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19407 North 33rd Avenue
Phoenix, Arizona 85027
1-602-869-6859
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,

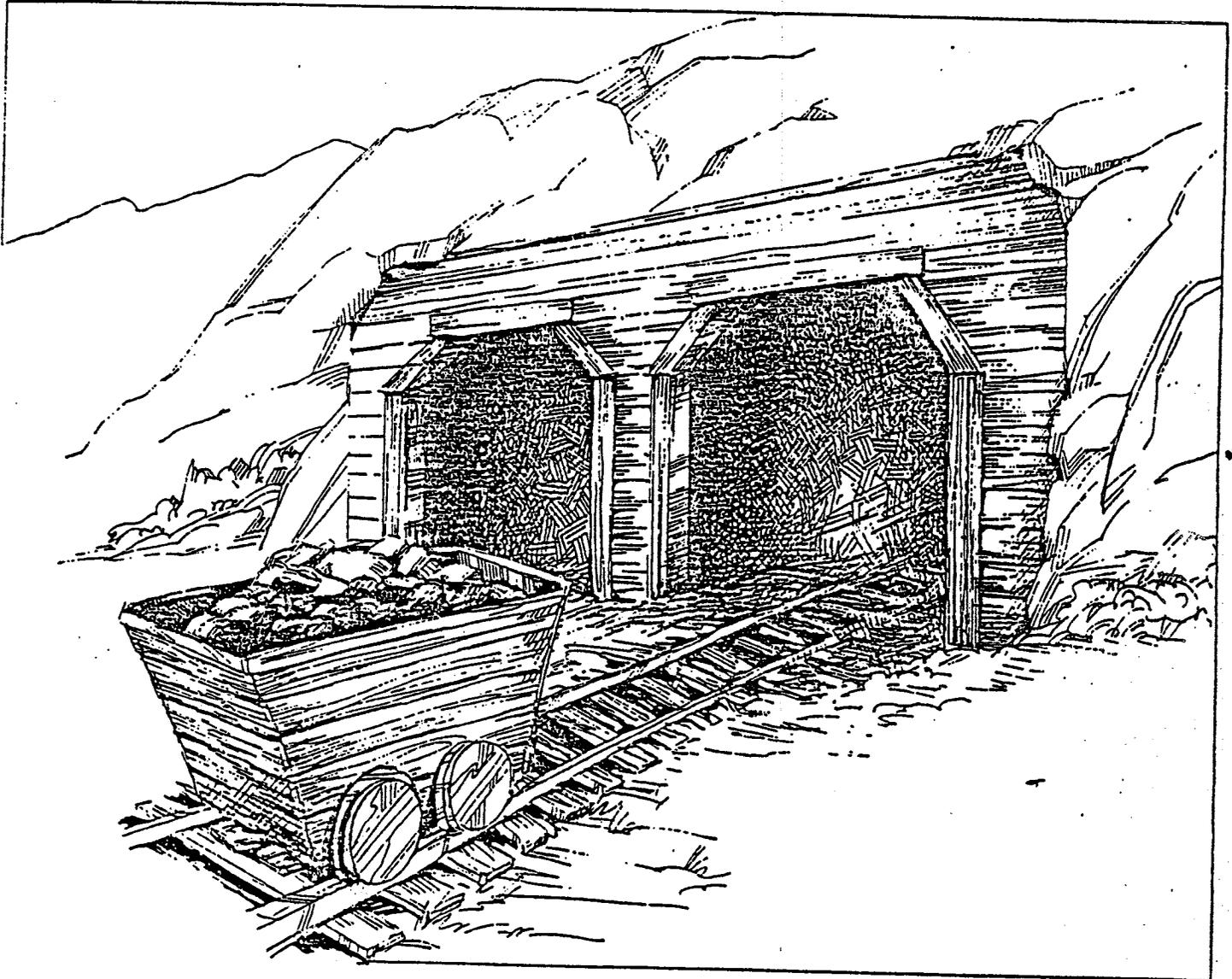


Frederic M. Rothermel, Ph.D.

