GEOLOGY AND MINERALIZATION OF THE RAY SILICATE OREBODY, PINAL COUNTY, ARIZONA

by

Neil A. Gambell

Abstract

The Ray orebody is owned and operated by Kennecott Copper Corporation and is located in eastern Pinal County, Arizona, 85 miles southeast of Phoenix. The orebody has been a major copper source since 1911, producing an estimated 2.2 million tons of copper. The bulk of this production has been derived from sulfide ores.

The Ray deposit is a porphyry copper with ore grade (0.4%+ Cu) hypogene and supergene sulfide mineralization largely restricted to Precambrian host rocks consisting of schist, quartzose sedimentary rocks, and diabase intrusive rocks.

Associated with the sulfide deposit is a complex body of silicate copper mineralization. By the early 1960's, drilling had delineated some 93 million tons of potential ore and a program of research and pilot plant studies was initiated to develop a viable extraction process. Success was realized in 1969 when a vat leaching system utilizing sulfuric acid from the smelter acid plant began production.

Silicate copper mineralization is found in the Precambrian Pinal Schist, Pioneer Formation, Dripping Spring Quartzite, diabase, and to a lesser extent in the early Tertiary Granite Mountain Porphyry. In postmineral rocks, significant amounts of silicate copper are present in the Whitetail Conglomerate and the Apache Leap Tuff.

The distribution of the silicate copper mineralization suggests that it developed in the core zone (low total sulfide, high chalcopyrite) of the sulfide system. Erosion, faulting, and folding also played an important role in localizing the orebody. Although the work is still in progress, the deposit appears to show definite zoning patterns in secondary mineral assemblages, and it is possible to demonstrate some paragenetic relationships.

Geologic aspects that affect the amount of copper recovered by the leaching process are the ore mineralogy, gangue mineralogy, rock type, and the nature of the mineralization (vein-fracture or disseminated).

In an attempt to anticipate potential problem areas, the construction of contour maps for feet percent copper and percent readily soluble of the total copper for the major lithologic types is a useful tool.

The term "silicate" is used in referring to the orebody because of the abundance of chrysocolla; however, the deposit also contains copper-bearing manganese wad, copper montmorillonite and halloysite clays, copper-iron oxide complexes, malachite, cuprite, libethenite, dioptase, azurite, native copper, and chalcocite.

At the present time, 10,000 tons of silicate ore are being mined on a five-day basis. This ore is crushed to minus 1/2 inch, classified (coarse fraction to leach vats; slime fraction to a thickener circuit), and leached with a 35 g/l sulfuric acid solution. After a ten-day leach cycle, a pregnant solution containing 20-35 g/l copper is sent to electrowinning. To date recoveries have ranged from 45 to 75 percent of the total copper with an acid consumption of approximately 100 pounds per ton of ore treated. Early in 1976, a 4000-ton-per-day expansion of silicate ore will be initiated with the completion of a new grinding and agitation leaching circuit. This circuit will allow utilization of increased acid production brought about by environmental considerations and yield better classification of the ore. At current operating rates, the silicate plant will produce some 28,000 tons of copper per year.

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[1] Kennecott Copper Corporation, Ray Mines Division, Hayden, Arizona 85237