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November 30, 1987

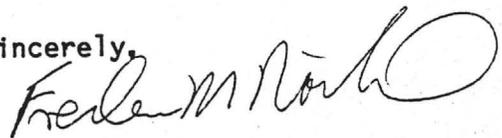
Gentlemen:

Enclosed is information on the famous TENNESSEE-SCHUYLKILL MINE at Chloride, Arizona. This large property, all patented, has a recorded production exceeding \$20,000,000.00. We are enclosing information completed by Mountain States Resource Development, Inc. According to the Wallapai Project completed by Cimetta Engineering & Construction Co., Inc. for Mountain States Resource Development Co., Inc., the TENNESSEE-SCHUYLKILL MINE contains proven and probable ore reserves of 350,000 tons and possible ore reserves of 2,800,000 tons. In addition, the Tennessee Mine also contains a large dump of 500,000 tons containing approximately 50,000 ounces of gold.

If you desire a large property with real reserves, then we invite your inspection of this fine property. We desire a lease-purchase arraignment and some up front money will be required.

We will be glad to personally show you the property.

Sincerely,

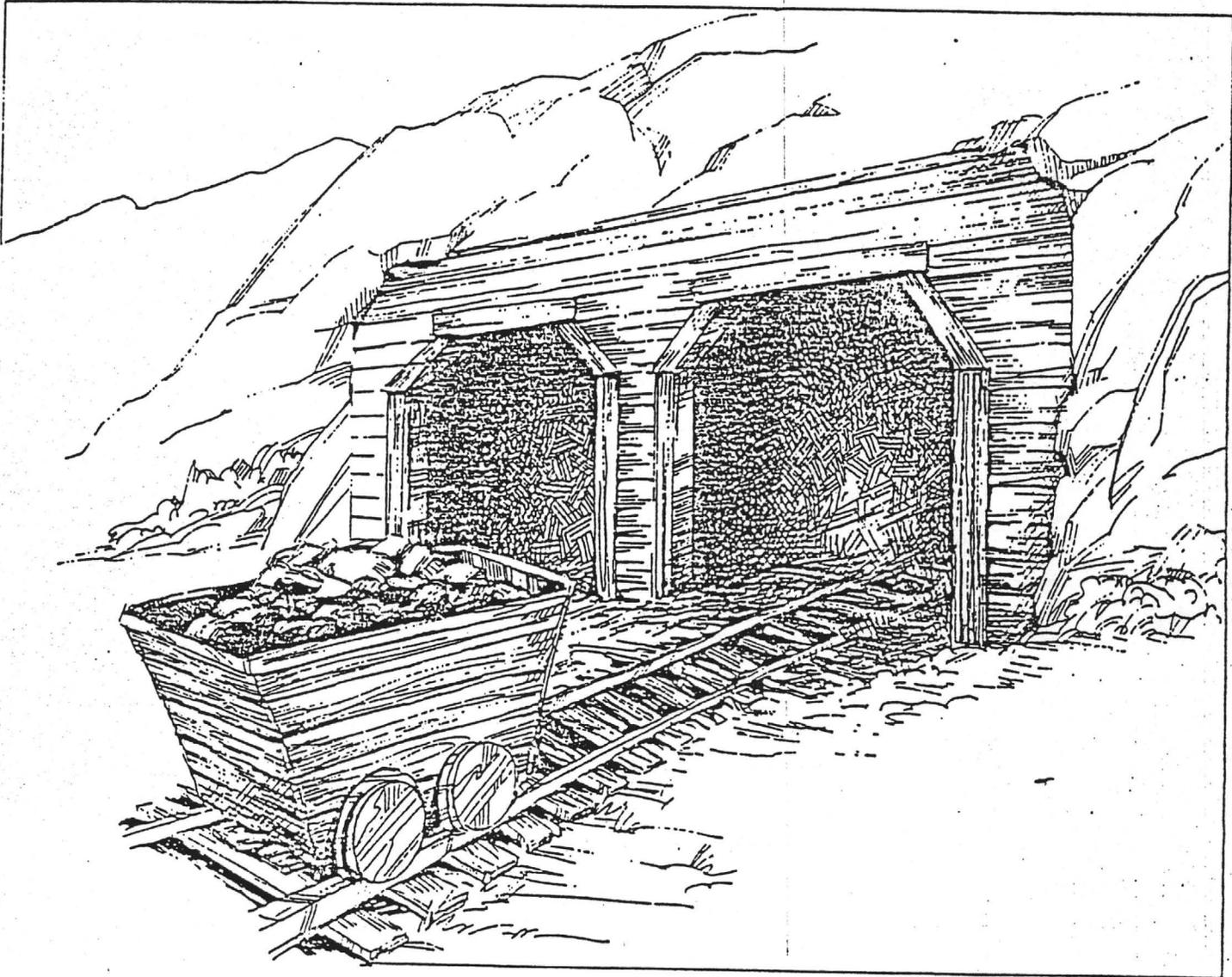


Frederic M. Rothermel, Ph.D.

EXHIBIT A

THE FOLLOWING REPORTS WERE WRITTEN BY THE COMPETENT PROFESSIONALS NAMED AND ARE BELIEVED ACCURATE BUT THE COMPANY MAKES NO CLAIMS TO THEIR ACCURACY OR COMPLETENESS

THE WALLAPAI PROJECT



Mountain States
Resource Development, Inc.



The Tennessee Mine at Chloride, 1970.

ts. Two custom mills are now under construction of the mines have already drawn the attention of men of nation-wide prominence interested here and a steady flow of investment on an extensive scale. This is a substantial, sure growth and development why? Because we have the ore—greatly mined and milled, and the profits are to see what this field is doing and on call of the wonderful opportunities fully developed, district.

E OUTLOOK

Arizona had a more promising future than any other mining district is attracting attention. Resources are coming from all over the United States, development, milling facilities, that during the year 1917 many more have been added to the growing list we now have. From present indications, should exchange of low-grade ore on dumps can be made as soon as the custom mills now operating. Copper—runaway copper—is being produced in this district and Jim Murray, of Butte, after inspecting this district, said: "I have seen the copper fields of Butte."

Men from all over the country have personally examined this district and have expressed their confidence in the permanency and continuity of the copper industry. Following are brief excerpts culled at random from the reports of engineers and geologists:

"I have studied its formation, and believe you have never seen such rich veins in America, and that within ten years it will be a world-lobe."

"Almost every mining district in the southwest, Arizona, ranks as one of the wealthiest, especially in copper. The claim can be made conservatively that in five years, more great producing mines than

any other district are long and well defined, and there is no question as to the continuity to a much greater depth than it is

found in other districts. Conditions are here for the existence of ore bodies of great contents."

"I have given a brief summary of the most important principal mines of the district and what they have developed. Make up a study of these, allow us to call attention to the feature of the present situation, viz: that the district have gone deep, the Tennessee vein at Golconda developed to the 1200 level, today, a powerful argument in favor of the district. Done, scores of others can and will do.

"The results scratched and results achieved as outlined that the Chloride District has before it a vast field of possibilities. We do not believe there are better opportunities today a mining district offering more opportunities than Chloride.

THE TENNESSEE MINE

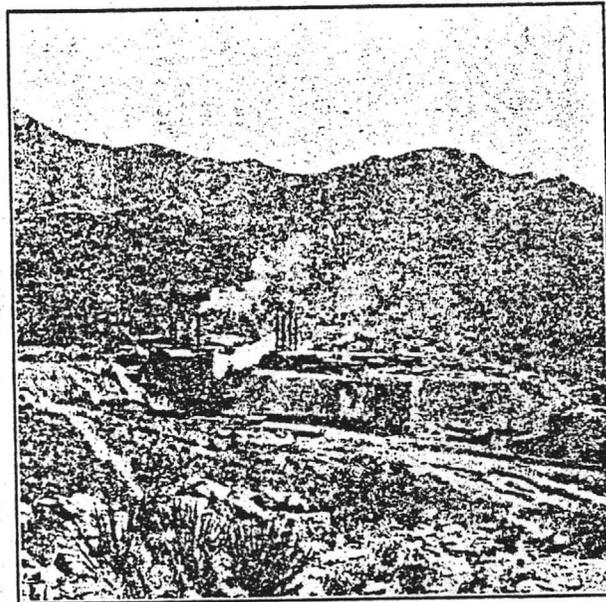
This famous mine, the largest producer of zinc-lead ores in the Southwest and the deepest mine in Mohave County, is situated about one mile east of Chloride's post office at the upper end of Tennessee Avenue. It is operated by The Needles Mining & Smelting Company, a subsidiary of The U. S. Smelting, Refining & Mining Company of Boston, who took hold of it in 1910. The mine has been worked for 25 years and has a record of production conservatively estimated at nearly \$20,000,000.

The real discovery of this remarkable mine dates from 1894, when this group was located by A. M. MacDuffee, a pioneer mining and business man who has long been prominently identified with the history of Chloride and Mohave County. Prior to that time, various other parties who held the ground failed to discover the existence of the ore shoot, and the claims were allowed to lapse. Mr. MacDuffee went farther north to sink his shaft and immediately uncovered rich galena ore.

There are two roughly parallel veins, the Tennessee and the Great Lead. The former strikes almost true North, while the latter trends more to the Northeast.

While some ore was produced from the Great Lead, almost the entire operation has been confined to the Tennessee vein. This vein dips to the East an average of 78 degrees from horizontal, but the dip is variable and for the last 700 feet has been almost vertical. This last fact is of considerable importance inasmuch as it shows conclusively that the ore in this district goes deep and also proves that after a vein enters the primitive formation it is unlikely to be disturbed by those forces of nature that often break, shatter and dislodge veins nearer the surface; nor must we overlook the great satisfaction felt by the management in being able to calculate with reasonable certainty just where the ore will be encountered on each succeeding level.

The Tennessee vein is quite large, being as much as 30 feet wide in places and averaging 12 or 15 feet. The gangue consists of quartz and porphyry between walls of pegmatite and schist. In this vein are lenticular ore bodies of sulphide ore, sometimes as high as 25



TENNESSEE MINE, CHLORIDE, ARIZONA

feet in width, averaging 3 to 8 feet. Zinc, lead, and iron sulphides occur in variable ratios, and the ore also carries copper, gold and silver. The ore shoot is several hundred feet in length. There are three shafts on the vein, the deepest being 1440 feet in vertical depth. A summary of the extensive development underground to date shows the following footage: Shafts, 2700 feet; Cross-cuts, 1100 feet; Drifts, 8400 feet; Raises, 4500 feet.

Here is a mine that has produced from the surface down, the best values and largest ore bodies having been found on the lower levels, yet its future bids fair to excel its past. The work of sinking to the 1600 level is now being prosecuted rapidly. Several cars of ore have been shipped daily since the Santa Fe extended their line to the Tennessee ore bins in 1912. During considerable of this period the shipments averaged from four to six cars per day, the ore going direct to the company's mill and smelter at Needles, California. Constant additions including modern electrical machinery, are being made to the extensive power equipment already in use, a large force of men is employed, and preparations are being made to excel last years output. N. J. Churchill, a graduate of the Michigan School of Mines, is the efficient superintendent, having assumed charge shortly after the property was taken over by the Needles Company.

While the Tennessee has been developed into a wonderful mine, we are firmly of the opinion that a great many other properties in the Chloride district have equally as good showings as far as they have gone as had the Tennessee at a corresponding depth and that they, too, will likewise develop into great dividend payers if they go deep and reach the more permanent ore zones. Judging from present indications, the year 1917 will herald the opening up of several other mines of equal magnitude. In this connection, allow us to call your attention to the belief held by many mining men—and freely expressed by them—that eventually the Tennessee will become a great producer of copper. It has been reliably reported that there is a very gratifying increase in gold values being found on the lower levels.

SCHUYLKILL

This property, owned and operated by the Schuylkill Mining Company, has long been considered one of the best in the district, and with good reason. On the south the Schuylkill endlines the famous Tennessee. There are two patented claims, the patents having been among the first issued in this region. The vein goes down nearly vertical, with a slight dip east, and the strike is N. 9 degrees W. The vein walls are unusually smooth and regular.

The working shaft, a slight incline, is 500 feet deep, the levels being 100 feet apart vertically. The very large dumps of many thousand tons show the extent of former operations. At least 50 per cent of this dump ore is of milling grade, the values being in gold, silver, lead and zinc.

A very aggressive campaign of development has been followed by the present company since acquiring control in the early part of 1916. Considerable new modern machinery has been installed and exploratory work underground has been pushed with vigor. Work is laid out on all five levels and at present they are drifting, winzing and raising, all in ore. Some very fine ore, much of it high-grade, is coming from this mine, although the present plans are confined to development

rather than extraction of the large ore shoot on two levels. Very soon the work depth of at least 1,000 feet will be

While considerable of the ore is of milling grade, the Schuylkill on an average that promises good profits and it is their own mill just as soon as the date is not far distant, judgment underground and on the dumps. The ore shoot is 8 feet wide and they are on the 200-foot level. On the 500-foot level it is 5 feet wide.

Equipment includes a 100 H. P. engine; 460 Cu. Ft. Sullivan Air compressor; D. C. electric lighting system. The property has all the earmarks of a highly gratified with the showing. The superintendent, is an assiduous worker. The Schuylkill in a very practical manner men freely predict that this will be a rival its big neighbor, the Tennessee.

