Lithos 192–195 (2014) 271–290

Contents lists available at ScienceDirect

Lithos

journal homepage: www.elsevier.com/locate/lithos

LA-ICP MS zircon dating, whole-rock and Sr–Nd–Pb–O isotope geochemistry of the Camiboğazı pluton, Eastern Pontides, NE Turkey: Implications for lithospheric mantle and lower crustal sources in arc-related I-type magmatism

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ARTICLE INFO

Article history:
Received 16 April 2013
Accepted 15 February 2014
Available online 27 February 2014

Keywords:
Camiboğazı pluton
Eastern Pontides
I-type
Late Cretaceous
Sr–Nd–Pb–O isotope
U–Pb zircon dating

ABSTRACT

Late Cretaceous I-type plutons are widespread in the Eastern Pontides, NE Turkey. The studied Camiboğazı pluton is a composite pluton consisting of diorite, tonalite, monzodiorite, monzonite, quartz monzonite, granite, and mafic microgranular enclaves (MMEs). Laser ablation ICP-MS U–Pb dating of zircon yielded crystallization ages of 76.21 ± 0.79 Ma, 75.65 ± 0.50 Ma, 75.04 ± 0.83 Ma, and 74.73 ± 0.86 Ma for diorite, monzodiorite, monzonite, and granite, respectively. The rocks of the pluton have I-type, high-K to shoshonitic and metaluminous character, displaying whole-rock geochemical features of arc-related granites. They are enriched in large-ion lithophile and light rare-earth elements, and depleted in high-field-strength elements. Major element variations can be attributed to fractionation of plagioclase, clinopyroxene, hornblende, and Fe–Ti oxides. The rocks show considerable variation in $^{87}Sr/^{86}Sr_{(i)}$ (0.70498 to 0.70622), $\varepsilon Nd_{(i)}$ (−2.79 to −0.36), $\delta^{18}O$ values (+6.3 to +11.4) and Nd model ages (T_{DM}) (0.81 Ga to 1.26 Ga). Besides, they have ($^{206}Pb/^{204}Pb$) = 18.44–19.09, ($^{207}Pb/^{204}Pb$) = 15.64–15.69, and ($^{208}Pb/^{204}Pb$) = 38.37–38.89. Although isotope signatures of the mafic microgranular enclaves (MMEs) ($^{87}Sr/^{86}Sr_{(i)}$ = 0.70551 to 0.70622; $\varepsilon Nd_{(i)}$ = −2.9 to −1.23; $\delta^{18}O$ = +8.3 to +9.7) are largely similar to the host rocks, MMEs are characterized by relatively high Mg-numbers (32–36), low contents of SiO_2 (52–56 wt.%) and low ASI (0.7–0.9). Estimated crystallization temperatures for the rocks of the pluton range from 735 ± 58 °C to 844 ± 24 °C and a shallow intrusion depth (<10 km) is estimated from Al-in-hornblende thermobarometry. Whole-rock geochemical and isotopic data suggest magma generation by dehydration melting of an amphibolite-type lower crustal component with additional input of a subcontinental lithospheric mantle component. Furthermore, Sr–Nd isotope mixing model reveals ~30% to 40% lower crustal magma contribution to the mantle component.

1. Introduction

Granitoids are present in almost every continental geological setting. Their origin is crucial in understanding the lithospheric evolution and the geodynamic processes operating during the Earth's history. Granitoids of significant volume occur in areas where the continental crust has been thickened by orogeny, either during subduction or collision. The genetic classification of granitoids is based on the amount of crustal, mantle, or mixed components involved during their petrogenesis (Altherr et al., 2000; Barbarin and Didier, 1992; Chappell, 1999; Chappell and White, 1992; Chen et al., 2002).

The Eastern Pontides in NE Turkey (Fig. 1a and b) represents an east–west trending Late Mesozoic–Early Tertiary magmatic belt. This belt is considered as a continental arc developed in response to the subduction of the northern branch of the Neo-Tethyan oceanic crust beneath the Eurasian plate (Okay and Şahintürk, 1997; Şengör and Yılmaz, 1981; Yılmaz et al., 1997) and the subsequent collision between the Pontides and the Tauride–Anatolide platforms. However, the timing of the collision remains controversial (e.g., Okay and Şahintürk, 1997; Robinson et al., 1995; Şengör et al., 2003). Okay et al. (1997) suggested that the collision should date back to Late Paleocene or Early Eocene, based on field relationships and age record of granitoids. The crystallization ages of the plutons range from the Cretaceous–Paleocene (Boztuğ and Harlavan, 2008; Karslı et al., 2010a; Kaygusuz and Aydınçakır, 2011; Kaygusuz et al., 2008, 2012a) to the Eocene periods (Arslan and

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http://dx.doi.org/10.1016/j.lithos.2014.02.014
0024-4937/