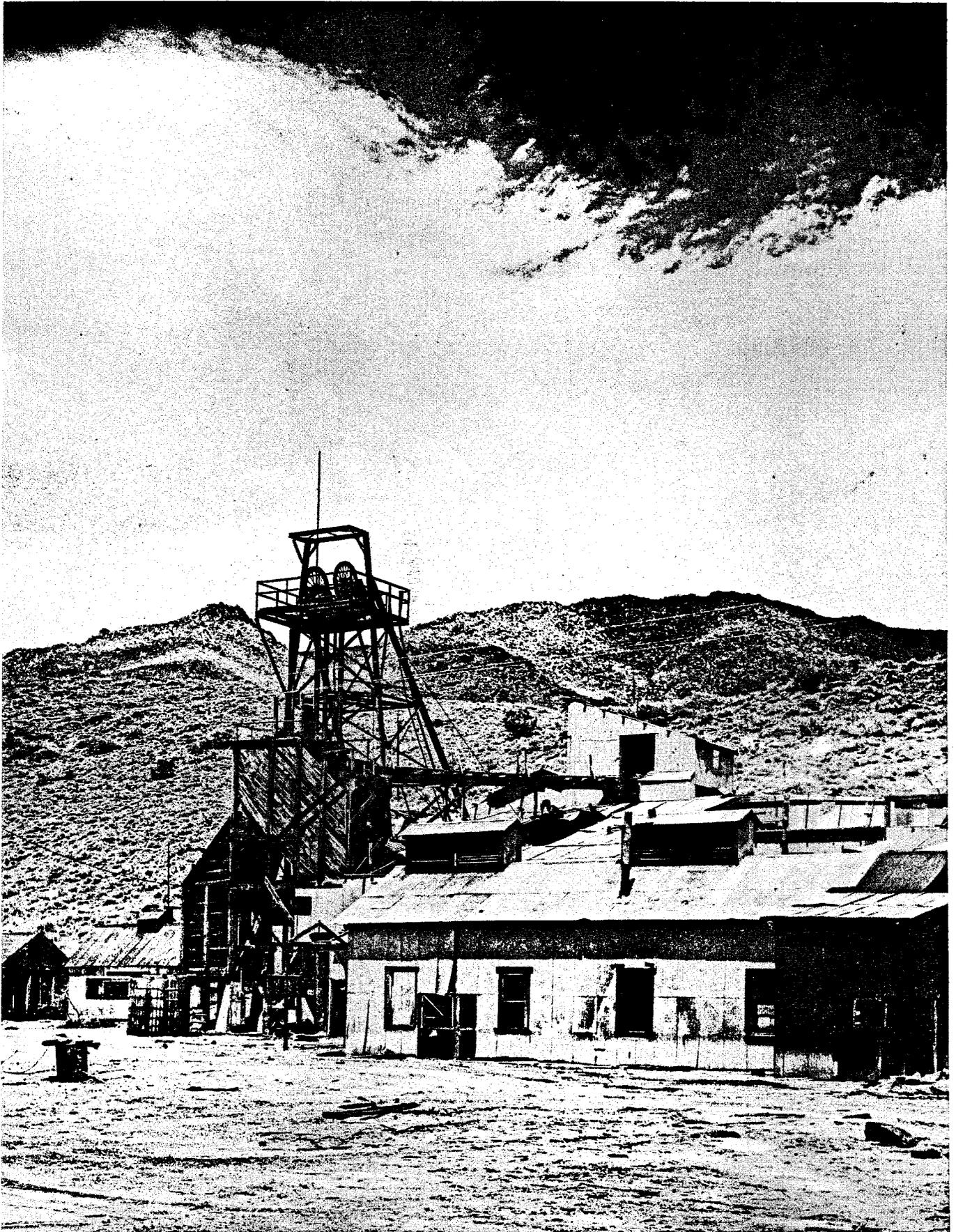
EXHIBIT A

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.

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

THE FUTURE OUTLOOK

The mining industry had a more promising future than
 any other. The Mining District is attracting attention
 everywhere as coming from all over the United
 States. Resources, development, milling facilities
 that during the year 1917 many more
 have been added to the growing list we now have
 coming from present indications, should ex-
 ceed the amount of low-grade ore on dumps can
 be used as soon as the custom mills now
 are in operation. Copper—runaway copper—is being
 mined in this district and Jim Murray,
 of Butte, after inspecting this district,
 said: "I have seen the future of Butte and
 Lead Butte."

