Petrogenesis and geodynamic significance of the early Eocene quartz diorite porphyries from the eastern Sakarya Zone, NE Turkey

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Although the presence of Latest Cretaceous intrusives (~70 Ma) and the early Eocene adakitic magmatic rocks (~57-50 Ma) in the eastern Sakarya Zone are well-known, the early Eocene non-adakitic rocks are very limited and have not been studied in terms of tectono-magmatic evolution. We described a small outcrop of non-adakitic quartz diorite porphyry in Kov area of the Gümüşhane from NE Turkey of which the genesis is significant in evaluating the syn- to post-collision-related magmatism. The LA-ICP-MS zircon U-Pb dating reveal that the Kov quartz diorite porphyries formed at ca. 50 Ma, coeval with adakitic rocks, ~20 Ma later than the slab roll-back-related intrusive rocks. The Kov porphyries are calc-alkaline in composition and enriched in large ion lithophile elements (LILEs), light rare earth elements (LREEs) and depleted in high field strength elements (HFSEs; e.g., Nb, Ta, Ti), with significant negative anomalies at Nb, Ta, and Ti but positive anomalies at Th, U, and Pb. Isotopic compositions of the samples show limited range of variation and slight enrichment of $^{87}\text{Sr}/^{86}\text{Sr}$ (0.70489 to 0.70555), $e_{\text{Nd}}$ (-1.4 to -1.2) with $T_{DM}$ of 1.11 to 1.61 Ga. Pb isotopic ratios of the samples point to an enriched mantle source. They probably were crystallized from the melt that originated by low-degree partial melting (~1-2%) of an EMII-type spinel-facies subcontinental lithospheric mantle (SCLM), followed by the fractionation of clinopyroxene with insignificant crustal assimilation. The SCLM was metasomatically enriched and the metasomatic agent was likely H2O-rich fluids rather than sediments released from subducting oceanic crust during the Late Cretaceous closure of the Neotethyan oceanic lithosphere.

In conjunction with the geological background and previous data, we envisage that generation of the Kov porphyries is resulted from a slab break-off event that caused ascending or infiltration of hot asthenosphere triggering mantle melting. Such sporadic occurrences of the porphyries, with coeval adakitic rocks in the Sakarya Zone are likely associated with the onset of extensional tectonics due to the earlier stage of slab break-off along the region during early Eocene period.

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