The Early Mesozoic Tectonothermal Events in the Eastern Sakarya Zone, NETurkey

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The early Mesozoic was a critical era for the geodynamic evolution of the Sakarya Zone, NE Turkey. Here, we present new in situ zircon U-Pb ages and Lu-Hf isotope data, whole-rock Sr-Nd isotopes, and mineral chemistry and geochemistry data of calc-alkaline lamprophyres and gabbroic intrusive rocks to better understand the magmatic processes during this period in the region. Hornblende $^{40}Ar/^{39}Ar$ and LA-ICP-MS zircon U-Pb ages yielded between 216 and 177Ma. The late Triassic lamprophyres and early Jurassic gabbroic samples belong to the high-K calc-alkaline and calc-alkaline series, respectively. They are slightly enriched in LILEs and LREEs and depleted in HFSEs. Gabbroic rocks have a depleted Sr-Nd isotopic composition whereas lamprophyres show an enriched isotopic signature. In situ zircon analyses show that both group ofrocks have positive $\varepsilon_{Hf}(t)$ values (4.6 to 13.5) and single-stage Hf model ages (T_{DM1}=0.30 to 0.65 Ga). Geochemical signature and Sr-Nd-Hf isotopic composition of all the samples reveal that the magma of the studied rocks was formed by the partial melting of a depleted mantle wedge metasomatized by slab-derived fluids for the gabbroic rocks and an enriched mantle for the lamprophyres. Trace-element modeling suggests that the primary magma of all the rocks was generated by a low and variable degree of partial melting (~1-10%) of a lithospheric mantle wedge consisting of phlogopite- and spinel-bearing lherzolite. Heat to melt the mantle material was supplied by the ascendance of a hot asthenosphere triggered by the roll-back of the oceanic lithosphere. Taking into account all data, we propose a slab roll-back model; this model suggests that the intrusives originated in a back-arc extensional environment associated with the southward subduction of the Paleo-Tethyan oceanic lithosphere during the early Jurassic period. Such an extensional event led to the opening of the northern branch of the Neotethys as a back-arc basin. Consequently, we conclude that the intrusives was related to intensive extension tectonic, which peaked during the early Jurassic in response to the roll-back of Paleo-Tethyan oceanic slab in the final stage of oceanic closure.

This work was supported by TUBITAK 112Y103 project.