The country have personally examined this
 to insure the permanency and continuity of
 the following brief excerpts culled at ran-
 ge of engineers and geologists:

"I have studied its formation, and believe you have
 the richest districts in America, and that within ten years
 will be the richest on the globe."

"I have almost every mining district in the southwest,
 and I range as one of the wealthiest, especially
 in this district. The claim can be made conservatively that
 in five years, more great producing mines than
 are now being produced in any other district in the
 United States."

"The ore is strong and well defined, and there is no question
 of its continuity to a much greater depth than it is
 in any other district in the United States."

"The conditions are here for the existence of ore bodies
 of great contents."

"I have given a brief summary of the most im-
 portant principal mines of the district and what
 they have made up a study of these, allow us to call
 it a feature of the present situation, viz:
 the district have gone deep, the Tennessee
 vein developed to the 1200 level,
 today, a powerful argument in favor of
 the work done, scores of others can and will do.
 The work scratched and results achieved as out-
 lined that the Chloride District has before
 it marvelous possibilities. We do not believe
 any other mining district in the United States today
 offers more opportunities than Chloride."

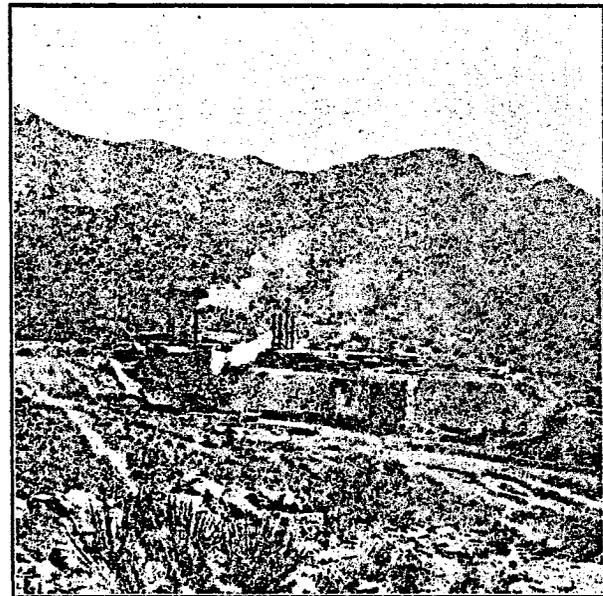
THE TENNESSEE MINE

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 Bos-
 ton, 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, vari-
 ous other parties who held

the ground failed
 to discover
 the existence of
 the ore shoot,
 and the claims
 were allowed to
 lapse. Mr. Mac-
 Duffee went far-
 ther north to
 sink his shaft
 and immediately
 uncovered rich
 galena ore.

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



THE TENNESSEE MINE, CHLORIDE, ARIZONA

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 en-
 countered 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

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, winzings 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 on two levels. Very soon the working 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 development this date is not far distant, just 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. 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 ago to operate the following series of rich ore: Alta, Banner, Infallible, Tigress. We have at hand authentic production of these mines to have a value ranging from \$100 to \$1,000 per ton. richly mineralized patented ground. The company also owns several other tracts a total of 500 acres in one corner.

In the early days, when operations the advent of railroads and modern methods ore was handled, the ore running far behind as worthless. The advanced mining methods since then, coupled with modern equipment, has changed all this; the 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 and will be increased as more adequate equipment ore blocked out. Figuring silver, at low prices, it is a safe estimate that is now available in the mines and mills. The estimated total operating cost at \$7.60 maximum; just figure out the ore averaging only \$20 per ton and the commercial value of a vast tonnage.

