield important information on the development of the former ocean basins which they represent. They are exposed as part of many orogenic belts and include sedimentary, magmatic, and metamorphic rocks of various types and ages, which occur randomly within a matrix commonly made up of serpentinites, sandstones, and mudstones (e.g., Bailey and McCallien, 1953; Çelik and Delaloye, 2006; Dilek, 1989; Hsü, 1968; Raymond, 1984; Yılmaz and Maxwell, 1984).

The İzmir–Ankara–Erzincan (IAE) suture zone is a major tectonic boundary in northern Turkey, which hosts ophiolitic mélangé units (e.g., Rojay, 2013). The IAE suture zone separates the Pontides, to the north, from the Anatolide–Tauride and the Kışırcık blocks to the south (e.g., Dilek and Moores, 1990; Okay and Tüysüz, 1999; Sengör and Yilmaz, 1981). It occupies a critical position between the Jurassic–Early Cretaceous Neotethyan ophiolites of the Balkans (e.g. Dilek et al., 2007; Dimo-Lahitte et al., 2001; Robertson, 2002 and references there-in) and those in Armenia (e.g., Galoyan et al., 2009) and Iran (e.g., Emile et al., 2005; Fig. 1).

According to previous studies (e.g., Brajin and Tekin, 1996; Göncüoğlu et al., 2010; Tekin et al., 2002), the initial rifting stage and beginning of the oceanic crust formation in the IAE ocean occurred in the Early Triassic or Late Carnian, respectively, based on the occurrence of radiolarian fauna in deep marine sediments intercalated with basaltic rocks. Göncüoğlu et al. (2006) and Tüysüz and Tekin (2007) suggested that oceanization (i.e., an extensional regime) in the IAE ocean...