



## **CONTACT INFORMATION**

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ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: LITTLE GRACE & LITTLE JESSIE

ALTERNATE NAMES:

ELLA  
CHAPARRAL MINING CO.  
OHIO MINES CO.  
PATENTED CLAIMS MS 1129  
PATENTED CLAIMS MS 1125-1126

YAVAPAI COUNTY MILS NUMBER: 1001E

LOCATION: TOWNSHIP 13 N RANGE 1 E SECTION 30 QUARTER SW  
LATITUDE: N 34DEG 28MIN 29SEC LONGITUDE: W 112DEG 18MIN 28SEC  
TOPO MAP NAME: POLAND JUNCTION - 7.5 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:

GOLD  
SILVER

BIBLIOGRAPHY:

USGS POLAND JUNCTION QUAD  
BLM MINING DISTRICT SHEET 228  
YAVAPAI MAG. MAR. 1918 P 4-6 SHARLOT HALL  
MUSEUM PRESCOTT, AZ  
LINDGREN. W. ORE DEPTS JEROME & BRADSHAW MTN  
QUADS USGS BULL 782 1926 P 132-133  
ADMMR LITTLE GRACE & LITTLE JESSIE FILE  
WILSON, E.D. ET.AL. AZ LODGE GOLD MINES AZBM  
BULL 137 1967 P 38

26

# GOLD BUG MINING GROUP

15 IN RED

Sec. 25

FOR OTHER CLAIMS IN SEC. 25  
SEE JESSIE-UNION MINE FILE

MIZPAH  
1148  
ARIZONA  
1149

YAVAPAI  
1150

USMM  
of Parts of  
Ticonderoga and  
Dividend Claims

INDEPENDENT  
Gen. No.  
COLL

35



Sec. 36

~~Do Not Reproduce~~

LITTLE JESSIE MINE (UNION MINE)

YAVAPAI CO.  
Big Bug Dist.

Little Jessie Mine, Yavapai Co - Walt Statler and two others are erecting a cyanide plant on little Jessie. His sample work indicates a 10,000 ton dump averaging 0.1 oz. of gold - Data from Walt Statler 4/25/78, visit at his office - Mr. Jett 4/28/78 sef

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KP/WR 10/23/79 - John Sanders reported that the experimental gold-silver leaching project at the Little Jessie Mine has been completed. It was determined that the dump material was not economically leachable. The project was operated by Walt Statler, Fred Lorette, and Sanders. Significant negative factors involved ph control and handling of fines.

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KAP WR 6/5/81: Tony Aguir, San Diego, Ca., reported he is investigating the Jessie Mine (file) in the Big Bug District, Yavapai, County.

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KAP WR 6/11/82: Frank Russell reported he has responded to an advertisement in the California Mining Journal. Tony Aguir of El Cajon, California is trying to either raise money to develop or turn the Little Jessie Mine, Big Bug District, Yavapai County. Mr. Aguir did mention the previous problems with trying to heap leach the Little Jessie dumps with cyanide.

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NJN WR 6/25/82: The Bureau of Geology and Mineral Technology provided the following information: From the Dividend Mine, Big Bug District, Yavapai County, during the years 1901-1908 and 1913-1923, 7,422 tons were produced. From that 379 lb Cu, 3,606 oz. Ag, 4,899 oz. Au and 34,494 lb. Pb were recovered.

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According to the "Start Up Sheet" from the State Mine Inspector's Office Amstar Petroleum Corporation, 770-885 Dunsmuir St. (No City Given but think that it is probably Vancouver, British Columbia) Ph: (604) 685-4216, is operating the Union Mine. Robert Sim is President, and John Reed is Geological Consultant. They are running mill tests for gold. (4/83)

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JESSE MINE - UNION MINE

YAVAPAI  
Big Bug District

See: ~~Union Mine (file)~~ File combined with Jesse Mine-Union Mine file on 4/6/84  
Yavapai Magazine March 1918, p. 4-6  
Wilson, Arizona Lode Gold Mines, ABM Bulletin 137, p. 37.

See: Gold Bug Mining Group (file) Yavapai County. This group includes the  
Juanita, Summit, Clipper, Jump Off, Aladin, Peerless, Starlight, Comstock,  
Omar, Galena, Dividend, Snow Storm, India, Bessie No. 1, Republic

See: IC 8969 -- Gold and Silver Leaching Practices in the U.S.; p. 16, 23

See: Palo Alto Gold Mining Co. (file) - Yavapai

XXXXXXXXXXXXXXXXXXXX

*Yonafai*

Mineral Bldg., Fairgrounds  
May 29, 1947

Mr. J. H. Morgan  
Morgan & Locklear  
Attorneys at Law  
425 Luhrs Building  
Phoenix, Arizona

Dear Joe:

We have your letter about the Union-Jessie  
property and will keep it in mind.

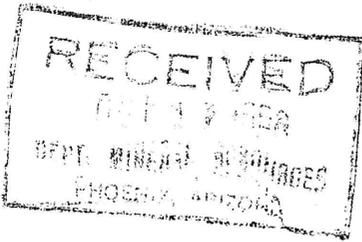
Of course you know that there is little demand  
for gold mines at the present time.

Yours very truly,

Chas. H. Dunning  
Director

CHD:mh

LIONEL B. LEBEL  
1930 MALCOLM AVENUE  
LOS ANGELES 25, CALIFORNIA



October 23, 1958

Department of Mineral Resources  
State of Arizona  
Mineral Building, Fairgrounds  
Phoenix, Arizona

Gentlemen:

Replying to your request of the 20th instance to fill in and complete "listing for sale" of the Jessie Mine Union Mine, Yavapai County, I have referred same to the office of Attorney, Joseph Morgan, Phoenix, Arizona, who has heretofore acted in our behalf in this matter.

Truly yours,

A handwritten signature in cursive script, appearing to read "L. B. LeBel".

L. B. LeBel

LBL:deh

MORGAN & LOCKLEAR  
ATTORNEYS AT LAW  
425 LUHRS BUILDING  
PHOENIX, ARIZONA

J. H. MORGAN  
E. C. LOCKLEAR  
D. J. MORGAN

May 23, 1947

TELEPHONE 3-5086

*Handwritten notes:*  
"Jessie Mine"  
"Union-Jessie Mine"  
"and also other mines"  
"as Union-Jessie Mine"  
"as Union-Jessie Mine"

Charles H. Dunning, Secretary,  
Arizona Department of Mineral Resources,  
Arizona Title Building,  
Phoenix, Arizona.

Dear Chuck:

Clients of mine own the old Union-Jessie property, which is not far from Humboldt. I think you are familiar with the lay-out. They own the patented claims and also a number of unpatented claims. This property, if properly exploited, might be of considerable value.

In the event you have any inquiries concerning a property of this type, would appreciate it if you will advise me, or Mr. L. B. LeBel, 321 So. Beverly Drive, Beverly Hills, Calif., C/o Buckley Brothers.

For your information, will say that the property is for sale and could be bought on very reasonable terms.

Sincerely yours,

*J. H. Morgan*  
J. H. Morgan

JHM/ka

cc to  
Mr. L. B. LeBel

WANTED: Old Mining Books.  
(503) 582-2796.

**\*900,000+ TON RESERVE\***

The Jessie-Union property in Arizona, held jointly by Amstar Petroleum Corp. and Arivaca Silver Mines Ltd., have shown known and potential ore reserves of more than 900,000 tons of ore.

The property consists of four patented and 10 unpatented claims on approximately 280 acres, has had previous production of 40,000 ounces of gold from the Jessie and Union vein structures.

Current reserves on the property include approximately 100,000 tons of ore grading .08 ounces of gold per ton, which remain in the underground Jessie workings at the property. In addition, there are about 25,000 tons of mine dump material which have an average grade of .10 ounces of gold per ton.

Potential reserves at depth are currently estimated at approximately 800,000 tons of ore averaging .25 ounces of gold per ton.

COLORADO: 25 Placer Claims. Will sell individually or as group. Must Sell! SGS, 1058 S. Doran, Mesa, AZ 85204.

**MINING ENGINEERING**  
Available for cost analysis Mining and milling method property evaluation and assessment work. P.H.T., 28 Shasta Rd., Berkley, 94708. (415) 848-5612.