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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 ship- ping 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 super- intendent, 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, Infallible, 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 scientific- ally 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	1,292.42	64,335	1,450	6,034		
1905.....	5,984	1,137.00	38,751	173	112,254		
1906.....	9,916	2,772.60	125,331	114,232	504,520		64,294
1907.....	13,013	5,354.62	58,835	62,917	1,222,654	30,664	222,294
1908.....	2,179	1,193.13	29,931	11,220	219,229	504,133	76,311
1909.....	11,658	2,320.77	69,676	1,771	113,112	4,264,121	374,365
1910.....	1,109	421.23	44,709	20,341	224,364		47,914
1911.....	12,692	2,734.73	71,213	27,428	2,394,629	960,697	290,230
1912.....	4,472	1,491.87	43,761	7,829	1,320,920	759,219	171,862
1913.....	32,633	2,953.27	177,534	30,782	5,171,988	4,221,642	650,320
1914.....	22,492	1,214.41	55,941	15,297	3,704,102	4,632,105	472,685
1915.....	85,635	5,212.75	213,512	46,171	6,432,406	17,582,849	2,627,642
1916.....	104,653	6,106.90	229,237	190,507	5,524,731	17,621,650	3,007,224
1917.....	101,362	7,012.38	294,197	84,394	6,037,712	17,127,296	2,620,973
1918.....	4,737	557.82	42,053	91,556	433,162	52,533	150,558
1919.....	3,352	572.91	41,531	60,922	504,095		111,241
1920.....	2,359	622.51	37,100	1	328,623		84,123
1921.....	10,296	1,022.89	52,917		278		114,323
1922.....	3,453	553.91	42,099				61,214
1923.....	1,150	234.81	25				30,617
1924.....	388	163.20			2,059		21,359
1925.....	3,169	748.29			311,616	174,703	32,316
1926.....	10,656	2,034.22	49,490		697,803	1,668,244	281,499
1927.....	19,289		10,450		694,056	1,134,484	192,666
1928.....	593		19,393		43,751	150,319	23,617
1929.....	1,827		19,393		64,294	131,414	27,889
1930.....		1,276,200	4,411		37,640	32,104	7,620
1931.....		1,276,200	541				494
1932.....		1,276,200	3,533	2,333	17,760		4,975
1933.....		1,276,200	3,517	1,422	54,946	11,021	9,927
1934.....		1,276,200	4,714	2,737	11,511	10,674	11,573
1935.....		1,276,200	76,510	24,264	140,723	134,203	154,970
1936.....		1,276,200	163,763	107,829	1,681,454	1,647,560	1,511,344
1937.....		1,276,200	325,610	470,182	4,978,230	3,424,334	1,292,479
1938.....		1,276,200	370,613	311,163	4,697,219	3,319,812	1,292,479
1939.....		1,276,200	41,325	164,677	1,404,543	1,302,602	754,234
1940.....		1,276,200	284,700	221,221	4,607,480	3,529,040	1,291,030
1941.....		1,276,200	219,377	182,740	4,404,350	4,392,000	1,074,422
1942.....		1,276,200	137,112	154,420	3,312,000	4,187,700	924,787
1943.....		1,276,200	88,493	236,540	2,784,800	3,084,100	703,619
1944.....		1,276,200	57,828	1,014,200	1,507,010	2,681,120	571,243
