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Geology and Tectonic Emplacement of Eclogite and Blueschists, Biga Peninsula, Northwest Turkey

FIRAT ŞENGÜN, ERDİNÇ YİĞİTBAŞ & İSMAİL ONUR TUNÇ

Çanakkale Onsekiz Mart University, Faculty of Engineering and Architecture,
Department of Geological Engineering, Terzioğlu Campus, TR−17020 Çanakkale, Turkey
(E-mail: firatsengun@comu.edu.tr)

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Abstract: The Biga Peninsula in northwestern Anatolia is a tectonic mosaic, comprising different tectonic units, representing the Sakarya Continent and oceanic assemblages of different origin and ages. The Çamlıca metamorphic association, a member of this orogenic mosaic in the westernmost part of the peninsula, is subdivided into three formations, from bottom to top; the Andıktaşı formation, the Dedetepe formation, and the Salihler formation. Eclogite-facies metamorphic rocks occur as tectonic slices within schist-marble intercalations of the Dedetepe formation. These slices, about 2 km long and 500 m wide, include two different rock types; (i) quartz-mica schists, and (ii) metabasite lenses with eclogite/blueschist paragenesis. Foliation in the Dedetepe formation of the Çamlıca metamorphic association generally dips SW and strikes NW−SE around Dedetepe hill and Çamlıca village. In contrast, eclogite-facies metabasite slices strike NE−SW with NW-dipping foliation.

The eclogite-facies metabasite lenses are typically low-temperature eclogites that may represent tectonic slices of an accretionary complex associated with a subduction zone. Blueschists were produced by retrograde metamorphism from eclogite during late stage shearing. The host rocks record only a single-stage greenschist-facies metamorphism and were juxtaposed with the eclogite-facies metamorphic rocks along ductile-semi-brittle (?) strike-slip faults after the eclogite-facies metamorphism and during or after the low-grade metamorphism of the Çamlıca metamorphic unit. Age constraints on the metamorphic units and the age of the common cover units suggest that this juxtaposition by strike-slip tectonics occurred between the late Cretaceous and early Eocene.

Key Words: eclogite, strike-slip tectonics, blueschist, Biga Peninsula, Turkey

Biga Yarımadası'nda (KB Anadolu) Yeralan Eklojit ve Mavişistlerin Jeolojisi ve Tektonik Yerleşimi

Özet: Kuzeybatı Anadolu'da bulunan Biga Yarımadası farklı kökende ve yaşta okyanusal topluluklar ve Sakarya Kıtası ile ifade edilen farklı tektonik birliklerden oluşan tektonik bir mozaiktir. Yarımadanın en batı kesiminde bu orojenik mozayiğin bir parçası olan Çamlıca metamorfik topluluğu alttan üste doğru üç formasyona ayrılmaktadır. Bunlar, Andıktaşı formasyonu, Dedetepe formasyonu ve Salihler formasyonudur. Eklojit fasiyesi metamorfik kayalar Dedetepe formasyonunun şist-mermer istifi içerisinde tektonik dilimler şeklinde bulunmaktadır. Yaklaşık 2 km uzunluğunda ve 500 m genişliğinde olan bu dilimler iki farklı kaya tipi içermektedir. Bunlar, kuvars-mika şistler ve eklojit/mavişist parajenezi içeren metabazit mercekleridir. Çamlıca metamorfik topluluğunun Dedetepe formasyonu genellikle Dedetepe ve Çamlıca köyü civarında GB eğimli foliasyona ve KB−GD yönelime sahiptir. Buna karşın eklojit fasiyesi metabazit dilimleri KD−GB yönelim ve KB eğimli foliasyon gösterirler.

Eklojit fasiyesi metabazit dilimleri tipik olarak yitim zonunda gelişmiş yığışım kompleksine ait tektonik dilimleri temsil eden düşük sıcaklık eklojitleridir. Mavişistler geç evre makaslama zonları boyunca eklojitlerden dönüşmüşlerdir. Çamlıca metamorfik kayaları sadece tek evreli yeşilşist fasiyesinde metamorfizmanın izlerini taşırlar ve sünümlü-yarı gevrek (?) yanal atımlı faylar boyunca eklojit fasiyesi metamorfizmadan sonra ve Çamlıca metamorfik kayalarının düşük dereceli metamorfizması sırasında veya sonrasında eklojit fasiyesi metamorfik kayalarla bir arada bulunurlar. Yanal atımlı tektonik ile farklı derecedeki metamorfik kayaların bir araya gelme yaşı birimlerin metamorfizma yaşı ve bu birimleri örten ortak örtünün yaşı nedeniyle geç Kretase−erken Eosen zaman aralığı olmalıdır.

Anahtar Sözcükler: eklojit, yanal atım tektoniği, mavişist, Biga Yarımadası, Türkiye

Introduction

High-pressure metamorphic rocks are common in the Alpine orogenic belt and are principal indicators for the existence of former subduction zones. Blueschist and low-temperature eclogite-facies rocks that formed in a subduction-accretionary wedge were later emplaced as tectonic sheets, imbricate slices, lenses or exotic blocks into a mélange or into metamorphic units (Ernst 1970, 1972; Gansser 1974; Goffé & Chopin 1986; Okay 1989; Maruyama *et al.* 1996; Topuz *et al.* 2008; Agard *et al.* 2009). These rocks contain key features for the understanding of tectono-metamorphic processes in former subduction zones. Since such rocks may have been tectonically juxtaposed with rocks with a different history, it is important to investigate the complete history of petrological and structural processes that affected the high-pressure rocks.

Many regional-scale exposures of eclogite-facies metamorphic rocks, such as in the Biga Peninsula, northwestern Turkey (Figure 1), include dispersed evidence for high-pressure (HP) metamorphism. Okay & Satır (2000a) first reported the existence of eclogites within the Çamlıca metamorphics. They proposed that the entire Çamlıca metamorphics experienced an initial Maastrichtian eclogite-facies metamorphism, which was strongly overprinted by greenschist-facies metamorphism. Rb-Sr phengite ages of eclogite-facies rocks in the Çamlıca metamorphics range from 65 to 69 Ma (Okay & Satır 2000a), and eclogitic assemblages have estimated minimum P–T conditions of 11 kbar and 510±50 °C (Okay & Satır 2000a). The tectonic setting and origin of these HP rocks, however, are still highly problematic, and new observations on the petrology of the HP rocks need to be considered. In this paper we show that greenschist-faces rocks were never subjected to eclogite-facies conditions, contrary to the suggestion of Okay & Satır (2000a). The purpose of this study is to reveal how and when the rocks occurring within the Çamlıca metamorphics, with different geologic histories and rocks from the enveloping Çamlıca metamorphics, were juxtaposed. This work is based on detailed structural and petrographic analyses that provide new insights into the metamorphism.

