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OTHER MINES AND PROSPECTS ON THE TENNESSEE VEIN

The Elkhart mine, at the extreme north end of the Tennessee vein, is an old mine that has been idle for many years. The total production from this mine from 1901 through 1948, as shown in table 2, has been small. The mine workings, now inaccessible, are reported to consist of three shafts, six levels (the lowest 500 feet deep), drifts totaling about 2,600 feet, numerous stopes, and several crosscuts.

The Silver Age mine, near the extreme south end of the vein, was primarily a silver mine (table 2). The silver was probably derived in large part from silver chloride (cerargyrite) found in the oxidized zone. Accurate data concerning the inaccessible mine workings could not be obtained. It is reported that the shaft is about 150 to 200 feet deep and that drifts and stopes extend northward from the shaft for some 200 or 300 feet. The vein material on the mine dump is partly oxidized, chiefly to iron hydroxides. Pyrite is the most abundant primary sulfide. Minor amounts of galena and sphalerite, together with sparse chalcopyrite, are associated with the pyrite in quartz gangue.

Several shafts have been driven and numerous pits and trenches have been dug along the Tennessee vein from the Silver Age shaft to the Tennessee shaft. The deepest of these is the Johnny Bull shaft (pl. 18), which is reported to be 88 feet deep. No drifting or stoping from this shaft is known.

Diamond drilling on the southern part of the Tennessee vein was carried out by the United States Bureau of Mines (Tainter, 1947) during the period from September 16 to December 8, 1943. The exploratory work consisted of eight drill holes on the Johnny Bull and Silver Knight claims, between 750 and 2,450 feet south of the Tennessee shaft. The holes were distributed along the vein at intervals ranging from 200 to about 375 feet. All holes were drilled from the surface and inclined toward the vein. Four were drilled from the west side of the vein outcroppings and the other four from the east side. Depths below the surface at which the vein was intersected ranged from about 100 to 350 feet, the deepest corresponding approximately in altitude to the 400-foot level in the Tennessee mine.

All holes intersected the vein, but the vein filling in seven of the eight cores was barren of ore minerals or was so low in grade as to be of little or no economic interest. The only hole that showed a substantial amount of the ore minerals was hole 8, located about 1,900 feet south of the Tennessee shaft. This hole intersected the vein about 100 feet below the surface, at an approximate altitude of 4,100 feet. A 3.5-foot interval of sphalerite, galena, and pyrite in quartz gangue assayed 7.6 percent zinc, 0.1 percent lead, and 0.03 percent copper.

This intersection might suggest that the top of an ore body was penetrated, but the Bureau of Mines engineers believed that the extensive drilling necessary to determine the existence of an ore shoot in the vicinity of hole 8 was not warranted.

TURQUOISE MINES

Deposits of turquoise are restricted to the Ithaca Peak granite and occur most abundantly in the southern half of the main intrusive body south of Mineral Park, particularly on Ithaca and Turquoise Peaks. Many small and shallow workings have explored these deposits, and only the larger ones are shown on plate 18. Some of the diggings are very old, having been started by the Aztec Indians. Very little work has been done on the deposits for many years.

Turquoise occurs typically in veinlets and small lenses in silicified, sericitized, and kaolinized porphyritic granite. Turquoise most commonly fills cavities in quartz veinlets, although some is in altered granite. Other minerals sparsely associated with turquoise in a few places are malachite, chrysocolla, and hydrous iron oxides. Sterrett (1908, pp. 847-852) describes some of the individual deposits in this area.

The features of the deposits suggest a secondary origin by supergene processes similar to those given by Paige (1912) for the origin of turquoise in the Burro Mountains of New Mexico.

LIST OF REFERENCES

The literature pertaining to the district is not extensive. The list given below includes the chief publications. Of these, Schrader's report on districts in Mohave County furnishes the most extensive description of the Wallapai district, and it is of particular value in furnishing descriptions of many of the mines. Thomas' manuscript contributes much information, particularly his detailed descriptions of the minerals and their paragenetic relationships. He includes a small-scale geologic map that covers an area extending from Mineral Park northwestward for several miles beyond Chloride. Most of the references are brief summaries of the geology and ore deposits, probably taken in part from Schrader's previous work.

- BASTIN, E. S., 1924, Origin of certain rich silver ores near Chloride and Kingman, Ariz.: U. S. Geol. Surv. Bull. 750, pp. 17-39.
 DARTON, N. H., 1925, A résumé of Arizona geology: Ariz. Bureau Mines Bull. 119, p. 180.
 DINGS, M. G., 1950, Wallapai mining district, Mohave County, Ariz.: Arizona Bur. Mines Bull. 156, pt. 1, pp. 138-142.
 ELBING, M. J., and HEINEMAN, E. S., 1936, Arizona metal production: Ariz. Bur. Mines Bull. 140, pp. 73-95.
 GARRETT, S. K., 1938, Tennessee-Schuyikill mine: Ariz. Bur. Mines Bull. 145, pp. 117-119.

R E P O R T
E L K H A R T P R O P E R T Y
C H L O R I D E , A R I Z O N A

Particularly that part known as the ARGYLE SHAFT SECTION
Leased to the Cerbat Silver Mining & Milling Company of
Arizona.

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PROPERTY:

The ELKHART property consists of ELKHART, BULLION, DUMFERNLIN, ARGYLE, VICTORIA, VICTORIA MILL SITE, DUMFERNLIN MILL SITE, BULLION MILL SITE, CHANCE, CHANCE, No. 2, EDGAR and ELKHART EXTENSION mining claims.

Of this group, the Cerbat Silver Mining & Milling Company of Arizona, has leased the following claims: DUMFERNLIN, ARGYLE, VICTORIA, VICTORIA MILL SITE, DUMFERNLIN MILL SITE, CHANCE, CHANCE, No. 2, EDGAR, And ELKHART EXTENSION, upon which this report particularly bears.

LOCATION:

This property is situated about one mile easterly from the Santa Fe Railway station at Chloride, Mohave County, Arizona, and only a few hundred feet from the railroad extension to the Tennessee mine. The ground is accessible, there being excellent roads directly to the workings.

GEOLOGY:

The rocks of this group are chiefly of Pre-Cambrian complex, schist and gneisses. The geology and mineral deposits of the Cerbat Range, and particularly the mines at Chloride, have been made a special study by the United States Geological Survey, and reference to this work can be found in Bulletin, No. 397, edited by Mr. F.C. Schrader, published in 1909. Subsequent developments have proven the accuracy of this geological work, although the bulletin does not pretend to have the actual history of the individual mines reported; for instance, historical statements of the ELKHART and of the earlier workings of the property were obtained, more or less, from hearsay, although in the main the important things stated about this property, being one of the older mines and under the early direction of the late, Dr. Theodore B. Comstock, are correct. Still earlier references to this section, and particularly the ELKHART property, were made by Dr. Comstock before the American Institute of Mining Engineers, in August, 1900, in his paper: "The Geology and Vein Phenomina of Arizona." Quoting this paper: "The principles worked out in 1892, and later, by the writer, were applied in 1895, in the selection of the ELKHART MINES, and it may not be out of place to add that we are now mining ores carrying \$ 16. a ton and over, in gold, over the axis of an E-W sub-fold. The veins of this (the Chloride) district

are mostly of the later origin than the auriferous epoch, and most of them have heretofore been worked for other than gold ores. In a parallel vein, struck on the 200-foot level of the ELKHART MINE, we have ore yielding \$ 20. per ton in gold. Other proofs come from the Argyle claim of the ELKHART group."

I quote the above to show the importance of the goldbearing series of veins which cross these properties and which were early recognized by students of geology.

Recent development at the Tennessee and Schuylkill mines, having the same veins and conditions, further confirm the importance of the gold-bearing series. Again quoting from Dr. Comstock: "The mineral bearing deposits are of three kinds: first, the most ancient gold-bearing series: and second, the middle period silver-lead-zinc; and third, the more modern silver ores."

Schrader, in his bulletin, says: "Probably no other region in the United States of equal importance in respect to mineral resources has received so little attention as western Arizona", and I may add that his statement particularly applies to the mines at Chloride, although Schrader speaks of the "Chloride district as the most important in the Cerbat Range."