**FOR SALE:** 6" Gorham Pump volume 90,000 gallon per hour, Ford 4 cyl. Industrial motor, 40 hours since complete overhaul, mounted on trailer with new tires, 40 inlet hose, \$950. (916) 529-0382.

**PROSPECTOR'S & MINE OWNERS INFORMATION PACKET:** Packet contains Legal Claim forms for hard-rock and placer, plus, on-site claim forms, all showing Markings of Boundaries and Performance of Discovery Work, Proof of Labor Forms, BLM Regulations (latest) and filing procedures. Information of BLM and U.S. Forest Service Offices, both Western and Eastern states plus more, including full-line catalog of Prospecting Literature, Books, and Government Bulletins, Metal Detectors and Mining Equipment. Send \$10.00 plus \$1.50 postage to: MINING & PROSPECTING, Box 282, Paso Robles, CA 93446.

HAPPY HOLIDAYS

# SOUTHWEST MINES DEVELOPMENT CO.

P. O. Box 27  
Humboldt, Arizona

SUBMITTED BY

FRANCIS H. CLARK, E. M.

The mines of the Union-Jessie-Dividend property, now controlled by the SOUTHWEST MINES DEVELOPMENT COMPANY, are located in the Big Bug Mining District, Yavapai County, Arizona, four miles northwest of Humboldt, Arizona. This property is about 24 miles from Prescott, Arizona, and about 80 miles north from Phoenix, Arizona, on good highways. Railroad connections, electric power lines, telephone lines are in close or direct connection with the property.

The property holdings cover a ground area of approximately 637 acres, patented and unpatented lode mining claims. In addition is 160 acres of patented ranch land, owning valuable water rights. The Union mine has patented water rights and a 20 acre mill-site. The property is well equipped with buildings of several kinds delegated to the various mine operating departments.

The deepest mine workings is the main Jessie shaft, 660 feet deep. When this shaft was sunk, no water of note was encountered even the last 50 feet, not furnishing water sufficient for drill uses. For a detailed description of the various workings, reference can be made to the reports of A. W. Warwick, E. M., of London, England; A. L. McCarty, E. M., of New York, N. Y.; W. A. Bradley, E. M., Professor of Applied Geology, Colorado State School of Mines, Golden, Colorado; W. Allen Nickerson, E. M., who has been in charge of the property for several years. All these Engineers are of World-wide reputation and their statements can be vouched for as accurate.

The history of the property dates back to the early 80's when the ores were worked by arasta and later by amalgamation and concentration, not as high an extraction was made of the values as could have been made by modern methods. In later years a cyanide plant was used in recovering values from old tailings dumps. Incomplete recovery records and smelter statements, show an approximate production to date of over \$800,000.00. This production came mostly from above the 300-foot level of the workings. It is proposed to install an up-to-date flotation system in the present 75-ton mill, thus, making a much higher saving of values.

From W. A. Warwick report: "A range of high granite hills running northerly and southerly bursts up through a highly metamorphosed and ancient slate. At or near the junction of the granite and slate there is found a great system of veins with a

## SOUTHWEST MINES DEVELOPMENT CO.

P. O. Box 27  
Humboldt, Arizona

-2-

strike of N.E. and S.W. These veins are of great size and accompany dykes of Elvan, commonly called in this district, porphyry. Such a geological state of affairs is highly favorable to the formation of orebearing veins. The main ore reserves have not been drawn upon. The mine workings are well laid out and are in pretty fair shape. A small expenditure would place them in first class condition."

From report by A. L. McCarty: "Throughout the present development, the ore has been continuous and found in a body of from 4 to 11 feet wide. The veins are continuous the full length of the company ground. The ore exists in shoots and is high-grade, these shoots are large and go to great depth. The ore may be divided into two classes: i.e., high-grade, which exists as an iron sulphide carrying gold. This class of ore will run from \$60.00 to \$1,000.00 per ton. And a milling grade ore consisting of quartz and highly silicified porphyry. Your ore is chiefly of a milling grade, averaging better than \$11.00 per ton. A gold mine that will develop itself is unusual. There is no gamble on this mine, it is sure to pay well when worked in a systematic and intelligent manner."

Both Messrs. Warwick and McCarty practically concur in the gross ore tonnage and total gross value of the ore, viz.: 161,275 tons of a gross value of \$1,555,900.00.

From report by W. A. Bradley: "The developed and undeveloped veins of the property are true fissures. The mineralized quartz will be found at depths carrying a higher value in gold and silver, than was mined from the upper levels. The ore zone, or system of veins, extends through and beyond the claims. The ore bodies are in lenses of quartz. The lenses are due to longitudinal faulting of the fissure walls. This indicates great depths. The mill ores have values from \$6.00 to over \$20.00 per ton, with streaks of high-grade rock. The extraction of the metal content should be above 85% of the assay value. The property should be operated under a competent management. The profits--judging from past operations--should be above \$4.00 per ton. The geological history of the property is not complex. The survey of the geological structure should be continued until the primary causes of the ore deposition have all been mapped."

From statements from W. Allen Nickerson: "I have made a thorough study of the conditions of the property and done much sampling, as well as making a number of mill-runs of dump and underground ores and can vouch for the accuracy of the values as given in reports by Messrs. McCarty and Bradley. Also I have demonstrated that the metallurgical problems are very simple and a high recovery of the assay values should be made. The property

## SOUTHWEST MINES DEVELOPMENT CO.

P. O. Box 27

Humboldt, Arizona

-3-

can be put under operation in a reasonably short time. Unwatering the Union shaft will require not to exceed four days. A body of excellent milling grade ore can be stoped from the 70-foot level immediately, this ore mixed in proportions with the dump ores from the Wright and Jessie shaft dumps will furnish a mill tonnage for continuous operation and should pay in excess of \$4.50 per ton, over cost of handling, transfer to mill and milling costs. The development has been by means of shafts, drifts, tunnels, raises and winzes and will total approximately 10,275 feet. Stoping for the high-grade lenses has been carried forward to a considerable extent above the 300-foot levels, leaving the low-grade mill ores as stope filling and gob. Unwatering operations carried forward through the Wright shaft connections will open a valuable shoot of ore extending toward the west from the shaft, this ore should be made available with a small expenditure of money."

The writer has been familiar with this property over a period of 25 years. The mine is equipped for limited operations with hoists, compressors, cars, rails, tools of all kinds and a mill. Pumping plant, capacity sufficient for a 200-ton mill. Assay office, Auto-motive truck and passenger cars. The mill should have added grinding machinery of the ball-mill type, impact amalgamators of approved design and added flotation equipment. With some improvement in the method of ore handling and the additions to the mill, it is my opinion that, the entire mining and milling cost should not be more than \$6.00 per ton. Gold mines, such as owned by the SOUTHWEST MINES DEVELOPMENT COMPANY, are limited in number. It is my opinion that, upwards of 75% of the mill ore values will be a direct mint product, possibly a well worked out metallurgical program, will raise even this high bullion percentage. From numerous inspections I have made of the property it impresses me as a good one and there is no reason in the world why it should not be a prolific producer under highly trained Engineering management. The total production has been around \$800,000.00. There is left in the present workings of the property, double that amount in recoverable values. Just what lower development will produce no one can tell, but lower workings should be far better than any of the upper workings, judging from the formation and character of the ores. I believe the ores will go to a depth of at least 2,000 feet. In any event the property when under full operation will be one of the big gold producers of Arizona.

Yours very sincerely,

FRANCIS H. CLARK.

Mining Engineer  
Prescott, Ariz.

Box 27  
Humboldt, Arizona.

June 1, 1934.

Mr. Homer P. Elliott,  
906 Security Bank Building,  
Charleston, West Virginia,

Copy  
orig/copy sealed  
3m.

Dear Mr. Elliott:

Yours of May 28th came today. The only claims shown on the itemized list which do not appear on the map are the Ohio, El Caney, Roosevelt, Teddy and El Tena. All of these claims are separate from the group shown on the map. The Ohio was not considered of sufficient value to keep and the others are held only for their value as a possible source of water. Two claims appear on the map that are not owned by us. They are the Independence and Columbia. The Little Oro Mill Site, Atlantic, Pacific and Union Water Rights do not appear on the map for the reason that the above mentioned ones do not. A water right does not have boundaries, hence cannot be mapped.

