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Geochronology and Geochemistry of Oligocene Dikes at Yanıklı, Artvin District, Eastern Pontides, NE Turkey: New Regional Implications

SAFAK UTKU SONMEZ[1], ROBERT MORITZ[1], SERDAR KESKIN[2], FRANCOIS TURLIN[1], ALEXEY ULIANOV[3], MASSIMO CHIARADIA[1] AND ÜMIT AYDIN[2]

[1]University of Geneva

[2]General Directorate of Mineral Research and Exploration of Turkey, Department of Mineral Research and Exploration, Ankara 06520, Turkey

[3]University of Lausanne

Presenting Author: safak.soenmez@unige.ch

The Artvin District is located in the Eastern Pontides, and it consists of discrete magmatic episodes recording the closure of the NeoTethys Ocean and the subsequent collision to post-collision evolution throughout the Late Cretaceous to Eocene. Rare occurrences of post-collision Oligocene magmatic rocks have also been reported in the Artvin District, but their petrogenesis remains poorly constrained, mainly due to a lack of outcrops. This study focuses on zircon U-Pb LA-ICPMS geochronology and whole-rock geochemistry of new Oligocene dike exposures recognized in the Yanıklı prospect within the Artvin district. Our study provides a better understanding of the geodynamic evolution of the Eastern Pontides during the Cenozoic.

The Oligocene dike swarms at Yanıklı can be divided into three types, namely the ODike-1, ODike-2 and ODike-3 types. The ODike-1, dated at 31.04±0.19Ma, presents a non-adakitic signature, whereas, the ODike-2 dated at 29.73±0.31Ma and 31.05±0.2Ma and ODike-3 units dated at 29.21±0.31 Ma have an adakite-like composition. Enrichments in Th, U, Nb, Ta and P, and Eu and Ti depletions are well-pronounced in the ODike-1. The adakite-like dikes have SiO_2 <60 wt% and MgO >2.5 wt%, thus they can be considered as low silica adakites. The Th/La, Nb/La, and U/Nb ratios increase with SiO_2 concentrations, and indicate fractional crystallization as the main melt evolution mechanism accompanied by crustal contamination for all Oligocene dikes. $^{143}Nd/^{144}Nd_i$ and $^{87}Sr/^{86}Sr_i$ vs. SiO_2 also indicate crustal assimilation for the ODike-1 and ODike-3. Moreover, $^{143}Nd/^{144}Nd_i$ vs. $^{87}Sr/^{86}Sr_i$ ratios of the ODike-1 and ODike-3 plot between the chondritic uniform reservoir (CHUR) and the depleted mantle (DM) field, which is interpreted as evidence for Oligocene asthenospheric mantle upwelling. In conclusion, the petrogenesis of the Yanıklı Oligocene non-adakitic and adakite-like dikes are attributed to fractional crystallization of magmas produced during delamination of the lower crust.

The exact petrogenetic process is still controversial due to limited studies of Oligocene magmatism in the Eastern Pontides. Nevertheless, we suggest that local tectonic extension together with asthenospheric mantle upwelling following crustal delamination, in a post-collision setting, can explain the petrogenesis of the local Oligocene dike swarms in the Yanıklı prospect.