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U-Th and REE enrichments in post-collisional potassic magmas: tracing the heterogeneous mantle

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Oligo-Miocene post-collisional magmatism in Western Anatolia produced widespread calk-alkaline to transitional magma series, characterized by strong LILE and LREE enrichments, HFSE depletions, and a spectrum of radiogenic Sr and Nd isotope compositions. These features suggest that the primitive melts were sourced from a lithospheric mantle modified by subducted slab-derived materials.

The Ezine-Ayvacık magmatic system (EAms) stands out among coeval and cogenetic systems based on appreciable U (7–108 ppm), Th 31–297 ppm) and REE enrichment. It consists of radioactive plutonic, hypabyssal and volcanic rocks. The mafic end members include foid-bearing phonolitic dykes and a nepheline monzogabro stock (SiO_2: 47–53 wt.%, CaO: 5–11 wt.%, K_2O/Na_2O: 1.4–3.3, Mg#: 46-57) with elevated U (5.7–34.3 ppm), Th (21.5–114 ppm) and ΣREE (344–482 ppm).

The U-Pb geochronology of EAms magmatic accessory phases (zircon, apatite, sphene, uranothorite) indicates simultaneous crystallization of the composite pluton at c. 21–22 Ma. Zircon $\delta^{18}O$ values are homogeneous (+5.3 to +5.8 ‰ relative to SMOW). Zircon εHf_t values range from -1.2 to -3.3 in a phonolitic dyke, -2.2 and -4.5 in monzonite and -2.8 and -4.1 in a dioritic enclave. In combination, this suggests negligible crustal contamination and a moderately enriched mantle source. Elevated trace element abundances in primitive rocks were likely inherited from mantle melts that were in equilibrium with phlogopite + pargasite + dolomite/magnesite/calcite.