Now as to the valuation I place on the property of \$ 250,000.00. My method of valuing this property is exceedingly conservative for the following reasons: First, a purchaser would not be paying out of his funds the full amount. After an amount not to exceed \$50,000.00 had been expended, the mine ~~will~~ should pay its way ~~at~~ x and make all payments on the purchase price. The purchaser would have an investment of \$ 50,000.00 from which he should win earnings of not less than five times that amount in not to exceed four years time, from ores known to exist. This would not exhaust the future possibilities of the mine which would all belong to the purchaser.

In arriving at tonnage I have not considered any tinnage from any of the other claims and have confined myself to the Jessie alone. All the reports I have shown more tonnage than I have shown which is 125,000 tons gross value \$8.00 per ton, or gross value of \$ 1,000,000.00. Mr Warwick shows a gross value of \$1,555,000.00.

In reducing the ore I show to cash value I follow the general formula used by all engineers, and the Department of Internal Revenue in valuing mines. This general method is known as the Hoskold Method and is somewhat complicated. It presumes first that there is a willing buyer and seller. The gross value of the ore is first found, then the cost of mining, milling and marketing is found. This reduces the ore to a net value, from which is deducted taxes county and state and Federal. After these items are determined the amount of return the buyer should expect is considered.

Amortization of Capital is its return with interest, at or before the time of exhaustion or death of the property. If there is to be a genuine profit, total operating profits must include an ultimate profit over and above amortization.

Amortization of property is usually effected by distribution of dividends, without discrimination between amortization of capital and ultimate profits. It is then the stockholders' responsibility to reinvest a sufficient proportion of the dividends to amortize the investment cost. On capital investment it is reasonable to allow 8% and in reinvestment of capital earnings 4%. Deduction of these items from net worth bring us the cash value of a mine and this is, in brief, the exact method used by the government in Washington in valuing mines. It is universally used by engineers, and if you care to submit this to any well informed Mining Engineer, you will find that I am correct.

Were I to use this method in valuing this property the purchase price would be higher than it now is.

In arriving at cost my figures are as follows:

125,000 tons at \$8.00 gross		\$ 1,000,000.00
\$1.50 per ton for mining	\$ 187,500.00	
\$1.50 per ton for milling and marketing	187,500.00	
\$0.50 per ton for additional equipment and development	62,500.00	
\$0.50 per ton for taxes and unexpected contingents.	62,500.00	
	<hr/>	
	500,000.00	

Leaving a profit of \$ 500,000.00 from which the purchase price of the property would be charged, and the net profit would be \$250,000.00 from an investment of not to exceed \$ 40,000.00. This from only one claim of the group.

The equipment and improvements are surely valuable as an adjunct to an operating mine and it would not be unreasonable to include them in any valuation.

In your letter you mention a probable life of the mine at from ten to fifteen years with the ores now available. On an average annual extraction of 30,000 tons of ore I can only see four years with the ore I show. It must be remembered that the extraction of these ores would not exhaust the mine's future. In my opinion the mine has not been touched as yet.

I have done my best to explain my position and hope that I have managed to make it clear.

We are going right ahead with the shaft at the Jessie. Yesterday and today we have been getting the compressor engine in shape to unwater the Union, and we started the water out this afternoon. We will keep right after it until the first level is in watered which should take two more days.

My family is home now for the summer and it is a great joy to me to have them home.

Developments at the mine will determine whether or not we will be able to represent this State at the dedication of your State Capitol.

Please remember me to your boys, and with best wishes, I am,

Very truly yours.

/s/ Wm. Allen Nickerson.

COPY

A. L. MCCARTY, E. M., PRESCOTT, ARIZONA

The Ohio Mines Company  
Columbus, Ohio

Gentlemen:

At your request I have made a thorough investigation of your property in Arizona, and report the following:

LOCATION: The property of The Ohio Mines Company is located in Yavapai County, two miles west of McCabe and eighteen miles east of Prescott.

The nearest railway station is Humboldt, Arizona. A good wagon road connects the mines and the town of Humboldt,  $4\frac{1}{2}$  miles distant.

PROPERTY: Consists of the following patented mining claims. Jessie, Little Grace, Diydent and Ella. Unpatented: The Marion C, Antelope, Bertha, Lucilla, and John Gill. Also the Little Ore millsite, and a ranch of one hundred and sixty acres.

In addition to the above, the Company owns a group of unpatented claims on and adjacent to Mr. Elliott: El Caney, Teddy, Roosevelt, and El Terra. These claims are located about one and one-quarter miles west of the Jessie group, and are known as the Mr. Elliott' group.

GEOLOGY: The country is made up of precambrian schists and enormous areas of granite. The intrusion of the granite gave the necessary pressure and heat to metamorphose all sedimentary deposits. At a later period this granite was cut by intrusions of Porphyry. These are the mineral bearing dykes and have a general east and west trend cutting a large part of the western part of the territory and in points of weakness of the earth's crust breaking through in many places often in parallel dykes not fifty feet apart. At a still later period the country was cut by dolerite intrusions which crossed the porphyry at an angle northwest and southeast. There was a period of mineralization with and immediately after both these intrusions. The dykes of porphyry were agents that opened up fissures for the mineral bearing solutions which were heavily charged with silica and carried the gold values. The hot saturated solutions penetrated all crevices and openings made by the dykes. The large fissures offering the least resistance produced an ideal condition for the formation of shoots of ore. In many points throughout the dykes the quartz has a width of two to five feet and in such points the adjacent porphyry is highly silicified and assays nearly as high as the quartz, showing clearly that the origin of the metal was not by the dyke but by the solutions which came at the same period and later.

The dolerite intrusions cut the country around the Jessie mine in many places. Following these was another period of ore making in shoots and lenses. At the intersection of the porphyry by the dolerite dykes there is always ore. The solutions following the dolerite intrusions were not as rich in gold and carried more iron and copper, and in some cases lead.

HISTORY: The property (~~now owned by the Ohio Mines Company~~) contains the famous Jessie Mine. This property produced over one-half million dollars and is mined to a depth of five hundred feet. This production was made from one shoot of high grade gold ore.

The first work of any importance was done under a lease by Mr. Wright of Prescott. During the term of his lease Mr. Wright mined over \$150,000.00 in high grade gold ore from one shoot of ore on the Jessie claim. His work was extended to a depth of 200 feet and shows the shoot of ore to be 225 feet long with a width of 6 to 8 feet. This shoot of ore dips to the east at the rate of 25 feet in 100 feet and at the 500 foot level is entirely east of the Jessie shaft.

After the expiration of the lease the property was operated by the owner, Mr. J. S. Jones. During a period of several years he continued mining and milling ore. Both the mining and milling was very poorly done. A knowledge of the occurrence of the ore and the best method of mining and milling was clearly lacking. Even under these conditions the smelter receipts and bullion returns show a production of \$750,000.00 from the Jessie and Dividend Claims.

DEVELOPMENTS: On the Jessie Claim there is an inclined shaft about 600 feet on the vein, 285 feet of this shaft is two compartments well timbered 5 feet by 5 feet in the clear. From this point to the sump there is but one compartment not timbered and in poor condition for hoisting. Levels are driven both east and west from the shaft at approximately every hundred feet. There is about 6,000 feet of development work in shafts, drifts, and raises. Much of this work is open and in good shape even though the timbers used were small and placed in a scattered manner.

The Dividend Claim has two shafts both on the vein and both shafts show the ore continuous for a depth of approximately 300 feet. Several hundred feet of drifting was done on the 100 foot and 200 foot levels and all ore stoped out to the 200 foot level. The vein is about 400 feet north of the Jessie vein and runs at an angle to it, so they will intersect about 600 feet east of the Jessie shaft. Throughout the present development the ore in the Dividend claim has been continuous and found in a body of from 2 feet to six feet wide. See assays. Various pits and openings show the Jessie and Dividend Veins continuous for the full length of the Company's ground.

EQUIPMENT: At the Jessie shaft there is a fine structure 120 feet by 60 feet covering the hoist, head-frame, compressor, boiler, etc. Ample buildings for accommodations of men are provided--1-6 inch by 8 inch gear hoist, 600 feet 7/8 inch cable, 1 cross compound air compressor in good condition and sufficiently large for present requirements. The head frame of 12 inch by 12 inch Oregon pine is well built and will be suitable for handling a large tonnage from great depth.