Geologic Framework

The Biga Peninsula in northwestern Anatolia is known as a region where different tectonic units, representing the Sakarya Continent and oceanic assemblages of different origins and ages, meet (Figure 1). The Biga Peninsula is bordered on its eastern side by the westernmost end of the Sakarya Zone (e.g., Şengör & Yılmaz 1981; Okay *et al.* 1991; Bozkurt & Mittwede 2001) to the north, it is bounded by the Thrace Basin and Strandja Zone along the Intra-Pontide suture (Okay & Tüysüz 1999). To the south, the Sakarya Zone is separated by the İzmir-Ankara-Erzincan suture zone from the Anatolide-Tauride block (Okay & Tüysüz 1999). High- to medium-grade basement rocks occur in several localities in the Biga Peninsula, including the Kazdağ Massif, the Çamlıca metamorphics and the Kemer mica schist (e.g., Okay & Satır 2000a, b; Beccaletto *et al.* 2007; Şengün & Çalık 2007). The correlation of these metamorphic rocks and their contact relations are still the subject of debate. These metamorphic rocks are unconformably overlain by Eocene and Oligo–Miocene volcanic and volcano-sedimentary rocks (Ercan *et al.* 1995; Siyako *et al.* 1989). This contribution focuses on high-pressure rocks (eclogite and blueschist) enclosed by the greenschist-facies Çamlıca metamorphics of the Biga Peninsula (Figure 1).

Lithology and Field Relations

The Çamlıca metamorphics are exposed on the westernmost part of the Biga Peninsula. They are tectonically separated from the Denizgören ophiolite in the west by the 33-km-long Ovacık fault (Okay & Satır 2000a), which forms a broad north- to northeast-trending arc (Figures 1 & 2). The Ovacık fault dips west to northwest at 35–40° in the north and 65–70° in the southwest. The steep dip of the fault plane north of Ezine implies that the southern part of the Ovacık fault was reactivated as a normal fault (Okay & Satır 2000a). Southwest of Ovacık village a mylonitic zone 1.5 km long and 8–10 m wide represents the Ovacık fault. In this area, lineations plunge 30–60° to the SW. Foliation planes dip 40–50° NW and show a NE–SW trend. Lineation, foliation and field data suggest that

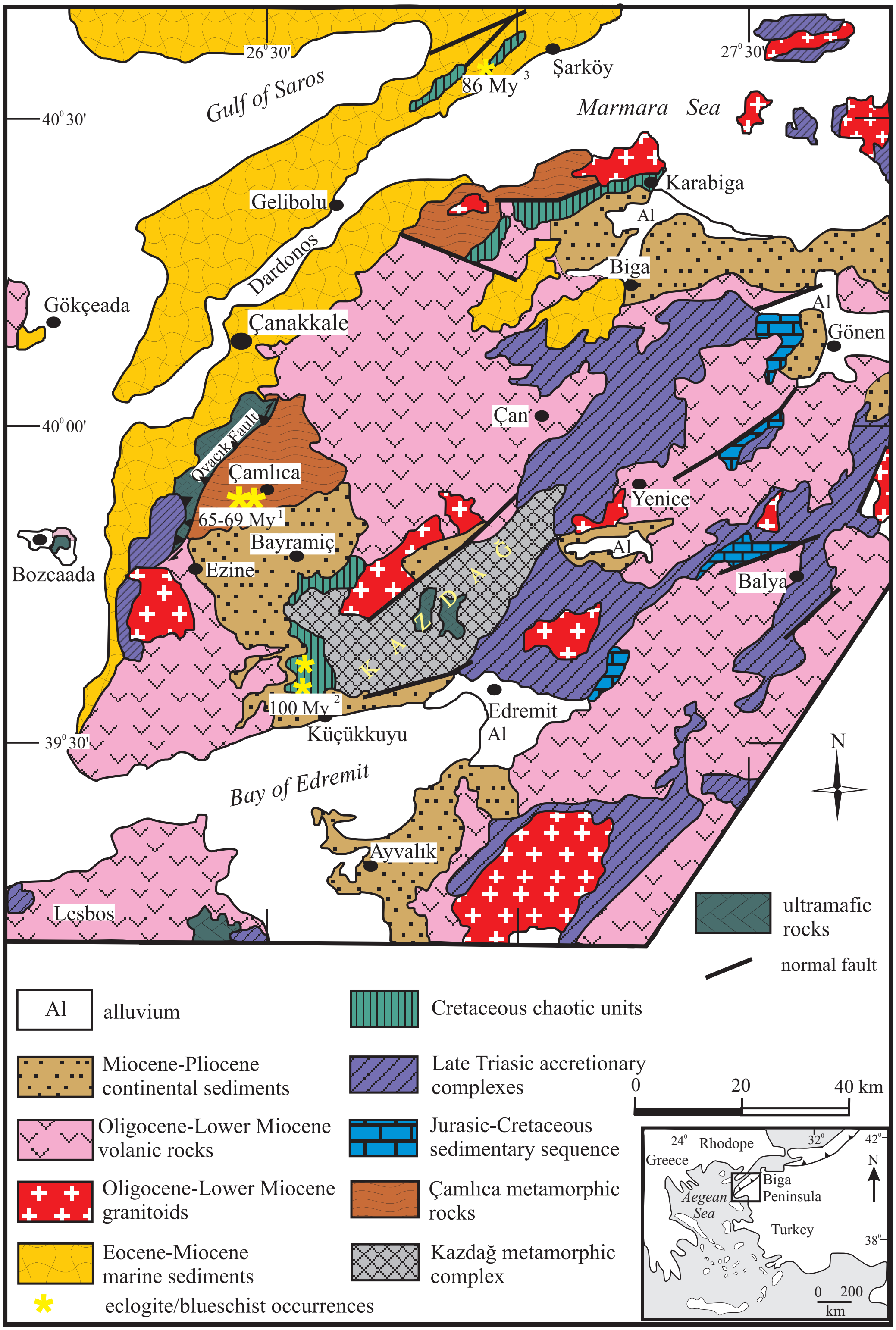

Figure 1. Generalized geological map of the Biga Peninsula modified from Okay & Satır (2000a). Inset map shows location of the Biga Peninsula. Sources of the isotopic ages of HP metamorphic rocks: 1– Okay & Satır (2000a); 2– Lips (1998), Okay & Satır (2000b); 3– Topuz *et al.* (2008).