ORE DEPOSITS: The ores of this group contain silver, lead, zinc, gold and copper; the gangue being quartz with some calcite and other carbonates. Many of the ore chutes are located at points where spurs, or feaders, join the veins, for which reason the Argyle shaft was selected by Dr. Comstock in the early work upon the group as the logical point for the richest and largest ore deposits. Many of the veins developed in the Tennessee, Schuylkill, Elkhart, Bullion, Distaff, Empire, Sunday School and Empire mines, cross this group, and converge in and about the Argyle shaft and vicinity. Some of the veins at the surface, show to be as wide as thirty to forty feet in places. The Argyle-Victoria vein - known as the gold-copper ledge - will probably average five to eight feet in width. All of the other veins have very strong surface showing. The deposits of the adjoining mines have been very large and rich, and the greatest depth attained, being in the Tennessee mine, (more than 1,600 feet), has demonstrated their persistency and increasing richness. I may add that none of the deeper development has ever been disappointing.

DEVELOPMENT: The mining claims, represented in the lease to the Cerbat Silver Mining & Milling Company of Arizona, have been worked mainly on the surface. The Argyle is the deepest and main working shaft, calculated to be sunk to great depth. This shaft is vertical and 200 feet deep. This shaft has recently been retimbered and a new gallows frame erected over it. On the Dumferlin claim there is a shaft some 50 feet or 60 feet deep, sunk for the purpose of developing a supply of water for the ELKHART mill. This vein is also very promising. A tunnel has been run on this Dumferlin vein at another point for a distance of about 100 feet. On the Victoria claim the following assays were made by A. C. Morehead, M. E., for gold only, making an average across 2 to 6 feet of ore: 4.60, 4.80, 5.12, 3.12, 6.40, 7.15, 4.14, 6.80, 7.24. It is to be remembered that the other veins carry silver-lead-zinc values, and I mention the importance of these assays as taken from the surface of the gold-copper vein. The deeper development of the Argyle

shaft will intersect several veins and be very close to others. In my opinion, this work is certain to disclose large bodies of rich ores of gold-copper character and of silver-lead-zinc character.

Dr. Comstock, in speaking of the Argyle shaft, said: The last work done has developed a very promising body of ore, and it is probable that here will be found some of the best values upon the whole property.

EQUIPMENT: A twenty-five horse-power gasoline hoist and a compressor of good size for development purposes, together with the necessary blacksmith shop equipment, cars, buckets, etc., have been purchased and are to be installed at the Argyle shaft in place of the old steam equipments. As further development progresses, and when it becomes economical to do so, a short electric pole line can be extended from the Bullion and Schuylkill shafts, which are about 1,500 feet distant, and electric power is available.

IMPROVEMENTS: On the ELKHART property there are very good improvements available to the Cerbat Silver Mining and Milling Company of Arizona, consisting of a concentrating mill of 150 tons daily capacity, well-equipped laboratory, mine offices, a large cook-house, with equipment, large bunk-house, a residence for the manager, and four other houses available for other employees.

HISTORY: CHLORIDE, is named from the character of its rich silver ores, was the first settlement laid out in this rich Cerbat Range. At that time the silver values, which were extremely rich and profitable enough to mine and ship to Swansea, Wales, was the principal metal looked for, and when the decline in the price of silver occurred, Chloride, like many other silver camps, was affected unfavorably. Subsequently, the miners of the camp began developing veins carrying gold, lead, zinc and copper values, and in about 1910, or 1911, the United States Smelting, Refining and Mining Company, came into the camp and developed to great depth the vein originally known as the ELKHART VEIN, and now commonly called the Tennessee Vein. The Tennessee is reported to have produced from this vein over \$18,000,000. and in the last two or three years averaging about \$3,000,000. annually. The Schuylkill mine, upon this same vein, and immediately adjoining the ELKHART workings, has sunk its shaft to the 800-foot level and is reported to have blocked out more than \$3,000,000. during the past year. The Bullion mine, of the ELKHART group, controlled by the Knight Investment Company of Utah, has within the past few months, sunk a shaft 300 feet, at which point they found the vein 16 feet wide and disclosing some very good ore of similar character to the Tennessee, Schuylkill and ELKHART. Vigorous development is being carried on by that company and very large bodies of ore are certain to be opened. The Schenectady mine, adjoining the property on the east, has within the past year discovered, even in their shallow workings, very high grade shipping ore, some of which assays as high as 1,800 ounces of silver, over 60 percent lead, and about \$20. per ton in gold. This property is, I understand, principally financed by Mr. Buckley Wells of Denver, Colorado.

On the other end of the ELKHART property are the Empire and Sunday School mines, which have produced very high grade ores, valued at many thousands of dollars.

Chloride, in 1900, was said to have had a population of 2,000. With depression of silver, the camp became more or less deserted, until not more than 400 or 500 people remained. But, in 1910, soon after the ELKHART changed hands, the camp began to renew its activities and gradually the population increased until the Chloride Chamber of Commerce estimated, last year, about 2,500 population. One of the draw-backs of this district has been the lack of milling and reduction plants, as the ores had to be of very high grade to admit of hauling and railway charges to remote smelting plants, and the older methods of ore treatment only recovered a small percentage of the gold-silver-lead values, and lost practically all of the zinc values, while none of the iron and by-products were recovered. Notwithstanding these facts, the statistics of the Chloride Chamber of Commerce show for the district a production of \$ 51,350,000. of which \$ 1,150,000. is credited to Elkhart.

SUMMARY & RECOMMENDATIONS:

It will be observed that I have quoted freely from such eminent authorities as the late, Dr. Theodore B. Comstock, and the government reports of Mr. F.C. Schrader. There are many others whom I could quote as well, in support of my own views concerning the Argyle shaft and its location as the proper place for the best and greatest developments of ore bodies in this zone. Without hesitation, I would recommend sinking the Argyle shaft to greater depth and drifting and crosscutting on each level. This work will undoubtedly develop sufficient ore reserves for many years operations.

F. A. Wright, M. E.

Chloride and the Wallapai Mining District

(By PROF. F. C. SMITH, Chloride, Ariz.)

Despite the great war; despite the frivolity of metal prices; despite the countless burdens of cost laid upon the shoulders of the everyday man by the political gymnastics of the most remarkable administration with which this country has ever been—blessed; despite the chronic pessimism of omnipresent homunculi, whose sum-total of aspiration and vision may be limited by the portentous functions of the next pay-day; despite all these handicaps, and "the flu," and woman suffrage, and national prohibition (with no caps) and all of the everyday trials and tribulations, Chloride keeps moving. She has a continually increasing number of mines in process of development in the immediate and tributary districts, with many indications today of a more solid and business-like procedure than ever before; this condition doubtless being caused not only by the fortunate development of good ore chutes, but also by a more comprehensive knowledge of the value of the ores mined. In the past, aside from the wasteful operations of a number of old-style concentrating mills, all ores from this district were shipped; sometimes to very great distances and even to Europe; and this fact had, to a certain extent, fixed the idea in the minds of the population that no different or less costly procedure would ever be possible. That the small gleanings of the "chlorider" as well as the larger tonnage of the deep mines must all be shipped—somewhere outside—and must thus stand the constantly increasing taxes of freight and immoderate smelter deductions and treatment charges. Today, glimmerings of the possibility of other and less expensive procedure pierce "the brick wall of prejudice," and the vast advantage attendant upon the erection of local mills—and mills erected in strict compliance with the startling advances in metallurgical knowledge—will serve as a sound basis for a system of operations which will very profitably replace that of the old days.