Two boilers, 1 40 H. P. and 1 80 H. P. Both need some repairs. A good supply of air drills is at hand--both large machines suitable for drifting and sinking and also a number of small stoping drills. And a rather complete supply of tools for general mining work.

The equipment of the Dividend Claim consists of:

*omit*

One 6 inch by 8 inch friction hoist in good order.  
One 30 H.P. boiler locomotive type.  
A very strong substantial head frame.  
Both joist and boiler well housed in one building.

ORE: The ore exists in shoots and is high grade. These shoots are large and go to great depth. The ore may be divided into two classes; high grade, which exists as an iron sulphide carrying gold. This class will run from \$60.00 to \$1000.00 per ton. (2)

~~and~~ A milling grade consisting of quartz and highly silicified porphyry. This means that the entire dyke from granite to granite is of milling grade when mined from around the high grade shoots.

*omit*

POWER: Coal costs \$9.00 per ton delivered at the mine. Oil \$2.00 per barrel. Electric power can be bought for about \$75.00 to \$85.00 per horse power year. This is about one-half what power from coal or oil will cost. A material reduction in the price of electric power may be expected within a year, as a new power company is now preparing to install a plant on the Verde River to deliver 15,000 H.P. Inasmuch as electric power is sold in other sections for \$55.00 to \$65.00 per H.P. year, a reduction to \$65.00 may be looked for here.

WATER: With what water the mine makes and will make with increased depth, together with what now exists in Big Bug and Chaparral Creeks, there will be ample water to supply a 500 ton concentration and cyanide plant.

OTHER PROPERTIES: South and east of the Jessie group about three-quarters of a mile is the McCabe and Gladstone mines. They are located on a parallel dyke of porphyry and have been operated for several years. Their production exceeds \$3,000,000.00 gross. All the ore has been mined out to the 1000 foot level. The ore shoots are still strong and rich on the 1000 foot level.

The production from these two mines in 1907 totaled \$480,000.00 -- gold and copper. All mined from below the 900 foot level. These figures were given for tax valuation and are probably under the true production.

It is interesting to note that one-quarter of this output was copper. It serves as an indicator of what may be expected from the Jessie at and below the 1000 foot level.

The Lelan and Mt. Elliott Mining Companies are both operating the properties north and west of the Jessie. Their ground is adjacent to yours. They have large bodies of commercial ore.

*omit*

At Humboldt there is a good smelter rapidly undergoing a small amount of remodeling. Mr. Bennetts, the manager, is a smelting man of ability and he says his rates will be such as to permit the mining of a ten-dollar ore. The opening of this plant for custom ore means much to the mines of that camp and adds materially to the value of your mines.

TREATMENT: Your ore is chiefly of a milling grade. One-half of the value can be saved by amalgamation and concentration. The remaining gold exists in such a finely divided state that it floats away on the water and can only be saved by cyaniding. But this is an ideal condition in cyaniding and your fine gold can be completely extracted in a few hours treatment by agitation in a cyanide solution.

Treatment test:

Heads crushed to pass 100 mesh screen assayed \$18.00 gold. Agitated for eight hours in a solution of three-tenths of one per cent potassium cyanide gave after careful washing a tailing assaying only 20 cents per ton. This is very rapid work and done with a consumption of only  $2\frac{1}{2}$  pounds of cyanide per ton of ore.

Crush in stamps followed by amalgamation and concentration, grind the tails in tube mills, crushing in cyanide solution, agitate the slimes in high steel tanks and filter press. This will give you the last dollar in your ore and if done at a capacity of 150 tons per 24 hours, can be done at a cost of mining and milling of \$4.00 per ton.

ASSAYS: General sample from waste dump 40,000 tons:

Gold -- .24 oz. \$4.80

Sample of ore and fines in dump left at Wright shaft, mined from top of big ore shoot:

Gold -- 3.85 oz. \$76.80

Sample of soft unsilicified porphyry:

Gold -- .10 oz. \$2.00

Sample taken 40 feet west on 140 feet level in the big shoot of ore which we will call the Wright shoot due to its history:

No quartz in sight other than 2 inch stringer, but the porohyry is highly silicified. Four feet wide:

Gold -- 4.02 oz. \$80.40

Sample taken 200 feet west in same shoot--2 feet wide silicified porphyry:

Gold -- 3.40 oz. \$68.00

Sample taken from quartz 12 inches wide and opened for over 200 feet on second level. This is an undeveloped shoot directly south and within 35 feet of the Wright shoot and is near the hanging wall of the porphyry dyke:

Gold -- 2.14 oz. \$42.80

Sample taken in face of 200 foot level west taken across 6 feet of soft vein matter near a dolerite dyke with cuts across the porphyry at this point:

Gold -- .92 oz. \$18.40

Sample of tailing pile which Mr. Jones leached with cyanide:

Gold -- Trace

Sample of sulphides from the Dividend Claim:

Gold -- 4.28 oz. \$85.60

Sample of clean white quartz from the Dividend Claim:

Gold -- .20 oz. \$4.00

Several samples taken from the dyke not near ore shoots showed from a trace to \$4.00

Three samples taken from the Mt. Elliott group assayed:

Gold -- \$8.40, \$8.80 and a trace

ESTIMATED EARNINGS: 150 tons at \$20 per ton equals \$3000.00, (\$3000.00 gross output per day). \$4.00 cost of producing X 150 tons, daily output equals \$600.00 total expense per day. (\$2,400.00 daily profit.) 300 days X \$2,400.00 equals \$720,000.00 profit per year.

RESUME AND OPINION: Your ore exists in shoots and lenses found at any position in the porphyry dyke with a rather regular occurrence along the foot and hanging wall. These shoots are large and especially so on the Jessie ground. They have uniformity of value and are easily followed. This width often reaches 20 ft. of ore of a milling grade. Development in adjoining property shows uniformity of value in gold for 800 feet, after that the same gold value for an additional 300 feet and a rapid increase in copper. With greater depth the mines of this camp will be copper mines with unusually high gold value.

Your ore shoots are all dipping east about 25 feet to the 100 feet of depth. The Wright shoot crops just west of the Jessie shaft and is entirely east of the shaft at the 500-foot level. Two smaller shoots crop east of the shaft. Their dip east has thrown them entirely out of your development.

Most all of your development work has been to the west, which shows some ore. Had the same work been done east, large ore bodies would have been opened. The mine has an indisputable production of between \$600,000 and \$800,000 in high grade ore and bullion. It would be difficult to show where over \$150,000 was spent in equipping and developing the mine.

Equip the mine with electric power at once, using the power for both hoisting and pumping.

As soon as the shaft reaches the 300 foot level some shipping ore can be mined and help carry further development work, and as soon as the 600 foot level is opened shipping ore can be mined to develop the property systematically and produce money enough to build the necessary milling plant. It is very unusual to find a mine that will develop itself. None but the high grade gold mines have done it.

The Wright shoot is the longest, widest and richest shoot of ore in the camp. If there were no other ore bodies, this alone would be sufficient to justify the proposed work.

The Dividend Claim is very valuable and lies close enough to the Jessie so they may both be worked from the one shaft.

\$100,000.00 will be ample to put the property on a producing basis and add the needed equipment.

Six months time will be required to put the shaft in first-class shape and to get the ore opened up ready for mining.

There is no gamble on this mine, it is sure to pay and pay well when worked in a systematic and intelligent manner.

Respectfully submitted,

A. L. MCCARTY, E. M.

REFERENCE: Silver City National Bank, Silver City, New Mexico; Prescott National Bank, Prescott, Arizona.