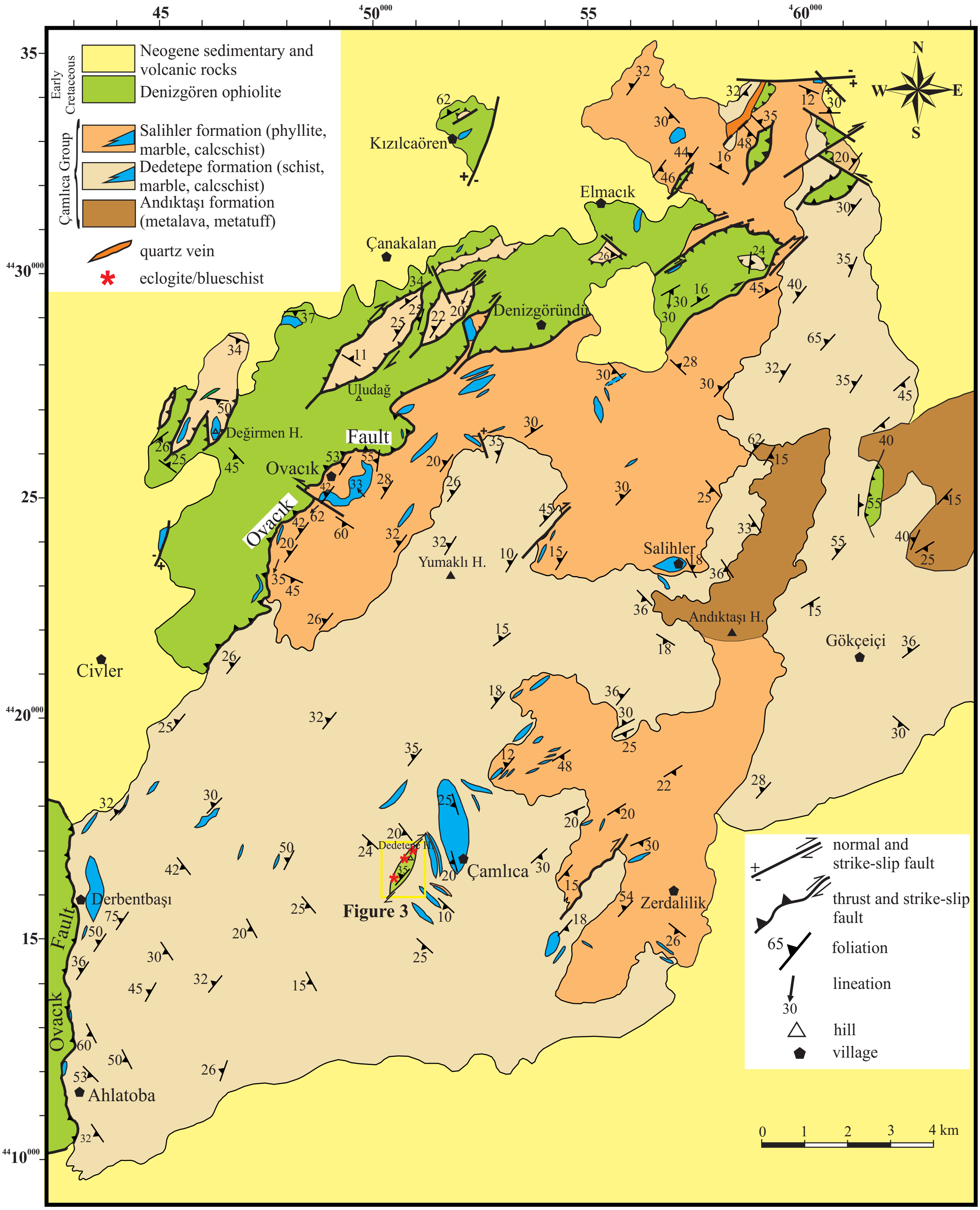

Figure 2. Geological map o f the Çamlıca metamorphics.

the Ovacık fault is a dextral transpressional strike-slip fault with a reverse component, which caused tectonic slicing. These tectonic slices consist of low-grade metamorphic rocks belonging to the Çamlıca metamorphics within the Denizgören ophiolite (Figure 2). The Çamlıca metamorphic association is subdivided into three formations. From base to top these are: (i) the Andıktaşı formation, comprising quartz + chlorite + epidote + albite + actinolite + calcite-bearing meta-lavas, and metatuff; (ii) the Dedetepe formation, which consists of garnet-muscovite schist, garnet-albite-chlorite schist, albite-epidote-chlorite schist, marble and calcschist; and (iii) the Salihler formation, mainly composed of phyllite, calcschist and marble intercalations. Eclogite and blueschist occur as lenses within a 2 km long, 500 m wide, quartz-mica schist slice in the Dedetepe formation (Figure 3). A high-grade association in these lenses comprises amphibolite, tremolite/actinolite schist and talc schist (Figure 4). Eclogite/blueschist lenses are elliptical, approximately 100 m long, weakly foliated, with heterogeneous textures. A few much larger eclogite/blueschists occur as large bodies several hundreds of m^2 in area. These lenses appear banded due to thin alternation of green omphacite-rich layers and blue glaucophane-rich layers. They are referred to as eclogite and blueschist, respectively. They are generally aligned parallel to the E–NE-trending quartz-mica schist. Rocks adjacent to the HP tectonic slices show no evidence of HP metamorphism but contain greenschist-facies assemblages. Late-stage quartz veins occur both within these slices and the Dedetepe greenschist-facies metamorphic rocks.

