

K-Ar dating, whole-rock and Sr-Nd isotope geochemistry of calc-alkaline volcanic rocks around the Gümüşhane area: implications for post-collisional volcanism in the Eastern Pontides, Northeast Turkey

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Abstract Volcanic rocks from the Gümüşhane area in the southern part of the Eastern Pontides (NE Turkey) consist mainly of andesitic lava flows associated with tuffs, and rare basaltic dykes. The K-Ar whole-rock dating of these rocks range from 37.62 ± 3.33 Ma (Middle Eocene) to 30.02 ± 2.84 Ma (Early Oligocene) for the andesitic lava flows, but are 15.80 ± 1.71 Ma (Middle Miocene) for the basaltic dykes. Petrochemically, the volcanic rocks are dominantly medium-K calc-alkaline in composition and show enrichment of large ion lithophile elements, as well as depletion of high field strength elements, thus revealing that volcanic rocks evolved from a parental magmas derived from an enriched mantle source. Chondrite-normalized rare-earth element patterns of the volcanic rocks are concave upwards with low- to-medium enrichment ($La_{CN}/Lu_{CN}=3.39$ to 12.56), thereby revealing clinopyroxene- and hornblende-dominated fractionations for andesitic-basaltic rocks and tuffs, respectively. The volcanic rocks have low initial $^{87}Sr/^{86}Sr$ ratios (0.70464 to 0.70494) and $\epsilon Nd(t)$ values (+1.11 to +3.08), with Nd-model ages (T_{DM}) of 0.68 to 1.02 Ga, suggesting an

enriched lithospheric mantle source of Proterozoic age. Trace element and isotopic data, as well as the modelling results, show that fractional crystallization and minor assimilation played an important role in the evolution of the volcanic rocks studied. The Eocene to Miocene volcanism in the region has resulted from lithospheric delamination and the associated convective thinning of the mantle, which led to the partial melting of the subduction-metasomatized lithospheric mantle.

Introduction

The Eastern Pontides spread inland from the Black Sea coast to about 200 km south along the İzmir-Ankara-Erzincan suture (IAES; Fig. 1a). This region is a paleo-island arc associated with pre-subduction rifting and post-subduction magmatism (Şengör and Yılmaz 1981; Okay and Tüysüz 1999). A collision between the Tauride-Anatolide Platform (TAP) and Eurasian Plate (EP), as well as the closure of the Neo-Tethyan Ocean, caused a continent-continent collision during the Late Cretaceous to Early Eocene. Therefore, Paleogene and Neogene post-collisional volcanisms were intensely developed in the Eastern Pontides, thereby providing an excellent example of the orogenic magmatism in the Alpine belt. The volcanic rocks in the Eastern Pontides are formed during three main volcanic episodes, namely, the Jurassic, Late Cretaceous, and Middle Eocene periods, the timing of which remains poorly constrained (Adamia et al. 1977; Tokel 1977; Şengör and Yılmaz 1981; Kazmin et al. 1986; Robinson et al. 1995; Genç and Yılmaz 1995; Çamur et al. 1996; Yılmaz et al. 1997; Okay and Şahintürk 1997; Arslan et al. 1997; Şen et al. 1998; Arslan and Aliyazıcıoğlu 2001; Aslan 2010).

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