COMMODITY INFORMATION

COMMODITIES PRESENT C10 <A.U., W.F.N., W.P., ...>
ORE MINERALS C30 <GOLD, ARSENOP., ... ERITE, GALENA, ANTIMONIOUS PYRITE>
COMMODITY SUBTYPES C41 <>
GEN. ANALYTICAL DATA C43 <PROBABLE PRODUCTION OF 4800,000 OZ OF GOLD. GOLD ASSOCIATED WITH SULFIDE MINERALS>
COM. INFO. COMMENTS C50 <>

SIGNIFICANCE

MAJOR PRODUCTS MAJOR <A.U., W.F.N., W.P., ...>
MINOR PRODUCTS MINOR <P.B., W.F.N., ...>
POTENTIAL PRODUCTS POTEN <>
OCCURRENCES OCCUR <>

\*PRODUCTION

PRODUCTION YES (circle) PRODUCTION SIZE SML MED LGE (circle one)
PRODUCTION (UND) NO (circle one)

EXPLORATION OR DEVELOPMENT

STATUS AND ACTIVITY A20 <A>
STATUS AND ACTIVITY A20 <L>

DISCOVERER L20 <>
YEAR OF DISCOVERY L10 <LATE 1890's> NATURE OF DISCOVERY L30 <B> YEAR OF FIRST PRODUCTION L40 <1895> YEAR OF LAST PRODUCTION L45 <>
PRESENT/LAST OWNER A12 <>
PRESENT/LAST OPERATOR A13 <AE CONSOLIDATED MINING COMPANY (1930's)>
EXPL. DEV. COMMENTS L110 <THE MAIN WORKINGS OF THE UNION MINE ARE ON THE UNION UNPATENTED CLAIM. PART OF THE UNION MINES PRODUCTION MAY HAVE BEEN RECORDED WITH THE LITTLE JESSIE. NO USGM-ABGANT PRODUCTION DATA>

DESCRIPTION OF DEPOSIT

DEPOSIT TYPE(S) C40 <VEIN>
DEPOSIT FORM/SHAPE M10 <TABULAR>
DEPTH TO TOP M20 <> UNITS M21 <> MAXIMUM LENGTH M40 <1250> UNITS M41 <FT>
DEPTH TO BOTTOM M30 <660> UNITS M31 <FT> MAXIMUM WIDTH M50 <660> UNITS M51 <FT>
DEPOSIT SIZE M15 <SMALL> M15 <MEDIUM> M15 <LARGE> (circle one) MAXIMUM THICKNESS M60 <20> UNITS M61 <FT>
STRIKE M70 <N 70 E> DIP M80 <60 SOUTHEAST>
DIRECTION OF PLUNGE M100 <> PLUNGE M90 <>
DEP. DESC. COMMENTS M110 <BASIC DIKE INTRUDES ALONG QUARTZ VEIN. TWO MAIN VEINS APPEAR IN WORKINGS: UNION VEIN (SOUTHEAST) AND BLAINE VEIN (NORTHWEST). BLAINE STRIKES N50 E. 75 NW AND MAY BE YOUNGER THAN UNION VEIN>

DESCRIPTION OF WORKINGS

Workings are: SURFACE M120 UNDERGROUND M130 BOTH M140 (circle one)
DEPTH BELOW SURFACE M160 <660> UNITS M161 <FT>
LENGTH OF WORKINGS M170 <6000> UNITS M171 <FT>
DESC. OF WORK. COM. M220 <1800 FT LONG ADIT ORIENTED N-S. MAIN WORKINGS ORIENTED NE-SW>

GEOLOGY

AGE OF HOST ROCK(S) K1 <L.C.R.E.T.-T.E.R.T.V. K/AR APPROXIMATELY 72-76 MILLION YEARS FOR GRANODIORITE>
HOST ROCK TYPE(S) K1A <GRANODIORITE, RHYOLITE>
AGE OF IGNEOUS ROCK(S) K2 <L.C.R.E.T.-T.E.R.T.V. AS LINE K1>
IGNEOUS ROCK TYPE(S) K2A <GRANODIORITE, RHYOLITE>
AGE OF MINERALIZATION K3 <L.C.R.E.T.-T.E.R.T.V.>
PERT. MINERALS (NOT ORE) K4 <>
ORE CONTROL/LOCUS K5 <FAULTING, SHEARING>
MAJ. REG. TRENDS/STRUCT. N5 <FOLIATION IN PRECAMBRIAN COUNTRY ROCKS TRENDS N25 E>
TECTONIC SETTING N15 <>
SIGNIFICANT LOCAL STRUCT. N70 <VEINS TEND TO PARALLEL FOLIATION>
SIGNIFICANT ALTERATION N75 <NONE>
PROCESS OF CONC./ENRICH. N80 <OXIDATION AT NEAR SURFACE>
FORMATION AGE N30 <>
FORMATION NAME N30A <>
SECOND FM AGE N35 <>
SECOND FM NAME N35A <>
IGNEOUS UNIT AGE N50 <L.C.R.E.T.-T.E.R.T.V. AS LINE K1>
IGNEOUS UNIT NAME N50A <GRANODIORITE - BIG BUG PLUTON>
SECOND IG. UNIT AGE N55 <L.C.R.E.T.-T.E.R.T.V.>
SECOND IG. UNIT NAME N55A <UNNAMED RHYOLITE PORPHYRY DIKES>
GEOLOGY COMMENTS N85 <DEPOSIT IS VEIN AND/OR DIKE-VEIN OF RHYOLITE PORPHYRY WHICH CUTS GRANODIORITE PLUTON>

GENERAL COMMENTS

GENERAL COMMENTS GEN <>





187

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L.M.

*W. C. Calkins*  
*Jan 27*

Feb 9th, 1921

GEOLOGICAL REPORT, THE UNION MINE.

LOCATION.

The UNION MINE is located in Yavapai County, Arizona, about five miles south from Humbelt. The latter point is on the Prescott and Eastern Railroad and is the site of the Consolidated Arizona Smelter.

GENERAL AND HISTORICAL GEOLOGY OF THE DISTRICT.

The oldest rocks in the region of the Union Mine are the schists. Most of the schists were originally sedimentary beds but some phases of them were probably intrusives or volcanic flows.

This series of sediments and volcanics was subjected to erosion, heat and pressure, so that the original sedimentary structure was destroyed and the folded and schistose structure produced.

During this period, while the lower layers of the strata were several thousand feet below the earth's surface, plutonic magma from beneath the earth's crust was forced into them. This magma hardened and crystallized as large masses of granite, in its various phases, and smaller stocks and dikes of granite and diorite.

The shape of the intrusive sheets shows that the plane of schistosity was nearly vertical at the time the intrusions took place. There were also many dikes both acid and basic, which represent the last stages of the intrusion, and which filled cooling cracks in both the schist and the intrusive itself.

The schists along the contact with the granite show contact metamorphism, where the schist becomes gneissic, or amphibolitic, and contains altered and metamorphosed minerals.

Contact metamorphism usually took place along the contact in the intrusive itself, the more basic or dioritic forms being segregated along the contact zone, or forming dikes in the schist.

After this period and marking a different period of eruption, intrusives of quartz-diorite filled fissures in schist, granite and diorite. These intrusions do not show evidences of

287 2  
2/9/21

strain as do the eldergranitic intrusions, this being evidence of their relatively younger age.

Veins containing precious metals were developed in abundance throughout the district, at or near the contact with the quartz-diorite, showing that this intrusion brought with it solutions carrying the precious metals and silica.

After this period all the rocks were further elevated and subjected to further erosion which has continued to the present time.

GENERAL AND HISTORICAL GEOLOGY, THE UNION MINE.

The UNION MINE is situated in the contact zone between the schists, the granite intrusives with its dioritic contact phases and dikes, and the quartz-diorite intrusions.

The lines of contact are as a rule quite indefinite, several hundred feet usually being covered in the passing from a formation definitely of one kind, to another.

In the cross cut tunnel which cuts through the hill on the Union and Paymaster Claims, the formation becomes more definitely quartz-diorite as one approaches the southern end, while the formation is definitely schist near and north of the northern entrance. This contact formation contains many lenses of quartz-diorite which have been intruded into the isoclinals of the schist.

At the time of, or just after, the intrusion of the main bodies of Granite in this district, a diorite or dolerite dike was intruded into the schist and parallel to its cleavage, along a line that is now approximately the centre line of the Union Claim. This dike is not very distinct on the surface, but is very definite and clear cut underground. It is three to six feet wide and of undetermined length, probably at least a thousand feet long, and strikes southwest and dips slightly to the east with the schists. When the later intrusion of quartz-diorite took place, the contacts between this dike and the schist were lines of weakness, along which rose the orebearing solutions and vapors which were connected with the quartz-diorite intrusion. These deposited as lense shaped veins of quartz, carrying precious metals, on both sides of the dike and replaced the dike itself to some extent.

