

Chapter 10

Anatomical Similarities and Differences Between Spatially Associated Porphyry Copper-Gold Deposits at the Reko Diq H14 and H15 Complex, Balochistan, Pakistan

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Abstract

The Reko Diq porphyry cluster in the western Chagai magmatic belt, Pakistan, contains a geologic resource of 5.9 billion tons (5.35 Bt) @ 0.41% Cu and 0.22 g/t Au, largely in the H14 and H15 porphyry deposits. These two deposits, located approximately 1 km apart, are related to a series of petrologically similar, middle Miocene (12.6–12.0 Ma), calc-alkaline porphyry intrusions hosted by Oligocene andesitic volcanic and clastic sedimentary rocks. The porphyry intrusions are characterized by phenocrysts of plagioclase, biotite, quartz, and amphibole in a microcrystalline mafic silicate-bearing quartzofeldspathic groundmass. Potassic, sericite-chlorite, sericitic, and propylitic alteration assemblages are zoned about the porphyry intrusions. The early and intermineral porphyry intrusions are overprinted by a pervasive potassic alteration assemblage composed of hydrothermal biotite-K-feldspar-magnetite ± anhydrite with associated chalcopyrite and bornite. Chalcopyrite, bornite, and lesser pyrite are disseminated or are associated with a stockwork of quartz ± magnetite ± K-feldspar A- and B-type and less common sulfide-only veins. Bornite characterizes a distinct high-grade core to the H14 deposit, but it is less common and always subsidiary in volume to chalcopyrite in the slightly older H15 deposit. Local sulfide mineral assemblages of pyrite-covellite-bornite-chalcopyrite associated with pervasive quartz-sericite alteration assemblages in the H15 deposit form narrow, steeply dipping vein-like zones or strata-bound horizons restricted to felsic tuff or sandstone. The late porphyry intrusions are weakly altered and mineralized, lack volumetrically significant veins, and generally have low Cu and Au concentrations.

Sulfide-deficient potassic alteration assemblages at greater than 1,000 m depth are overprinted by a texturally destructive alteration assemblage of albite-epidote ± actinolite ± chlorite, inferred to represent a sodic-calcic alteration assemblage. Total sulfide contents at these depths are less than 1%. At shallow depths, a sericite-chlorite alteration assemblage overprints potassic alteration mainly along late-stage centimeter-scale chalcopyrite-pyrite D-type veins. The sericite-chlorite assemblage is much more extensive in the H15 deposit than in the H14 deposit. An outer sericitic alteration assemblage composed of quartz-muscovite-pyrite ± chalcopyrite flanks the sericite-chlorite assemblage. An intermediate argillic alteration assemblage composed of clay minerals (illite, smectite, montmorillonite) and carbonate is common in remnants of plagioclase within the sericite-chlorite and sericitic alteration assemblages. A propylitic alteration assemblage of chlorite-epidote-albite ± pyrite-carbonate is developed in the peripheral volcanic and sedimentary host rocks surrounding the H14-H15 porphyry complex.

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