1945.....		1,276,200	49,704	44,200	1,203,000	1,307,000	420,414
1946.....		1,276,200	34,222	350,500	737,000	971,000	318,495
1947.....		1,276,200	43,233	454,100	1,305,000	1,713,000	526,016
1948.....		1,276,200	694,000	621,400	591,100	1,344,700	342,501
Total.....	1,276,204	121,191.40	4,563,737	1,712,992	71,473,202	109,520,515	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)	222	35,499	22,265	16,476	
Altata and Altata Extension (c)	382	36,024	136,616	7,691	
Badger, Hercules, and Hercules group (c)	961	12,287	1,419	331,365	32,524
Banner group (s)	1,697	79,382	21,603	2,195,983	39,946
Blackfoot (cer)	158	11,896	19,617	101,365	111,369
Blue Bell (c)	169	20,934	16,274	162,001	
Cerbat (cer)	12	2,035	1,133	4,120	
Champion (cer)	822	23,689	11,631	825,693	325,391
C. O. D. (s)	1,540	151,263	23,921	348,872	23,165
Columbus-Murree Doctrine (cer)	946	3,083	4,370	17,322	134,533
Copper Ace (c)	3	1,262	278	21,373	
Distad (c)	93	55,884	1,392	149,600	
Elkhart (c)	652	10,383	7,482	245,199	
Empire and Silver Union (c)	1	2,475	122		
Eureka (c)	1	2,311	3,371	23,861	42,714
Flores (cer)	422	364	172	512	
George Washington (m)	114	17,080	15,777	34	
Golconda (c)	2	510,180	331,703	2,031,719	36,225,050
Golden Eagle and Bolstad (m)	1,777	25,245	690	40,076	
Golden Gem (cer)	2,478	8,212	3,265	14,960	
Hidden Treasure (c)	25	9,074	1,229	152,801	231,345
Idaho (cer)	250	3,283	6,742	9,345	37,000
Junco (c)	1,229	43,128	4,817	235,496	154,138
Keystone (m) <i>Div. 11</i>	2,703	482,049	340,778	348,845	114,063
Little Chief (c)	391	63,331	2,070	111,925	
Lucky Boy (c)	1,923	40,439	230	8,140	
Mary Bell (c)	24	955	357	19,153	28,733
Midnight (c)	44	8,533	10,746	4,122	
Minnesota-Connor (c)	2,890	224,129	50,703	169,722	71,933
Mint (m)	225	15,265			
New London (cer)	13	3,268	1,558	130,699	31,213
Nighthawk group (m)	324	16,277	3,410	1,889	
Old Colony (s)	21	2,968	624	4,370	
Paymaster (cer)	99	25,060			
Payroll (c)	123	4,104	11,694	39,925	102,137
Pinkham (c)	56	14,685	35,130	3,133	
Rainbow (c)	2,400	34,982	6,749	313,271	22,426
Redemption (c)	21	4,012	11,449		
Rico (s)	1,149	15,369	1,449	2,620	
Samoa and Esmon (c)	4,459	57,691	4,454	656,377	67,886
St. Louis (cer)	21	11,142	1,059	855,841	1,496
Silver Ace (c)	21	3,350			
Silver Hill (c)	703	8,842	10,722	229,949	143,394
Tennessee and Schuykill (c)	47,353	1,514,187	539,847	59,597,096	68,803,507
Town (c)	14	6,276	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, Cerbat 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 38448
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 MSRD 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 MSRDR 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 MSRDR 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.

