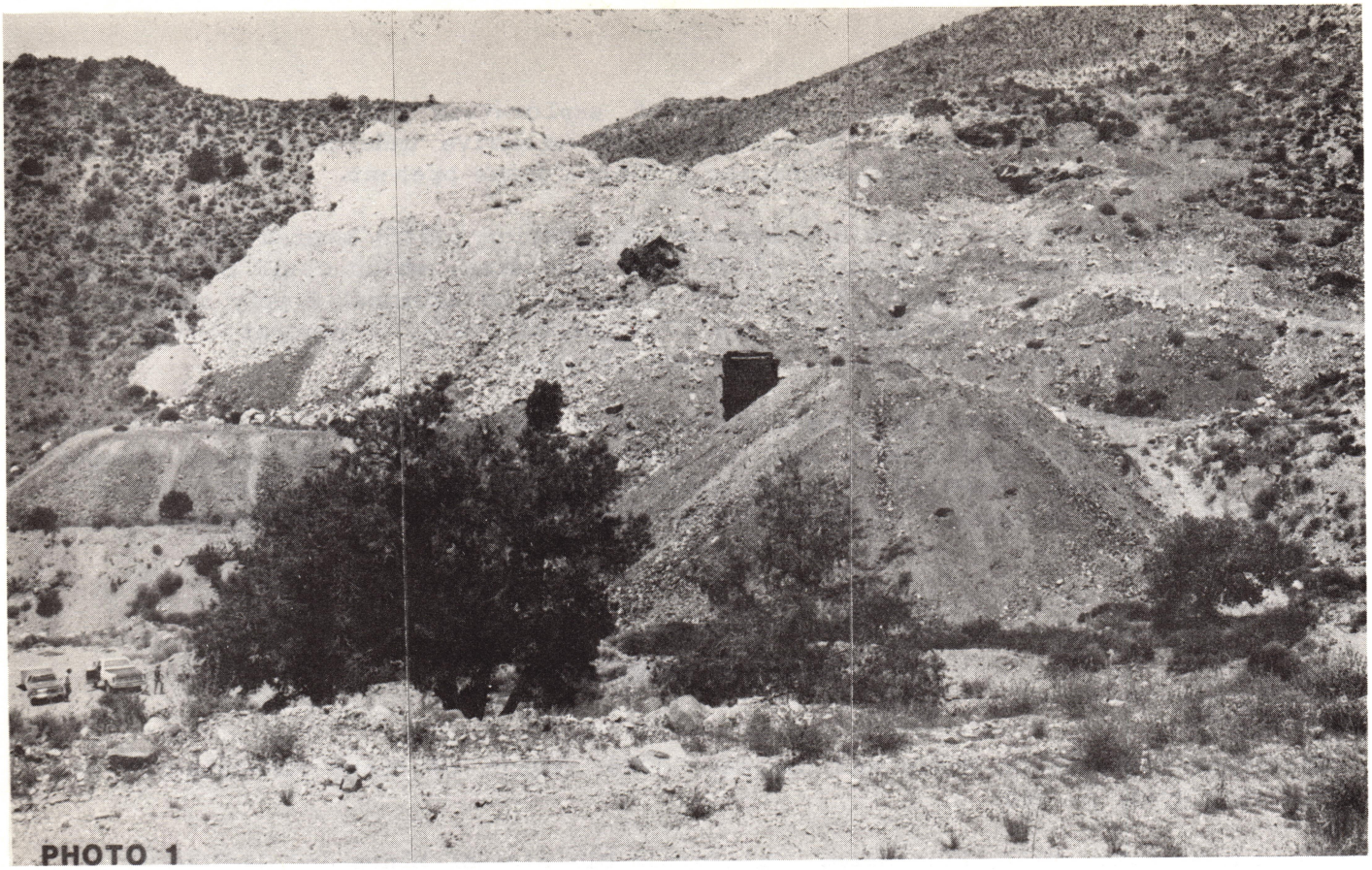

PHOTO 1

THE COPPER WORLD MINE
NORTHEASTERN SAN BERNADINO COUNTY, CALIFORNIA

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INTRODUCTION

The Copper World Mine lies within the Clark Mining District on the southwest flank of the Clark Mountains, Township 16 North, Range 13 East, San Bernardino Base and Meridan, northeast of Valley Wells. The mine is comprised of four patented claims currently under the ownership of the Dan Murphy Foundation of Los Angeles, California.

