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Metamorphic sole rocks and their mafic dykes in the eastern Tauride belt ophiolites (southern Turkey): implications for OIB-type magma generation following slab break-off

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Abstract – The metamorphic sole rocks observed between the Pozantı–Karsantı ophiolite and the melange unit are located on the eastern part of the Tauride carbonate platform. They consist of ortho-amphibolites at the top and metasedimentary lithologies at the base. Amphibolites from the metamorphic sole rocks are represented by OIB, MORB and IAT based on their major, trace and REE compositions. The isolated dolerite dykes intrude both the metamorphic sole rocks and the ophiolitic unit at different structural levels. The dolerite dykes cutting the metamorphic sole rocks are enriched in LILE and depleted in HFSE. Enrichment in LILE such as Th, relative to HFSE, is indicative of the presence of a subduction component. Flat-lying REE patterns of the dolerite dykes also confirm an IAT source. Pyroxenite and albitite dykes also cut the metamorphic sole rocks. REE patterns of pyroxenite dykes show prominent LREE enrichment, similar to that observed in within-plate alkaline basalts. The alkaline isolated pyroxenite dykes were probably the result of late-stage magmatism fed by melts that originated from an OIB source, shortly before the emplacement of the Pozantı–Karsantı ophiolite onto the Tauride carbonate platform. A hydrothermal alteration stage is characterized by albitite formation in the joints of the metamorphic sole rocks and by secondary mineralization along the contact zones of dolerite dykes. Mineral parageneses in the metamorphic sole rocks exhibit amphibolite and greenschist-facies assemblages. Geothermobarometric studies based on a newly recognized mineral assemblage (e.g. kyanite) and chemical compositions of minerals in the metamorphic sole rocks indicate that the metamorphic temperature during the metamorphism was 570–580 °C and the pressure was around 5–6 kbar.

Keywords: ophiolite, geochemistry, metamorphic rocks, dykes, East Mediterranean.

1. Introduction

The Tauride belt in southern Turkey consists of a succession of nappe systems. It is composed of Palaeozoic and Early Mesozoic platform carbonates, Palaeozoic to Early Mesozoic volcano-sedimentary and epiclastic rocks, Cretaceous ophiolite complexes, Late Cretaceous and younger post-collisional sedimentary and volcanic rocks (e.g. Özgül, 1976). The Tauride Belt Ophiolites are a remnant of the Mesozoic Neotethyan Ocean (Juteau, 1980) (Fig. 1). The Neotethyan Ocean started to close between the Eurasian and Afro-Arabian plates by intra-oceanic thrusting and subsequent ophiolite emplacement during Late Cretaceous times (Şengör & Yılmaz, 1981; Robertson & Dixon, 1984; Dilek & Moores, 1990; Çelik, Delaloye & Feraud, 2006). Petrographic and geochemical analytical results of ophiolite-related intrusives and extrusives suggest that the Late Cretaceous ophiolites of the Tauride belt were formed in a supra-subduction zone environment (e.g. Pearce, Lippard & Roberts, 1984; Parlak, 2000; Parlak, Delaloye & Bingöl, 1996; Parlak, Höck & Delaloye, 2000, 2002; Çelik, Delaloye & Feraud, 2006).

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The Tauride Belt Ophiolites do not exhibit a complete section and are located on the Tauride platform carbonates as dispersed slices. The deepest parts, such as tectonites, have been best preserved, and in the upper parts of the assemblage, sheeted dykes have generally disappeared. All the ophiolites of the Tauride belt comprise basaltic lavas and associated sediments such as radiolarites and pelagic limestones. The ophiolite-related alkaline volcanic rocks are very extensive along the Tauride belt and can be observed either below or above the ophiolitic massifs (Whitechurch, Juteau & Montigny, 1984). These alkaline volcanic rocks have been thought to be Late Triassic in age and interpreted as the product of the initial rifting stage of the Neotethyan Ocean (Marcoux, 1976; Robertson & Woodcock, 1981). Tholeiitic volcanic rocks have been observed in the Antalya, Pozantı–Karsantı and Mersin ophiolites (A. S. Çataklı, unpub. D.Sc. thesis, Univ. Nancy, 1983; Robertson & Waldron, 1990; Parlak, Delaloye & Bingöl, 1995). Tauride belt ophiolites are commonly underlain by ophiolite-related metamorphic sole rocks and Cenomanian ophiolitic melange. The age of the metamorphic sole rocks along the Tauride belt ophiolites ranges from 91 to 93 Ma, based on ^{40}Ar–^{39}Ar geochronology (Dilek *et al.* 1999; Çelik, Delaloye & Feraud, 2006).