ARIZONA

The Arizona-Butte Mines Company go to operate the following sections of rich ore: Alta, Banner, Infallible, Tigress. We have at hand authentic production of these mines to have ranging from \$100 to \$1,000 per ton. richly mineralized patented ground. The company also owns several other tracts them a total of 500 acres in one corner.

In the early days, when operations the advent of railroads and modern ore was handled, the ore running far behind as worthless. The advanced mining methods since then, coupled with equipment, has changed all this; grade milling ore that will readily be commercially treated. This is one reason why wonderful opportunities to mining

The Arizona-Butte Company, it is evident, acquired this valuable ground 200-ton concentrating mill to treat the holdings. This mill has now been turning out 5 cars of concentrates. The output will be increased as more adequate equipment is blocked out. Figuring silver at low prices, it is a safe estimate that the ore is now available in the mines and mills. The estimated total operating cost is at \$7.60 maximum; just figure out the value of ore averaging only \$20 per ton and the commercial value of a vast tonnage.

Zinc, lead, and iron sulphides are also carried copper, gold and silver. The ore is several hundred feet in length. There are at least being 1440 feet in vertical development underground to the shafts, 2700 feet; Cross-cuts, 4500 feet.

Worked from the surface down, the ore having been found on the lower level its past. The work of sinking has proceeded rapidly. Several cars of ore have been sent. Santa Fe extended their line to the mine. A considerable amount of this period the ore is being shipped six cars per day, the ore going direct to Needles, California. Conveyors, electrical machinery, are being installed already in use, a large force of men are being made to excel last year's production of the Michigan School of Mines graduate, having assumed charge of the mine over by the Needles Company.

The mine developed into a wonderful mine, as good showings as far as they get at a corresponding depth and that of a great dividend payer if they get to the ore zones. Judging from present conditions the opening up of several other mines in connection, allow us to call your attention to mining men—and freely expressed our opinion that the Lessee will become a great producer. We reported that there is a very gratifying amount of ore found on the lower levels.

SCHUYLKILL

Controlled by the Schuylkill Mining Company, one of the best in the district, and the Schuylkill endlines the famous ore claims, the patents having been secured in this region. The vein goes down nearly vertical and the strike is N. 9 degrees W. The ore is regular.

The incline, is 500 feet deep, the levels are on the very large dumps of many thousand tons of operations. At least 50 per cent of the ore is high-grade, the values being in gold, silver,

and copper. Development has been followed by the company in the early part of 1916. A shaft has been installed and exploration pushed with vigor. Work is laid out and they are drifting, winzing and raising, much of it high-grade, is coming from the shaft. Plans are confined to development

rather than extraction of the large bodies of ore already opened up on two levels. Very soon the work of sinking the main shaft to a depth of at least 1,000 feet will be begun.

While considerable of the ore now being blocked out is of shipping grade, the Schuylkill on an average is a big milling proposition that promises good profits and it is the company's intention to erect their own mill just as soon as developments in the mine justify; this date is not far distant, judging from their present showing underground and on the dumps. In a tunnel near the surface the ore shoot is 8 feet wide and they are now raising on this ore from the 200-foot level. On the 500-foot level the ore shoot averages at least 5 feet wide.

Equipment includes a 100 H. P. steam hoist; 108 H. P. gas engine; 460 Cu. Ft. Sullivan Angle-Compound compressor; drill sharpener; D. C. electric lighting system, etc., all well housed. The property has all the earmarks of a winner and the management is highly gratified with the showing thus far. W. M. Leete, the superintendent, is an assiduous worker and is rapidly developing the Schuylkill in a very practical and commonsense manner. Mining men freely predict that this will be a great mine and some think it will rival its big neighbor, the Tennessee.

ARIZONA-BUTTE

The Arizona-Butte Mines Company was organized about a year ago to operate the following sextette of noted one-time producers of rich ore: Alta, Banner, Infalible, Jubilee, Prince George and Tigress. We have at hand authentic data showing the total combined production of these mines to have exceeded \$1,000,000., the ore values ranging from \$100 to \$1,000 per ton. This group covers 250 acres of richly mineralized patented ground about 10 miles south of Chloride. The company also owns several other promising claims, thus giving them a total of 500 acres in one continuous group.

In the early days, when operating costs were high and before the advent of railroads and modern milling practice, only high-grade ore was handled, the ore running from \$15 to \$30 per ton being left behind as worthless. The advancement in metallurgical science and mining methods since then, coupled with the installation of modern equipment, has changed all this; now, \$30 ore is considered high-grade milling ore that will readily yield good profits when scientifically treated. This is one reason why the Cerbat Range presents such wonderful opportunities to mining men.

The Arizona-Butte Company, seizing the opportunity so plainly evident, acquired this valuable group and immediately erected a 200-ton concentrating mill to treat the ores from their extensive holdings. This mill has now been in operation several weeks and is turning out 5 cars of concentrates per week. Gradually this output will be increased as more adequate mining equipment is added and ore blocked out. Figuring silver, lead and zinc even at their former low prices, it is a safe estimate that over \$1,000,000 of millable ore is now available in the mines and old dumps of this great property. The estimated total operating cost per ton of this mill ore is figured at \$7.60 maximum; just figure out for yourself the profit per ton on ore averaging only \$20 per ton and you can obtain a fair idea of the commercial value of a vast tonnage of such milling-grade ore now

The Wallapai
Mining District
Cerbat Mountains
Mohave County
Arizona

GEOLOGICAL SURVEY BULLETIN 978-E



126 CONTRIBUTIONS TO ECONOMIC GEOLOGY, 1951

TABLE 1.—Production of gold, silver, copper, lead, and zinc in the Wallapai district, Mohave County, Ariz., 1904-48, in terms of recovered metals

(Compiled by Metal Economics Branch, U. S. Bureau of Mines, Salt Lake City, Utah)

Year	Crude ore produced (dry tons)	Gold (oz.)	Silver (oz.)	Copper (lbs.)	Lead (lbs.)	Zinc (lbs.)	Value (dollars)
1904.....	1,531	1,372.42	64,335	1,450	6,034		
1905.....	3,364	1,137.00	58,751	173	112,254		64,294
1906.....	9,916	2,772.60	128,331	114,402	501,521		
1907.....	13,013	3,338.62	58,825	62,917	1,323,634	30,600	229,206
1908.....	2,179	1,193.13	29,031	11,220	249,323	504,133	78,313
1909.....	11,638	2,350.77	69,576	1,771	113,112	3,224,121	374,365
1910.....	1,109	421.23	48,709	20,341	233,344		47,204
1911.....	12,692	2,734.73	71,243	27,424	2,394,629	960,697	270,220
1912.....	4,472	1,481.87	43,781	7,523	1,320,930	729,219	171,562
1913.....	32,933	2,153.27	177,534	30,782	5,171,988	4,223,642	650,350
1914.....	22,492	1,215.41	58,981	18,297	3,764,102	4,632,108	472,685
1915.....	53,635	3,212.73	213,512	46,171	6,432,406	17,332,849	2,675,542
1916.....	104,655	6,106.20	229,237	190,897	3,823,731	17,621,620	3,007,224
1917.....	101,362	7,012.33	294,197	84,394	6,037,712	17,127,396	2,620,573
1918.....	4,737	557.82	42,023	91,656	333,162	82,333	150,358
1919.....	3,332	572.91	41,331	60,527	204,993		111,591
1920.....	2,359	422.51	37,700	1	325,623		44,123
1921.....	10,294	1,022.89	82,947		277		114,393
1922.....	3,433	531.94	42,099				61,214
1923.....	1,151	235.81	23,800				30,617
1924.....	388	163.20			12,088		21,354
1925.....	3,102	738.29	49,486		311,616	174,703	39,346
1926.....	10,646	2,031.20	10,470		697,803	1,669,294	231,499
1927.....	12,289		19,293		694,056	1,134,434	129,666
1928.....	593		10,470		43,751	150,319	23,617
1929.....	1,800		19,293		64,294	133,414	27,850
1930.....		1,031.62	2,411		37,640	35,104	7,620
1931.....		1	341				44
1932.....	200		3,333	2,333	17,760		4,673
1933.....	324		3,517	1,422	34,944	11,024	9,627
1934.....	1,000	1,223.60	4,714	2,737	11,814	10,676	11,623
1935.....	1	1,641.20	76,519	24,324	140,723	133,293	124,679
1936.....	34,123	3,782.00	123,783	107,579	1,681,474	1,647,500	491,344
1937.....	112,214	13,318.00	328,610	469,182	4,978,220	3,424,354	1,311,603
1938.....	109,810	13,027.00	290,513	311,253	4,067,219	3,319,812	1,292,479
1939.....	68,716	9,301.00	431,323	144,027	1,404,533	1,819,622	753,254
1940.....	75,517	5,143.00	284,790	221,221	4,017,480	3,539,640	1,251,029
1941.....	75,565	7,201.00	219,577	132,740	4,316,350	4,632,000	1,054,429
1942.....	70,414	3,896.00	137,112	154,459	3,312,000	4,487,700	954,787
1943.....	43,721	1,821.60	88,993	256,530	2,781,860	3,084,000	703,619
1944.....	33,379	593.00	57,828	1,003,200	1,367,000	2,601,000	571,243
1945.....	21,462	1,053.00	49,704	454,200	1,503,000	1,307,000	420,414
1946.....	34,829	752.00	38,222	320,500	737,000	971,000	318,495
1947.....	46,221	474.00	43,233	454,100	1,305,100	1,713,200	349,016
1948.....	51,734	694.00	22,022	621,400	591,100	1,544,700	326,501
Total.....	1,276,294	121,121.40	4,893,137	2,712,892	71,473,202	109,820,513	22,172,902

.098oz. 3.81oz. 4.48# 56# 85.8#

Zinc-lead production reached its peak in the years 1915-17, which coincided with large-scale production from the Tennessee and Golconda mines under the stimulus of high metal prices.

At the time the present investigation was being carried on in the district (early 1943), the Tennessee mine was producing and milling about 150 tons of crude ore per day averaging 7 percent zinc, 3.5 percent lead, and 17 to 25 ounces of silver per ton. A disastrous fire destroyed the Golconda mill in October 1917. Since then the Golconda has produced only intermittently and on a small scale, and the mine is now largely inaccessible on account of caving and the encroachment of water.

FIELD WORK AND ACKNOWLEDGMENTS

Field work for the present investigation was carried on from February to June 1943. Aerial photographs on a scale of about 1 inch

400. Au

10. Ag

.25 Pb

.40 Zn

.72 Cu

Per Ton

\$39.00 Au

\$38.10 Ag

\$ 3.22 Cu

\$34.32 Zn

\$14.00 Pb

\$128.64

TABLE 2.—Production of gold, silver, copper, lead, and zinc of selected mines in the Wallapai district, Mohave County, Ariz., cumulative from 1901 through 1948, in terms of recovered metals

[Compiled by Metal Economics Branch, U. S. Bureau of Mines, Salt Lake City, Utah]

Mine	Gold (oz.)	Silver (oz.)	Copper (lbs.)	Lead (lbs.)	Zinc (lbs.)
Alpha (m)	292	33,199	22,263	16,478	
Altata and Altata Extension (c)	382	36,021	136,616	7,691	
Bader, Hercules, and Hercules group (c)	541	12,287	1,415	331,365	52,524
Banner group (s)	1,697	79,352	21,702	2,193,983	39,946
Blackfoot (cer)	155	11,556	15,617	101,263	111,320
Blue Bell (c)	169	20,931	16,274	162,001	
Carbat (cer)	12	2,033	1,153	4,120	
Champion (cer)	882	23,609	11,631	825,993	323,391
C. O. D. (s)	1,540	151,281	23,921	345,872	23,165
Columbus-Murree Doctrine (cer)	846	3,053	4,370	17,322	154,533
Conner (cer)	7	1,003	268	21,373	
Distad (c)	81	33,234	1,322	149,600	
Eikhart (c)	672	10,383	7,482	243,199	
Empire and Silver Union (c)	1	2,473	122		
Eureka (r)		2,311	3,371	23,861	42,714
Floras (cer)	422	364	172	612	
George Washington (m)	111	11,050	15,777	34	
Golconda (c)	712	310,150	351,702	2,031,712	58,225,020
Golden Eagle and Goltad (m)	1,777	23,333	690	40,076	
Golden Gate (cer)	2,473	8,213	3,283	14,950	
Hidden Treasure (c)	251	9,071	7,527	156,841	291,317
Idaho (cer)	250	3,233	4,742	2,345	3,009
Juno (c)	1,239	43,125	4,517	235,496	134,135
Keystone (m)	2,703	432,049	340,778	348,845	114,063
Little Chief (c)	391	63,331	2,070	111,825	
Lucky Boy (c)	1,923	40,439	2,270	8,140	
Mary Bell (c)	24	933	437	19,155	23,733
Midnight (c)	44	8,333	10,716	4,122	
Minnesota-Connor (c)	2,980	229,122	50,702	169,722	71,933
Mint (m)	222	15,255			
New London (cer)	13	3,298	1,355	136,629	31,213
Nighthawk group (m)	324	16,727	5,410	1,589	
Old Colony (s)	21	2,509	654	4,370	
Paymaster (cer)	92	23,050			
Payroll (c)	124	4,104	11,694	39,925	192,137
Pinkham (c)	59	14,083	53,130	3,133	
Rainbow (c)	2,400	34,382	4,719	213,271	22,429
Redemption (c)	21	4,012	11,449		
Rico (s)	1,149	15,302	1,449	2,620	
Samson and Esamson (c)	4,425	57,691	4,454	656,377	67,836
St. Louis (cer)	21	11,142	1,050	855,841	1,496
Silver Ace (c)	24	3,350			
Silver Hill (c)	703	8,642	10,722	222,949	143,394
Tennessee and Schuivikill (c)	47,353	1,514,187	532,837	59,597,026	66,803,507
Torno (c)	114	6,256	2,108	5,516	
Vanderbilt (cer)	1,012	2,119	327	2,568	
Washington and Washington Extension (m)	38	2,203	1,610	1,700	

c, Chloride camp; m, Mineral Park camp; cer, Carbat camp; s, Stockton camp.

