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Geology, Geochronology, and Alteration of the High-Sulfidation Epithermal Au-Ag Deposit and Porphyry Cu-Mo Occurrence at the Kirazlı District, Biga Peninsula, Turkey

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The Kirazlı district is located at the center of the Biga peninsula, which is a major metallogenic province at the northwestern tip of the Anatolian plate. The district contains a high-sulfidation (HS) epithermal Au-Ag deposit (0.33 Mt at 0.71 Au) and a porphyry Cu-Mo occurrence hosted by late Eocene-Oligocene magmatic rocks. There are five main target zones, including Kirazlı main, Çatalkaya, Rock Pile, Kale, and easternmost Iri. A NNW-trending HS orebody hosted by an Oligocene volcanic-volcaniclastic sequence covers large areas at the Kirazlı main, Çatalkaya, and Rock Pile. The sequence consists mainly of basaltic andesite lava flow and lithic/crystal tuff. A middle Eocene undifferentiated intrusive rock has been intersected by drilling at Kale, which hosts the porphyry Cu-Mo occurrence and is highly deformed by a conjugate fault system. LA-ICP-MS U-Pb zircon dating of the host units has yielded ages of 31.9 ± 0.5 to 32.7 ± 0.3 Ma and 41.5 ± 0.5 to 40.5 ± 0.3 Ma for the epithermal and porphyry systems, respectively.

The host lithological units in the Kirazlı district have been affected by pervasive hydrothermal alteration. A mineral-based alteration map was obtained by the portable infrared mineral analyzer (PIMA) studies using surface and drill core samples. Kirazlı Main has a proximal to distal zoned alteration pattern, including silicification, alunite-, dickite-, and more regional kaolinite-rich alteration assemblages, and subsidiary montmorillonite., Pyrophyllite- and sericite-rich alteration zones are more prominent towards the Çatalkaya and Kale zones, at topographically lower elevations. They document a transition from epithermal to porphyry environments. The Au-Ag mineralization occurs as disseminations, small veins, and veinlets within argillaceous and silicified (mainly vuggy and massive) host rocks and hydrothermal breccia in the HS environment. The Cu-Mo mineralization occurs as disseminations in a sericite-rich alteration zone and porphyry-type veins in the potassic alteration zone overprinted by sericite-chlorite and younger argillic alteration assemblages in the Kale zone. Re-Os geochronology on two molybdenite samples from quartz-pyrite-molybdenite veins at the porphyry mineralization yielded a 33.6 ± 0.2 Ma age.