Ore minerals are principally cerargyrite (silver), native gold, galena (lead) sphalerite (zinc), and chalcopyrite (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>	
<u>Proven & Probable</u>	350,000 tons
<u>Possible</u>	2,800,000
Central Area (Copper Age Mine)	
Proven & Probable	95,000
Possible	4,730,000
Souther Area (Golconda Mine)	
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.

Sincerely,
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

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 MINE⁴³

By S. K. GARRETT⁴⁴

LOCATION

The Tennessee-Schuykill 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

⁴³ 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-Schuykill 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-Schuykill 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-Schuykill 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-Schuykill 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 development no galena but considerable

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

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

The paragenesis, determined sphalerite, galena, pyrite, and

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

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

The fine-grained chalcedonic the sulphide ore.

MONTANA

By GEOLOGIST

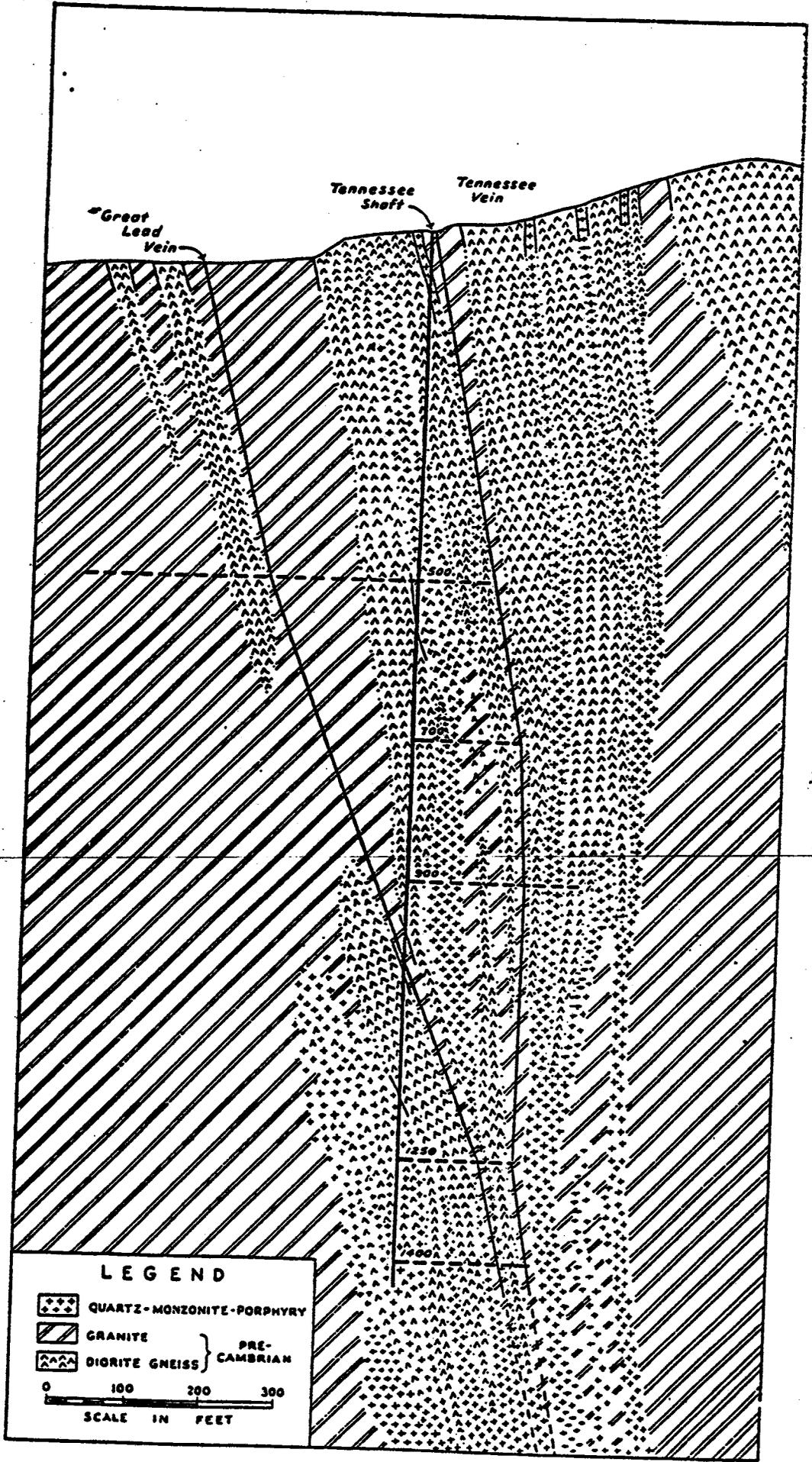
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A brief description of the Montana Mine is presented years a much larger area was bodies that could be worked. At a later date it is hoped to tion as well as to give further (Pl. XXXII).

The Montana Mine is in the Cruz County, Arizona, 5 miles about 30 miles west of Nogales