FUTURE ECONOMIC IMPORTANCE OF THE DISTRICT

It is believed that the future economic importance of the district will lie chiefly in the base-metal content of the fissure veins. Most of the veins have not been explored sufficiently at depth to test the base-metal content and particularly the zinc content. On the basis of a geologic study of the veins in the district there is no reason for assuming that any of several other veins will not be as productive of lead and zinc as the Tennessee or Golconda veins. Future development work, particularly at greater depths, on the many miles of veins in the district may disclose several that will prove to be their equal or better.

P.O. BOX 36448
TUCSON, ARIZONA 85740

Cimetta
Engineering &
Construction Co., Inc.

9 Jun 82

Mr. Eldon Lee
Mountain States Resource Development, Inc.
P. O. Box 104
Berthoud, CO 80513

RE: Wallapai Project
Ore In Place, Dump, &
Tailings Reserves

Dear Eldon:

Persuant to your request we have reviewed all of the data made available to us on the Wallapai Project by MSRDR and others and the data that we have collected since our involvement. The purpose of this review was to determine tonnages and grades of reserves that are contained on your properties. We did not attempt to rate the metallurgical aspects of each reserve since this is the purpose of the work now being conducted. We did comment on the overall metallurgical treatment concept and expected results of the district.

The Wallapai Project basically encompasses the bulk of the Wallapai Mining District so for purposes of this review we will use the two synonymously. Of course, it must be acknowledged that Duval Corporation's Mineral Park Property is located in the middle of the district.

Up until the advent of the Mineral Park Porphyry Mine, the two main producers in the district were the Tennessee and Golconda Mines. Their production from 1904 to 1948 was as follows:

Golconda	20,752 oz Gold
	510,180 oz Silver
	354,703 lb Copper
	2,031,719 lb Lead
	56,226,020 lb Zinc
Tennessee	42,383 oz Gold
	1,514,187 oz Silver
	839,837 lb Copper
	59,897,096 lb Lead
	66,805,907 lb Zinc

It would appear on the surface that the Tennessee in the northern part of the district was the main property. However, when one considers the fact that the Golconda was destroyed by fire in

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October of 1917 and didn't produce anything of substance from that time forward and the Tennessee continued to produce right on up into the 1950's one must look again at the facts. In other words, the Golconda achieved its production in 13 years whereas the Tennessee achieved its in 44 years.

The main thing to note here is that the two major high grade producers in the district are part of the MSRD holdings. Also important to note is that one property was halted due to a disaster, not depletion of the mine or uneconomical conditions. (Note: This is not saying the Tennessee is depleted.)

When one looks at the district from a geological standpoint the following facts stand out:

1. The center of the district is dominated by the Ithica Granite stockworks. This has been developed into the Mineral Park Porphyry Mine and seems to be the source of mineralization for the district.
2. There are numerous vein deposits, both to the north and south of the stock. The north veins are dominated by the Tennessee and Copper Age groups while the south is dominated by the Golconda.
3. The Emerald Isle Mine is a property which seems to have no relation to the veins or the porphyry and seems to be the exception that proves the rule.

Since the Ithica Granite Stock is owned and mined by Duval, it is being eliminated from further discussion. The same is true of the Emerald Isle Mine since it was not taken up by MSRD in its acquisition program due to a lack of values.

The veins in the district are fissure veins that seem for the most part to be younger than the rocks into which they have intruded. It would appear that these veins were formed by the intrusion of the Ithica Granite Stock and subsequently mineralized by solutions from the stock.

For the most part these fissure veins pinch and swell from just a few inches to over 100 feet in width with the average width being 3 to 4 feet. However, the veins have an average strike length of over one mile and the exposed outcrops of the district have shown the veins to have a combined strike length of over 85 miles.

The veins are filled with pyrite and quartz with their oxidized zone extending down to 150 feet below the surface on an average basis. Depths of 1600 feet have been reached in mining with no apparent bottoming of the veins and well known and respected geologists estimate that the veins will extend to at least 2500 feet below the surface.

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Ore minerals are principally cerargyrite (silver), native gold, galena (lead) sphalerite (zinc), and chalcopryrite (copper). Some arsenopyrite occurs along with cerrusite and oxidized base metal minerals. One can consider this to be a typical "Rocky Mountain Lead, Zinc, Copper Ore."

In March 1977 Messers Dale and Rudy reported on their efforts to justify a custom mill for the small miners of Mohave County. They were funded by a government grant and did their work in conjunction with a number of governmental agencies. In the northern part of the district they report 256,700 tons of dump and tailing ore grading .018 to .103 oz/T gold, .66 to 6.63 oz/t silver, .03 to .16% copper, .13 to 1.79% lead and .50 to 3.56% zinc. They considered this to be proven ore.

It is interesting to note that this is only the northern part of the district and only includes materials that were easily accessible. Items like the buried table and jig tails at the Tennessee were not included.

H. Mason Coggin, a well known and respected mining engineer, evaluated the Copper Age group of claims in April, 1980. He measured many ore occurrences and interpreted a number of undeveloped one in the Copper Age group has a potential of 4.730 million tons averaging \$200/ton.

In the Hidden Treasure section of the property Mr. Coggin estimates .5 million tons of ore grading \$200/ton or better.

The Arizona Bureau of Mines lists the following known reserves in the Wallapai Mining District:

<u>Mine</u>	<u>Tons</u>	<u>% Cu</u>	<u>% Pb</u>	<u>% Zn</u>	<u>oz/T Au</u>	<u>oz/T Ag</u>
Banner	3841	.5	22.6	11.9	.21	7.4
	5000	.5	22.6	11.9	.21	7.4
Summit	25,000	.58	4.3	6.3	.066	4.5
	25,000	.58	4.3	6.3	.066	4.5
Golconda	40,000	.5	.5	14.0	.20	4.0
	40,000	.5	.5	14.0	.20	4.0
Fountain Head	1,250	.61	.65	16.4	.2	3.5
	3,750	.61	.65	16.4	.2	3.5
Detroit	1600	2.31	1.0	5.5	.01	7.2
	1600	2.31	1.0	5.5	.01	7.2
Wrigley	56,000	.1	9.0	.1	.1	.2
Tennessee	29,503	.1	4.1	8.2	.01	.2
	50,000	.1	4.1	8.2	.01	.2

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Tennessee	100,000	.1	4.1	8.2	.01	.2
New Moon	11,000	.1	5.0	8.0	.05	7.5
	9,900	.1	5.0	8.0	.05	7.5
	10,000	.1	5.0	8.0	.05	7.5
Minnesota	900	.6	5.0	4.0	.01	.2
Lone Jack	2000	.19	5.51	4.66	.035	3.47
Copper Age	7,000	.1	3.6	7.3	.06	2.0
	7,000	.1	3.6	7.3	.06	2.0
Champion	570	.1	8.0	15.6	.26	10.0
	6,000	.1	8.0	15.6	.26	10.0
	6,000	.1	8.0	15.6	.26	10.0

While the above represent substantial exploration and are very conservative, especially since this is what their taxes are based upon, it is not fully conclusive. Mining costs, metallurgical techniques and markets must be developed. However these do show the substantial amounts of ore left in the mines.

Howard H. Heilman examined the Golconda Mine in great detail. He measured the reserves in numerous structures and defined those reserves as follows:

Virginia	350,000 tons
Tub	400,000
Little Jimmie	150,000
Peach Triangle	350,000
Golconda	300,000
Prosperity	80,000
Primrose	80,000
Blackfoot	90,000
	<u>1,800,000</u>

Mr. Heilman values these ores as follows:

Zinc	16%
Lead	.5%
Copper	.5%
Gold & Silver	\$120.00/T*

* Bases on \$300/oz gold and \$6.00/oz silver.

The whole emphasis that comes from the Golconda reports is that the mine was shut down when the fire occurred and once stopped was not restarted. The stopes that were in production are in approximately the same situation as when the mine closed.

Tonnages as indicated above were confirmed by H. G. Humes and The American Metal Company. Grades in their estimates ran higher in lead and copper and slightly lower in zinc.

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Dump samples on the Golconda were taken and measurements of tonnage were made. The measured tonnages are as follows:

Chats	15,000 tons
Lower Blackfoot	3,000
Middle Blackfoot	7,000
Upper Blackfoot	500
Prosperity	8,000
Tub	3,000
Silver	7,000
Tails	20,000
Golconda	30,000
	<u>93,500</u>

Of the dump ore, approximately 6,000 tons of it will not meet \$65/T gross metal value criteria leaving some 87,500 tons.

Samples taken by CEC have confirmed some of the grades quoted. The ongoing program of sampling each dump by complete trenching and then metallurgical testing the sampled material will accurately prove not only the tonnage and assay of each dump, but will also define what can be recovered from these dumps.

Metallurgically the ores in the Wallapai District are best treated by flotation. Recoveries as follows can be expected on ores that are freshly mined:

Lead and Silver	90-95%
Copper and Gold	85-90%
Zinc	75-85%

Ores that have been oxidized by weathering (e.g. dump ores) are also best treated by flotation unless the weathering is severe. One might expect a 5% reduction in recovery, but otherwise the treatment should be unaffected.

Gravity separation means can also be used on the Wallapai ores. Recoveries are lower, but oxidation has no effect. Some cases of highly oxidized ores yield higher recoveries than flotation, but these are not very important in the district.

Ores with high sulfides should never be treated by leaching techniques. This is a waste of time, money and resources.

The most important item in determining the best method of treatment is metallurgical testing. Ores, even ores from similar mines, must be tested and the parameters for optimum treatment established. A few dollars spent on professional metallurgical testing will save hundreds of thousands in the final analysis.

Summarizing one can state that dump ores and tailings in the district that will meet a \$65/T gross metal value are substantial. If the reports issued by competent personnel quoted herein are correct the tonnage is in excess of 300,000 tons. While CEC is

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just getting started, work to date has indicated that the reserves represented by the men quoted herein have been conservative in both tonnage and grade.

Ore in place has been estimated by many. While today's prices for metals make some of it uneconomic there are substantial reserves in the district. If one were to have to estimate what could reasonably be developed it might look like the following:

<u>Northern Area (Tennessee Mine)</u>	
Proven & Probable	350,000 tons
Possible	2,800,000
<u>Central Area (Copper Age Mine)</u>	
Proven & Probable	95,000
Possible	4,730,000
<u>Souther Area (Golconda Mine)</u>	
Proven & Probable	1,800,000
Possible	3,000,000

Again the tonnages shown must be proven by exploration, but as McClelland G. Dings put in his report:

"On the basis of a geologic study of the veins in the district there is no reason for assuming that any of several other veins will not be as productive of lead and zinc as the Tennessee and Golconda veins. Future work, particularly at greater depths, on the many miles of veins in the district may disclose several that will prove to be their equal or better."

The district and the project have the potential for greatness, long life and emense profit. One must only be sufficiently tenacious and approach the problems professionally. As I have said many times, mining is a tough business and is not for the faint hearted, but the rewards are comensurate.

In closing, we feel the Wallapai Project has an excellent chance of being one of the formost in the now developing rejuvenation of the mining industry as it was known at the turn of the century. We are looking forward to being associated with this project knowing that with a dilligent, professional approach it will be the success we all desire.

Sincerly,
Cimetta Engineering & Construction Co., Inc.


J. B. Davis

Potentials for ore development can be broken down as follows:

- (1) Possibility of reprocessing old dumps and tailings.
- (2) Reopening of old mines to produce ore which was considered low grade in the past.
- (3) Development of deeper extensions of existing veins.
- (4) Location and development of hidden veins running parallel to known veins.
- (5) Mining of the upper zones of known veins by open pit methods.
- (6) The potential development of large porphyry type mineralization.

Many of the old mines were mined for silver and lead and a few for copper. However, the predominant mineral in the district is sphalerite (zinc sulfide). Large blocks of zinc ore were left by the miners at the turn of the century. In those days the blocks were worth little or nothing. Today those blocks are high grade ore.

Some discussion was put forth by Theodore B. Comstock about buried auriferous veins trending across the main veins. Where these intersected the main north-south veins, massive high grade sheets of ore were developed. There is some evidence to support this theory and if valid, the possibility of many yet undiscovered high grade ore bodies increases substantially.

After reviewing the information available one could draw the following conclusions about the potential for developing mining operations on the properties controlled by M. S. R. D. in the vicinity of Chloride, Arizona:

- (1) The dumps and tailings contain many tons of valuable ore. Flotation recovery techniques will be needed in combination with highly trained crews to achieve maximum profitability, but gravity techniques could be used to get started.
- (2) The principle metal value in the district is zinc. This is closely followed by copper.
- (3) The upper reaches of the veins contain zinc, lead and precious metals. With depth the lead will convert to copper.
- (4) Many ore zones containing mainly zinc were left by early miners opening the possibility of reopening many of the major mines. This can only be determined by reopening and examining these mines and carrying out drilling programs to determine the existence of parallel veins and downward vein extensions.
- (5) Most of the veins will carry principally copper and zinc values with minor precious metal values.