The workings of the mine are in highly altered zones of the Teutonia Quartz Monzonite-Goodsprings Dolomite contact. The mined ore bodies contain from a fraction of a percent to as much as 15 percent copper, mainly as the oxides, malachite and azurite. The principal workings include several thousand feet of tunnels, drifts and a shaft 100 feet deep (Figure 1). Photo 1 above shows the more recent open-pit mining on the crest of the hill above the dumps.

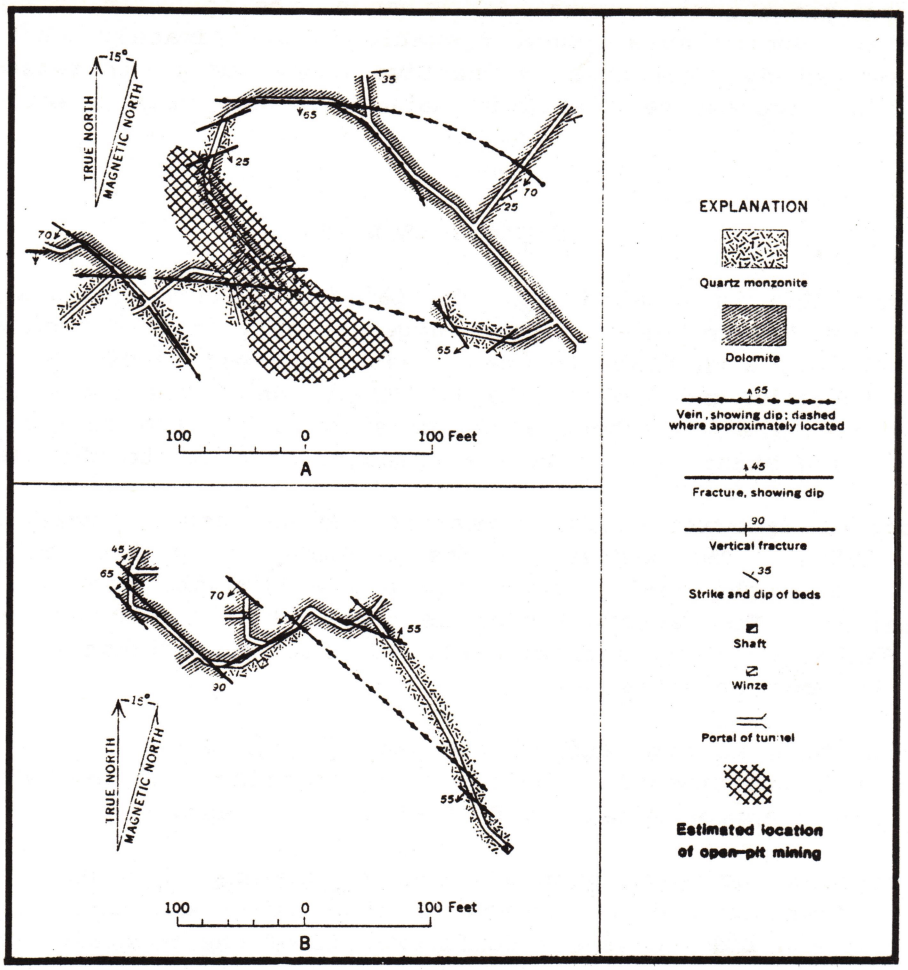

Figure 1. Principal mine workings: A, Tunnel Level; B, 100 foot level (modified from Hewett, 1956).

Although there are records of shipments as early as 1869, there was very little production until the period between 1906 and 1908, and then again in 1916 through 1918. During this latter period of operation, the Copper Mine World was at its peak; 1735 tons of crude ore containing about 4 percent copper were shipped to Valley Wells, (Tucker, 1921). In 1944, several thousand tons of old tailings were treated, and in 1949 copper furnace matte was shipped in a cleanup operation at the old smelter site located near Valley Wells. The mine lay dormant again until 1977 when Par Gem spectrum leased the property for a few years from the current owners

and open-pit mined the area using a D-9 Caterpillar in search of gem quality azurite and malachite. With no milling costs for gem production, hand sorting excepted, and no great environmental disturbance, the open pit method was profitable for a time. During this recent operation, approximately $600,000 worth of material was extracted. The mine is inactive today due to increased faulting at depth and to the progressively erratic nature of the vein bearing gem-quality oxides.