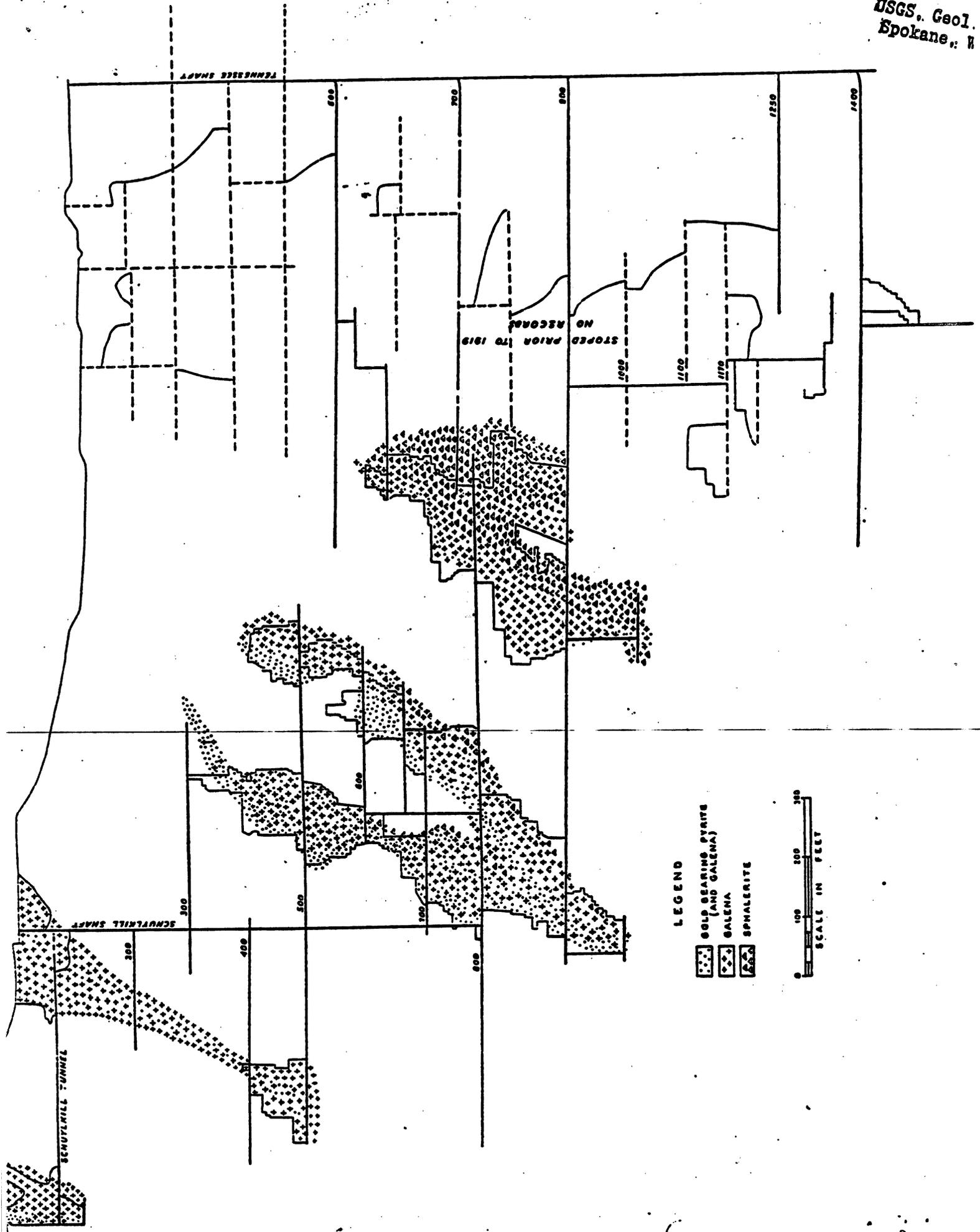
¹ Paper prepared for, and original of the A.I.M.&M.E. held at Tucson

² Consulting geologist, Joplin, Mo.



USGS, Geol. Div.,
 Spokane, Wash.

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



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-Schuykill 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</u> <u>(oz)</u>	<u>Silver</u> <u>(oz)</u>	<u>Lead</u> <u>%</u>	<u>Zinc</u> <u>%</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

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PHONE: (303) 277-1687

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



BARRINGER LABORATORIES INC.

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



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Project :

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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

210-599 Cerbat Chloride, Mohave Co. AZ
SUBJECT: 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'.