387 4  
2/9/21

### ECONOMIC GEOLOGY AND RECOMMENDATIONS.

The economic values in the Union Vein are mostly gold and this condition will no doubt be found throughout the property. The ore lies in the vein in lense shaped bodies. Sometimes the lenses overlap and sometimes they are separated by an area of more or less barren vein material. The lenses attain a size up to one hundred feet in diameter by ten feet or so thick in the centre. The larger lenses are usually the best ore and the thicker portion is usually higher grade than the margins. This makes much more satisfactory mining than if the reverse had been true.

The important lenses will probably be found to form ore sheets, that is a series of good lenses may be found to have comparatively poor ground on either side of them horizontally, but are more liable to continue as good ore lenses in a vertical or nearly vertical direction.

There is no reason why the value of the ore should decrease or increase in depth. Very little leaching has taken place in the vein, and the ore was no doubt formed under deep seated conditions. The dike and attending fissures are definite and strong and have nothing to do with surface conditions.

Lean zones or spots will be found as further depth is attained but in this case still further development should again encounter ore.

In this type of formation too great stress cannot be laid on the importance of sufficient crosscutting. In a schist formation where the ore deposition has taken place in the cleavage planes of the schist, a parallel weakness is very liable to have developed and to have been mineralized.

All mineralized cross fractures or veins should also be carefully watched, as they will often indicate an enrichment or lead to parallel deposits of importance.

The old rule of following the ore should be adhered to as far as practicable, as otherwise important lenses may be missed in the ordinary development.

More specific recommendations would be in the drift east of the main cross cut tunnel, together with a connection between this drift and the known vein on the surface. Sinking and drifting on the main ore sheet in the west drift together with crosscuts on a lower level to the shear zone that has been partially developed in the tunnel level.

487  
2/9/21

ARGUMENTS.

1. Relative age, granite, schist, quartz-diorite. The diorite a phase of Bradshaw Granite.
2. Union mine in schist.
3. Union dike pre-mineral.
4. Mineralization associated with quartz-diorite intrusion.

1.(c) The schists are older than the granite because the schists near the contact with the granite contain dikes and lenses of granite in its various phases. (b) Lenses of schist are included in the larger granitic stocks. (c) In other parts of the district alternations of schist and granite a few feet wide indicate that the granite has been intruded into the schist in narrow dikes and bands. (d) Zones of indurated or metamorphic schist follow granite contacts. (e) The granite shows indirect evidence of its intrusion into the schist by increased basicity and development of diorite along contact zones.

The diorite is a phase of Bradshaw Granite because (a) quartzose phases of diorite contain the same strained quartz as the granite and shows other mineralogical evidences of magmatic relationship. (b) The diorite occurs chiefly as a margin of the granite on contact with the schists. (c) Formations are visible where there is a gradual merging of the granite into diorite.

The quartz-diorite is younger than the schists and granite because (a) It can be observed in intrusive contact with the schists and with the granite and its dioritic phases. (b) The absence of strain effects or any schistose or gneissic structure, so common in the older granite and diorite. ~~for~~

(2) Union Mine in schist. The contact zone in which the Union Mine ~~is~~ is situated, lies between areas definitely schist, granite, and quartz diorite, and contains evidences of all three. This zone has been classed as a schist because (a) the zone cannot be classed as a quartz-diorite because it has a schistose or gneissic structure, an account of its having been subjected to strains which are absent in the younger quartz-diorite intrusions. (b) It contains diorite dikes, a phase of the granite, an elder formation.

While the zone could be classed as a granite because a great deal of the material is quite granitic mineralogically, and the gneissic structure is common to the border phases of the granite, yet it seems more reasonable to class it as a schist which has been indurated and metamorphosed by the granite intrusion because (a) lenses of comparatively unaltered schist are present. (b) The gneissic structure is parallel to the schistosity of the

587  
2/9/21

district. (c) The included diorite dike is a phase of the older granite and while it is perfectly possible that it might fill a fissure in the granite itself it is more liable to have been intruded into an outlying formation, namely the schist. (d) Mineral veins, while occasional and possible in the granite, are more liable to occur in the quartz-diorite or schists.

(3). The diorite dike along the Union vein is pre-mineral because (a) It belongs to the age of the granite intrusions, while the mineral is associated with the quartz diorite, a later intrusion. (b) The formation of mineral veins along a pre-mineral dike as a line of weakness is a common occurrence. (c) The dike shows alteration and replacement by the mineralizing solutions.

(4) The mineralization is associated with the quartz-diorite intrusion because the important mines of the district occur at or near its contacts, showing that formation of veins and mineralization of the older rocks accompanied or followed the quartz-diorite.

GEOLOGIC AGE.

Without going into the details in regard to the data which determinations of the geologic age of these formations to be made, it may be stated that from observations made in the Grand Canyon and at Jerome, Arizona, that the schists have been determined to be Lower Algonkian, and the intrusive granite and diorite represent a period after the deformation of the Lower Algonkian and before their uplift and erosion to receive the deposits of the Upper Algonkian.

The quartz-diorite intrusion and the vein formation is probably post Carboniferous and certainly pre Tertiary, as no veins in the district extend up into the Tertiary lavas flows that cover much of this section of the country.

PETROGRAPHICAL DESCRIPTIONS.

(1) Bradshaw Granite: The Bradshaw Granite is a coarsely crystalline aggregate of quartz, orthoclase, and microcline, in about equal quantities, with occasional small quantities of oligoclase, biotite, magnetite, and hornblende. Alteration of the feldspar to sericite is very common. Marginal phases occur showing transition to diorite, where the soda-lime feldspars become more prominent and the quartz becomes more scarce.

687  
2/9/21

(2). Diorite: The diorites are dark colored usually blue-black rocks containing an abundance of green or brown hornblende, sometimes somewhat altered to uranite. The feldspar varies from acid oligoclase to acid labradorite and is usually fairly well preserved but occasionally altered to epidote and zoisite.

(3) Yavapai Schist : The Yavapai Schist may be described as an argillaceous phyllite varying to slate, mica schist, chlorite schist, gneiss, and epidote and hornblende schist. Within the schist area are zones of intense metamorphism where the rocks are amphibolitic or contain an abundance of other alteration or metamorphic minerals. These highly metamorphic phases usually occur at or near the contact with igneous intrusives.

The typical phyllite is a blue or silvery schist consisting chiefly of quartz and sericite. The great bulk of the phyllite was not doubt originally of sedimentary origin, but phases of the schist exist that appear to have been of intrusive origin. One of these phases contains an abundance of feldspar in relatively large crystals with partly preserved crystal form. The presence of this feldspar indicates that the schists containing it were probably derived from acid igneous rocks such as granite porphyry.

Another of these intrusive phases of the Yavapai Schist is a schistose uranite-diabase showing only a slightly schistose structure, and composed of small needles of uranite hornblende, and plagioclase feldspar laths. This rock is regarded as undoubtedly derived from an igneous intrusive, probably a diabase.

These igneous phases are quite rare however, and the greater part of the Yavapai Schist is no doubt of sedimentary origin.

Special metamorphosed phases of the Yavapai Schist are described under their respective headings below.

- (4) Yavapai Schist, Amphibolitic Phase
- (5) Yavapai Schist, Granite contact phase.
- (6) Yavapai Schist, Quartz-diorite contact phase.

(7) Quartz-diorite: The quartz-diorite is a medium to coarse grained crystalline rock. Oligoclase feldspar is the chief constituent and is usually fresh and unaltered. Fresh green to brown hornblende, and biotite or chlorite occur in about equal quantities subordinate to the plagioclase. Small amounts of quartz, orthoclase and microcline are present. Accessory minerals are titanite, apatite and zircon.

The absence of strain effects is prominent in the older

787  
2/9/21

granites is a notable feature of this rock and emphasizes its relatively younger age.

(8) Quartz and Vein Material: The vein filling is mostly white quartz, sometimes showing the banded structure caused by the fissure having been filled by precipitation along its walls.

Gold occurs free and also mechanically combined with pyrites. The amount of pyrite is not large, the average ore making a concentrate of about 20 into 1.

Other metallic minerals occur only in small quantities and are not important.

The other veins on the property have not been as extensively developed as the main Union vein but are of similar character and give promise of showing similar ore bodies with sufficient development.

The following pages are submitted  
as representing the true conditions  
of the property of the  
UNION CONSOLIDATED MINES CO.,  
Chaparal, Yavapai Co.,  
Arizona.

April 18, 1924.

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sealed.  
J.M.