April 22, 1982

(6) . Some of the flat dipping veins and the wider veins will allow open pit mining techniques to be applied. This will allow the treatment of much lower grade ores.

(7) The most promising target for the development of a mining operation, excluding dumps and tails, is the Tennessee-Schuylkill Group. This is closely followed by the Golconda-Prosperity Group. Properties immediately north of Mineral Park in the vicinity of the Copper Age Mine will take considerably more work to develop.

(8) The possibility of another large porphyry in the district is a distinct possibility. However, capital costs to develop such properties are at present prohibitive and so exploration for such a deposit should be given a low priority.

In summary, the M. S. R. D. controlled properties have excellent potential for developing a 300-500 tpd operation for the treatment of dumps and tailings. Such an operation could be moderately profitable over the next ten (10) years.

The potential for developing a number of small sulfide mines that would feed a central concentrator are excellent. It shouldn't be difficult to develop reserves to keep a 500-1000 tpd flotation plant running for ten (10) years or more. However, it would have to be realized that base metals would be the primary products and precious metals would be incidental to this production. The production of pyrite for the manufacture of fertilizer should not be ignored.

The potential for the development of large mining operations would not seem to be good in the immediate future. However, extensions of Duval's Mineral Park property into the Golconda area are possible and the possibility of a separate porphyry in the Chloride area is certainly worth the exploration funds to find out if it is present.

What has basically been said is that there are no proven ore reserves on the M. S. R. D. properties, but minimal exploration expenditures should prove up many reserves. However, the efforts necessary to explore all of the properties will take years, but the key to it all is that M. S. R. D. has the property position to carry out a professional exploration program that will allow development when ore is proven. M. S. R. D. will not be in the position of finding ore on property belonging to others.

As was started in the beginning, this is a very preliminary review. As more data is collected we can become more specific. In the mean time if you would like to review any of the information supporting this report it is available here in Tucson.

Sincerely,

CIMETTA ENGINEERING & CONSTRUCTION CO., INC.



J. B. Davis

JBD/jmr

TENNESSEE-SCHUYLKILL MINE

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high-grade silver can be expected to extend downward more than a very few hundred feet.

Gold has been enriched residually by leaching of zinc and iron from heavy sulphide ore shoots carrying relatively low primary gold. A thin zone of very rich gold ore is reported near the bottom of the oxidized zone in several veins. This may be secondary gold. Nature of gangue, ground-water chloride ion, common presence of pyrite, and persistent though only locally abundant manganese oxides are all favorable for gold enrichment. Some gold enrichment has occurred, but how much residual and how much chemical is unknown. Such gold ore shoots have been small, but some were spectacular. Many sections of veins that are very low grade in the sulphide zone have yielded small bodies of gold ore of shipping grade from the oxidized zone.

Summary.—The Cerbat Range is an area of numerous veins with mostly small ore shoots. The excellent grade ores and fair-sized shoots of several mines indicate the area to be important and worthy of study. The great need of the present is for a good topographic map of adequate scale and for a sufficiently detailed geologic map to bring out essential features. Many problems of structure, petrology, ore occurrence, and mineralogy are unsolved. Microscopic study of ordinary sulphide ores is needed. The exact manner of occurrence of gold and silver in ores of ordinary grade should be determined.

Acknowledgments.—The writer is indebted to G. M. Fowler, of Joplin, Missouri, for direction and for the opportunity to study part of the Cerbat area. Many local people facilitated the field work and gave information.

TENNESSEE-SCHUYLKILL MINE⁴²BY S. K. GARRETT⁴⁴

LOCATION

The Tennessee-Schuyllkill Mine is at the western foot of the Cerbat Range, about 1 mile east of Chloride, in the Wallapai mining district, Mohave County, Arizona.

ROCKS

The rocks of the Wallapai mining district can be grouped as diorite gneiss, granite, quartz monzonite porphyry, rhyolite, and diabase. The oldest rock, diorite gneiss, has been intruded by granite, and both the diorite gneiss and the granite have been intruded by quartz monzonite porphyry. The rhyolite and diabase

⁴² Paper prepared for, and originally presented at, the regional meeting of the A.I.M.&M.E. held at Tucson, Arizona, November 1-5, 1938.

⁴⁴ Geologist, Tennessee-Schuyllkill Mine.

occur as dikes, some of which are in the same fissures as veins. In one place a diabase dike has been intruded along an earlier rhyolite dike.

VEINS

The fissure veins near Chloride can be grouped according to strike. One set strikes nearly north and the other about N. 25 degrees W.: the dip ranges from 35 degrees E. at the western foot of the range to 85 degrees W. near the crest. The progressive steepening toward the crest of the range may indicate overthrusting stresses as the cause of the fissuring.

The Tennessee-Schuylkill fissure vein, which can be traced for nearly 2 miles, strikes N. 5 degrees W. and dips 85 degrees NE.

Strong gouge is present on both the hanging and footwalls of the vein. There was some movement on the fissure after the formation of the vein.

At abrupt changes in strike, there is some horse tailing of the fissure, but there are no cross fissures.

ORE DEPOSITS

The Tennessee-Schuylkill deposits occur as a vein filling a fissure in the complex of diorite gneiss, granite, and quartz monzonite porphyry. The ore is in shoots which, above the 900-foot level, rake northward and between the 900- and 1,400-foot levels are nearly vertical (Pl. XXX).

Most of the ore shoots range from 35 to 300 feet in length and average about 5 feet in width.

ORE CONTROLS

The different wall rocks have not influenced the deposits; the ore filling is as wide in diorite gneiss as in quartz monzonite porphyry. The only recognized control is that of strike and dip of the fissure.

The four ore shoots in the Tennessee-Schuylkill Mine (Pl. XXX) occur where the vein has changed to a more than average northwesterly strike. The ore filling is wider on steep dips than on flat dips.

The combination of strike and dip control the rake of the ore shoots. A change to a northwesterly strike on a flat dip gives a pronounced northward rake, and a change in strike on a steep dip gives a rake that varies from slightly southward to vertical.

ZONING

There is marked horizontal zoning of the ore minerals in two of the ore shoots above the 900-foot level. The north limits of these two shoots contain principally galena and gold-bearing pyrite with practically no sphalerite. As the south limits of the shoots are approached, the galena and gold-bearing pyrite decrease, and sphalerite increases until, at the southern limits of the shoots, sphalerite is the only ore mineral present (Pl. XXX).

Little is known of the than a general decrease of crystalline pyrite with in a small amount of develop no galena but considerabl

The hypogene ore mine: ing pyrite, and sphalerite. fine-grained chalcedonic opyrite.

Supergene ore minerals, plumbojarosite, anglesite, gold, and, rarely, native si importance.

The paragenesis, determ sphalerite, galena, pyrite, a

The sphalerite occurs as a "jack." Some galena shows of the walls of the fissure count for the small amount

The pyrite is of two va crystallized cubes and pyr somewhat massive and fine of gold per ton in the pure so finely divided that color: pyrite concentrate.

The fine-grained chalcido the sulphide ore.

MONTA

By GEO

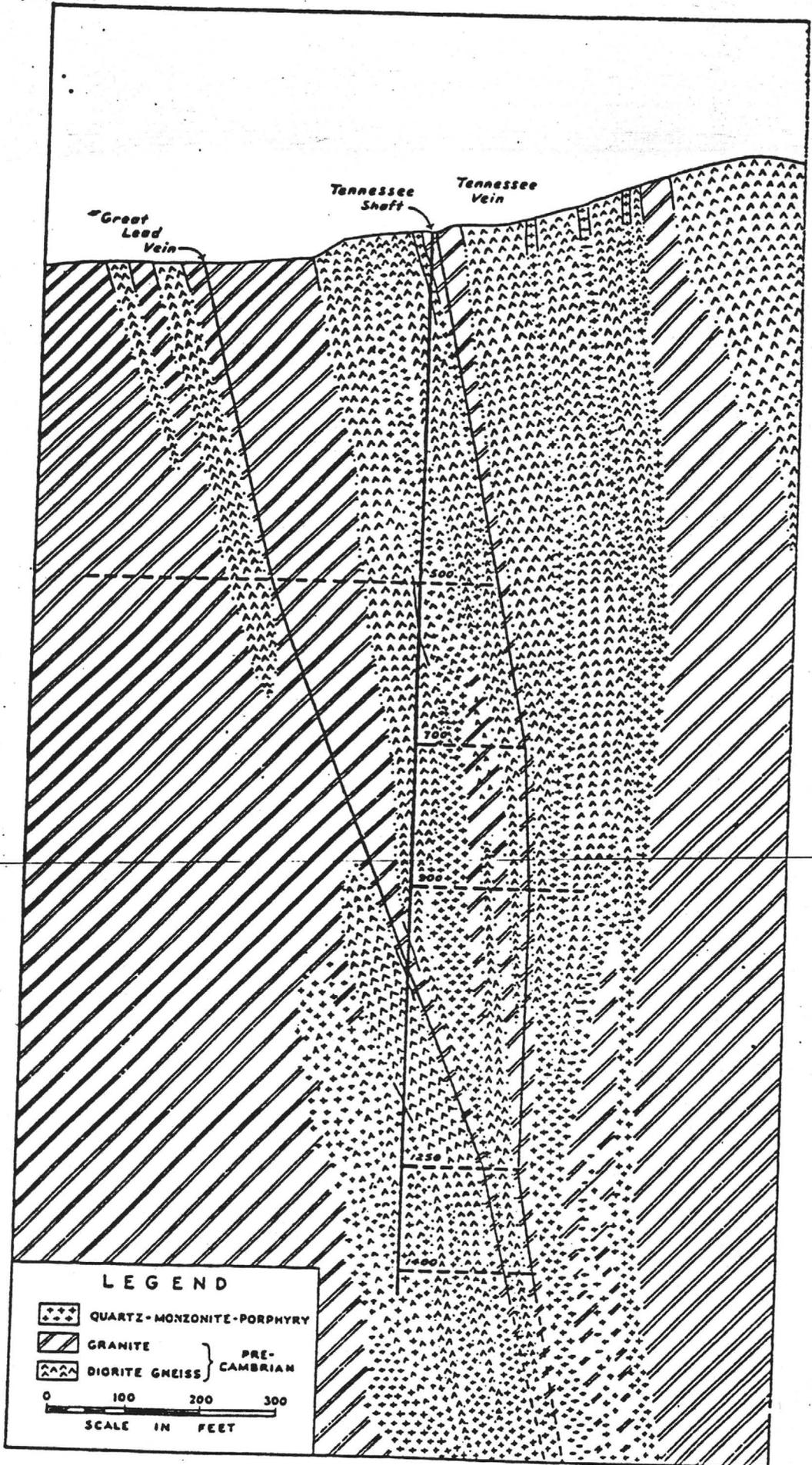
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A brief description of the Montana Mine is presented years a much larger area was bodies that could be worked At a later date it is hoped to tion as well as to give furtl (Pl. XXXII).

The Montana Mine is in tl Cruz County, Arizona, 5 mile about 30 miles west of Nogale

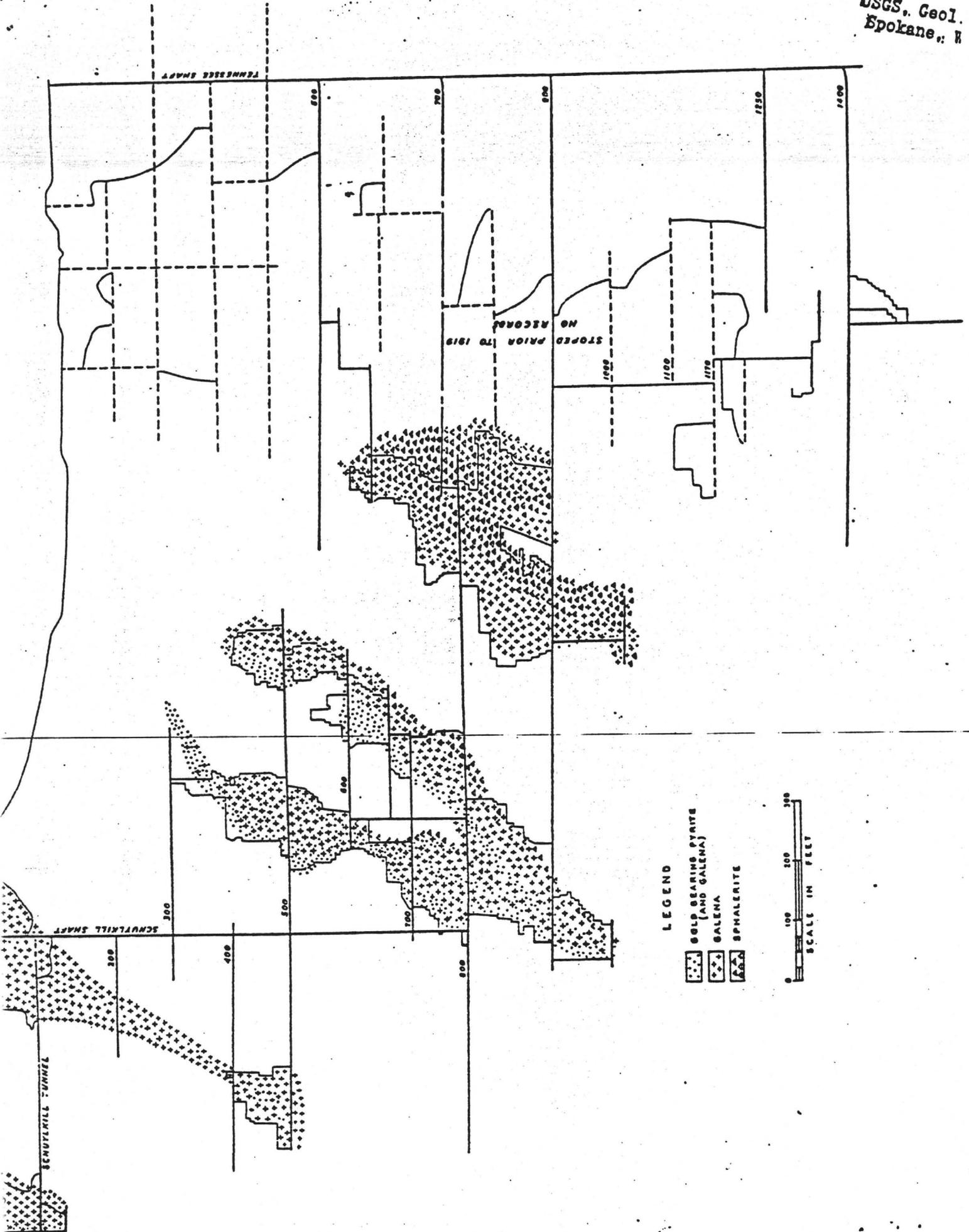
⁴⁵ Paper prepared for, and origi of the A.I.M.&M.E. held at Tu

⁴⁶ Consulting geologist, Joplin, I



USGS, Geol. Div
Spokane, Wash

Plate XXXI.—Tennessee-Schuykill Mine, cross section.