Structural and field evidence suggests that the late-stage shear zones associated with blueschist

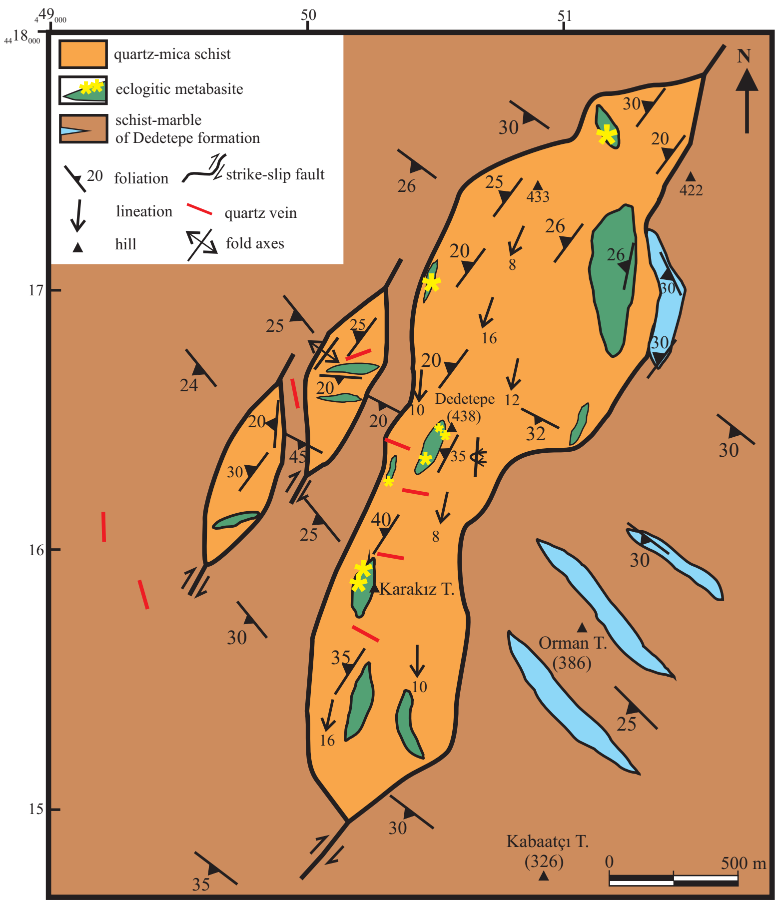

Figure 3. Geological map showing the eclogite-facies metamorphic slices in the Çamlıca metamorphics.

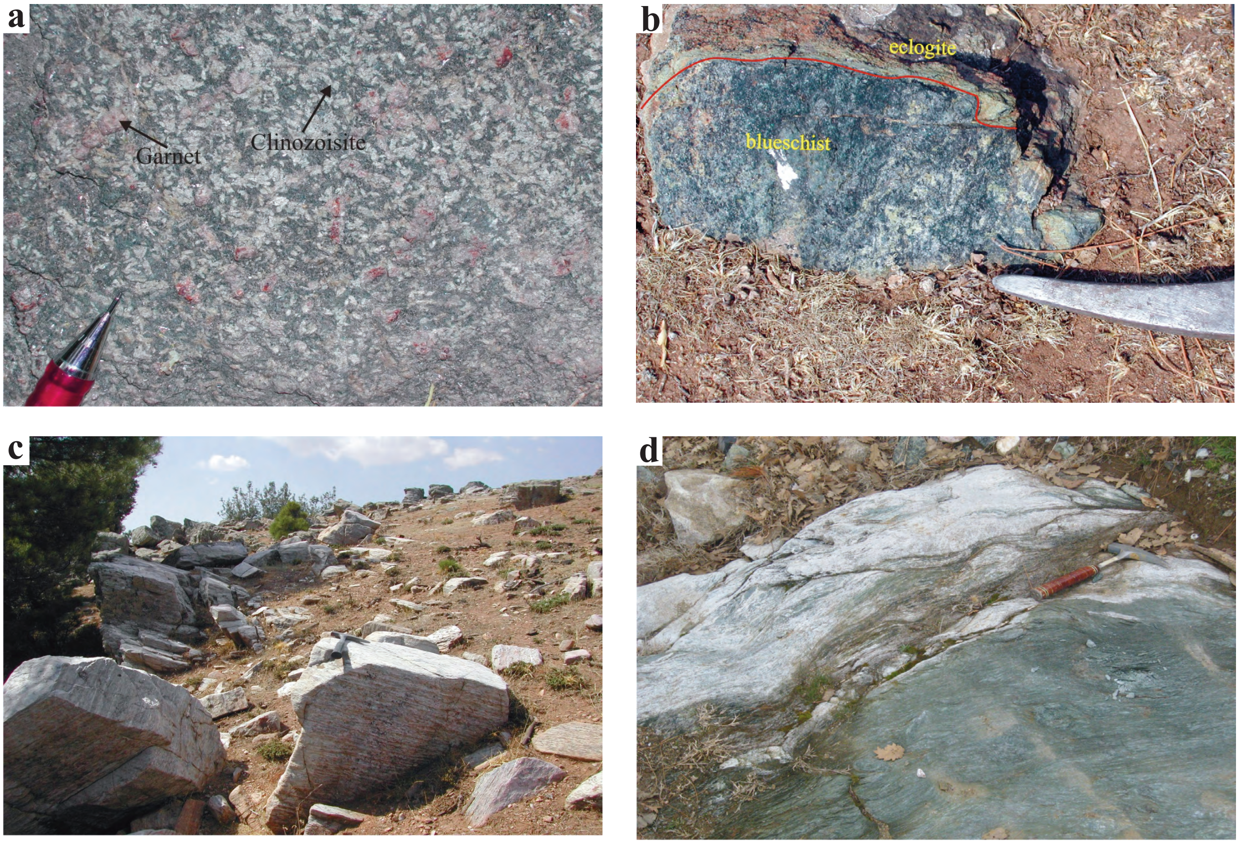

Figure 4. Photographs of rocks within the HP tectonic slice **(a)** amphibolite with relict magmatic texture, **(b)** eclogite/blueschist domain, **(c)** quartz-mica schist, **(d)** talc schist retrograded from the serpentinite along ductile–semi-brittle (?) strike-slip contact. The hammer head is 33 cm long.

assemblages (Figure 5) formed under ductile-semi-brittle (?) conditions during strike-slip displacement. This tectonic contact, a general relationship observed at multiple sites in the field, is deformed by a mesoscopic isoclinal fold. These Alpine high-pressure blueschist and eclogites were overprinted by greenschist-facies retrograde metamorphism, indicated by partial replacement of glaucophane by albite, chlorite, and tremolite/actinolite.