## CONCLUSIONS

THE MINES and the undeveloped veins of Chaparal and contiguous gulches are true fissures.

THE MINERALIZED QUARTZ will be found at depth carrying higher values in silver, gold and copper than were mined from the upper levels.

THE ORE ZONE, or system of veins, extends through and beyond the claims.

THE ORE BODIES are in lenses of quartz. The lenses are due to a longitudinal faulting of the fissure walls. This indicates great depth.

THE ORE is found wherever the metal solutions found a channel way and the main channels were in the shattered primary quartz and schistose vein-filling.

THE QUARTZ LENSES HAVE PAY ORE ON ONE OR BOTH WALLS OF THE VEIN, and in all fractures or interstices of the primary quartz.

THE METALS are in gold, silver, lead and copper. The gold-copper ores will increase with depth and particularly in the veins that extend into the schists. It is reported that the pay ores have values from \$6.00 to over \$20.00 per ton with pay streaks of high grade rock.

THE LEAD ORE will have no value as lead. The silver will be recovered in the smelting but the lead will be lost.

THE TREATMENT OF THE ORE will be concentration from 10 or 15 to 1. The value of these concentrates has been proven to be \$75.00 to \$150.00 per ton.

MINING AND MILLING COSTS should not be more than \$6.00 per ton with 50 ton capacity.

THE EXTRACTION OF THE METALS should be above 85% of the total assay, less the lead.

There is available ore in the Chaparal District from the three developed properties to operate a mill of not less than 300 tons per day.

These properties should be operated under one competent management.

The water from each gulch should be conserved so that the above capacity may be attained the entire year.

The profits--judging from the past history--should be over \$4.00 per ton.

When a 300 ton mill is in operation the transportation of twenty-five tons of concentrates would warrant the consideration of the most economical means to get it to the smelter.

Future development should be done on each vein to open ore bodies--at which time the ways and means for mining and hauling can be determined.

The survey of the geological structure should be continued until the primary causes of ore deposition have all been mapped--as indicated under the heading "Geology".

When these steps of constructive progress and understanding have been considered and the ways and means decided on, and then carried out, this District will take its place as one of the prosperous mining centers.

But it will have to be under the guidance of men who have the ability to see large results from efficient business and engineering experience properly applied. It is altogether possible that such ability will find the great ore deposits outside of the Quartz Diorite intrusive.

It may be added that the Jessie and Lelan Mines are part of this ore zone and are, therefore, necessarily included in the geological summary of this report.

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DATA RE THE UNION MINES

LOCATION of the Mines is at Chaparal, five miles west from Humboldt, Arizona, and four and one-half miles from the railroad siding.

ROADS are fairly good in dry weather. A new road of uniform grade is being built to avoid the steep grades of the old road.

CLIMATE. Operation of mine and mill may be carried on the entire year unless an unusual winter freezes all water, or an unusual drought should occur in summer.

CLAIMS are 18 in number, covering 325 acres.

TITLE. The claims are not patented but are held under the mining laws of location and subject to the annual assessment work which has more than been covered each year.

The title to all these claims is in the UNION CONSOLIDATED MINES CO., subject only to the payment of the balance of the purchase price.

THE PLANT EQUIPMENT. The equipment of the plant, when finished, will constitute a modern milling and concentration plant of over 50 tons capacity per 24 hours.

It can be doubled with a comparatively small increase in investment.

The equipment now on the ground or in place consists of the following:

- One sub-station with complete power connections from high voltage power line to three 50 K.W. transformers, with lightning arresters--all properly housed.
- One two-stage Sullivan Air Compressor.
- One blacksmith shop and tools.
- One 15 H.P. Electric Hoist.
- One double compartment shaft, heavily and well-timbered.
- Over a mile of narrow-gauge tracks from mine to mill.
- One gasoline locomotive with all-steel, roller bearing mine cars to haul ore.
- One 3" water main  $1\frac{1}{2}$  miles long.
- One #5 Austin crusher.
- One five foot Ball mill.
- One Dorr duplex classifier.
- Two Butchart roughing tables.
- Two Frenier sand pumps.
- One K & K flotation machine.
- One automatic oil feed.
- Two Wilfley concentrating pilot tables, settling tanks and clear water tank with pump.
- Electric motors for individual drive of each machine.
- One central switchboard, controlling all operations with one mill man per shift.
- One up-to-date assay office with laboratory equipment.
- One modern boarding house, kitchen and full equipment; also ice-box.
- Bunk-houses, residence and office.
- Telephone connection to Prescott with Humboldt.
- Gasoline truck and runabout auto.

DEVELOPMENT. The development of the veins has been largely confined to the Union vein, and to the upper oxidized stopes as shown on the map of underground work.

Recent development has been on the two lower levels, where the ore bodies have been found in both of these drifts, and at the bottom of the shaft which has been sunk to a depth of 165 feet.

THE VEINS. There are at least four well defined veins, the outcrops of which are exposed at intervals but are generally covered by the debris of erosive weathering. There is at least one--and probably under the geological events there are more than one--cross-vein, which may be co-incident with cross fractures of large displacement.

THE GENERAL DIP of the veins varies and, so far as development discloses, the dip may be vertical or 30 degrees or more from the vertical.

It is probable that all parallel veins have a general dip toward the center of action of the uplifting force that caused the fissures.

THE DISPLACEMENT or throw of the longitudinal faulting was great enough to bring the concave curves of each wall nearly opposite and thus form lenses--which pinch out where the convex curves met and crushed and sheared the walls.

THE THICKNESS OF THE VEINS. The faulting would result in wide but shorter lenses, and in less width but longer lenses. The distance between the lenses depends on the local angle of deviation of the fissure from the direction of fault movement, and does not appear to be dependent on the length of the lenses. The widths of the developed lenses vary from four to twenty feet at their widest points.

THE LENGTH OF LENS in the Union has been determined by the ore stoped out, and shows a length of 200 feet on the level of the main drift.

This may be the horizontal length of the shoot of pay ore that extends upward to the surface and downward to an unknown depth. Within this shoot there are areas of vein filling without the massive quartz, and these areas may be large fragments of the walls sheared from the convex bends of the fissure by the throw of the faulting movement. The development does not clearly show the exact fact.

- THE DEPTH OF THE VEINS is discussed under "Geology."

THE PAY ORE. All lenses so far developed show pay ore. Where lenses are very wide the pay ore occurs where the massive primary quartz has been shattered by the faulting of the fissure. This shattered, re-crystallized and cemented condition may be one side of the massive quartz or on both sides, or in the central part, or it may reach from wall to wall.

Between the lenses there is a condition of schistose material which is the sheared and pulverized wall rock. In this schistose or talc material there are in places several streaks of very high grade ore.

Pay ore will be found wherever the metal solutions percolated, and the indicator for these pay-streaks is generally small veinlets of quartz, provided the deposition was contemporary with the cementation of the shattered massive quartz. But where later leaching has occurred,

then the sulphides will be found without quartz.

ORE TREATMENT. The flow sheet may be outlined as follows:

The ore is crushed and stored in 100 ton bins; thence to Ball mill--pulverized to 60 mesh; thence to Classifier; thence to Butchart tables--recovering about 50% of the ore. The tailings back to Ball mill for final grinding;

To Classifier: the fines to flotation;  
the sands to the tables;  
the slimes to disc filter.

The tailings from the flotation to Wilfley tables; concentrates to bags--and the water with the tailings to settling tank, the water to reservoir, the tailings to waste.

All concentrates to the smelter.

Smelter cost \$6.00 per ton Concentrates, or about 50¢ per ton of ore.

ORE TREATMENT NOTES. The treatment of these sulphide ores is simply that of concentration. Until the ores have been tried out in a practical way, the most efficient and economical way to concentrate can not be known, but a systematic study when in actual operation will very soon determine the best method of concentration, which means only the best method of operating the concentrating tables--their most efficient capacity--the volume of water, etc.

In the flotation apparatus the same study will have to be followed by an experienced observer.

It is known that a clean concentrate of sulphide of copper handles easily in the flotation process with a mineral oil, but a complex ore of copper, lead and zinc gives trouble and requires several flotations and with different oils.

Or, again, where a copper ore is made up of different sulphides of copper, there will be a selective concentration.

The combination of conditions in flotation are many, but in the hands of one who has had wide experience (not with success, but with trouble) the way is always found to smooth operation.

