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Geochemical and Geochronological Characterization of the Early-Middle Eocene Magmatism and Related Epithermal Systems of the Eastern Pontides, Turkey

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The eastern Turkish Pontides is characterized by E-W–trending tectonomagmatic domains developed due to northward subduction of the Tethyan oceanic crust beneath the Eurasian plate. The Eocene magmatism in the eastern Pontides, a favorable host for epithermal systems, appears to be associated with postcollisional events. The aims of this study are to characterize geochemical and geochronological features of the Eocene magmatism in the eastern Pontides and to link them to the regional variability of epithermal mineralization. The epithermal systems examined in this study are aligned or controlled mainly by normal faults and occasionally by strike-slip to oblique-slip faults striking in N20-30W, N30-40W, N50-70W, and E-W directions. These structures may well control either the emplacement of magmatic rocks or silicification associated with gold mineralization. They locally act as weakness zones through which clay alteration and postmineral calcite and/or barite veins and iron oxide phases are also observed. High- (HS), intermediate- (IS), and low-sulfidation (LS) epithermal systems of the eastern Pontides are hosted by (i) porphyritic volcanic rocks with intermediate composition (andesite, trachyandesite, basaltic andesite, and basaltic trachyandesite), (ii) intermediate to felsic, alkaline to subalkaline plutonic rocks (diorite, quartz diorite, granite), and (iii) hydrothermal and volcanic breccias. The host rocks exhibit typical arc-related geochemical signatures with depletion in Nb, Ta, and Ti elements on primitive mantle-normalized spider diagrams and highly fractionated light rare earth elements (LREE) with depletions in heavy rare earth elements (HREE) concentrations. U-Pb SIMS geochronology of zircon minerals yielded ages of 48.13 ± 0.52 Ma from the Mastra epithermal Au deposit and 47.35 ± 0.43 and 47.28 ± 0.43 Ma from the Aktutan epithermal prospect. εNd values vary between 0.565701 and 3.238152, whereas $^{87}Sr/^{86}Sr$ ratios range from 0.70445 to 0.705298. $^{176}Hf/^{177}Hf$ ratios measured on zircon grains from the Aktutan IS epithermal prospect yielded a range of 7.8 to 9.7. The Sr-Nd-Hf isotopes indicate an enriched mantle source with considerable asthenospheric input for the host-rock petrogenesis of epithermal systems.