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Geochemical and geochronological evidence for Early Triassic calc-alkaline magmatism in the Menderes Massif, western Turkey

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Abstract Pan-African basement rocks and a Paleozoic cover series, which were intruded by the protoliths of leucocratic orthogneisses, have been recognized in the Menderes Massif, located in the western part of the Alpine orogenic belt of Turkey. This geochemical and geochronological study focuses on the evolution of the Menderes Massif at the end of Paleozoic time. Geochemical data suggest that the crustally derived leucocratic orthogneisses have chemical composition typical of calc-alkaline and S-type granite. Zircon grains which are euhedral with typical igneous morphologies were dated by the $^{207}\text{Pb}/^{206}\text{Pb}$ evaporation method. Single-zircon dating of three samples yielded mean $^{207}\text{Pb}/^{206}\text{Pb}$ ages of 246±5, 241±5 and 235±6 Ma. These ages are interpreted as the time of protolith emplacement in Triassic. Geological and geochronological data suggest that leucocratic granites were emplaced in a period following a metamorphic event related to the closure of the Paleo-Tethys. The leucocratic granites were metamorphosed during the Alpine orogenesis and transformed into orthogneisses. The similar Triassic magmatic event at 233±2 Ma was also occurred, using single-zircon evaporation method, from granitic gneisses which rest upon the migmatites with tectonic contacts in Naros, Cycladic complex. This indicates that the Menderes Massif and Cycladic complex had a common pre-Early Triassic magmatic evolution.

Keywords Menderes Massif · Cimmerian · Paleo-Tethys · Pb/Pb zircon dating · Calc-alkaline · Leucocratic orthogneiss

Introduction

The Menderes Massif occupies a vast area of the western Anatolia, and is tectonically overlain by the Bornova Flysch Zone of olistostromal character in the northwest, the Afyon Zone consisting of low-grade metapelite and Metacarbonate in the north, and the Lycian Nappes comprising shale and carbonate sediments and thick ophiolitic slices, in the south (Sengör and Yilmaz 1981; Dora et al. 1995). The Menderes Massif is divided into three submassifs by E/W-oriented Late Miocene–Pliocene graben systems. These submassifs are, from north to south, the Demirci-Gördes, Ödemis-Kiraz and Çine submassifs (Fig. 1). In early studies, it was accepted that the Menderes Massif had a simple internal structure, made up of a Precambrian basement and an Early Paleozoic–Early Tertiary cover series (Schúling 1962). Recent studies show that this massif does not have a simple structure, but is made up from a nappe stack related to the Alpine compressional tectonics (Konak et al. 1994; Partzsch et al. 1998; Gessner et al. 1998).

Despite its complex tectonic structure, the Menderes Massif can be separated into two main rock associations (Dora et al. 1995): Pan-African basement rocks and cover series. The Pan-African basement comprises partly migmatized Late Proterozoic clastic metasediments, i.e. paragneisses and micaschist, which were intruded by the protoliths of Precambrian eclogitic gabbros and post-Pan-African orthogneisses. The basement rocks were subjected to polyphase metamorphism at granulite-, eclogite- and amphibolite-facies conditions which were related to Pan-African orogenesis at the Precambrian–Cambrian boundary (Dora et al. 1995; Oberhänsli et al. 1997; Candan and Dora...
Fig. 1  

a Tectonic map of the western Turkey and surrounding regions shows major continental blocks and tectonic zones (modified after Okay et al. 1996). b Simplified geological map of the Menderes Massif and distribution of Early Triassic leucocratic orthogneisses (modified after Candan 1994).