

indicated by sampling, a condition which is so frequently the cause of failure in mining. Jones¹ says that operation was stopped because of an inability to save the valuable metals, the inference being that the ore contains an appreciable amount of metal which might be extracted by more efficient metallurgical treatment.

NORTH MAGDALENA DISTRICT

The North Magdalena district includes a number of claims and prospects in the volcanic rocks just northwest of Magdalena. Nearly all the veins have long outcrops and seem to be of the shear-zone fault-contact type. The ores contain copper, lead, zinc, vanadium, gold and silver.

COPPER BELT SILVER & COPPER MINING CO. PROPERTY

Location and ownership.—The Copper Belt Silver & Copper Mining Co. owns a group of 13 claims 2½ miles a little west of north from Magdalena on the east slope of Silver Hill. The company was incorporated in Colorado in 1919.

Geology.—The claims cover the extensive outcrops of two steeply dipping, intersecting fissure systems which strike N. 25° W. and N. 50° W., respectively. The outcrops, although not prominent, are easily followed. A third system, striking southwest, is less well exposed. Figure 2 is a claim map of the company's holdings showing the vein systems. The country rock is predominantly andesite, but quartz latite occurs in places. Possibly the Lake Valley (Kelly) limestone, Sandia formation and Madera limestone are present beneath the Tertiary lavas.

Workings.—A considerable number of test pits, cuts and shallow shafts have been opened on the various veins. The main shaft, a two-compartment, well timbered opening, is 300 feet deep. Water was struck at about 200 feet. Two drill holes which have been put down to investigate the supposedly underlying limestone bottom at 825 feet and 1,020 feet respectively, both still in igneous rocks.

Mineralogy.—The ore minerals include chalcocite, covellite, argentite, chrysocolla, and malachite. Quartz is the chief gangue mineral. Limonite is present in the more highly oxidized parts of the vein. Calcite, though generally absent, is locally abundant.

Chrysocolla, which is the youngest mineral, is most abundant, but argentite may be more important commercially. Locally there is considerable malachite and granular orthorhombic chalcocite. A small amount of covellite always occurs with the chalcocite as the first product of oxidation, in places in megascopic quantities.

Argentite is associated with the chalcocite and its oxida-

¹Idem.