For these favorable conditions, and for the ultimate importance of Chloride—on a big scale—it may be as truly said of this mining area as of a certain notorious coffee-substitute—"there's a reason?" and this reason (supplemented by the certain promise of sensible milling) is becoming firmly fixed in the minds of a number of men who are both mentally and financially equipped to profit by it. The "reason" is this: That the Cerbat Range has the ore, and in vast amount! Only during the past week this reason has been enthusiastically expressed by two different mining operators of wide experience, and independently of each other; each of whom made substantially the following statement: "I have looked over practically all of the mining districts in North America, and I have come here to stay, for I have never seen a section of the earth of similar size so well mineralized." "Why man! even if you want to cut out the properties offered for sale, there are thousands of prospects which are opened to location which have been superficially opened twenty years ago and abandoned, which show conditions and values which, if they were—say in Tonopah, would be gobbled up at big prices." "The ore-chutes, as found in the main

veins at least, go down; as shown in the only two deep mines you have, the Tennessee and the Golconda; what better do you want?" These ideas are not exaggerations; they are facts. If this be the case, the query arises as to just why these conditions have not been more largely exploited to profit. The answer is easy, although it is a function of several varieties:

(1) Strictly local milling of these complex ores (containing lead, zinc, copper, silver and gold in varying percentages) was the only economic procedure thirty years ago, as it is today. A very superficial consideration proves this axiomatic; since it is difficult to conceive a situation warranting the expense of wagon and railroad freights on waste. For many years (we might say even up to a year ago) the milling of complex ores has been in a very weak condition to say the least; the main function of the machinery supply houses being to sell the machinery, and let the buyer take his chances as to its adaptability. As a matter of fact, until the advent of flotation, no milling methods have been available which afforded more than a very rough and incomplete saving on such ores. Hence, many deposits of complex ores have hitherto been of only problematic value; since complete milling was impossible in many cases, and only the richest portions of the ore would pay for shipment.

(2) Minds unacquainted with the recent discoveries in the metallurgy of these ores have no recourse but to base their opinions as to their commercial value (and unfortunately, to broad-cast these opinions) upon past history, which includes the record of some salient mistakes and of higher costs than are necessary today; and it must be confessed that this category includes many visiting engineers, who camouflage a lack of the necessary technical knowledge to cover the situation wisely, by such deductions from the past; fortifying their adverse conclusions by the use of maximum mining costs for the district (whether logical or not) together with maximum treatment and selling costs, backed up by minimum saving as obtained in some operating mill, whether the latter is properly efficient or not. These conditions unjustly, but quite frequently, befit the situation.

(3) The fallacy of the attempted exploitation of the complex ores of the district by laymen, profoundly ignorant of the enforced nicety of technical detail required, has strewn the district with pitiful wrecks which cannot fail to render observers skeptical of success. A few years ago there was some excuse for this condition; but today there is none.

Here, then, are a few of the reasons for the interrupted progress of Chloride, whereby it has evidenced repeated periods of great activity, with alternate periods of depression; explaining very fully why many promising ore-deposits have been abandoned before fruition, and why many investors have been afraid to proceed, or to properly finish what they have begun. Notwithstanding this limping progress, a real progress is being accomplished, simply

as the natural result of the occurrence of so many ore-deposits which simply cannot be neglected; and there is a practical taint of the early erection of a stream-modern and efficient mill for the treatment of the ores from the Schuylkill-Tennessee mines. The erection of this mill should absolutely solve the problem of Chloride's future; ridding it of the further incubus of the installations of process cranks and visionary dreamers, and affording a proper pattern for business-operators.

The fact must not be omitted that there are already two small flotation mills being in this section; the Washington and Keystone. Neither of these has yet come into active operation, but there is reason to doubt their entire efficiency when they do.

Among the mines, the Schuylkill-Tennessee carries out a steady improvement and development policy; operating two shifts and opening up new ore-reserves against the day of production. Connections have recently been made with the 800-foot shaft on the Schuylkill end-line, by raising from the Tennessee 900-foot level north, thus establishing the entirety of the one vein, draining the Schuylkill and giving better general ventilation.

The Cerbat Silver Mining Company is actively operating the old Elkhart property, northward on the same vein; using the Schuylkill shaft and surface plant, and continuing the drift on the 800-level northward into Elkhart ground. This will bring the exploration some 300 feet below the old Elkhart shaft, and in these new workings good ore has been already encountered. There are two parallel veins, one carrying silver-lead ores, the other pyritic gold ores.

Still to the northward, the Chloride Queen Company is drifting on the 250-foot level, and producing some very fine ruby silver ore. This property covers the intersection of some East-West silver veins which have produced a quantity of high grade ore, with the North-South vein upon which are the mines above-mentioned.

A short distance east of the Tennessee, an operation has been undertaken which is of great interest to the whole district. It consists of a double-track cross-cut tunnel, opened near the south end of the Payroll claim, which is to be driven about two miles easterly to intersect and drain the many veins at great depths. The enterprise has been started by Colonel Rankin, and the tunnel has a depth of something like 300 feet. It is understood that T. B. Scott, the owner of the Payroll, has become interested, and that the work will proceed without delay.

The Brunswick property, on the Tennessee vein, has recently begun active operations, and promises to take a prominent part in the ore production of the camp. It is located a few hundred feet south of the Tennessee.

In this immediate vicinity and near the old Altata mine, the Rescue or Dorothy claim has recently jumped into prominence having produced and shipped some of the

Concentrates

A Concentrated Summary of the Mining Activities of the Southwest

COCHISE COUNTY

Swisshelm Gold-Silver Company, recently shipped a carload of ore to Calumet & Arizona smelter at Globe, which showed a silica content of 10 per cent and the gold-silver content valued to \$31.80, of which \$8.60 was in gold and \$23.20 was in silver.

Shipments of silver, gold and lead ore from the Tombstone district both by lease and the Bunker Hill company continue to average in the neighborhood of 100 tons per month, according to the reports at the local depot. With sil- ver at \$1.30 an ounce this means a value of at least \$100,000 per month.

It is reported that a rich body of ore has been struck on the properties of the Arizona Mining company, at Drag- ways on the body running \$75 to \$100 in silver and lead.

Calumet & Arizona Mining com- pany have declared a quarterly dividend of \$1.00 per share, payable March 22nd, an increase of 50 per cent over the previous quarter.

A strike of sulphide copper ore is being worked by the Middlemarch mine, situ- ated about five miles from Pearce. Ore carry- ing values of silver and gold was reported in the main shaft at the 800- foot level.

L. Fuffner of Paradise reports several mining properties in the Tombstone district in which he is interested are showing favorably, the Cochise Mia- mi company has recently installed a new engine which is driving a de- cent tunnel. Also the Ajax prop- erty is about to start work soon, as well as the extension of the Extension Co.

Shattuck Arizona, in the last two months has shown signs of a recovery in operations, after a partial suspension of the mines due to a fire.

GILA

Production of the Miami Copper mine is being kept down awaiting a market. Production is averaging the same as 1914 production.

Work on the main shaft of the Iron ore mine in the Globe district from the 1300 to 1500 foot level was started re- cently. Progress on the building for a new concentrator is rapid. Ore re- sults are being steadily increased.

Old Dominion at Globe is doing deep sinking. The main operating shaft has been sunk from the 18th to the 19th level; K shaft from the 19th to the 20th level; the Grey from the 14th to the 16th level.

On the report for the quarter end- ing in December, 1919, more than 120 feet of new shaft has been added to the Foot- wall of the Superior and Boston com- pany at Globe. Several small stopes are being opened on the 400 level. Drifting on the 500 level is also reported to be in progress.

Van Dyke Copept company of Mi- ami has established the world's record in sinking, having sunk 10 feet a day

for one month of 31 days, or a total of 308 feet.

It is reported that a rich strike has been made on the 140-level of the Irene mine which is situated in the Globe district, about one mile north of the Old Do- minion.

The Porphyry Mining company of Globe has successfully completed the under- raising of the drill hole for the 12 1/4-in. casing at the old Barney shaft and the casing lowered to a depth of 500 feet.

The Gila Copper Sulphide company at Christmas has emerged from its trouble with formal action by Judge Sawtelle, in the U. S. Court of Arizona, in dismiss- ing the receivership and turning the prop- erty back to the owners.

GREENLEE

The Stargo mine, located one mile out of Morenci, has been shipping to the C. & A. Smelter. The silica content has been as high as 82 per cent and the net return on a carload after paying all freight and smelter charges was between \$1100 and \$1200.

The \$150,000 mill of the Duncan Mining & Milling company has been completed and is now ready for operations. As soon as the mine is unwatered, which will take about 15 days more, active mining opera- tion will be commenced.