REGIONAL GEOLOGY

The Copper World Mine is located near the California-Nevada border in the east-central part of the Mojave Desert. This rugged, highly faulted area is nearly 5000 feet above sea level, with Clark Mountain reaching almost 3000 feet higher to the northwest (See Location and Geologic Map). Mountains in the surrounding area have been carved from Paleozoic carbonate and clastic rocks, and Mesozoic clastic and volcanic rocks which stand well above the Precambrian rocks to the east.

Two broad types of Cambrian rocks, a western and an eastern facies, occur in the area (Hewett, 1956). The western facies is made up of the Prospect Mountain Quartzite and the Pioche Shale, which are a few thousand feet thick and highly folded and faulted. The eastern facies is composed of the Tapeats Sandstone and Bright Angel Shale, totaling approximately 400 feet in thickness and lies unconformably over Precambrian gneisses.

The Paleozoic section is composed of the Goodsprings Dolomite, the Sultan Limestone, the Monte Cristo Limestone, Bird Spring Formation, and the Kaibab Limestone, which together total approximately 6,000 feet in thickness.

The Mesozoic section includes about 300 feet of Moenkopi Limestone, approximately 1000 feet of sandstones and siltstones of the Chinle and Aztec Formations, and about 600 feet of ash flow tuffs and tuffs breccia of the Mountain Pass rhyolite.

GEOLOGIC HISTORY

During the Cretaceous period, previously formed rocks throughout the area were highly deformed by compressional forces. Some formational units slipped over one another to form minor bedding plane thrust faults.

After major folding, the Precambrian gneisses were faulted against Paleozoic and Mesozoic rocks along the steeply northwest-southeast trending southwest dipping Clark Mountain fault zone.

Closely following this episode of faulting, crustal shortening again took place, but this time on a far larger scale. Large blocks of rock, measuring many square miles in area, were thrust over one another and, in places, over the Clark Mountain fault zone. Four major thrusts have been mapped in the area. From oldest to youngest, they are the Mescal, Mesquite, Pioche, and Prospect thrusts. Each displays a distinctive pattern, a general northerly strike with dips to the west at modest to steep angles. Significant brecciation, shearing and tight folding are also common along the contacts of these thrust blocks.

