

Compositional change of granitoids from Eastern Pontides Orogenic Belt (NE Turkey) at ca. 84 Ma: Response to slab rollback of the Black Sea

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Magma generation and evolution is a natural consequence of mantle dynamics and crust-mantle interaction. As a result, changes of magma compositions in time and space can be used, in turn, to infer these deep processes. In this paper we report new zircon U-Pb age and Hf isotope, whole-rock major and trace element, and Nd isotope data for the granitoids from Kürtün in Eastern Pontides. These data, together with the data in the literature, reveal the occurrence of magma compositional variations at ca. 84 Ma in the region, providing new insights into the mantle dynamics responsible for the generation of the extensive Late Cretaceous felsic magmatism in Eastern Pontides Orogenic Belt (NE Turkey) (Eyuboglu et al., 2015). Group I samples ($\text{SiO}_2 = 77\text{-}62$ wt.%) were concentrated in 91-86 Ma and are characterized by their low CaO (1.6-1.5 wt.%) and Th (8.2-3.0 ppm) contents and low $\text{K}_2\text{O}/\text{Na}_2\text{O}$ (0.7-0.1) and Th/La (0.4-0.2) ratios. Group II samples ($\text{SiO}_2 = 71\text{-}63$ wt.%) were concentrated in 82-72 Ma and include high concentrations of CaO (5.2-3.0 wt.%) and Th (29.6-14.3), high $\text{K}_2\text{O}/\text{Na}_2\text{O}$ (1.5-1.1) and varying Th/La (1.0-0.5) ratios. Group I samples have positive zircon $e_{\text{Hf}}(t)$ (+9.6 to +7.6) and whole-rock $e_{\text{Nd}}(t)$ (+3.5 to +2.5), significantly differing from those of Group II samples with $e_{\text{Hf}}(t)$ of +1.9 to -1.5 and whole-rock $e_{\text{Nd}}(t)$ of -3.6 to -3.8. Modeling results indicate that the Nd-Hf isotopic compositions of Group I and II samples can be interpreted as having derived from partial melting of the low-K amphibolite within the juvenile lower crust beneath the Eastern Pontides Orogenic Belt that incorporated into 15-20% and 70-75% enriched components from the basement rocks represented by the Carboniferous granites exposed in the region, respectively. In combination with the geological observations that indicate the occurrence of regional thermal subsidence (Bektaş et al., 1999) and extensional structure (Bektaş et al., 1999, 2001) during the Campanian (83.6-72.1 Ma), the coeval intense magmatism represented by Group II samples along the Eastern Pontides Orogenic Belt was linked with the enhanced melting of the juvenile lower crust due to the upwelling of hot asthenosphere material in an extensional regime. In such a case, the enhanced incorporation of basement-derived melts induced by the extensive melting of the juvenile lower crust would result in the changes of magmatic compositions from Group I to Group II. Considering the southward decrease in zircon $e_{\text{Hf}}(t)$ documented by the Cretaceous granitoids from the northern part of the Eastern Pontides Orogenic Belt, we tentatively suggest that the Group I and II samples may be associated with the southward subduction and subsequent slab rollback of the Black Sea seafloor, respectively. However, we address that such slab rollback hypothesis remains to be verified by future work using the information from the spatial and temporal migration of the Cretaceous magmatism and the origin of coeval mafic rocks.

References

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