Petrography

The eclogites consist predominantly of omphacite + garnet + epidote + quartz + glaucophane ± phengite ± rutile (Figure 6a). However, eclogites retrogressed to blueschist-facies assemblages along late-stage shear zones are identified for the first time by petrographic and field observations (Figure 5). Euhedral, relatively large (0.2–0.8 cm) porphyroblasts of garnet are scattered through a fine-grained matrix, and contain inclusions of epidote, quartz, actinolite and rutile. The blueschists are fine-grained, with 0.5–2 cm long crystals of blue amphibole, and comprise garnet + glaucophane + epidote + chlorite ± phengite ± quartz with accessories, titanite + rutile + calcite (Figure 6b). Glaucophane is abundant along the shear zone. Phengite and epidote form elongated grains that define the foliation. Garnets contain inclusions of glaucophane, rutile, phengite and quartz. Chlorite is texturally late, indicative of breakdown, and replaces garnet and omphacite. Glaucophane crystals are rimmed and partially replaced by Ca-amphibole. Therefore they are inferred to be late minerals, not in equilibrium with the high-pressure phases. Glaucophane crystals are oriented due to shearing (Figure 5b). In these shear bands, omphacite is almost completely replaced by glaucophane. Quartz is not very abundant and widely shows undulose extinction. Most rutile grains are mantled by titanite.

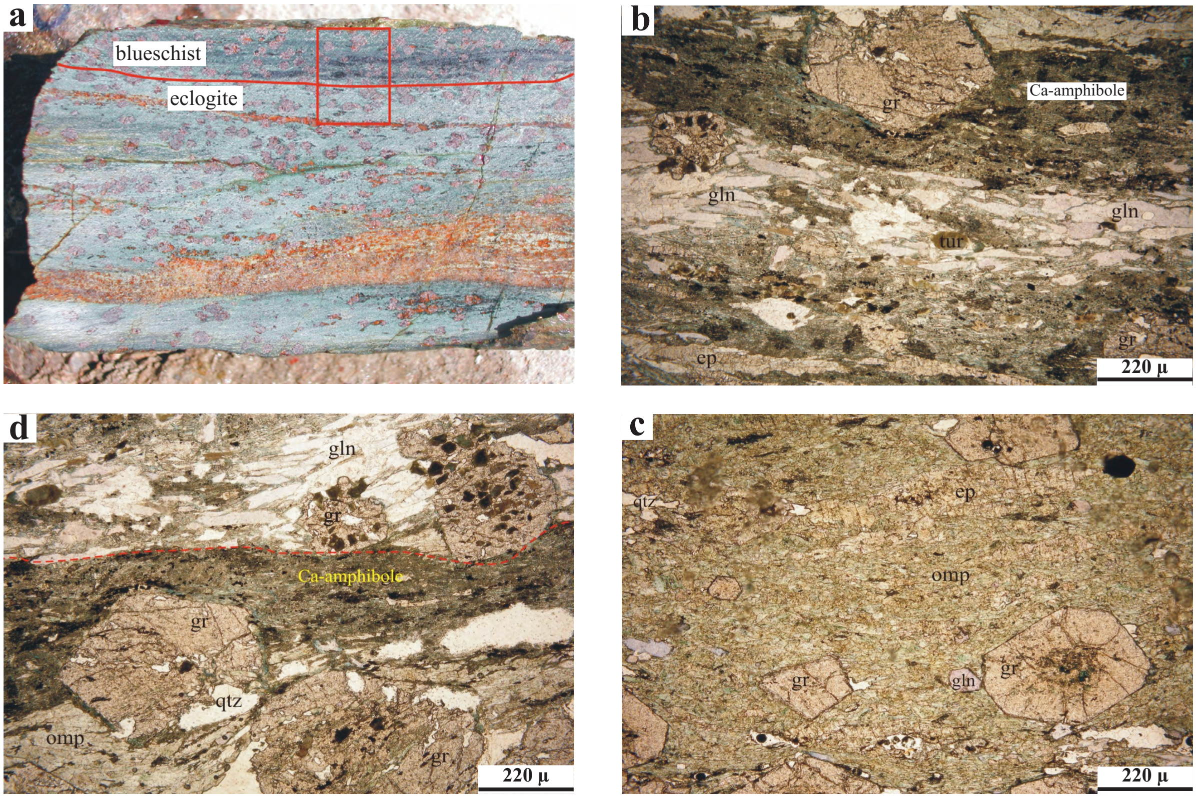

Figure 5. **(a)** Photograph of eclogite/blueschist domain in a late stage shear zone; **(b)** photomicrograph of blueschist domain, omphacite is replaced by glaucophane; **(c)** photomicrograph of eclogite domain; **(d)** photomicrograph showing the syn-kinematic transformation from eclogite to blueschist (plane light, gr– garnet, omp– omphacite, gln– glaucophane, ep– epidote, qtz: quartz).

The mineral assemblages of quartz-mica schists within the tectonic slice are made up of quartz + phengite + garnet + chlorite + piemontite. Quartz-mica schists are lithologically separated from the schist-marble intercalation of the Dedetepe formation. Schist-marble intercalations include the index minerals albite-garnet-epidote-chlorite, indicating greenschist-facies metamorphism. The quartz-mica schists always occur with eclogite/blueschist, serpentinite and amphibolites, unlike in the other formations of the Çamlıca metamorphics. High white mica Si contents show that quartz-mica schist within the tectonic slices experienced high-pressure metamorphism (Okay & Satır 2000a), and this supports our field and petrographic observations.

Based on petrographic investigations, observations of the index minerals of albite, garnet, epidote and chlorite in all three formations of the Çamlıca metamorphics indicate that they were subjected to a single-stage greenschist-facies metamorphism. Moreover, the albite-epidote paragenesis of schists exhibit MP/MT greenschist-facies conditions (Figure 7). Garnets are replaced by chlorite + epidote along rims and fractures.