LEGEND

- GOLD BEARING PYRITE
(AND GALENA)
- GALENA
- SPHALERITE



Little is known of the zoning below the 900-foot level other than a general decrease of galena and increase in sphalerite and crystalline pyrite with increased depth. On the 1,600-foot level a small amount of development along one of the ore shoots shows no galena but considerable sphalerite and crystalline pyrite.

MINERALOGY

The hypogene ore minerals are galena, fine-grained gold-bearing pyrite, and sphalerite. The gangue minerals are milky quartz, fine-grained chalcedonic quartz, crystalline pyrite, and arsenopyrite.

Supergene ore minerals, found to a depth of about 80 feet are: plumbojarosite, anglesite, cerussite, bromyrite, cerargyrite, native gold, and, rarely, native silver. The supergene ores are of little importance.

The paragenesis, determined megascopically, is milky quartz, sphalerite, galena, pyrite, and fine-grained chalcedonic quartz.

The sphalerite occurs as older "black-jack," and younger "rosin-jack." Some galena shows a flow structure suggesting movement of the walls of the fissure after deposition. Argentite may account for the small amount of silver that the ore contains.

The pyrite is of two varieties. One variety occurs as well-crystallized cubes and pyritehedrons with no gold; the other is somewhat massive and fine grained and contains 0.3 to 15.0 ounces of gold per ton in the pure specimens. The gold in the pyrite is so finely divided that colors cannot be panned from a high-grade pyrite concentrate.

The fine-grained chalcedonic quartz occurs as fracture fillings in the sulphide ore.

MONTANA MINE, RUBY⁵⁵

BY GEORGE M. FOWLER⁵⁶

INTRODUCTION

A brief description of the geology of a limited area around the Montana Mine is presented in this paper. During the past few years a much larger area was studied in an attempt to find new ore bodies that could be worked in conjunction with this operation. At a later date it is hoped to present the results of this investigation as well as to give further details about the Montana Mine (Pl. XXXII).

The Montana Mine is in the Oro Blanco mining district, Santa Cruz County, Arizona, 5 miles north of the Mexican boundary and about 30 miles west of Nogales, Arizona.

⁵⁵ Paper prepared for, and originally presented at, the regional meeting of the A.I.M.&M.E. held at Tucson, Arizona, November 1-5, 1938.

⁵⁶ Consulting geologist, Joplin, Missouri.

- C/
8. The Tennessee-Schuylkill mine is the other large mine in the district. It produced high quality lead-zinc ore with gold and silver. The Tennessee exceeded the Golconda in total production by virtue of it being mined for many more years and to greater depth. The Golconda, however, is clearly much longer in strike than the Tennessee.

Comparison to the Tennessee gives direct confirmation that the Golconda will continue in depth. The Tennessee workings extend down to 1600 slant feet with good quality ore in evidence. The U. S. G. S. survey reports shoots in the Tennessee of 400 feet in length. This comparison of dimension shows the Golconda exceeding the Tennessee in length by some threefold indicating that the Golconda should exceed the depth by far that of the Tennessee.

Similarly a comparison of the slant depths and elevations bears out the same expectation for the Golconda. The shaft elevation of the Tennessee is 4200 feet and the slant depth is 1600 feet whereas the Golconda has an elevation of 4900 feet and a slant depth of 1100 feet (equivalently worked levels). In view of this, and in terms of slant depth, using a 60 degree dip, the Tennessee shoot is now some 1400 feet greater depth than the Golconda.

Reference to the Tennessee in the above manner to show firm support for the depth continuation of the Golconda shoot obviously involves the conclusion that the Tennessee was of high quality from shallow workings to the lowest levels. The Tennessee's production record through a long period of years certifies this conclusion. On the other hand, as in many instances, mineralized fissure veins in the district pinch and swell on both strike and dip. This is true in either the Tennessee or the Golconda. The important point is the average recovery

of quality ore over the length of the whole ore shoot for each level as has been established for the Golconda and the Tennessee.

It is unfortunate that partially negative observations regarding mines like the Tennessee or the Golconda take on expanded meanings and irrefutable stature as the years go by unless the contrary and complete data is well publicized. In many cases the negative comments are taken out of context and not limited to the restricted facts that originated them. Contradictory statements are even reported in the U.S.G.S. survey for the Tennessee where, for example, Garrett of the Tennessee group in 1938 reported the gold values as being in the pyrites as opposed to Sharpe, also of the Tennessee staff, who reported in 1943 that the galena contained the gold and the pyrites was barren. Obviously neither condition can be 100% correct for the average of the mine but in the absence of one of these comments the written record of later years would show only one conclusion.

Sharpe was the metallurgist at the Tennessee in 1943 and his studies were based largely on production then from the 900 foot level. Garrett preceded him and was associated with the Tennessee in 1938 or earlier. This directly points up the fact with regard to the time of any observation and the circumstances of that time. Some time in 1938 or earlier the fact that the Tennessee did show a marked barren zone around the 500 or 600 level could have been the determining factor in an appraisal for the Tennessee at that particular time. Opposing this now is its later operating history with its demonstrated strength, size, and quality of ore shoot to the 1600 foot level.

The U.S.G.S. Survey of 1943 (Bulletin No. 978-E) shows a notable example of the misinterpretations to be obtained with regard to the size of the ore shoots in the district. The Bulletin reports on Page 143 - "Ore shoots are generally small and as a rule range from 8 to 10 inches to 3 or 4 feet in thickness. The thickest shoot measured 20 feet in the Tennessee mine. An ore shoot in the Golconda mine is reported to have greatly exceeded in size any in the Tennessee, but the Golconda was not accessible for examination." At the time of this survey it is true that the Golconda ore shoot proper could not be inspected via the shaft and this fact probably resulted in the failure to make other inspections in the Golconda area. If such inspections had been made at that time it was possible to observe the Tub ore shoots from two places underground and from one surface cut that exceeded by far the thickest shoot of 20 feet found in the Tennessee. Furthermore the Bulletin refers to the fundamental work of Schrader. In Schrader's work are observations that the Tub veins are from 30 to 100 feet wide in the Tub claim, Silver, etc.

The quality and continuation of the Tennessee mine with depth can be readily certified from the available records of mill assays and production data. Both in the files of Golconda Chemicals and in the files of the Tennessee trustees in Mohave County are the authentic records showing the quality of the Tennessee in the later years of its operation and at the lower levels. As an illustration we have in the Golconda Chemicals' file the records of the last eight months operation of the Tennessee from February to September of 1945. The final average for

the entire eight months showed a mill heads average of gold - 0.077 oz./ton, silver - 2.64 oz./ton, lead - 6.03% and zinc 7.23%.

We also have in file the certified statement of the operator in charge of the mining at that time under lease to the trustee. The operator affirms the requirement upon him of ore recovery from the total width of the ore shoot (20 feet) as opposed to the removal of only the 5 to 8 feet of high grade in the shoot.

The ore recovered from the Tennessee during 1944 and 1945 came in the largest quantity from the levels ranging from 900 to 1300. A review of the mill and production records however shows the quality of the ore also in the deeper levels. At the end of this section is an illustrative tabulation of the ore values removed during 1944 and 1945 from the Tennessee.

At the close of this lease operation at the end of 1945 an extension of the Schuylkill shaft was made from 1350 to 1400 feet by the operator. This extension showed another body of high grade at this point in the shoot of over (50% lead.)

The record of the Tennessee is outstanding for quality and quantity of ore. Unfortunately much of the earlier mining was done in the most temporary and expedient way for scalping of ore values. This resulted in poor tunnels in size, maintenance, etc. A cooperative, corporate structure was also involved for some years. This arrangement dictated that capital expenditures be kept to a minimum for any long term development work. The looseness of management control, etc., resulted in underground conditions almost precluding rehabilitation and also indebtedness, still current, of large magnitude to public utilities, and for government taxes, etc. Had these not been the conditions the Tennessee would have warranted much more effort for rehabilitation and control. Even in 1943, when the U.S.G.S., was receiving all out aid from the local trustee of the Tennessee, they reported that most of the Schuylkill workings were inaccessible.

TENNESSEE RANDOM SAMPLES 1944-1945

<u>Date</u>	<u>Level</u>	<u>Gold (oz)</u>	<u>Silver (oz)</u>	<u>Lead %</u>	<u>Zinc %</u>
Aug. 44	1600 (6 Cars)	.01	.76	14.1	-
July 44	1600 (6 Cars)	.11	3.7	.5	7.2
June 44	1600 (2 Cars)	.05	2.09	1.7	16.7
July 45	1427 (30 Cars)	-	-	9.8	9.4
April 45	1400 (N. Drift)	.14	4.29	10.6	14.9
April 45	1400 (No. 1)	.10	2.86	4.5	19.2
June 45	1400 (N. Drift)	.43	1.72	3.1	4.6
June 45	1427 (Raise)	.10	1.43	3.1	8.1
June 45	1427 (Raise)	.23	2.10	7.3	6.9
June 45	1427 (Floor)	.03	.53	.5	8.4
June 45	1400 (Stope - 39 Cars)	.20	4.97	13.0	11.4
May 45	1427 (Stope)	-	-	.6	2.3
May 45	1400 (Raise - H. W.)	.07	9.66	22.3	10.7
May 45	1400 (N. Drift)	.25	2.70	.6	3.4
May 45	1400 (Raise Face)	.07	1.44	1.0	11.8
June 45	1400 (Winze - 40 Cars)	.10	2.24	3.1	15.7
Feb. 45	1350 (Winze)	.20	1.6	1.8	11.1
Mar. 44	1323 (28 Cars)	.21	2.14	5.8	5.6
Mar. 44	1323 (25 Cars)	.06	5.07	14.7	6.3
Feb. 44	1323 (54 Cars)	.06	6.80	5.5	9.2
April 45	1227 (Muck Pile)	.01	7.66	5.3	3.7
July 45	1227	-	-	11.9	5.2
April 45	1229 (Raise)	.10	5.87	15.7	4.9
May 45	1129 (Drift)	.12	3.68	9.7	9.8
Aug. 44	1128B (16 Cars)	.02	.94	15.1	9.4
Sept. 45	904 (115 Cars)	-	-	3.4	12.2
May 45	904S (8th Floor)	.03	1.7	2.0	7.4
May 45	904 (41 Cars)	-	-	1.9	12.8
May 45	904 (80 Cars)	-	-	5.9	11.8
May 45	904 (65 Cars)	.04	2.84	8.5	6.5
May 45	904 (67 Cars)	.04	2.99	6.6	8.0



BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1887

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

9-Nov-87

Riken Resources LTD.
2995 Jamica Blvd. S.
Lake Havasu City, Nv 86403

Page: 1
Copy: 3 of 3

Authority: Alan Brown
Project :

Purchase order :
SAMPLING OF 500,000 ton dump

FINAL report: job number 8715

Type	Sample number	Ag AA ppm	Au FA ppb
Grab	Tenn-1	8.5	2500
	Tenn-2	12.4	2566
	Tenn-3	29.9	10171
	Tenn-4	17.9	3014
	Tenn-5	4.9	9
	Tenn-6	8.5	1529



BARRINGER LABORATORIES INC.

15000 W. 8TH AVE., SUITE 300
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9-Nov-87

Riken Resources LTD.
2995 Jamica Blvd. S.
Lake Havasu City, Nv 86403

Page: 2
Copy: 3 of 3

Authority: Alan Brown
Project :

Purchase order :

FINAL report: job number 8715

Abbreviations:

Analyses:

Ag : Silver
Au : Gold

Methods:

AA : Atomic Absorption
FA : Fire Assay

Units:

ppm : Parts per million
ppb : Parts per billion

Quality control:

*=Interference D=Not detected
I=Insufficient sample M=Missing
N=Not analyzed P=Questionable precision
T=Trace

Signed: 

.....
Vernon K. Peterson
Laboratory Manager

cc: 2995 Jamica Blvd. S.