MOHAVE

W. D. Grannis has made preparations for the resumption of work on the Great Republic mine of the Arizona Bullion company in the Cedar District. The Great Republic is one of the old producers of the Cedar district and they claim to have gold opening running better than 50 ounces of silver.

President Wold, of the Tom Reed com- pany, Oatman, reports conditions better at Oatman than at any time in the last three years. Oatman is said to be paying the highest wages of any gold camp in the world.

The Petosi mine, formerly the Bella Union, situated at Chloride, is reported to have been taken over by Chas. Schoen- mehl, who is planning a campaign of de- velopment.

The shaft of the Kingman Silver-Gold Mines company, situated about eighteen miles from Kingman, in what is known as Hardy's Butte, has reached a depth of 30 feet and a big hoist and compressor in- stalled. The work from now on is to be carried on with machine drill and big progress is expected.

Considerable excitement has been caused in Oatman by the opening of an ore body in a crosscut from the tunnel level of the Alexander mine of the Oat- man Southern Mining company. Four feet of the vein are reported to have given assays of more than \$2,000 to the ton.

The Combination Silver Mines com- pany of Hackberry, which took over the Combination properties recently, is get- ting shaped up for a busy season of min- ing is the report coming from that sec- tion.

The crosscut from the 540-level of the Telluride mine at Oatman, has been car- ried over 40 feet and is close to the ore shoot that was encountered on the 380- level.

Leasers of the Rainbow mines at Chlor- ide have entered an ore body three feet in width that gives average samples of from \$50 to \$75 per ton. This ore body was encountered close to the lower level and gives backs of 250 feet for stoping.

Recently the Chloride Queen Mining company shipped a small car of ore to the smelter at Humboldt which netted \$1270 or \$35 per ton.

It is rumored that the Senate Silver Mines company and the Hackberry will consolidate.

It is understood that the Elkhart mine is to undergo thorough development after which the main shaft will be actively ex- tended in depth, crosscuts will be car- ried to both walls and into the parallel veins.

Operators of the Antler and Copper World claims, east of Yucca, are sinking a winze below the 100-level of the Antler. Ore taken from this winze is said to carry values of 24 ounces silver, 30 per cent copper and a small amount of gold.

A good body of ore is reported 390 feet from the portal of the tunnel being driven by the Gates Ajar, Kingman. The ore shows silver-lead values.

The Goldroad Annex Mines company at Kingman is being financed to the extent of \$50,000 for development work, according to report.

The Copper Age mine at Chloride which is owned by the Arizona Ore Reduction company, is driving its tunnel towards a cross vein, and at a depth of 2800 feet from the portal has struck a flow of water that is said to indicate proximity to the vein.

The mines and holdings of the Arizona Butte Mines company have been examined recently by eastern men and it is an- nounced that they recommend the financ- ing of the properties on a large scale. New equipment will have to be installed to carry on this work.

The Diana at Chloride is making good headway according to recent reports from that section. On the 300 the drift has been cut 70 feet west and 18 feet east. Fifty feet west of the main shaft a cross- cut is being run to tap the foot wall. An eighty-foot ore shoot is encountered which shows to be a very good milling ore.

The shaft of the United American at Kingman has reached a depth of 450 feet. The vein now being entered is unexplored, no work having been done on it at any point, although the outcrop looks good.

Drifting is being carried on to the east of the shaft on the 650 level of the Gold Ore mine.

It is reported in Kingman that the Diamond Joe mine has just made a ship- ment of concentrates.

A new lease has been made on the Rainbow at Chloride. A strike of high grade was recently made and the ore is being hauled down for shipping.

ore which the district has

ports indicate that the three min-
ties recently operated under the
ent of Mr. J. B. Hughes have
olidated, and that active develop-
the entire group will be com-
once.

erald Isle Copper Company has
out down to make alterations in
olytic plant. This company has
ty of oxidized copper ore, occur-
nglomerate, and it has already
the production of two tons of
opper.

of Chloride, in the flat country,
shoe is installing a heavy duty
ump, with the intention of sink-
the 1000-foot level; their ore as
showing fine values in silver
with much less lead and zinc
found in the ores of the main
It is expected that the Diana will
sume work, as well as the Golden
als Co. Both of these proper-
fine-grained pyritic gold ores in
matrix, especially well adapted to
centration.

ral and Buckeye mines in Min-
have been purchased by a syn-
represented by Mr. M. B. Dudley,
being rapidly developed. The
an old property which has not
ed in many years, but which has
filled the cabinets of Mohave
with the most magnificent speci-
ative silver. After unwatering
conditions have been found of a
eter character than could have
ected, and there is little doubt
two properties will very soon be-
very silver producers.

Washington mine, also in Mineral
being rapidly brought to the pro-
stage, as the mill is practically
and has already passed the ex-
al stage. The property shows sev-
interesting veins, with certain
carrying high values in ruby
It is being operated by a syndi-
Mr. F. E. G. Berry in charge.

these properties, many others are
activity with the advent of many
al operators, and new finds are
ly reported. Many of the former
of Chloride, who left the camp
after the war conditions became
are returning; all expressing their
atisfaction at their ability to resume
the finest mining camp they ever

THE ARIZONA GEM MINES

(Special Correspondence)

ed at Mineral Park, 20 miles
Kingman, Arizona, is perhaps the
producing turquoise mines in the
A large percentage of the stone
over, and of the poorer grade consisting
and blended with turquoise and
ed by the trade "matrix"; while
tractive and has a large sale, it
rated in price with the clear
The prices prevailing up to 1907
from \$2.50 to \$12.50 per pound
ough, but since that time prices
aterially dropped, until for several
ast these mines have been closed

largest producing company, with
est acreage, is that of the Aztec
Company of New York. This
y was the pioneer, being followed

by the Southwest Turquoise Company of
Los Angeles, the Los Angeles Gem Com-
pany and the Arizona Turquoise Company
of New York.

There is evidence that the mines were
worked in the stone age as numerous stone
hammers and hand clipping stones were
found there. The late Jas. W. Haas was
the original discoverer of the turquoise
at Mineral Park, operating the old Monte-
zuma mine in the Turquoise mountains
southwest of Ithica Peak, but upon find-
ing the later mines in the Ithica Peak
country the old Montezuma mine was
abandoned.

Another important deposit is that of
Chrysoprase in the River range, some 18
miles north of Oatman. These properties
are of late discovery and are expected
to rival the famous old turquoise output,
as it is of more commercial value and
very rare. This gem is remindful of the
remotest antiquity; a hard semi-trans-
luscent green stone, carrying stripes and
colored with nickel. Perhaps the only
operating mine of this stone in America
today is located at Porterville, California,
and owned in New York.

Owing to its high market value, all
grades are used, comprising a dozen dif-
ferent grades from common to clear, and
values run all the way from a few dollars
to around \$400 a pound.

STANDARD MINERALS DEVELOPING

A strike of gold and silver ore has been
made on one of the claims of the Stand-
ard Minerals company, twenty miles east
of Kingman. The company had been sink-
ing a shaft on the Standard claim and at
a depth of thirty feet ran into ore that
gave results of from four to ten ounces
gold and 325 ounces silver.

The vein in which the strike was made
is about five feet in width, the rich streak
having a width of from eighteen inches
to thirty inches. The whole width of the
ore-bearing streak is pay.

The Standard Minerals company has
been operating a mill on its molybdenite
properties and have been opening the ore
bodies on the deep levels. The mill has
been doing good work, a product of about
sixty per cent molybdenite being secured.
The company is understood to have con-
tracts covering all the concentrates the
mill can produce.

The mill is under the direction of S. S.
Jones, who is also consulting engineer for
the company. Mr. Jones is one of the best
mining engineers and metallurgists in the
country and the Standard Minerals com-
pany is to be congratulated on securing
his services. George Williston, a young
engineer and metallurgist, is assistant to
Mr. Jones in the mill work and Gerald
Stimpson is general manager.

Through the hospital system the work-
men of the Warren district get all medi-
cal care and surgical attention necessary
for sickness and accident, and the families
of the workmen get all medical attention.

The railroad from Cedar Glade to Clark-
dale, the smelter town of the United Verde
Copper company, runs through a minia-
ture Grand Canyon; this has not been ad-
vertised to any extent, but it is a rare
scenic attraction.

