Geology, alteration and mineralization at the Zijinshan high sulfidation epithermal copper-gold deposit, Fujian Province, China*

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The Zijinshan ore field is located in southwest Fujian province, southeast China, and is the largest Cu and Au producer in southern China. The Zijinshan high-sulfidation deposit is located in the middle of the Zijinshan ore field, and contains 326 t Au and 2 Mt Cu. The deposit is hosted in the Zijinshan lithocap, which developed primarily within the Zijinshan intrusive complex, a Yanshanian granite complex. High sulfidation Cu-Au mineralization is Cretaceous.

Systematic Anaconda-style mapping of the Zijinshan open pit has provided detailed information about lithotypes, structures, veins, alteration, and mineralization. A dacite porphyry has intruded the Zijinshan granite and appears to be closely related to mineralization. The intrusive contacts are north-west and east-trending. The north-west-striking tensional faults dip moderately to the SW, whereas the north-east-trending wrench faults dip steeply to the SE. The faults appear to be related regional scale faults (e.g., Shanghang-Yunxiao Fault) in Fujian province.

Several stages of veins have been recognized within the lithocap, including pre-mineralization quartz–pyrite veins with or without quartz halos, and syn-mineralization alunite–pyrite–cavellite–digenite veins, and dickite–alunite–cavellite–digenite veins. There are also dickite and alunite veins of uncertain paragenesis, and weathering has produced supergene jarosite and hematite veins in the upper parts of the lithocap. The pre-mineralization quartz–pyrite veins do not have any preferred orientations, whereas the syn-mineralization veins are preferentially aligned to the northwest, and dip moderately NE and SW.

There is a polymict lithic breccia dike in the center of the Zijinshan high sulfidation deposit. The main dike is surrounded by a series of sub-horizontal, sub-parallel breccia veins. The central facies of the breccia dike contains clasts of granite and dacite porphyry, and is clast-supported with minor quartz–pyrite cement. The peripheral breccia veins primarily contain quartz–pyrite cement with a minor component of altered granite clasts. The breccia dike is elongated to the northwest, whereas the peripheral breccia veins strike randomly.
The clay mineralogy of each assemblage has been determined by short-wave infrared spectroscopy techniques. Silicic alteration is dominated by massive quartz and locally vuggy quartz, and typically occurs in the center of high-grade ore zones. The zones of intense silicic alteration grade laterally outward from mineralized structures to peripheral advanced argillic and argillic alteration assemblages, including quartz–dickite, quartz–alunite–dickite, and quartz–dickite–muscovite assemblages. Alunite alteration is typically pervasive and its relationships with the surrounding alteration assemblages are complex. Fine-grained intergrowths of alunite–quartz ± dickite have replaced feldspar phenocrysts, and also occur as disseminations in the altered groundmass of porphyritic igneous rocks. Alunite alteration that formed coeval with Au-Cu mineralization is associated with coarse grained clusters and rosettes of alunite–digenite–covellite breccia cement. Minor alunite–digenite–covellite veins have alunite-quartz halos.

Most of the Au mineralization occurs as disseminations and impregnations in the silicic alteration zones, but is restricted spatially to the supergene zone. Copper ores occur in the alunite alteration zone, as veins, stockworks and breccia cement, typically consisting of intergrowths of alunite, digenite and covellite.