MEMORANDUM

TO: Kingman, Salida, Reno

DATE: February 25, 1981

FROM: W. Schull

SUBJECT: 210-599 Cerbat Chloride, Mohave Co. AZ
Geologic Mapping - Gneiss Belt Sulfide Prospecting

Accompanying is a crude map and legend for the 1"=500' scale geologic mapping I did last week around the Tennessee Schuylkill veins to get an idea about what can be obtained from mapping on a scale of 1"=500'.

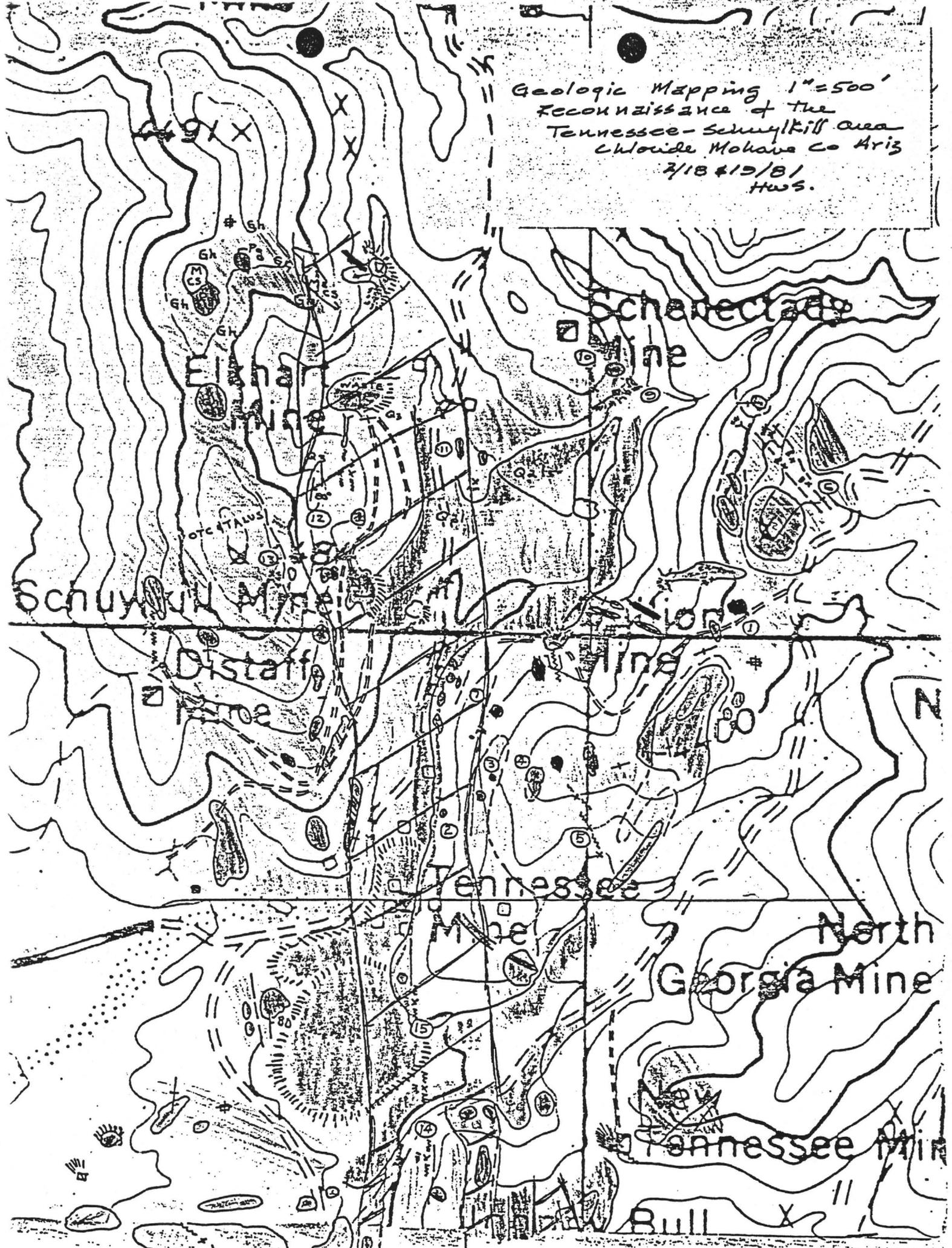
The location of the Tennessee Schuylkill "veins" mine workings coincides with a zone of rusty weathering banded glassy quartzite mixed with, in the Elkhart area, carbonate and calcisilite with the quartzites are garnet biotite rich gneiss and garnetiferous quartz feldspar gneiss. Also the Tennessee - Schuylkill zone are some prospect pits exposing a narrow, less than 5' wide, drusy quartz veins whose strike is parallel to that of the Tennessee Schuylkill mine workings.

A few small pieces of massive sulfide type material have been found on the Tennessee and Schuylkill waste dumps. The waste dumps appear to have been picked over pretty thoroughly.

In summary the garnet biotite rocks and the quartzite carbonate (chemical sediments) rocks point to a gneiss belt setting and the drusy quartz veins indicate Laramide - Tertiary veins. I suspect that both types of mineralization were mined at the Tennessee Schuylkill.

For reconnaissance prospecting, mapping at scales of 1"=500' or even 1"=1,000' is adequate to find the "favorable horizons" or zones of chemical sediments. To get a understanding of what gneiss belt sulfide geology is really like, however, one will have to map at scales of 1"=200' or larger.

Geologic Mapping 1"=500'
Reconnaissance of the
Tennessee-Schuykill Area
Claude Mohave Co Ariz
2/18 & 19/81
HWS.



GEOLOGIC LEGEND - 1" = 500' MAPPING OF THE
 TENNESSEE AREA CHLORIDE MOHAVE CO. ARIZ
 2/18 & 19/81

MINERALIZATION



Veins of drusy quartz and sulfides



Zones of disseminated sulfides - mainly a dark grey sulfide that ^{on} weathering stain the rock with a yellow coating



Massive sulfide of galena and sphalerite can be found on the Tennessee & Schuykill ^{waste} dumps.



Zones of chemical sediments and rocks rich in garnet and biotite, similar to the host rocks found with "gneiss belt" type sulfide ores.

ROCK TYPES & MAP UNITS



Alluvium & Waste Dumps



Tertiary Porphyry Dikes Feldspar porphyry with very fine grained green groundmass. Rubble outcrop. Dikes 10'-20' wide.



Country Rock or Monotonous Gneiss: feldspathic gneiss and granofels with porphyro clasts or blasts of feldspar and interstitial quartz and biotite. Bold outcrops & rubble outcrop. outcrops may be banded-gneissic, roddeed-lined, or lacking any preferred orientation textures-granofels. In map scale the feldspathic gneiss is the host rock or "sea of gneiss" that encloses the other rock types



Pegmatoid: coarse grained pegmatitic quartz and alkali feldspar, very little mica, local trace of garnet. Bold outcrops and "roll down" type scree. In map scale, as pods and masses up to 200' across.



Hornblende Gneiss: Banded (gneiss) & nonbanded (granofel) black hornblende and plagioclase. Bold etc and "roll down" type scree. Map scale as layers, lenses and pods.



Quartz Feldspar Garnet Gneiss: Banded & nonbanded biotite porphyro garnetiferous gneiss. Bold outcrops & rubble outcrop. Map scale interbedded with the biotite garnet gneiss and the quartzites.



Biotite Garnet Gneiss: Banded, commonly in contorted folds of biotite rich gneiss with garnet porphyroblasts. outcrop folds of 1'-10' in amplitude and wavelength.

ROCK TYPES & MAP UNITS contd

Q3

Quartzites: Glassy and massive quartz on broken surface. Banded on weathered surface. Believed to be cherty chemical sediment. Weathered outcrops are rusty & banded as subdued outcrop and rubble. Map scale as layers and lenses in Gfg and G6g.

M

Marble: light grey crystalline carbonate with scattered grains of non carbonate. Rubble outcrops. Map scale, mixed with quartzite and calcisilicate.

CS

Calcisilicate: coarse grained crystalline monomineralic of pale green glassy cleaved mineral believed to be plagioclase. Resembles skarn or pegmatoid outcrop as rubble. Maps as part of marble and quartzite

SYMBOLS

- ⊙ Field Note or sample station.
-  Outcrop & Geologic Contact
-  Inferred Geologic Contact
-  strike outcrop on quassic banding which here is >80°
-  Waste Dump
-  Prospect Pit
-  Vein
-  shaft
-  adit

ABBREVIATIONS

P	Porphyry	f	feldspar
Pg	Pegmatoid	b	biotite
G	Gneiss	g	garnet
Q3	Quartzite	q	quartz
M	Marble	k	hornblende
CS	Calcisilicate		

Tennessee-Schuylkill
 Dumferlin
 Elkhart
 Argyle
 Victoria
 Empire
 Sunday School
 Bullion

REPORT

ELKHART PROPERTY

CHLORIDE, ARIZONA

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

-0-

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 feeders, 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.

The Sunday School Mine is claimed as the Empire No.6

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:

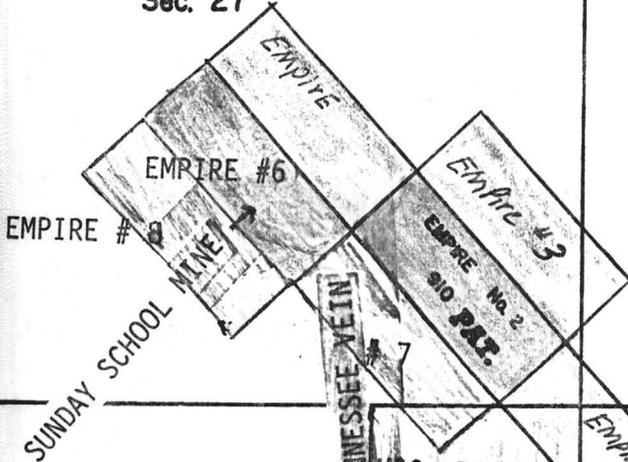
It will be observed that I have quoted freely from such eminent authorities as the late, Dr. Theodore B. Comstock, and the government reports of Mr. F.C. Schrader. There are many others whom I could quote as well, in support of my own views concerning the Argyle shaft and its location as the proper place 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.
F.A. Wright, M. E.

As of December 6, 1987, the ELKHART MINE is actually encompassed by the claim: TENNESSEE SCHUYLKILL NORTHERN EXTENSION.

Sec. 27

Sec. 26



EMPIRE #4

SUNDAY SCHOOL MINE

4100 feet of TENNESSEE VEIN

VICT. - DA. EX.

VICT. DARD.

ARGYLE

EMPIRE #5

SILVER UNION MINE

MERCHANT 3449 PAT.

Sec. 34

TENNESSEE-SCHUYLKILL NORTHERN EXTENSION

LEAD GREAT NORTHERN EXTENSION

SCENECTADY EXTENSION 2204 PAT.

ELKHART

BULLION

BLACK ROCK SPRING LODGE 3422 PAT.

Cheetah
Three Point
300 PAT.

WOODCHUCK 3447 PAT.
WATER OF BADGER VEIN 3447 PAT.

North Wind
BADGER

MAJESTIC 3447 PAT.

HERCULES 3447 PAT.

WILD 3447

ORIDE STARR 3440

WESTERN EXT. GREAT LEAD

DISTAFF 1013

WILLACE 1014
BULLION BECK 1428

GREAT LEAD 1427

PEGGY 3550 PAT.

BURLOCK 3520 PAT.
BULLION SOUTH 3520 PAT.

BLACK PRINCE 4009 PAT.

RAMBLER 3444 PAT.

LITTLE WONDER 1428

Sec. 3

MOLLY GIPSON PAT. 1426

MONTANA 3363

ARIZONA 3363 PAT.

BRUNSWICK 1571

CENTURY 3571

SILVER AGE 3571

BRUNSWICK 1571

LITTLE GIANT 3073

ALTATA 3073 PAT.

CINCO DE MAYO 3073 PAT.

TENNESSEE SOUTH 1427

TENNESSEE EXTENSION 3565

SILVER KNIGHT 3368

Sec. 2

PAY ROLL PAT. 4009
RATTLER MINE 950

CONNOR GEN. 218 PAT.

ARASTA 2968 PAT.