The Chloride Queen

The Chloride Queen Mining Co. has five
claims and two fractions, over one hundred
and twenty acres of ground in one block
side-lining on the north side of the Cerbat
Silver Mines Co. (known as the Elkhart
mine) and end-lining the Empire property
northeast of Chloride about one and one-
half miles.

The equipment consists of one 12-H. P.
hoist complete, one 60-H. P. oil burning
Bessemer engine, Chicago Pneumatic com-
pressor with capacity of 417 cubic feet,
blacksmith shop fully equipped, change
room, ore bins, and large galvanized iron
building covering all the machinery.

The main shaft is timbered down 260
feet, with manway and working shaft,
with a drift run at the forty level, 100-
foot drift at 100 level, and at the 200
level the drift is in two hundred feet
going under the hill, which when in about
200 feet more will give a depth of about
600 feet. Crosscuts have been run on this
level 21 feet to the south and 22 feet to
the north without encountering either wall.
A good vein of ore at times widening to
thirty inches has been continuous for over
100 feet, with values at times running
over \$150 a ton in silver, besides values
in lead and gold. The drift is being pushed
to the west on the east and west vein of
the property, and well versed mining men
say that the company will sure have a
very large body of ore under the hill from
all indications. One thing noticeable is
that the work is being done on the east
and west veins, which are so rich, leaving
the north and south veins to be opened up
later. These north and south veins have
given up millions in rich ores, to such well
known companies or properties as the Elk-
hart, Schuylkill, Distaff, Schenectady and
Tennessee in this immediate vicinity.

It is the intention of the management
to run the drift under the hill and open
up the ore and go on a producing basis.
In fact, the first car of ore will be shipped
to the Selby smelter within a month. The
short haul of one mile with a good road
from shaft to the railroad at the Tennes-
see mine is an added feature of low pro-
duction cost to the company. The Chloride
Queen Mining Co. has hundreds of feet
of stoping ground from the 200-foot level
up carrying rich values in silver ores, be-
sides the hundreds of feet of ground be-
low this level which will be opened up as
the property is developed, and which is
assured by what the Elkhart and Tennes-
see properties have proven, and especially
the latter, which has a depth of 1400 feet,
with valuable ore practically all the way,
and a reported production in the past of
something like \$18,000,000. One must
not lose sight of the fact that the Elkhart,
which side-lines the Chloride Queen on the
south, is reported to have produced over
one million dollars with deepest workings
500 feet.

The management of the Chloride Queen
Mining Co. is confident that their prop-
erty with proper development in the next
few years will produce its millions in rich
silver ores, and with present prices of sil-
ver the outlook for the company to go on
the dividend-paying basis in the very near
future is of the best.

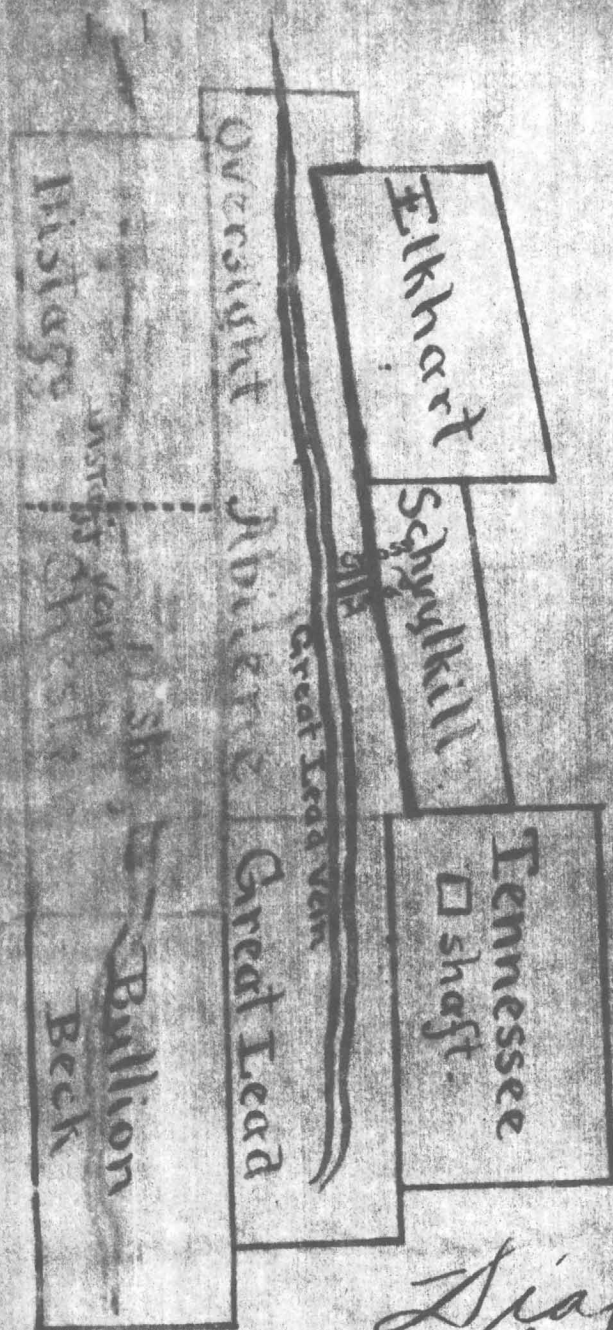


Diagram showing some of the most prominent mines of the camp.

Distaff Chloride mines in red



Diagram - showing some of the most prominent mines of the camp. ~~~~~
 Distaff Chloride Mines in red

OTHER MINES AND PROSPECTS ON THE TENNESSEE VEIN

The Elkhart mine, at the extreme north end of the Tennessee vein, is an old mine that has been idle for many years. The total production from this mine from 1901 through 1948, as shown in table 2, has been small. The mine workings, now inaccessible, are reported to consist of three shafts, six levels (the lowest 500 feet deep), drifts totaling about 2,600 feet, numerous stopes, and several crosscuts.

The Silver Age mine, near the extreme south end of the vein, was primarily a silver mine (table 2). The silver was probably derived in large part from silver chloride (cerargyrite) found in the oxidized zone. Accurate data concerning the inaccessible mine workings could not be obtained. It is reported that the shaft is about 150 to 200 feet deep and that drifts and stopes extend northward from the shaft for some 200 or 300 feet. The vein material on the mine dump is partly oxidized, chiefly to iron hydroxides. Pyrite is the most abundant primary sulfide. Minor amounts of galena and sphalerite, together with sparse chalcopyrite, are associated with the pyrite in quartz gangue.

Several shafts have been driven and numerous pits and trenches have been dug along the Tennessee vein from the Silver Age shaft to the Tennessee shaft. The deepest of these is the Johnny Bull shaft (pl. 18), which is reported to be 88 feet deep. No drifting or stoping from this shaft is known.

Diamond drilling on the southern part of the Tennessee vein was carried out by the United States Bureau of Mines (Tainter, 1947) during the period from September 16 to December 8, 1943. The exploratory work consisted of eight drill holes on the Johnny Bull and Silver Knight claims, between 750 and 2,450 feet south of the Tennessee shaft. The holes were distributed along the vein at intervals ranging from 200 to about 375 feet. All holes were drilled from the surface and inclined toward the vein. Four were drilled from the west side of the vein outcroppings and the other four from the east side. Depths below the surface at which the vein was intersected ranged from about 100 to 350 feet, the deepest corresponding approximately in altitude to the 400-foot level in the Tennessee mine.

All holes intersected the vein, but the vein filling in seven of the eight cores was barren of ore minerals or was so low in grade as to be of little or no economic interest. The only hole that showed a substantial amount of the ore minerals was hole 8, located about 1,900 feet south of the Tennessee shaft. This hole intersected the vein about 100 feet below the surface, at an approximate altitude of 4,100 feet. A 3.5-foot interval of sphalerite, galena, and pyrite in quartz gangue assayed 7.6 percent zinc, 0.1 percent lead, and 0.03 percent copper.

This intersection might suggest that the top of an ore body was penetrated, but the Bureau of Mines engineers believed that the extensive drilling necessary to determine the existence of an ore shoot in the vicinity of hole 8 was not warranted.