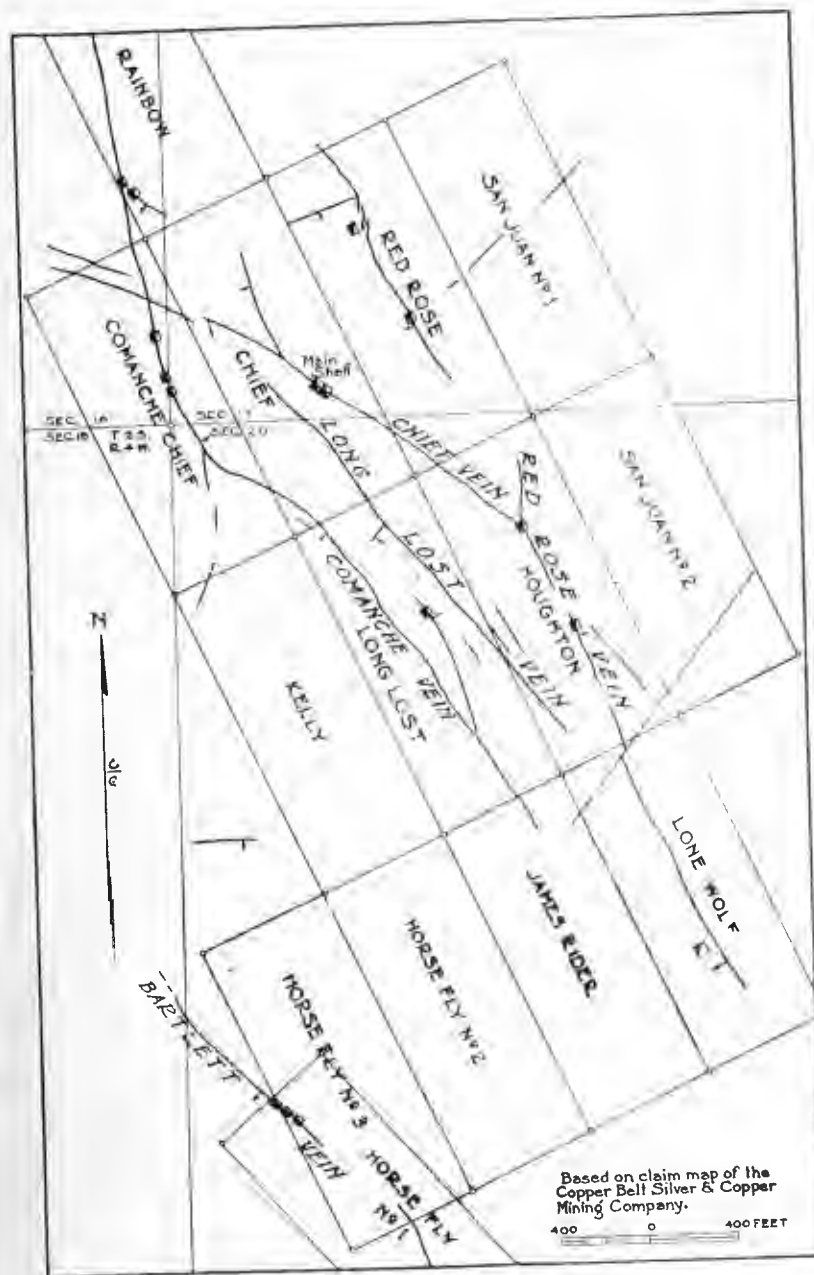


Figure 2.—Claim map of the Copper Belt Silver & Copper Mining Co. property showing vein systems.

tion products. The argentite is indistinguishable from some of the chalcocite on the clean polished surface under the microscope, and only by etching with HNO_3 or KCN does it become exposed. Normally it is unrecognizable by the unaided eye in these ores, but the polished surfaces of specimens of highly oxidized ore reveal minute though visible residuals of argentite and also a few small areas of covellite and chalcocite which have escaped complete oxidation. (See Plate II, A.) Each speck of argentite lies within a matrix of malachite surrounded by a shell of limonite. Veinlets of chrysocolla cut the malachite and limonite, the malachite being completely replaced in places.

The number of minute residuals of argentite in the highly oxidized ore suggests a more abundant supply of this mineral than is visible in the chalcocite even at the highest available magnification. The argentite may have been contained within the chalcocite in particles of submicroscopic size, possibly in solid solution. An interesting feature is the absence of native silver, the presence of which would be expected if the argentite were a replacement of the chalcocite.¹ The appearance of the specimens is suggestive of oxidation and solution of the chalcocite, grain by grain, with almost instantaneous neutralization of the solution. If the dissolving solutions were rapidly neutralized, as suggested, they would perhaps have had an opportunity to extract only the most soluble material, and as oxidation progressed some of the less soluble argentite may have migrated inwardly and together, finally to form a visible particle if enough were present within the grain.

The Ore.—The ore occurs in small pockety shoots within the veins. Mineralization, consisting of the filling of fissures and breccia openings in andesite and quartz latite, seems to have been independent of the chemical nature of the host rock. The location of the ore shoots appears to have been controlled by the amount of fracturing. The best showing of ore is on the Chief vein. The main shaft is on this vein, and ore is reported in the bottom at a depth of 300 feet. The lower part of the shaft is under water. At a depth of about 100 feet a drift along the vein exposes a thin stringer a few feet long of copper silicates. Good ore is exposed on the Red Rose vein and on a number of the smaller fractures. A small amount of ore has been extracted and shipped from the larger outcropping oreshoots. Small lots are said to have contained several hundred ounces of silver to the ton.

Possibilities.—Because of the small amount of work done the possibilities of this prospect can be only a matter of con-