WILL SITE 2268 PAT.
EMERSON 2968

RELL

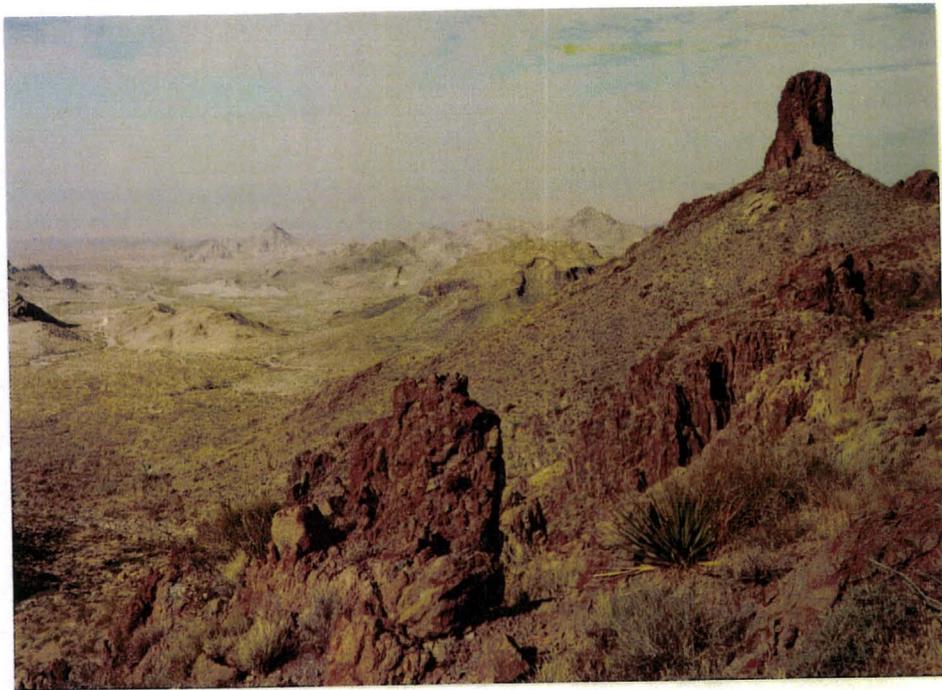


Figure 5: View west from Telluride vein to Minneapolis vein (small dump in center of photo)

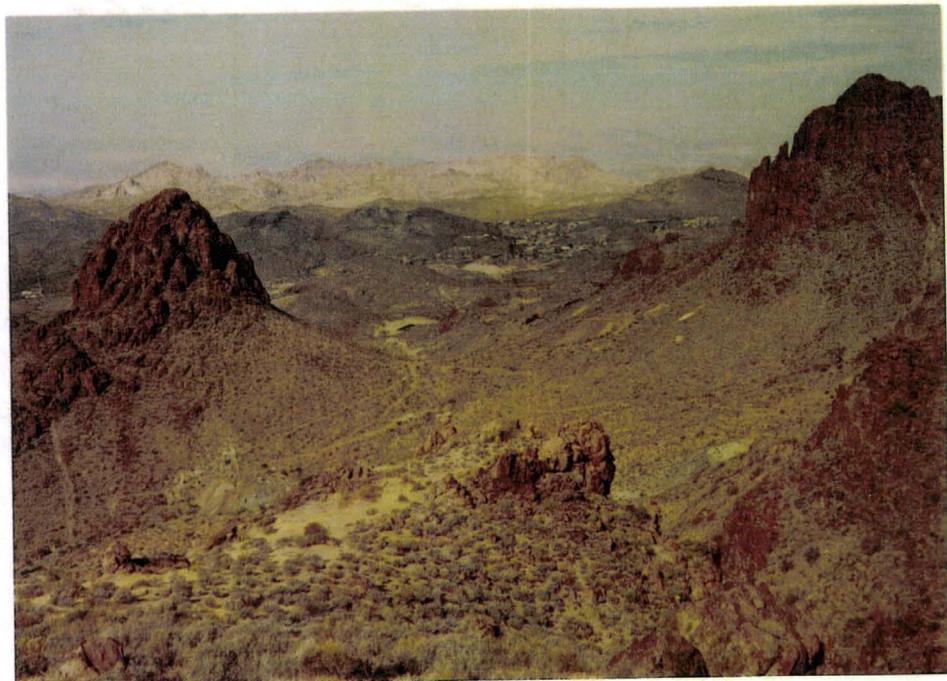
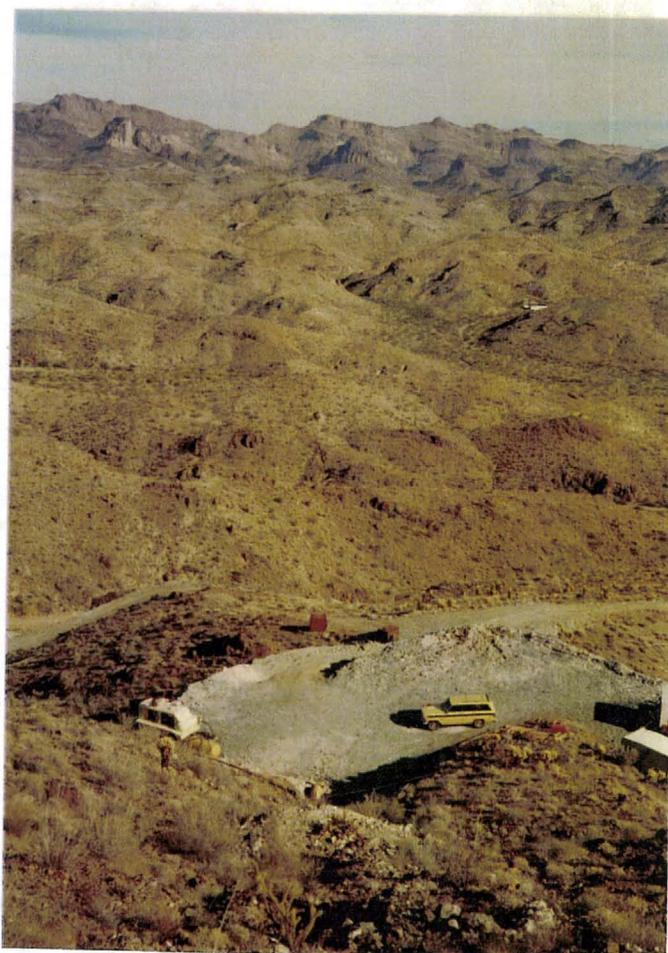


Figure 6: View northwest along Telluride vein to town of Oatman with tailings just in front of town



Figures 7 and 8:



Minneapolis Mine, 100 level
portal and view from above
portal, eastward into the
Black Mtns.



Figures 9 and 10:



Minneapolis vein at face of 100 and 200 level drifts (each 490' from their portals) showing the white, massive calcite vein and its stringer zone parallel to the N wall. Assays vary from 0.01 to 0.1 oz/t Au.

Note the absence of argillic alteration, the presence of only propylitic alteration and minor iron stain.



Figures 11 and 12: Views of the argillic or clay alteration halo around three parallel veins of the Sunnyside vein system and a close up of the same alteration above the Telluride vein, both near the east extreme of Grubstake's land holdings. This alteration is associated with all the great producing veins of the Oatman camp and is notably absent at the Minneapolis vein.



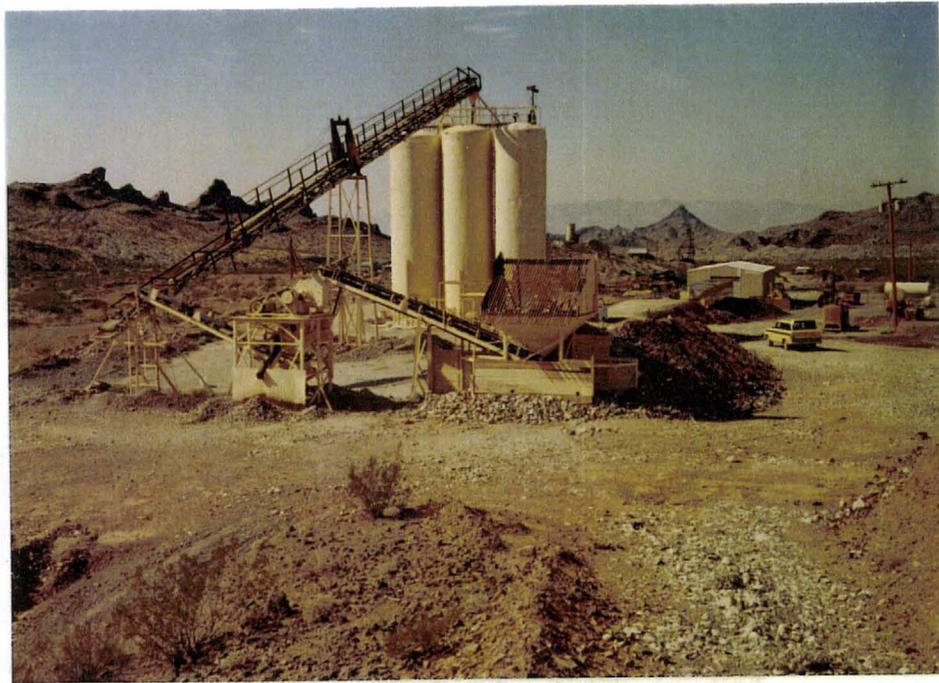
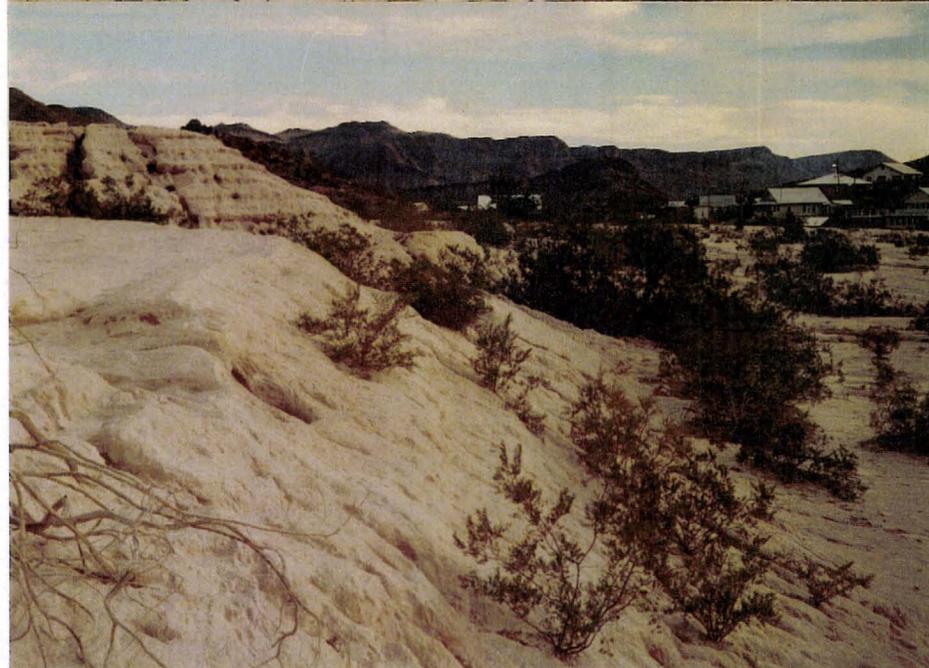


Figure 13: Canyon City Milling Company's mill site near the White Chief mine. Note grizzly, conveyor feed, three leaching tanks.



Figure 14: Three leaching tanks with crusher, rear left.



Figures 15, 16 & 17:

Various views of the pinkish, very fine grained, sandy and homogeneous cyanide tailings of the big mines and mills of Oatman. They total about 3.5 million tons at average 0.015 oz/t Au, according to a state of Arizona publication. Higher assays, averaging .034 oz/t were obtained on a few grab samples by the author.

There seem to be no slimes. Their leachability is unknown.

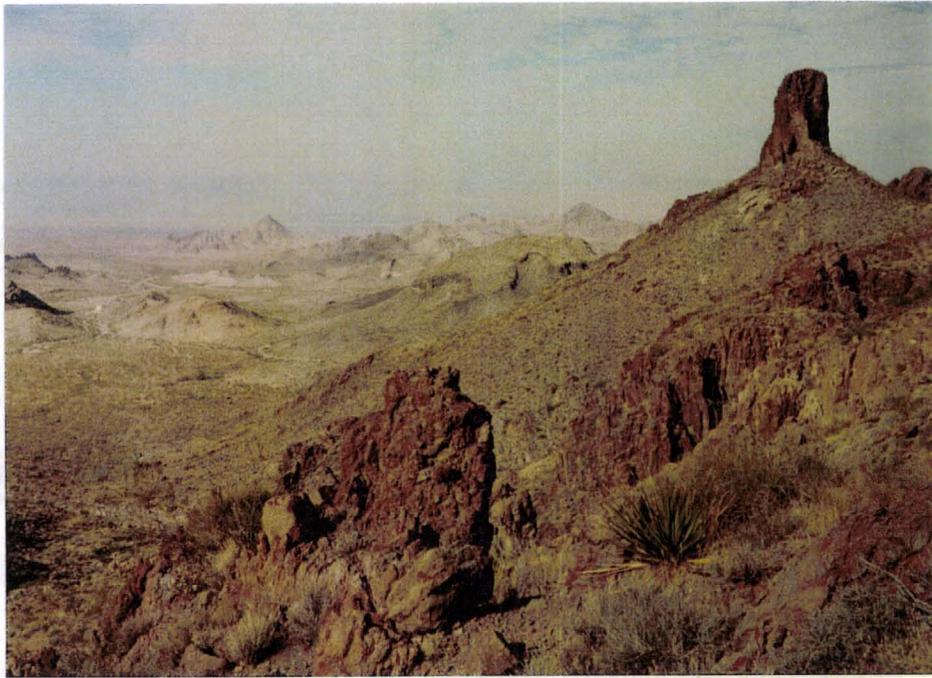


Figure 5: View west from Telluride vein to Minneapolis vein (small dump in center of photo)