Structural Analysis

Foliation planes in schists and marbles of the Dedetepe formation, around Dedetepe and Çamlıca, strike NW–SE, dipping 25–30° to the SW (Figure 8a, c). However, the foliation of the quartz-mica schists within the eclogite-facies metamorphic slice strikes NE–SW, and dips 20–40° to the NW (Figure 8b, d). This implies that the change in metamorphic grade marks a tectonic boundary. Evidence for a strike-slip system includes: (i) En-échelon array of eclogite/blueschist and amphibolite lenses in the tectonic slices. These overstepping features are oblique to

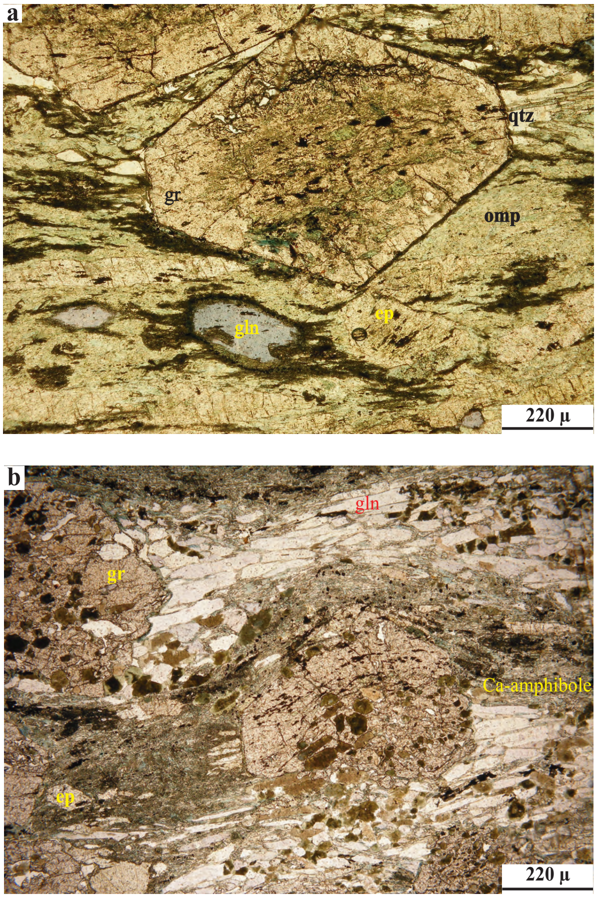

Figure 6. (a) Photomicrograph of the eclogite domain, garnets have inclusion of epidote-quartz-Ca amphibole. Glaucophane formed in an early crystallizing phase; **(b)** photomicrograph of blueschist. Glaucophane formed in a ductile shear zone during deformation (plain light, gr– garnet, omp– omphacite, gln– glaucophane, ep– epidote, phg– phengite, qtz– quartz, ttn– titanite/sphene).

the overall structural trend. (ii) A large number of isoclinal folds with axial (surfaces) planes parallel to foliation occur in the quartz-mica schist of the eclogite-facies metamorphic slices, and belong to the last deformation phase. These folds are probably related to regional NW–SE contraction during NE–SW extension (Figure 8c). This is regionally consistent with a NE–SW-oriented extensional regime in the southern Menderes Massif, Lycian Nappes and the Biga Peninsula (Walcott & White 1998; Beccaletto *et al.* 2007). Fold axes plunge 35° to the SW and there is a 45° angle between the E–W-trending eclogite/blueschist lenses and the fold axes. Northeast-trending anticlines are overturned to the northwest. (iii) Quartz-mica schists in the eclogite-facies metamorphic slice show N–NE-trending mineral lineations defined by quartz and mica. Within the HP/LT slices shear direction is roughly parallel to mineral lineation. However, lineation from the greenschist-facies metamorphism is seen east of Ovacık village and in metamorphic slices within the Denizgören ophiolite shown in Figure 2. Greenschist-facies metamorphic rocks show NE-trending mineral lineation defined by mica. Asymmetric boudinage of quartz in the quartz-mica schist indicates top to north-northwest shear senses. The contact, juxtaposing rocks that record very different metamorphic conditions, is strongly deformed. Along the contact tremolite/actinolite schists and talc schists, most probably retrograded from serpentinite, were observed (Figure 4). The talc schists exhibit macroscopic and textural similarities to serpentinite. (iv) Foliation planes in schists and

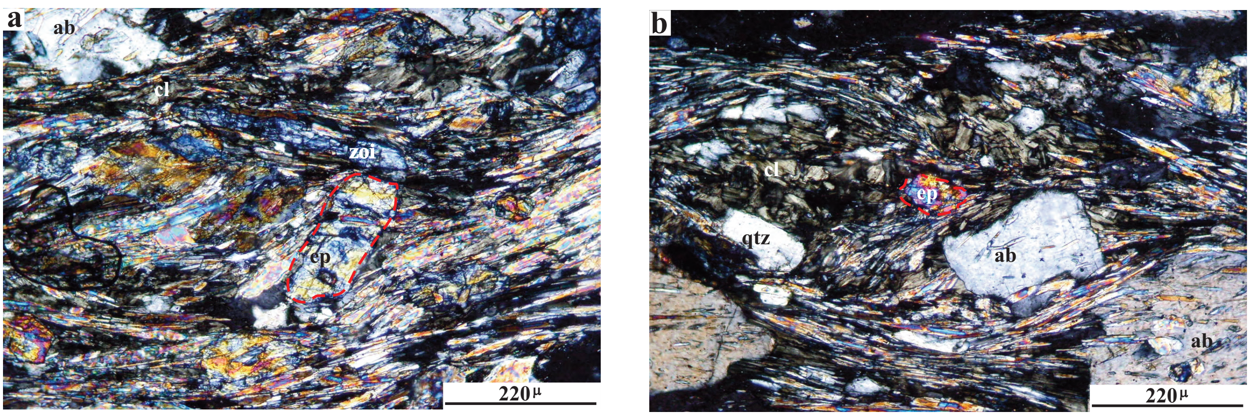

Figure 7. (a, b) Photomicrograph of greenschist-facies metamorphic rocks within the Dedetepe formation (cross light, ep– epidote, qtz– quartz, ab– albite, cl– chlorite, zoi– zoisite).