TURQUOISE MINES

Deposits of turquoise are restricted to the Ithaca Peak granite and occur most abundantly in the southern half of the main intrusive body south of Mineral Park, particularly on Ithaca and Turquoise Peaks. Many small and shallow workings have explored these deposits, and only the larger ones are shown on plate 18. Some of the diggings are very old, having been started by the Aztec Indians. Very little work has been done on the deposits for many years.

Turquoise occurs typically in veinlets and small lenses in silicified, sericitized, and kaolinized porphyritic granite. Turquoise most commonly fills cavities in quartz veinlets, although some is in altered granite. Other minerals sparsely associated with turquoise in a few places are malachite, chrysocolla, and hydrous iron oxides. Sterrett (1908, pp. 847-852) describes some of the individual deposits in this area.

The features of the deposits suggest a secondary origin by supergene processes similar to those given by Paige (1912) for the origin of turquoise in the Burro Mountains of New Mexico.

LIST OF REFERENCES

The literature pertaining to the district is not extensive. The list given below includes the chief publications. Of these, Schrader's report on districts in Mohave County furnishes the most extensive description of the Wallapai district, and it is of particular value in furnishing descriptions of many of the mines. Thomas' manuscript contributes much information, particularly his detailed descriptions of the minerals and their paragenetic relationships. He includes a small-scale geologic map that covers an area extending from Mineral Park northwestward for several miles beyond Chloride. Most of the references are brief summaries of the geology and ore deposits, probably taken in part from Schrader's previous work.

- BASTIN, E. S., 1924, Origin of certain rich silver ores near Chloride and Kingman, Ariz.: U. S. Geol. Surv. Bull. 750, pp. 17-39.
- DABTON, N. H., 1925, A résumé of Arizona geology: Ariz. Bureau Mines Bull. 119, p. 180.
- DINGS, M. G., 1950, Wallapai mining district, Mohave County, Ariz.: Arizona Bur. Mines Bull. 156, pt. 1, pp. 138-142.
- ELBING, M. J., and HEINEMAN, E. S., 1936, Arizona metal production: Ariz. Bur. Mines Bull. 140, pp. 73-95.
- GARRETT, S. K., 1938, Tennessee-Schuylkill mine: Ariz. Bur. Mines Bull. 145, pp. 117-119.

able tailings in the dump are estimated by H. L. McCarn at 12,000 tons, and they will concentrate about 60 per cent, or about 1 ton of zinc in 4 or 5, and will besides carry 8 to 10 per cent of lead and some silver and gold. Of zinc alone, by fine grinding and proper treatment, they are expected to yield about 300 tons of concentrates. There seems to be little doubt that the zinc, which heretofore has been regarded as a detriment, can be marketed at a good profit. In January, 1908, after the foregoing was written, Mr. McCarn informed the writer that the tailings were being worked over with jigs, tables, and electrostatic separators.

The most important of the surface improvements at the mine are a well-equipped steam concentrating mill, having a capacity of 100 tons in twenty-four hours, and two substantial steam hoists, that to the south having a capacity for a 1,000-foot shaft.

SCHUYLKILL MINE.

The Schuylkill mine, one of the oldest in the district, is about 1 mile northeast by east of Chloride, on a patented fractional claim adjoining the Tennessee on the north. It is on the west side of Tennessee Wash, and 100 feet above it, at an elevation of about 4,300 feet. It is owned by the Southwestern Mining and Smelting Company, a Pittsburg corporation.

The mine in early days was worked by Monroe Salisbury, who operated the Benson smelter, to which much of the ore was shipped. Later it was sold to the present company, which did the deep development work planned to extend to a depth of 1,000 feet, and is said to have blocked out much good ore ready for stoping when, about three years ago, work was suspended.

It is situated in alignment with the Tennessee and Elkhart mines and is supposed to be on the Tennessee vein (fig. 5); the country rock and ore are similar to those of the Tennessee mine. The vein here strikes N. 9° W. The large dump shows that much work has been done. The developments consist of a steam hoist, an excellent shaft 500 feet deep, two long crosscut tunnels, and considerable drifting and additional crosscutting. The mine has produced much good ore and has much more in sight reported to carry good copper and gold values. That from the surface workings was mostly of high grade. Rich silver-lead ore is also reported to occur on the 400-foot level, and on this and the lower levels are ores with native silver, running \$100 a ton. The mine was closed at the time of the writer's visit.

ELKHART MINE.

The Elkhart mine (Pl. V, A) is situated a little more than a mile northeast of Chloride, west of Tennessee Wash, and adjoins the

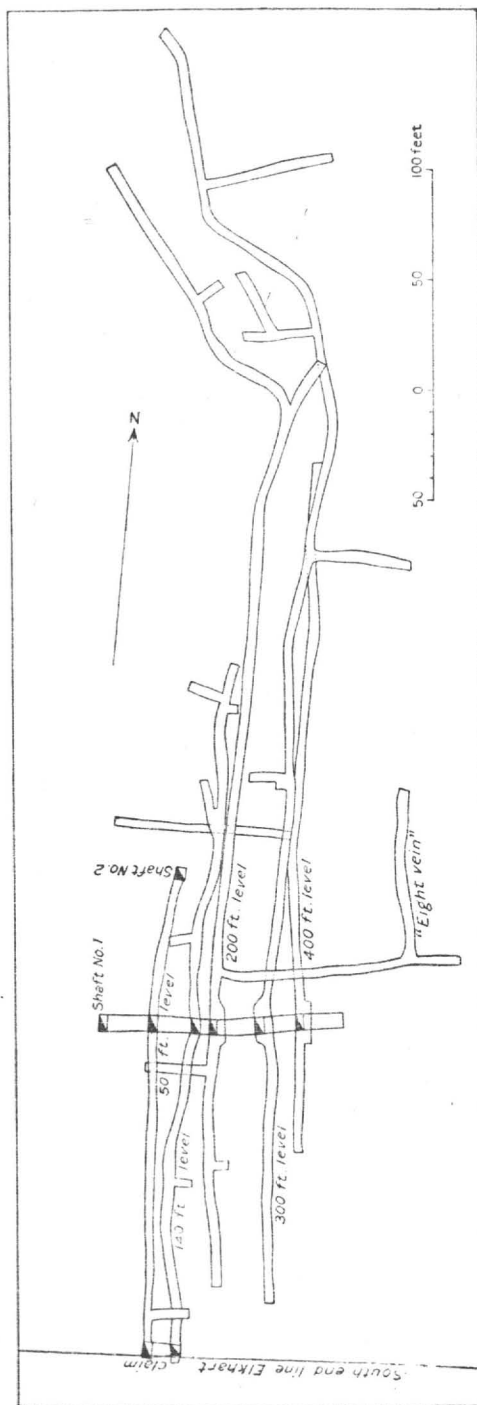


FIGURE 7.—Plan of Elkhart mine.

Schuylkill mine on the north. Its property embraces four claims, the Elkhart, Argyle, Dumferlin, and Bullion, as shown in figure 7.

The Elkhart is one of the older mines of the region. It was located in the early eighties and produced several thousand tons of rich ore from the surface down. Later it was worked by Ohio people and still later sold to a Scotch company, of which Theodore Comstock was the general manager. He put up the mill and installed the machinery about 1895-96. In 1902 another company bought it from Mr. Comstock and later it passed into the hands of J. H. O'Neill, of Los Angeles. In 1906 it was acquired by the present company. The mill closed in April, 1906, but started later and ran until October 15. A large amount of money has been spent on the mine, for which it has returned but little. It is owned by a corporation of Glasgow and Los Angeles capitalists, with headquarters at Los Angeles. It is located on the northern part of the Tennessee or "big lead" vein, or a similar vein lying in its trend, and has associated with it one or two

parallel veins or supposed feeders or spurs. The country rock is pre-Cambrian granite and gneiss similar to that at the Tennessee mine. Some diabasic rock is present near by, but was not observed in association with the vein. The zone of oxidation extends to a depth of about 80 feet.