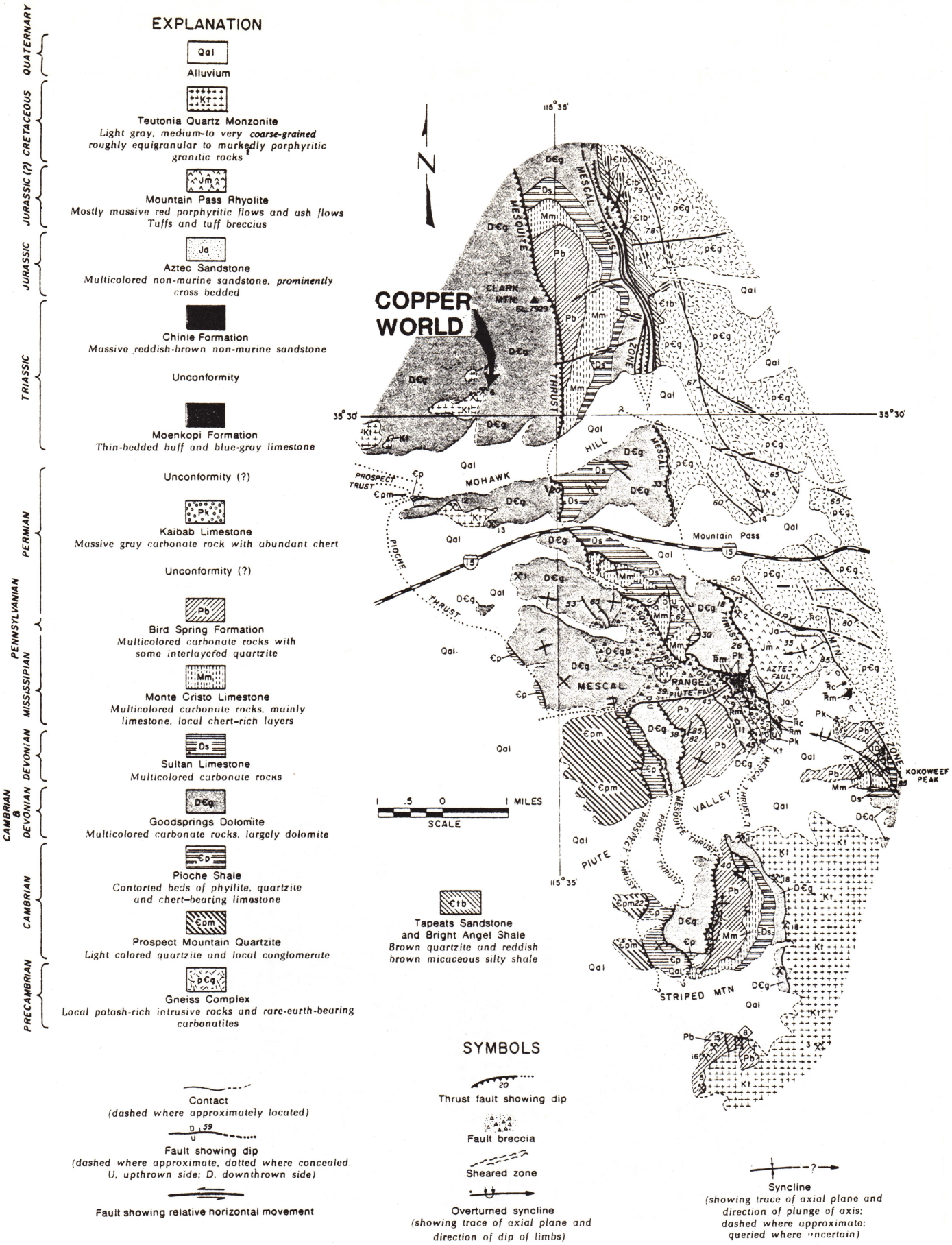

Figure 2. Location and simplified geologic map showing the Copper World mine in relation to the major faults and folds. (from Evans, 1974)

Following major deformation from thrust faulting, granitic rocks of the Teutonia Quartz Monzonite (named by Hewett, 1956) were emplaced into the deformed materials. Intrusive igneous rocks were injected primarily along the major trusts in the area. However, many sill-like and other discordant bodies were injected into the Paleozoic carbonate rocks in the area causing extensive alteration (Evans, 1974).

LOCAL GEOLOGY

The Copper World Mine, along with several other mines, is located in a scarn zone (a contact metamorphic rock of lime-bearing silicates), produced from intrusion of Teutonia Quartz Monzonite into bedding planes and fractures of the Goodsprings Dolomite. The bedding is locally contorted, but generally strikes northwest and dips 25° to 40° to the southwest. The discontinuous mineralized zones are up to a few hundred feet wide in some places and continue for about 2000 feet in a southwesterly direction.

In the Mojave Desert region, typical primary metallic minerals in skarn zones are magnetite, chalcopyrite, galena, sphalerite, pyrite, arsenopyrite, gold, and silver. Secondary oxidation of these minerals has produced tenorite, hematite, hemimorphite, cerussite, hydrozincite, smithsonite, malachite, azurite, and chrysocolla (Evans, 1974).

All mining at the Copper World Mine has taken place in the skarn zone (see Photo No. 2). The ore bodies are irregular, with the richest bodies being found at the contact between dolomite and quartz monzonite. Oxidation has penetrated 100 to 150 feet below the surface, producing ores consisting of the carbonates of copper, lead and zinc, with some gold and silver. Malachite and azurite are the most common minerals. Other, more exotic, minerals from this zone are: Linarite ($PbCu(SO_4)(OH)_2$; Bisbeeite ($CuSiO_3H_2O$); Chalchanthite ($CuSO_4(H_2O)_5$); Caledonite ($Cu_2P_5(SO_4)_3(CO_3(OH)_5$; and Melanterite ($FeSO_4(H_2O)_7$).

Photo 2. Open pit mine in skarn zone, looking southeast.

Photo 3. Open pit mine, looking west

The average grade of ore treated in the past was around 4% copper. An estimated 5000 tons of 2% copper still remain (Tucker, 1943).

HISTORY

It is not known exactly when mining began in northeastern San Bernardino County, but it probably started in the 1860's when extensive travel began across the area between Los Angeles and the Salt Lake Valley. Prospectors in the early days sought only those deposits that could be worked profitably by, at most, a few men. This is probably how the Copper World Mine originated. Although the exact discovery date of the mine is not recorded, it was one of the first mines of the region to be explored, and there is a record of shipments as early as 1869 (Crossman, 1890-91).

