STRATIGRAPHY, ALTERATION, AND ORE CONTROLS IN THE MAIN ORE ZONE, TWIN BUTTES MINE, PIMA COUNTY, ARIZONA

by

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Abstract

The Twin Buttes and Sierrita-Esperanza deposits are located at the two known mineralization centers on the eastern side of the Sierrita Mountains. Both centers are characterized by plugs and dikes of quartz monzonite porphyry intruded along the southern and southeastern flank of a Laramide granodiorite batholith.

At Twin Buttes, a southeast-trending, elongate mass of quartz monzonite with a variety of related porphyries extends from the batholith and intrudes the Paleozoic and Mesozoic sequences. A thermal and metasomatic aureole has been formed around this intrusive complex. The Paleozoic through Laramide rocks are covered by 300 to 600 feet of gravels; the lower portion of which is of probable Pliocene age. The Twin Buttes deposit is segmented by postmineralization, northeast-trending normal faults and low-grade intrusions. The main ore zone is located on the southwest side of a quartz monzonite porphyry mass dated at 58 m.y.

The Mesozoic sequence in the main ore zone is folded into an open syncline. At the top of this sequence is the two-member Angelica Arkose. The Angelica is underlain by volcanics and clastics of Triassic and possible Jurassic age. An angular unconformity separates Triassic from younger Mesozoic rocks. At the base of the Mesozoic is a carbonate-rich conglomerate which overlies the Paleozoics along a 50° SW.-dipping angular unconformity.

The Paleozoics generally have steep northeast dips and are strongly folded. The youngest, northernmost, Paleozoic in the main ore zone is the Permian Concha Limestone and the oldest is the Earp Formation. Between these formations are a three-member Scherrer Formation, a four-member Epitaph Formation, and the Colina Limestone.

Alteration in the Mesozoic clastics and volcanics consists of partial recrystallization, biotization, and later sericitization developed most strongly along quartz-sulfide veinlets. In these rocks, there is a general decrease in biotite and an increase in epidote and pyrite away from the intrusion. Only the Angelica Arkose contains persistent unenriched grades above 0.4 percent copper.

Early skarn formation in the Paleozoic carbonates involved extensive magnesium metasomatism. Diopside, pale garnet, and local wollastonite were among the first alteration minerals developed. A later stage of darker garnet with associated chalcopyrite-rich sulfides replaced and veined the earlier calc-silicates. Subsequently, the earlier skarns were partially altered to hydrous calc-silicates, such as tremolite, actinolite, and nontronite, adjacent to pyrite, chalcopyrite, quartz, anhydrite stringers and near the relatively permeable siltstones. Hypogene alteration-mineralization essentially ended with the introduction of quartz-pyrite veins containing some sphalerite, chalcopyrite, and galena and minor amounts of fluorite and tetrahedrite. Increased amounts of partially silicated marbles is the most obvious manifestation of decreasing metasomatism in the Paleozoic carbonates.

In the quartzose clastics of the Paleozoic section, early alteration consists of partial recrystallization, biotization, and formation of diopside in calcareous siltstones and

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quartzites. Later alteration of diopside to hydrous calc-silicates and alteration of biotite to sericite occurs along quartz, anhydrite, sulfide veinlets, and in varying degrees throughout particular siltstone horizons.

The single most important ore control at Twin Buttes is the altered carbonate rocks. Superimposed on this dominant feature are factors such as distance from the mineralization center, proximity to permeable rocks, intensity of fracturing, and partial reworking of early sulfides by later hydrothermal events.

An understanding of these controls and careful documentation of their effects allowed postulation of a high-grade reserve in the main ore zone. Subsequent drilling has proved the presence of a number of strata-limited ore bands containing a significant tonnage of high-grade mineralization.