The mine is developed by shafts and levels. The main shaft is on the vein and is sunk to a depth of 500 feet; another is down 200 feet, and a third 80 feet. There are six levels, but they are somewhat irregular and there is reported to be about 400 feet of drifting on each level, not including numerous stopes and crosscuts. The principal surface equipments consist of a steam hoist with a capacity for a shaft 1,000 feet deep and a dry-crushing concentrator mill having a capacity of 100 tons in twenty-four hours. The mill is in good condition and formerly turned out a carload of concentrates a day. Both mine and mill are accessible by a good wagon road of easy grade.

The ore contains galena and carries gold and silver, the gold being contained mostly in the pyrite, as at the Tennessee mine; but the ore differs from that of the Tennessee mine in the absence or scarcity of zinc blende. The sulphide ore is reported to approximate as follows: Lead, 63 per cent; silver, 25 ounces per ton; gold, \$10 per ton.

The ore is reported to be much the same in quality from the surface down, and to favor the hanging wall. The ore bodies are said to be 15 feet in width in some places.

According to Comstock^a a parallel vein struck on the 200-foot level yielded \$20 in gold to the ton, and on the same level prolonged northward a cross vein of similar type belonging to the old latitudinal series was worked, carrying ore plentifully sprinkled with yellow pyrites running well in gold, the gangue being entirely different from that of the main vein. This new vein is also present on the 300-foot level. On the 400-foot level white orthoclase feldspar dikes, which are probably aplite, are reported to be closely associated with the vein series to which it belongs.

In portions of the mine refractory clay or kaolin-like deposits of considerable extent, derived from kaolinization of the feldspar in the country rock, form the walls of the vein.

With the exception of some ore on the second level, the ore in sight is about all worked out down to the fourth level, and new ore bodies will have to be opened before the mine can produce much. The vein splits between the fourth and fifth levels, and above this split the ore, though principally lead, carries \$8 to the ton in gold. The best ore

^a Comstock, Theodore B., Geology and vein phenomena of Arizona: *Trans. Am. Inst. Min. Eng.*, vol. 30, 1900, pp. 1048-1049.

encountered thus far has been taken from the 500-foot level. Here the vein is reported to be 14 feet thick and to contain some very high-grade ore. The dumps, which are large, contain much ore and are all to be milled.

DISTAFF MINE.

Three-quarters of a mile east of Chloride and about one-fifth of a mile west of the Tennessee vein and about parallel with it, lies the Distaff-Mollie Gibson vein, on which are situated the Distaff, Mollie Gibson, and other properties.

The Distaff mine is located on a patented claim in the foothills just north of Tennessee Wash, at an elevation of 4,100 to 4,400 feet. It is owned by Charles E. Sherman, of Mineral Park. The country rock is the younger medium-grained granite described under "Geology" as characteristic of the region lying north of Chloride. Hornblende and mica schist also occur, notably on the east side of the claim. The granite is roughly schistose and the vein is about parallel with the schistosity. The vein strikes north with vertical dip and has a known extent of about a mile. It is but 2 or 3 feet in width and is easily worked, but pinches on the northern part of the Distaff ground.

The principal developments consist of about 2,000 feet of underground workings, including a 240-foot shaft and drifts. Recent shipments of what was formerly considered low-grade ore from the old dumps of the Distaff are reported to have netted several hundred dollars per carload. The production has been about \$50,000, the ore being chiefly chloride or horn silver, with much native silver occurring in slabs or chunks many pounds in weight in the deeper part of the workings.

MOLLIE GIBSON MINE.

The Mollie Gibson is situated south of the Distaff and beyond Chloride Wash, the Bullion-Beck claim intervening. It is on the same vein as the Distaff. It is credited with developments 200 feet in depth and with having produced considerable lead-silver ore, some being of high grade.

HERCULES MINE.

The Hercules is a small mine, situated about 2 miles northeast of Chloride and about one-half mile east of Tennessee Wash, at an elevation of about 4,700 feet. It is close to the wagon road leading to the Lucky Boy and Samoa mines.

The Hercules was discovered about 1899 and held by Comstock & Ferguson until 1903. They drove a 60-foot tunnel from the canyon side and sunk four shafts to the depth of 20 feet, with no material results. In 1903 F. H. Kraft, the present manager and part owner

of the property, sunk a little deeper and struck good \$30 ore, and the mine has been a steady though small producer ever since.

The country rock is the usual pre-Cambrian gneiss. The vein is 25 to 30 feet in thickness. It trends N. 54° W. and dips about 70° SW., with porphyritic granitoid gneiss on the hanging wall and black hornblende-mica schist on the foot wall. A neighboring vein trends N. 80° W. and dips 80° N. It occurs in the dark foliated schist, and the mine is probably on a chimney or ore body enriched by the intersection of this vein with the Hercules.

The principal developments are a 90-foot shaft sunk on the vein and some drifting, notably on the 50-foot level. The bottom of the shaft shows a pay shoot of very good ore 1½ feet thick. The mine yields a plentiful supply of excellent potable water. The ore is galena, running high in silver and containing good values in gold.

BADGER MINE.

Two miles northeast of Chloride and one-eighth mile north of the Hercules mine, on what is known as the Badger ground, occurs a large 20-foot vein known as the "Big vein." It strikes N. 40° W. and dips 80° SW. It has produced considerable ore. Tests from surface pits sunk on it show \$16 ore, of which \$12 is in gold. In a canyon one-eighth mile east of the Hercules the vein is cut by a close sheeting or cleavage structure trending N. 80° E.

At about 250 feet northeast of the "Big vein" and parallel with it, but dipping 80° NE., lies the well-known Badger vein. It has been mined to a considerable extent at several points to the northwest and has produced considerable ore.

Among the properties situated on it are the Badger group and the Badger and Woodchuck mines, located on eastern tributaries of Tennessee Wash. The two latter, owned by S. L. Chadwick, have produced considerable rich lead ore, which occurs in large bodies, but some of the ore is said to contain much zinc. The Badger group property is reported to have produced several hundred tons of good ore, chiefly in gold and silver, from a 300-foot tunnel 150 feet deep at the face.

EMPIRE MINE.

The Empire mine is situated about 2 miles north-northeast of Chloride, in a northeast gulch of Tennessee Wash, on a large vein which is supposed to be the northwestward extension of the Badger vein. It is one of the oldest and first patented properties in the district. It is developed principally by a shaft 200 feet deep. The values are principally in silver, which is very soft and very rich, and the yield has been good from the surface down. The production has been about \$70,000. The mine was owned by William Raymond, one

of the discoverers of Pioche, and was worked by lessees with good profit. Later E. F. Thompson sank the shaft to greater depth and shipped ore of good grade.

PAY ROLL MINE.

The Pay Roll mine is about $1\frac{1}{2}$ miles east of Chloride, near the middle of the west slope of the Cerbat Range. It is situated on Pay Roll Gulch near its head, at an elevation of about 4,400 feet, whence the surface rises steeply to about 5,200 feet in Rainbow Mountain on the northeast. The mine is approached by a good wagon road of easy grade.

The property, aggregating 40 acres, consists of two claims, known as the Pay Roll and Black Prince quartz. It is owned by Mrs. Mary Murphy, of Kingman, and Judge J. J. Hawkins, of Prescott. It was located in March, 1887, by J. W. Murphy.

The country rock consists of the usual pre-Cambrian crystalline schists, with granitoid rock predominating in the hanging wall and schist on the foot-wall side. A diabase dike is locally associated with the vein, which is cut off on the northwest by a raised fault block of black hornblende schist. In the gulch just below the mine the schists are cut by dikes of relatively young light-colored garnet-bearing aplitic granite.

The principal development work, all on the Pay Roll claim, consists of three shafts, aggregating about 500 feet in depth, over 600 feet of tunnels, about 400 feet of drifts, and some crosscuts and stopes. Shaft No. 1, the main working shaft, sunk off the vein, is 225 feet deep, and contains water in the sump. Shafts Nos. 2 and 3 are sunk on the vein to depths of 100 and 60 feet, respectively. The main drift is about 500 feet in length and the main crosscut tunnel about 130 feet. Where the latter intersects the vein a winze about 50 feet deep is sunk on the vein.

