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Regional Structural Controls on the Evolution of Low-Sulfidation Epithermal Au-Ag Mineralization in Sindirgi, Western Turkey

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Western Turkey hosts several low-sulphidation epithermal gold-silver deposits of Miocene age, several having been mined since the early 2000s. In the Sindirgi District, Balikesir Province, a series of deposits occur along a NE-oriented trend referred to as the Sindirgi Gold Corridor (SGC). This corridor terminates against the Simav Fault to the SW and contains four principle epithermal quartz vein fields constituting a total vein length of 51.2 km, two of which are examined here. The veins show various orientations and represent hydrothermal deposition at a variety of different crustal depths.

These systems are interpreted to have been generated under a N-S extensional regime approximately coeval with, or just postdating, volcanic activity. The deposits are primarily hosted by rocks of the Sindirgi Volcanic Complex, which comprises a thick sequence of dacitic and rhyodacitic-rhyolitic welded pyroclastics and felsic intrusions, which occur as domes and dikes. These volcanic rocks overlie sedimentary and ophiolitic rocks of dominantly Upper Cretaceous age.

Two large-scale regional structures, the Bigadic and Karabahce faults, trend WNW and appear to dissect the SGC. These structures probably represent fragmented splays of the Simav Fault, a major fault zone that defines the half-graben to the north. Elsewhere within the corridor, other NNE- and NE-trending structures occur as prominent faults. The orientation of veins varies from NW-SE, N-S, NE-SW, to E-W, in order of decreasing economic importance.

The mineralization shows various morphological and textural features suggesting deposition through several phases of hydrothermal activity, controlled by the development of several key structures and the relative position of the palaeowater table. The >0.4 Moz (Au equivalent) Kiziltepe Mine is located at the SW end of the SGC (lat.39^{o}16’45”N, long.28^{o}15’00”E) and contains four dominantly NW-trending vein zones. These zones are characterized by massive and multiple subparallel quartz veins, including stockworks and breccias in places. Weakly banded crustiform-colloform (with ginguro) vein textures are associated with the highest gold grades.

At the opposite end of the SGC, 23 km NE of Kiziltepe, lies the <0.1 Moz Kizilcukur deposit (lat.39^{o}23’05”N, long.28^{o}27’51”E). Like Kiziltepe, the veins trend largely NW, but are hosted by an Upper Cretaceous basalt unit, exposed to the north of the regional WNW-trending Karabahce Fault. Gold mineralisation is associated with manganese carbonates and base metal concentrations an order of magnitude higher than those at Kiziltepe. The veins display distinct banding and are typically more crystalline, with well-developed dog-tooth textures, suggesting a deeper level of deposition than at Kiziltepe.

Three decades of mineral exploration data comprising geologic, geochemical, and geophysical information are utilized to improve interpretation of the regional and local structural controls on the distribution of mineralization. Particular focus is applied to the kinematic relationships between regional and local structures, the definition of pre- and synmineralization structures, and the confirmation of structures significant to the control of hydrothermal fluid flow. This will establish links between the orientation, kinematics, and relative age of key structures and the evolution of the epithermal deposits in the region and, consequently, will aid the development of predictive models for future mineral exploration.