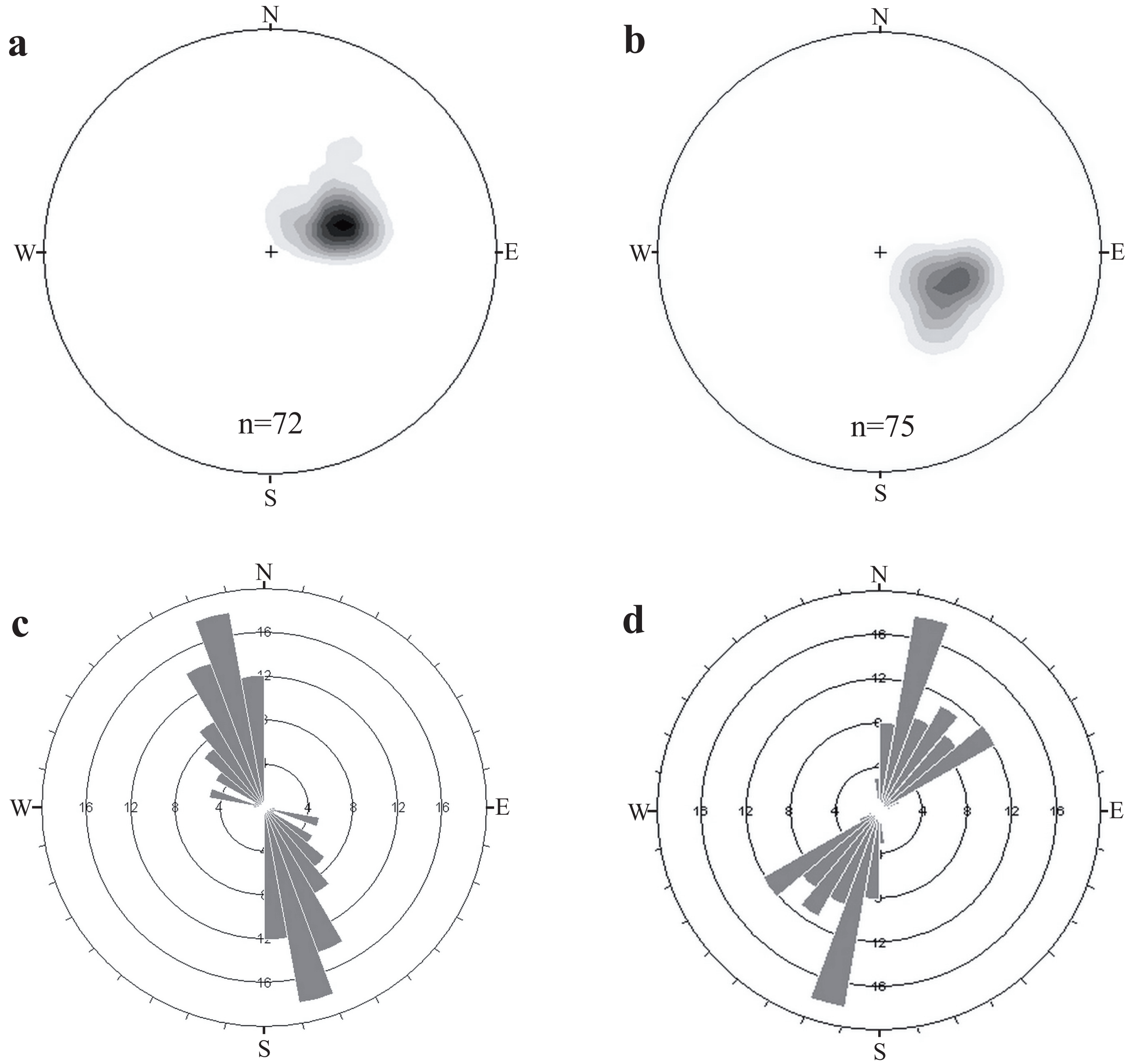

Figure 8. Equi-areal projection (lower hemisphere) of the main foliations **(a)** schists and marbles of the Dedetepe formation, around Dedetepe and Çamlıca, **(b)** high - grade metamorphic slices. In the contoured stereonet, the contours are at 4, 8, 12 and 16%, **(c)** rose diagram of trends in schists and marbles within the Dedetepe formation, **(d)** rose diagram of metabasite slices. NE–SW-trend is regionally consistent with trends in the Biga Peninsula.

marbles of the Dedetepe formation intersect at approximately 45° with foliation planes in the high-pressure metamorphic rocks. In other words, foliation planes of both units cross each other as a result of strike-slip tectonics. The contact of the marble lens in the northwestern part of the field (Figure 3) might have begun to rotate from south to north along the late stage shear zone. (v) Late-stage quartz veins trend NW–SE and indicate NE–SW extension. Although the Çamlıca host rocks record only a single-stage greenschist-facies metamorphism, the tectonic slices experienced eclogite-facies metamorphism. Field observations indicate that both these units with their highly different metamorphic grades were juxtaposed by a strike-slip shear zone. Consequently, the sense of shear in the HP metamorphic slice is dextral, as indicated by the arrangement of en-échelon eclogite/blueschist and amphibolite lenses, asymmetric boudinage, mesoscopic isoclinal folds and the alignment of quartz veins. Structural analysis suggests that an exotic metabasite block was sliced into fragments by strike-slip faults and emplaced by right-lateral strike-slip displacement into the Çamlıca metamorphics. The orientation of principal strain axes was determined from strain markers in quartz veins, asymmetric boudinage and folds, and used to constrain the strain ellipse. According to the strain ellipse, shortening takes place parallel to the short axis and folds develop perpendicular to this axis. Parallel to the long axis of the ellipse stretching occurs, while veins develop perpendicular to this axis (Figure 9).

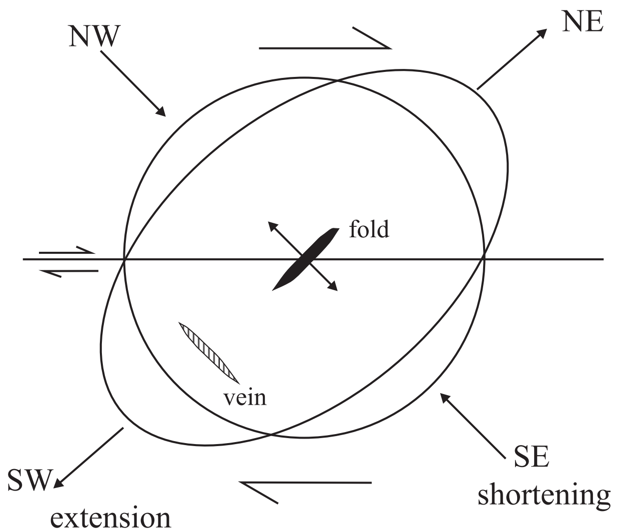

Figure 9. A detail of the strain ellipse indicating that folds form perpendicular to the shortening direction and veins form perpendicular to the extensional direction.