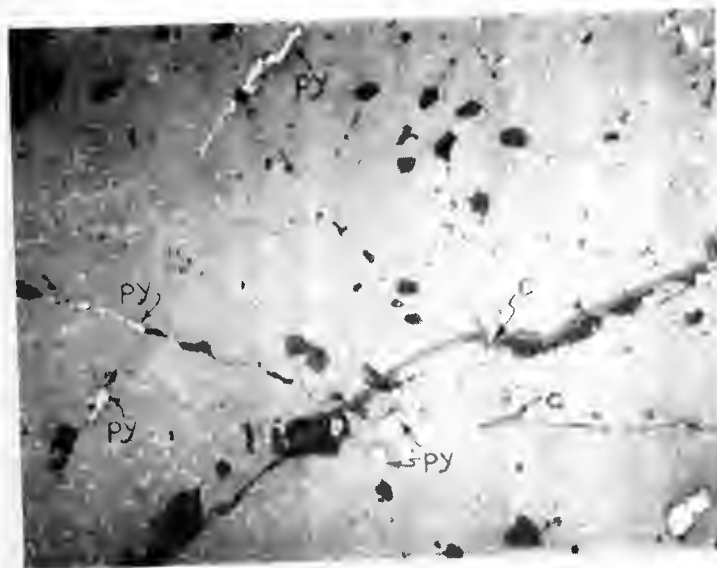
¹Palmer, C., and Bastin, E. S., *Metallic minerals as precipitants of silver and gold*: Econ. Geol. vol. 8, pp. 140-170, 1913.

The precipitation of native silver from silver solutions by chalcocite is so delicate that the reaction is used as the basis of a method for the determination of the comparative presence of cuprous and cupric ions in certain mixtures of the two. (Econ. Geol., vol. 10, p. 503, 1915.)



A. POLISHED SPECIMEN OF OXIDIZED COPPER ORE FROM COPPER BELT SILVER AND COPPER MINING CO. PROPERTY.—Enlarged 2 diameters.

cv, residuals of covellite with a little intergrown chalcocite; arg, residuals of argentite presumably left behind on complete oxidation of the copper sulphides; mal, malachite; lim, rings of limonite which have developed around centers of oxidation; chr, late veinlets of chrysocolla.



B. PHOTOMICROGRAPH OF ORE FROM NUTTER LEASE, NORTH FORK CANYON, WATER CANYON DISTRICT.—Enlarged 100 diameters

Inclusions of chalcopyrite (white dots and rods) in sphalerite (gray background), with late veinlets of pyrite (py) and calcite (cc).

jecture at present. The ore in sight indicates only a moderate degree of mineralization. However, since the andesites are not particularly favorable for copper deposition, the exposures of ore cannot be taken as indicative of the total mineralization which may be present. The chalcocite suggests secondary transportation from a previous source, and there is thus a possibility that ore shoots larger than those already exposed may be found within the volcanic rocks. Such shoots could have derived their content of both copper and silver not only from the original source but also from the secondary ore shoots now exposed, all of which show advanced oxidation.

The zone of fissuring is extensive in strike, and even at a very moderate ratio of length to depth some of the fissures might be expected to cut the underlying limestones if these are present. The effusive rocks are not readily mineralized, and sufficient mineral matter to form a workable deposit may have reached the limestone from above, unless the limestone lies at such depth that much of the ore may have been dissipated in small pockets before reaching it.

If some underlying igneous body, perhaps related to the intrusives at Kelly, is the primary source of the copper and silver, as is probable, there is a somewhat greater chance of ore at the deeper and more favorable horizons.

JACK FROST AND NIGHT HAWK GROUPS OF CLAIMS

Location and ownership.—The Jack Frost and Night Hawk claims are contiguous but separately owned groups located for the most part on the same vein in the island of volcanic rocks about $2\frac{1}{2}$ miles north of Magdalena on the road to Riley. The Jack Frost group of eight claims is owned by A. Dugger, and the four claims of the Night Hawk group, which adjoin the Jack Frost claims to the east, are owned by P. B. Moore. Some of the claims are on state land.

History.—According to reports, shipments were made by ox teams from these claims in the early days of the district to the smelter at Socorro and to the old Pennsylvania mill in Pueblo Canyon. During the period from 1925 to 1927 a small amount of concentrates was marketed by N. L. Brown of Albuquerque. No work was in progress in July, 1929.

Geology.—The predominant rocks of the area are andesite and quartz latite. Basic dikes are numerous, and in many places they form one or both of the vein walls.

The main vein, called the Jack Frost vein, strikes about N. 80° W. and dips 65° - 80° to the north. It is constant in strike but irregular in dip. Eastward it breaks up into a number of divergent stringers which finally join with a vein that at this place strikes N. 50° W. and dips 70° NE. The second vein is