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Chapter 5

Cenozoic Crustal Extension and Its Relationship to Porphyry Cu-Au-(Mo) and Epithermal Au-(Ag) Mineralization in the Biga Peninsula, Northwestern Turkey*

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Abstract

Epithermal Au-(Ag) and porphyry Cu-Au-(Mo) mineralization of the Biga Peninsula in northwestern Turkey occurs in a district comprised of NE- to ENE-trending metamorphic horst blocks separated by half-graben volcano-sedimentary basins. These developed as a result of rollback of the northward-subducting African slab during the Eocene, Oligocene, and Miocene. We propose that epithermal and porphyry systems occupy distinct, favorable positions within the overall extensional architecture and fault/fracture array. High- and low-sulfidation epithermal alteration systems, along with related quartz veins, preferentially occupy half-graben basins and border faults. These epithermal systems are found above a core complex detachment fault system, forming major strata-bound silicified zones fed by steeply dipping extensional faults and associated fractures above inferred intrusions. At greater depths and higher pressure and temperature conditions, porphyry-style alteration systems are spatially associated with porphyritic stocks that occur in close association with plutonic bodies. These plutons have intruded the footwall of ductile to brittle extensional faults and spatially and temporally link to metamorphic core complex exhumation. Episodic changes in the tectonic stress resulted in pulses of crustal extension that favored porphyry-type and high-sulfidation-style mineralization during mid to late stages of Eocene and Oligocene extensional tectonic phases. On the other hand, the early stages of each extensional phase promoted higher structural permeability, enabling the development of vein systems and low-sulfidation epithermal-style mineralization. Postemplacement crustal extension resulted in "domino-style" block rotations and half-graben formation throughout the Miocene and Pliocene. Since the early Pliocene, the westward propagation of the North Anatolian fault has resulted in dextral transtension in the Biga Peninsula and, as a result, postmineralization structural dismemberment of deposits and alteration systems is common.

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* Electronic Appendices for this paper are available at www.segweb.org/SP19-Appendices.