Discussion

Blueschist-facies metamorphism in the Biga Peninsula is described for the first time in this study. There are two generations of glaucophane. The first is related to blueschist layers developed from eclogite due to retrograde shearing. The second is glaucophane in stable coexistence with omphacite during eclogite-facies metamorphism. These new observations of blueschist-facies assemblages are important for understanding the metamorphic petrology and structural geology of the HP-LT rocks and for interpreting the tectonic evolution of this part of northwestern Turkey. The tectonic importance and tectonic setting of the Çamlıca metamorphics remain highly questionable. Şengör & Yılmaz (1981) regarded the ophiolitic mélange outcrops north of Şarköy as marking the location of the Intra-Pontide suture, which transects the centre of the Biga Peninsula and extends north to Marmara Island (Okay *et al.* 2010). It has been suggested that the high-pressure metamorphic rocks within the Çamlıca metamorphics are related to the Intra-Pontide Ocean (Okay & Satır 2000a), but field and petrographic data from this study do not support this conclusion. Eclogite/blueschist are reported from field, petrographic and structural observations along shear zones at several key localities, for example, the Franciscan Complex (Fossen & Tikoff 1998), the Sivrihisar Massif (Davis & Whitney 2006; Çetinkaplan *et al.* 2008), Tongcheng Massif, Eastern China (Lin *et al.* 2009), North-East Greenland Caledonides (Sartini-Rideout *et al.* 2006), and New Caledonia (Rawling & Lister 2002). In these localities, meso-structures and petrographic data related to HP metamorphic rocks similar to the HP tectonic slice within the Çamlıca metamorphics have been observed. Blueschists in NW Turkey are also found in southern Thrace as either exotic blocks in Middle Eocene sediments (Okay & Satır 2000a) or as an uplifted tectonic sliver of the pre-Eocene basement of southern Thrace (Topuz *et al.* 2008). They were transported into a Mid-Eocene flysch basin (Şentürk & Okay 1984; Okay & Tansel 1992) or transported along a transpressional segment of the North Anatolian Fault (Topuz *et al.* 2008), both of which differ in age from the Çamlıca metamorphics. Blueschist-facies metamorphism in southern Thrace occurred during the Late Cretaceous at a depth of 23–29 km, temperatures of 270–350 °C and a pressure of ~8 kbar (Topuz *et al.* 2008). The Çamlıca metamorphics are lithologically and structurally similar to the Kemer micaschist exposed on the northern part of the Biga Peninsula. Both units form a continuous metamorphic belt in the Biga Peninsula (Beccaletto *et al.* 2007). Moreover, the Kemer metamorphics include high-pressure mineral assemblages and their metamorphic conditions are constrained at a temperature of 550±50 °C and pressure of 8–14 kbar (Aygül *et al.* 2009). In terms of tectonic setting the Çamlıca eclogite/blueschists can be compared to eclogites in the Rhodope Massif (Okay & Satır 2000a). The Rhodope Massif comprises high-temperature eclogites within medium-grade continental crust material indicating that crustal thickening occurred as a result of continent-continent collision (Wawrzenitz & Mposkos 1997). However the eclogite/blueschists within the Çamlıca metamorphics are typically low-temperature eclogites. The age of metamorphism of high-pressure metamorphic rocks in the Çamlıca metamorphics is also different from the eclogites in the Rhodope Massif, which are not associated with an accretionary complex. Within the Çamlıca metamorphic, however, high-pressure metamorphic rocks may represent tectonic slices of an accretionary complex associated with a subduction zone. Thus, the Çamlıca metamorphics may not be part of the Rhodope Massif.

Although the eclogite assemblages are locally retrogressed to blueschist along shear zones, pristine assemblages are also preserved. Preservation of high-pressure–low-temperature metamorphic assemblages implies that part of the subducted oceanic crust separated from the descending slab and was rapidly exhumed. The association of the HP rocks with quartz-mica schists and talc schists is consistent with metamorphism of the rocks in a subduction-accretionary complex.

In previous studies, it was suggested that the Çamlıca metamorphics as a whole, including mica schists and metabasites, have undergone regional eclogite-facies metamorphism (Okay & Satır 2000a). Field and petrographic observations of this study differ from those described for this locality by Okay & Satır (2000a). This study concludes that the host Çamlıca rocks record only a single-stage greenschist-facies metamorphism and were underwent post-metamorphic juxtaposition with the high-pressure rocks along ductile-semi-brittle (?) strike-slip faults. These eclogite/blueschists appear banded due to thin alternation of green omphacite-rich layers and blue glaucophane-rich layers at hand specimen and outcrop scales (Figure 4b). The banding must have formed syn-kinematically along a shear zone. Hence, eclogites/blueschists occur as tectonic slices. The present outcrop of the high-pressure metamorphic slice (eclogite/blueschist) is related to a strike-slip shear zone. Strike-slip is an important mechanism for emplacement of high-pressure metamorphic slices into lower-pressure metamorphic rocks, but eclogite/blueschists were not raised from their place of formation by a strike-slip fault. After formation and uplift they were emplaced as tectonic slices into the mica schist of the Dedetepe formation together with quartz-mica schists, amphibolite and serpentinite.

The Çamlıca metamorphics must have been exhumed before the Eocene, since they are unconformably overlain by Eocene volcanics (Ercan *et al.* 1995) and lower Eocene sediments (Siyako *et al.* 1989) west of Karabiga. This gives an upper limit for the amalgamation of different metamorphic associations by strike-slip tectonics. The age of the eclogite-facies metamorphism is Late Cretaceous (65–69 Ma, Rb/Sr white mica, Okay & Satır 2000a), which gives a lower limit for strike-slip tectonic emplacement. Thus, emplacement of the HP tectonic slices into the Çamlıca metamorphics occurred between the Late Cretaceous and the Early Eocene.

Conclusions

The Çamlıca metamorphics, situated in the westernmost part of the Biga Peninsula, contain high-pressure metamorphic slices (eclogite/blueschist). Field observations and petrographic analysis in this study document the presence of blueschist facies for the first time, in addition to eclogite-facies metamorphism on the Biga Peninsula. The Çamlıca metamorphics themselves record only greenschist-facies metamorphism, but the high-grade metamorphic slices record HP metamorphism at the end of the Late Cretaceous. The eclogite/blueschist rocks formed in a subduction-accretionary complex. In contrast to previous interpretations, the Çamlıca metamorphics did not experience high-pressure metamorphism. Structural analyses and field observations suggest that eclogite-facies metamorphic slices were emplaced by right-lateral strike-slip tectonics into the medium-grade Çamlıca metamorphics and were strongly overprinted by the same greenschist-facies metamorphism.

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