The mine is situated on the Pay Roll vein or lode, which strikes about N. 30° W. and dips steeply to the northeast; the structure in the adjacent rocks trends about N. 40° W., with the dip approximately vertical. The Pay Roll is one of the large veins in the Chloride region. As shown by its persistent croppings it has a horizontal extent of nearly a mile, but is reported to be somewhat broken in the bottom of the mine. It varies from 6 to nearly 100 feet in thickness, 10 feet being perhaps a fair average, and contains in places a fair grade of concentrating ore. The gangue is mainly quartz, and the vein is in places separated from the wall rock by a thick sheet of argillaceous or talcose gouge.

Near the mine, as shown in figure 4, the vein is joined by the Redemption Clyde vein, which probably enriches the Pay Roll ore shoots.

The ore in the persistent pay shoots consists of lead carbonates and galena, with some pyrite and chalcopyrite; it contains both gold and silver. The total production of the mine was not learned, but it is reported to include many carloads of rich shipping ore that run about \$80 a ton, mostly in gold, derived principally from the surface workings, excellent values being found in the south shaft. So far as can be judged at present the deposit is a good-sized body of low-grade ore.

REDEMPTION MINE.

The Redemption mine, also known as the Ferguson, is a new property situated 2 miles east of Chloride and half a mile east of the Pay Roll mine. It is working on the Redemption Clyde vein, which lies east of the Pay Roll vein and joins that vein at the Pay Roll mine. The Redemption Clyde vein strikes N. 60° W. and dips 85° NE., and is known to have an extent on the surface equal to the length of at least four claims. Where opened on the Redemption property it attains an elevation of about 5,000 feet. Like the Pay Roll vein, it lies in the pre-Cambrian crystalline schists. It is opened by tunnels and winzes. The vein is about 4 feet thick, and the ore shoot is about 18 inches thick. The ore contains chalcopyrite in quartz and carries about 8 per cent of copper, 1 to 2 ounces of silver to the ton, and some gold. The production amounts to 200 tons of ore.

LUCKY BOY MINE.

The Lucky Boy mine is about 3 miles east of Chloride and about a mile east of the Redemption mine. It is near the crest of the Cerbat Range, at an elevation of about 5,750 feet, in the head of a gulch which is tributary to Windmill Wash. The property embraces four claims, the Lucky Boy, Brighter Days, Queen, and Baldwin. The total output is said to have had a value of about \$150,000.

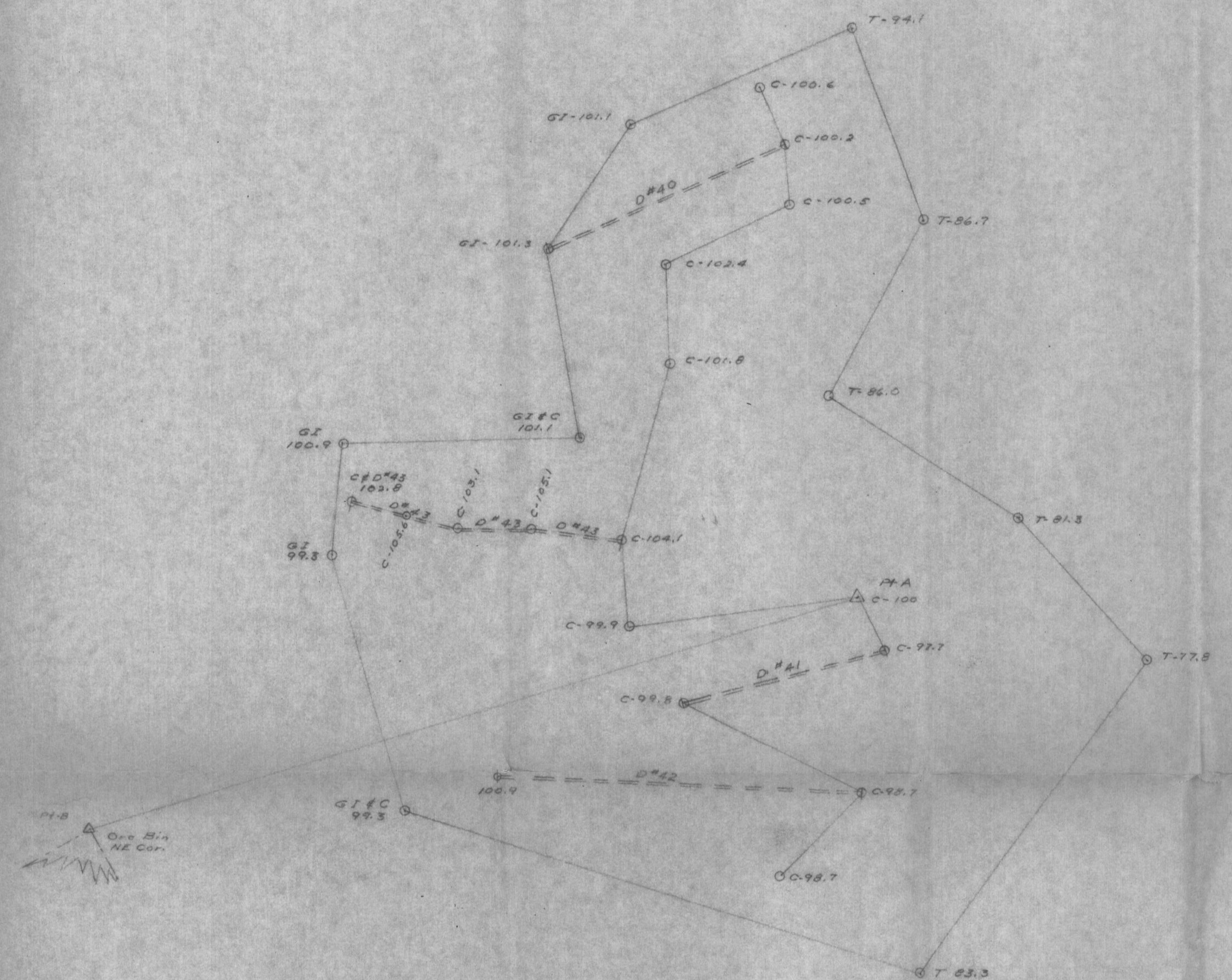
The Lucky Boy mine is an old property, located in 1892. It has been producing more or less all along and has been operated steadily for the last seven years. For some time it was owned by the Scott Lucky Boy Consolidated Mining Company, of Norfolk, Va., and was leased and worked by a company composed of Kingman men, Fred Stull being superintendent. Early in 1907 it was reported that the property had just been sold to an English company. In 1908 it was worked only on a small scale by lessees.

The principal rock is a medium-grained biotite granite, in which biotite, quartz, orthoclase, and much oligoclase are the essential minerals. This rock may possibly be of post-Cambrian age. It is intruded by a light-colored, fine-grained granite porphyry.

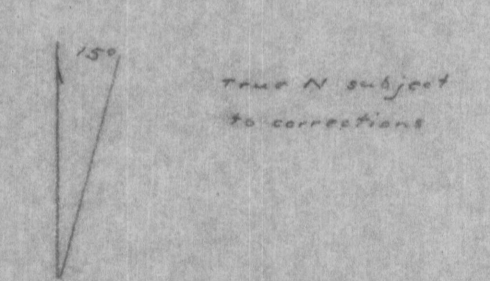
The mine is worked by shafts, crosscuts, tunnels, drifts, and stopes, the underground workings aggregating somewhat more than 4,000

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Date	Sample No.	Tons	Gold oz/T	Silver oz/T	Cu %	Pb %	Zn %
	40		0.051	0.49	0.03	0.68	0.15
	41		0.057	0.99	0.03	1.96	0.83
	42		0.034	1.09	0.03	2.20	0.44
	43		0.080	1.17	0.05	2.12	0.50
Total tons =			Weighted Average =				



LEGEND
 G1 ~ Ground Intercept
 C ~ Crest of Dump
 T ~ Toe of Dump
 --- D#1 ~ Sample Trench
 P1-A ~ Station
 P1-B ~ Elevation datum assumed
 O ~ Temporary stations



ELKHART MINE
 Mohave County, Arizona
 Walcott Mng. Distr.
 T24N. R18W. Sec. 34
 Mine Study Project. Oct. 1976
 Date Drawn 10/13/76 Revised 10/18/76