After exhaustion of the high-grade deposits, a second phase of mining took place in the area which dealt with larger, but lower-grade, deposits than those worked earlier. This phase began about 1900 with the construction of railroads into the area and peaked during World War I. The Copper World Mine reached its glory during these years. The mine was operated by the Ivanpah Smelting Company in 1898 when some black copper, 98% pure, was produced along with other ore averaging 12 to 15% copper (Ver Planck, 1961). This brief campaign of exploration was successful at first due to a 50 ton/day capacity smelter erected at Valley Wells. Copper worth $750,000 was refined at this smelter, but the enterprise finally failed due to a high loss of copper in the resulting slag.

In 1907, the mine was reopened by the Cocopah Mining Company. Ore production averaged 6 to 10 percent copper and was shipped to Needles to a company-operated custom smelter. The mine was closed in 1908 (Ver Planck, 1961).

The principal period of operation of the Copper World Mine extended from 1916 to 1918, during World War I, when the demand and price for base metals increased enormously. Railroads and graded roads significantly contributed to these peak years in the form of lower freight rates. The property was operated during this time by the Ivanpah Copper Company. The ore was again smelted at the old smelter site in Valley Wells. This smelter was improved and was capable of handling 100 tons per day by November 1917 (Tucker 1921).

Ore shipped to the smelter was generally of a low grade, averaging 2 to 4 percent. Old slag dumps containing 13,000 tons averaging 2 to 10 percent copper were also treated. In addition, minor amounts of gold and silver were also refined and separated. This operation ceased with the advent of the low market price of copper at the end of the war.

A third phase of mining in San Bernardino County took place after World War I. The general trend of metal mining activity plumeted. Base metal mines reversed this trend only temporarily in response to the high demand resulting from World War II. However, production of copper was small and no attempt was made to reopen the Copper World Mine. During this phase, metal mining declined virtually to the vanishing point. The Copper World's day was over; however, in 1944, several thousand tons of old tailings were treated, and in 1949, copper furnace matte was shipped in a cleanup operation at the old abandoned smelter.

The Copper World Mine lay dormant for nearly 30 years until a small mining company from Lancaster, California, Par Gem Spectrum, obtained a lease from the Dan Murphy Foundation in 1977 and started an open-pit mining operation in July of that year (Photo No. 3). Working with track drills and a D-9 bulldozer, semi-precious minerals, chiefly azurite and malachite were mined. Ninety percent of the mined specimens were sold overseas, while a few were given to San Bernardino County museums. According to the owner of Par Gem Spectrum, the operation terminated in November of 1978 because the enterprise was no longer economically feasible. The vein with gem quality oxides became erratic with depth and increased faulting, making the exploration too costly.

The San Bernardino County Museum is reported to have ore specimens and many old photographs of the Copper World Mine and its crews (personal communicaltion, Bob Reynolds, 1980, San Bernardino County Museum).

ACKNOWLEDGEMENTS

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SELECTED REFERENCES

Aubury, L.E., 1902, Copper resources of California: California Mining Bureau Bulletin 23, 282 p.

Aubury, L.E., 1908, Copper resources of California: California Mining Bureau Bulletin 50, 336 p.

Crossman, J.H., 1890-1891, San Bernardino County, its mineral and other resources: Mining and Science Press, v. 61 and 62. A series of weekly articles from 12 July 1890 to 31 January 1891.

Evans, J.R., 1974, Relationship of mineralization to major structural features in The Mountain Pass area, San Bernardino County, California: California Geology, p. 142-155.

Hewett, D.F., 1956, Geology and mineral resources of the Ivanpah quadrangle, California and Nevada: U. S. Geological Survey Professional Paper 275, 172 p.

Tucker W.B., 1921, San Bernardino County: California Mining Bureau Report 17, p. 333-374.

Tucker, W.B., and Sampson, R.J., 1930, San Bernardino County: California Division of Mines Report 26, p. 202-325.

Tucker, W.B., 1943, Current mining activity in southern California: California Division of Mines Report 39, p. 118-138.

Ver Planck, W.E., 1961, History of mining in northeastern San Bernardino County: Calif. Div. of Mines, Mineral Information Service, vol. 14, no. 9, p. 1-8.

Wright, L.A., Stewart, R.M., Gay, T.E., Jr., and Hazenbush, G.C., 1953, Mines and mineral deposits of San Bernardino County, California: Calif. Jour. of Mines and Geology, v. 49, p. 49-259.