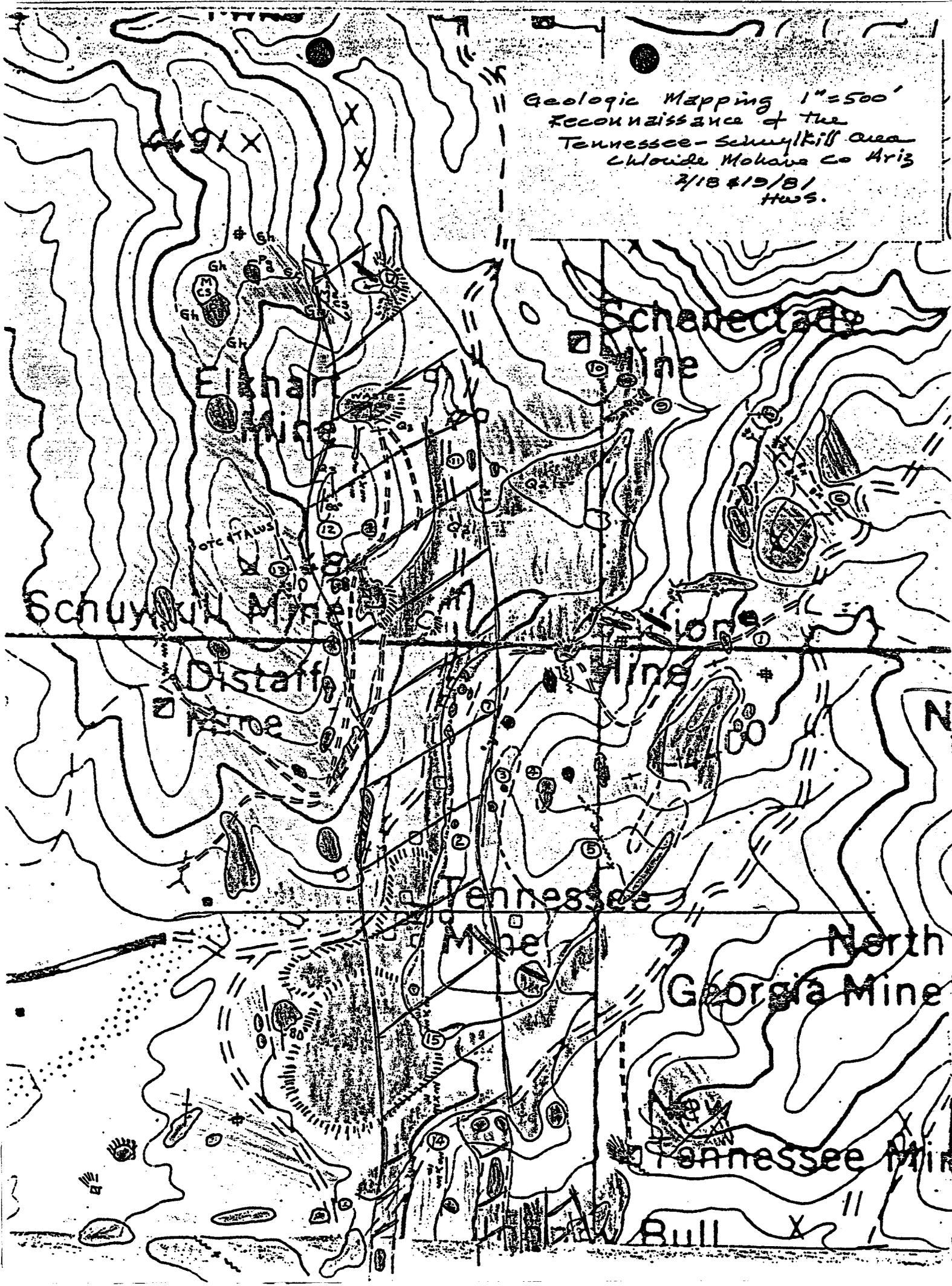
The location of the Tennessee Schuylkill "veins" mine workings coincides with a zone of rusty weathering banded glassy quartzite mixed with, in the Elkhart area, carbonate and calcisilite with the quartzites are garnet biotite rich gneiss and garnetiferous quartz feldspar gneiss. Also the Tennessee - 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 M. Mohr Co. Ariz
2/18 & 19/81
Huss.



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, rodded-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 porphyro-blasts. 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 Gbg.

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

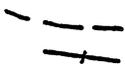
SYMBOLS



Field Note or sample station.



Outcrop & Geologic Contact



Inferred Geologic Contact
Strike outcrop on gneissic 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		

23500000 114° 12' 30" W
114° 12' 30" W

3574

3574

3572

114° 16'

114° 14'

3572

3574

114° 12'

114° 10'

3570

3568

114° 08'

114° 06'

114° 12'

114° 10'

114° 08'

3574

3572

3570

3568

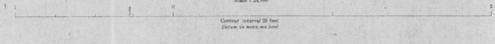
114° 08'

114° 06'

QUATERNARY
PLEISTOCENE
MIOCENE
Eocene
Oligocene
Miocene
Pliocene
Pleistocene
Holocene

- EXPLANATION
- Gravel
 - Claystone
 - Shale
 - Sandstone
 - Chert
 - Coal
 - Iron ore
 - Lead ore
 - Copper ore
 - Gold ore
 - Silver ore
 - Mercury ore
 - Antimony ore
 - Vanadium ore
 - Uranium ore
 - Thorium ore
 - Plutonium ore
 - Other rare metals
 - Open-cut limestone mine

GEOLOGIC MAP OF THE WALLAPAI MINING DISTRICT, MOHAVE COUNTY, ARIZONA



Geology by McClelland G. Dings and Paul K. Sims, 1963

Geologic Map of the Wallapai Mining District
Mohave County, Arizona
by McClelland G. Dings