

The Geology of the Kışladağ Porphyry Gold Deposit, Turkey

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The giant Kışladağ porphyry gold deposit (17.4 Moz) is located in western Anatolia, Turkey, and is hosted in a nested complex of late porphyries that intruded coeval volcanic rocks of the Beydağı stratovolcano and the Menderes metamorphic basement. The intrusions and volcanic rocks have a high-K calc-alkaline to shoshonitic affinity similar to the regional volcanic rocks of western Anatolia. Three main intrusive phases are recognized within the deposit with economic gold grades highest in the earliest Intrusion 1 phase, followed by lower gold contents in Intrusion 2/2A and a weakly mineralized late-stage Intrusion 3. The highest gold is also associated with the higher-temperature potassic core of the deposit centered on Intrusion 1. Surrounding and partly overlapping the potassic zone is a distinct tourmaline-white mica (\pm pyrite \pm albite \pm quartz) alteration with tourmaline abundant up to 500 m from the center of the deposit. Stockwork veinlets are common within the potassic and tourmaline-white mica zones and evolve from volumetrically minor quartz-rich to quartz-pyrite, to quartz-pyrite with tourmaline envelopes, to the most abundant pyrite-tourmaline veins and breccias and pyrite-only veins. A poorly mineralized advanced argillic alteration assemblage (quartz-alunite \pm dickite \pm pyrophyllite \pm pyrite) postdates the tourmaline-white mica alteration and is particularly abundant in the eastern flank of the deposit and as a lithocap. The most widespread alteration is argillic, comprising kaolinite \pm smectite \pm pyrite \pm quartz, and overprints all alteration phases and is particularly widespread in the surrounding volcanic package. New geochronological results from the Kışladağ deposit constrain the timing and duration of magmatic and hydrothermal activity within the Beydağı stratovolcano to ca. 1.2 million years (14.8–13.6 Ma). The deposit formed through a succession of brief magmatic and hydrothermal pulses: 1) Intrusion 1 (ca. 14.76 Ma), 2) potassic alteration coeval with mineralization and Intrusion 2 (ca. 14.56–14.36 Ma), 3) Intrusion 3 (ca. 14.36 Ma), and 4) advanced argillic alteration (ca. 14.13–13.55 Ma). The deposition of gold can be constrained by the emplacement of the sulfide mineralization dated at 14.49 ± 0.06 Ma by Re-Os on molybdenite. The Kışladağ deposit has exceptionally low Cu values (average \sim 200 ppm) and, as such, can be classified as one of the few giant gold-only porphyry deposits globally.