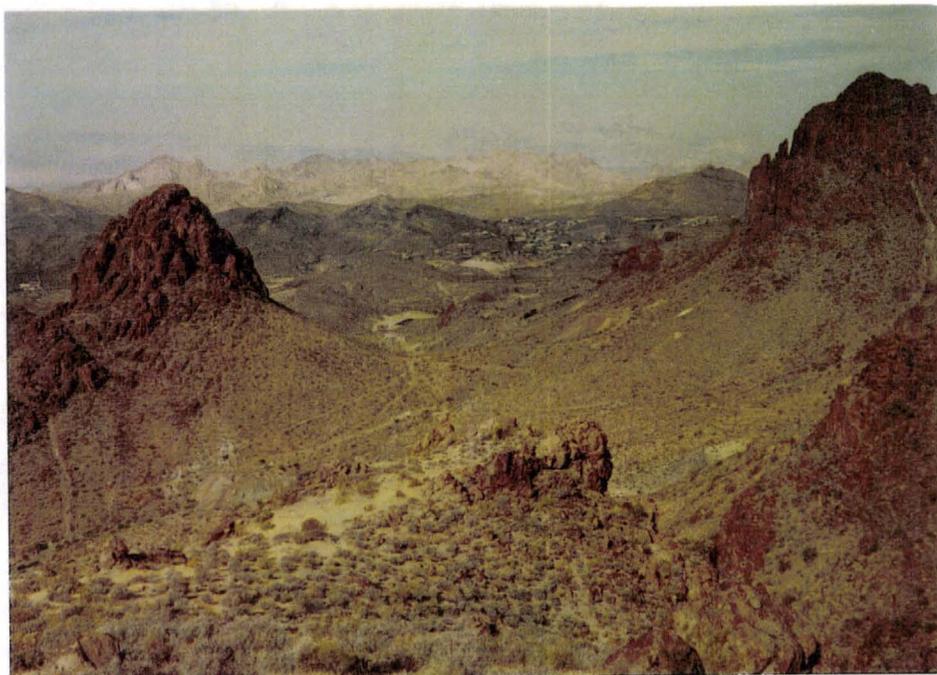


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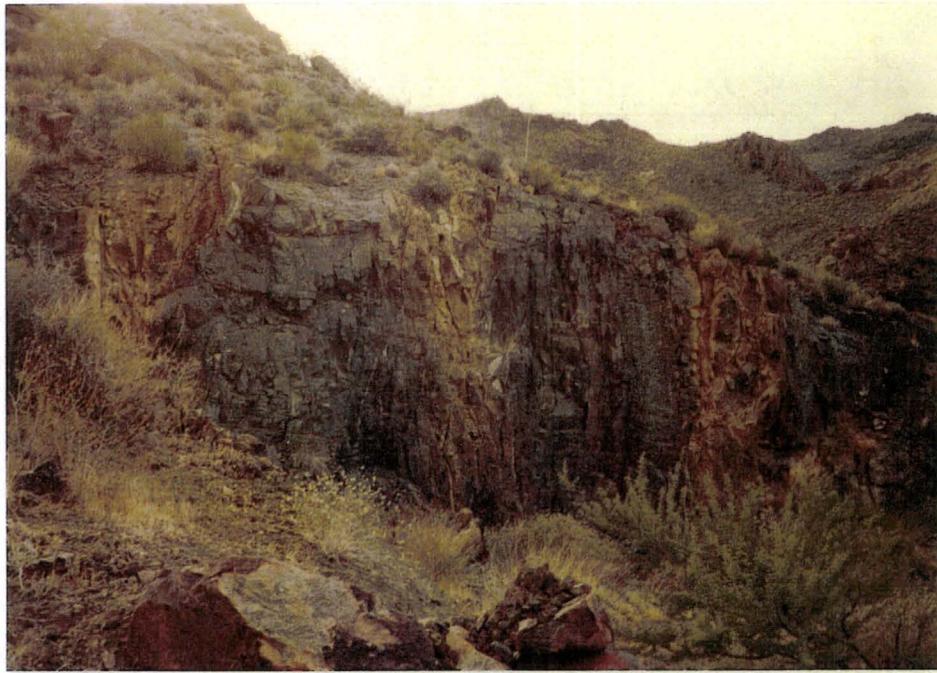


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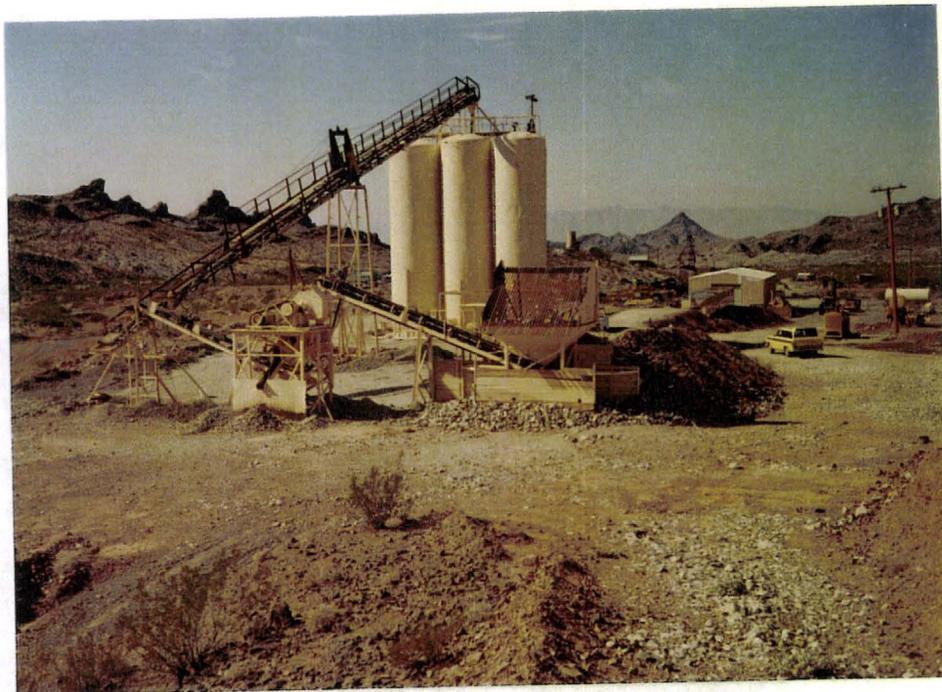


Figure 13: Canyon City Milling Company's mill site near the White Chief mine. Note grizzly, conveyor feed, three leaching tanks.

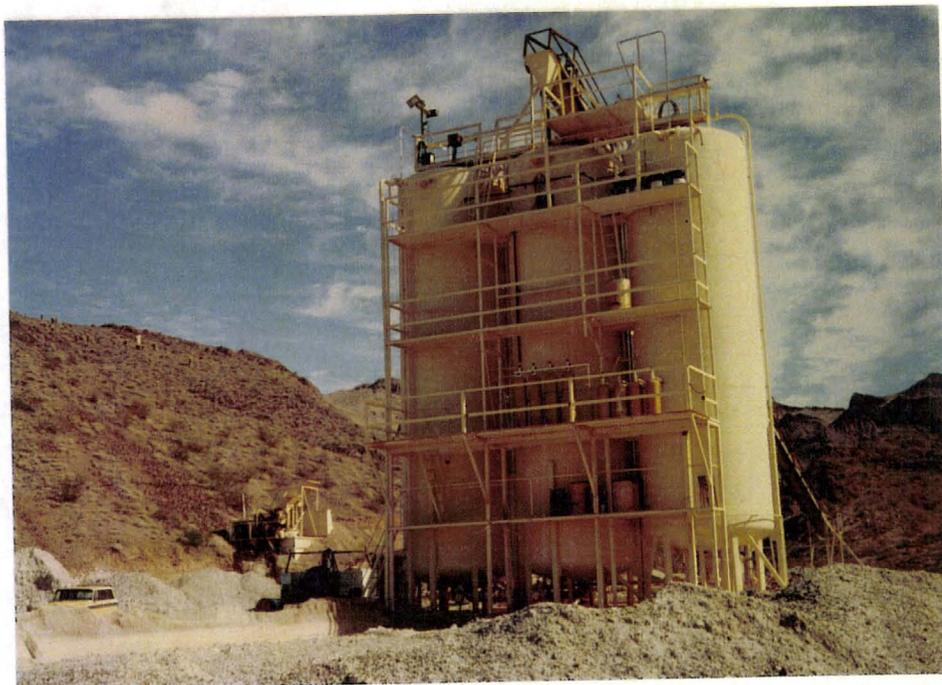
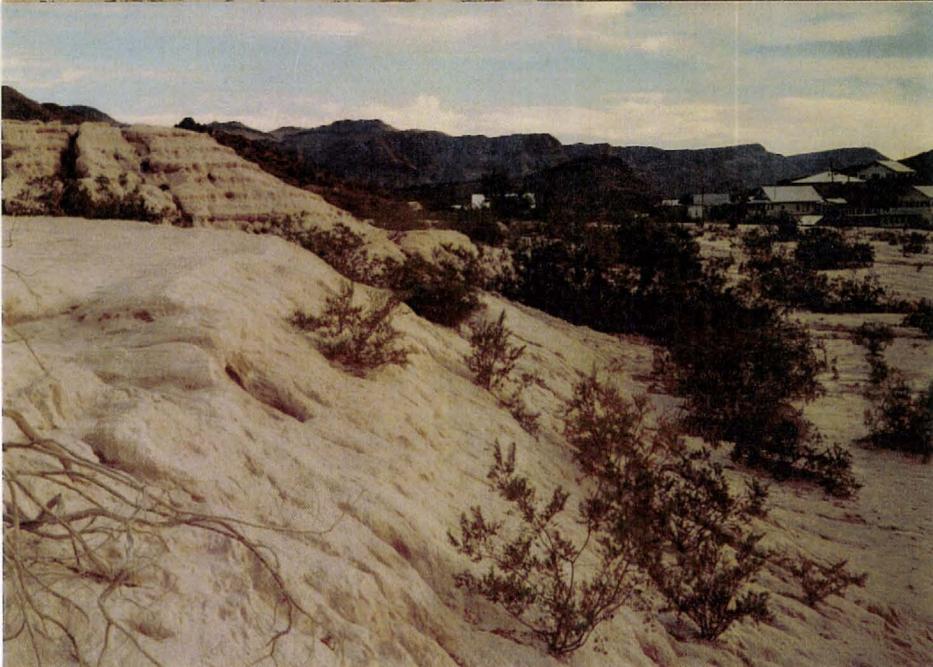
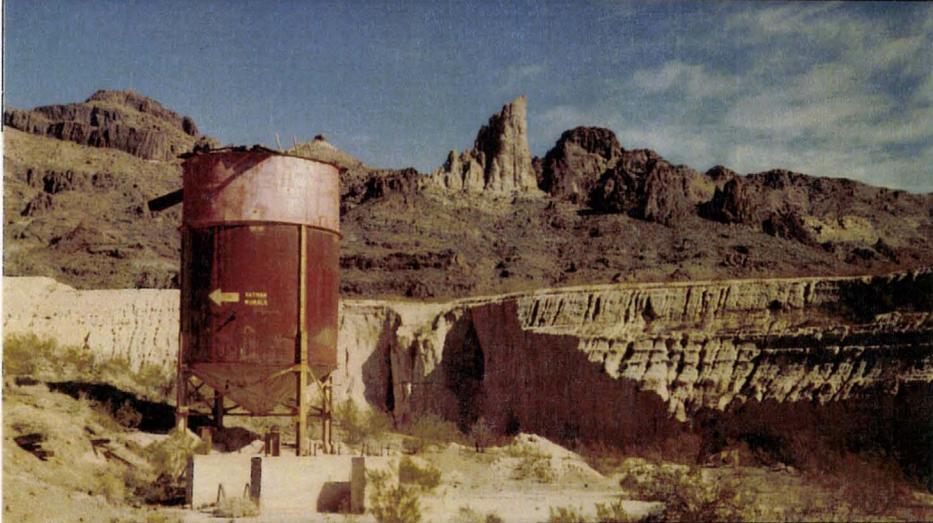
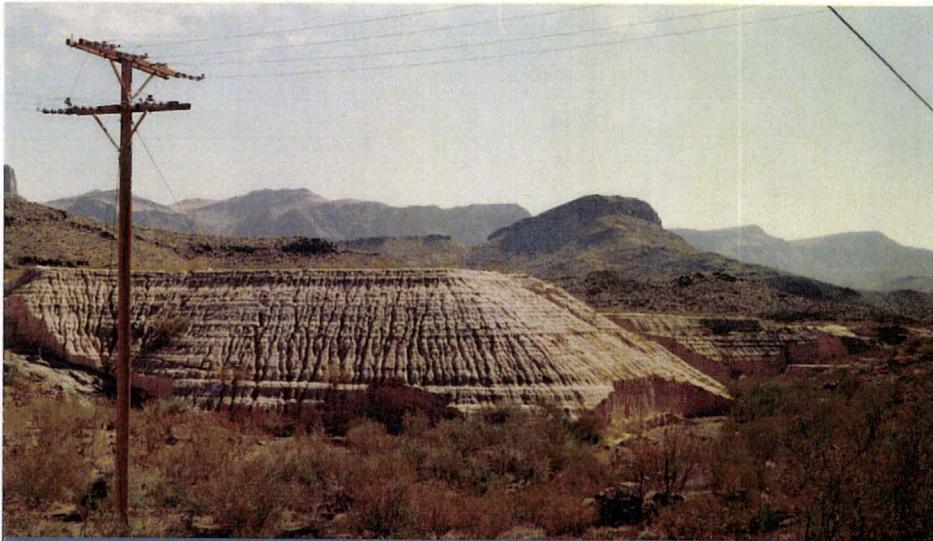


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