POWER. Electric power lines are now connected to mine and mill.

WATER. The average flow of water in the gulch has not been determined but it appears ample to operate the mill to double its capacity.

The conservation of water is being studied. Covered storage tanks appear the best.

CONCENTRATES. The losses in smelting concentrates may appear to be the sole business of the Smelter, but when concentrates are sold on the assay values and the net returns to the Smelting Company cause a loss, they will refuse to pay the values indicated by the assay of the samples from the mechanical sampler. The loss then becomes of interest to the shipper of the concentrates.

In such a case a one hundred per cent control analysis of many samples is a necessity to determine wherein or what is the constituent or condition that causes a loss.

LOSSES IN MILLING. It is often taken for granted that all the values in an ore are recovered either on the tables or by flota-

tion or other form of concentration.

The analysis of an ore for values only, does not always tell the needed story. There are ores that cannot be milled and concentrated economically.

Ores containing soluble salts of any of the metals or alkaline products may analyze high in value and give low returns in the concentrates.

Concentrates that will calcine in the smelter or reverbatory frequently disappear up the stack.

Ores that contain a volatile constituent may disappoint the shipper of concentrates.

Enough has been indicated to show the necessity of knowing all about the ores before milling, as well as about the concentrates before shipping.

This property and others in the district demand, and are worthy of, the direction of men of large calibre.

Up to date, the work accomplished on the ground, the first-class equipment purchased, and the general improvement everywhere, exhibit careful thought and remarkable ability to purchase at bargain prices. There is evidence on every hand that shows watchful economy and the writer is pleased to take this occasion to contrast this project with many others.

**GEOLOGY.** The geological history of the immediate district at Chaparal is not complex, but is obscured by weathering and surface disintegration.

The only point of interest in the general geological formations of the region is that of the Yavapai schists which will be considered later. The structural history of the formations at Chaparal so far as it affects ore deposition is important to this case.

To grasp the significance of cause and effect a very brief statement of the general geology seems necessary:-

THE PRIMARY ROCKS underlying the entire region are granite, the Archean granite. These were mountainous.

These Archaen mountains extended from Alaska to the Gulf, from the North Sea to the Great Lakes, from Eastern Canaga and New England States to Alabama, etc.

Centuries of erosion filled the shores and the bottom of the inland seas with the muds and debris washed from the disintegrating mountain chains prior to the Cambrian period. These muds, sands and rock debris constitute the oldest sediments of geological time, and are named in Arizona the Yavapai schists.

During their deposition, mountain chains of Archaen Granite projected from an ocean. A thousand centuries of erosion and gradual uplift with volcanic eruptions; with continental outpouring of later lavas, which broke through and pushed aside the partly indurated sedimentary strata which made up the former bottom and shores of the inland seas, and corrugated them into anticlinal and synclinal folds.

Thus the vast extent of these stratified muds, sands and conglomerates of the ancient seas were laid unconformably on the primary granites and then through the eras that followed they were buried beneath the formations of all the later geological ages.

These same slates or schists are found at the base of the Grand Canyon five thousand feet below the rim rock.

Centuries of erosion have worn away the formations that covered these schists at Chaparal.

One of the greatest known periods of ore deposition occurred during their deep submergence beneath the younger formations.

THE YAVAPAI SCHISTS are of the same age and formation as the slates that are now being mined for gold at the Homestake mine in the Black Hills of South Dakota--one of the greatest gold mines on this continent.

The Yavapai Schists are the same that have been converted into ore at Jerome where they appear mostly as green-stone schists.

The Yavapai schists are contemporaneous with silicified schists of the Coeur d'Alene region in northern Idaho, where the richest lead mines are being operated.

There are other great mineral deposits that were found in the formations of the pre-Cambrian age, and these citations are made only to impress the fact that the Yavapai schists at Chaparal have all the known conditions and history that the great ore deposits cited have also.

At this point of history we find the Chaparal district as it is today.

The FIRST rock intrusive that we find is a great stock of massive Quartz Diorite--two miles wide, east and west, by four miles long north and south. This is but one of the tremendous intrusions that broke through the schists and it is stated by the Geological Survey to be the latest, or the youngest, of the great volcanic mass formations. We have, therefore, to consider this massive Diorite and its relation to the schists and to the dikes that have fractured it, and their effect on the ore deposits.

THE FIRST PROBABLY CAUSE of ore that has been noted is a series of north-south faults that are seen by their effects in the tunnels and other developed openings, and particularly in one case on the surface where the faulting of the contact between the Massive Quartz-Diorite and the Yavapai Schists shows a displacement of about 150 feet. These primary faults appear to be factors in the genesis of the ores.

THE SECOND VOLCANIC MOVEMENT noted was the southwest and northeast line of uplift and faulting, which caused a series of fissures that followed an irregular line along the direction of the uplift.

The Throw or displacement by faulting was both horizontally and vertically. This movement of the walls resulted in bringing the concave curves of the fissure more or less together, forming lenses which were later filled with the silicic acid waters from which the primary quartz was precipitated.

In like manner, the convex curves of the walls were brought into contact; the walls were sheared and crushed, forming the schistose condition of the pulverized wall rock in the fissure.

This displacement or throw of the walls indicates a fracture that extends downward to the plastic condition of the Quartz-Diorite mass and this depth is beyond man's ability to excavate.

Such a displacement or fault movement of sedimentaries might be due to a lava flow into the bedding planes at moderate depth but in a massive primary formation of uniform igneous magma such horizontal intrusions do not occur. The series of parallel and overlapping quartz filled fissures that cut through the Chaparral district a mile or more in length and less than a mile between the outer veins or fissures, clearly indicate (in this Quartz-Diorite massive magma) that the uplifting force was far below the zone of induration and that such movement could only occur where rock flowage takes place.

Therefore, it is believed that these quartz filled fissures descent to the base of the zone of cementation, at which depth all fissures close by rock flowage or by crumbling under a weight too great for the strength of the rock to sustain.

It appears probable from the observed conditions that the uplift, which caused the several parallel fissures, occurred prior to the general subsidence below sea level at the beginning of the Cambrian period. This deduction is made to accord with the primary deposition of pure silica in all of the parallel veins.

This white quartz, when in the form of dissolved or colloidal silica, was not mingled with ascending waters which usually contain, or have in solution, the salts of various minerals either alkaline or acid.

It is evident that surface waters carrying carbon dioxide descended into these fissures and the carbon dioxide replaced the silica of the soda-lime feldspars of the Quartz-Diorite, liberating the silica as a colloidal solution which crystallized and filled these primary fissures.

THE THIRD VOLCANIC MOVEMENT fissured the diorite mass in an east-west course. Except for minor movements, this was the last that affected the deposition of ore.

The volcanic force that ruptured the Quartz-Diorite mass at this time was profound in its depth, for the fissures were filled from an unknown depth by molten lava and formed dikes that cut across the lines of the former fissures. These dikes, in meeting the older quartz filled fissures, deviated from their strike and followed the quartz veins for a distance.

The dike that entered the Union vein split the quartz filling for a few hundred feet and thus formed two veins. The faulting caused by the entrance of these later dikes fractured the primary quartz and reopened the channels for the flow of the underground metallized waters.

THE YAVAPAI SCHISTS. The geological history has been briefly outlined.

The depth of these schists or slates has been determined by the surveys to be from 5,000 to 7,000 feet and prior to erosion the depth was over 10,000 feet.

While buried beneath the later formations the schists were silicified and recrystallized, indurated and at some period they were mineralized with the sulphides. Cementation was complete. They were subjected to the general uplifting movement, fractured by cross fissures, and ruptured by the various dikes of Diorite-Diabase, Olivine Basalt and other igneous intrusives. They were subject to creeping faults and were schistosed and metamorphosed.

Erosion removed all the later sedimentaries and more than 2,000 feet of the schists. Weathering has disintegrated the lime-soda compounds and oxidized the iron salts, disclosing the schistose structure.

The foregoing pages give a brief review of the geological history of the district.

THE MINERALOGICAL DATA OF THE ORE DEPOSITS.

1. The primary quartz found in the lenses show massive structure and the deposit of a white quartz free from metal sulphides. It is, therefore, believed that this quartz was mostly derived from the decomposed feldspars of the wall rock and, as previously stated:-
2. At some later period another volcanic action caused a second series of fractures that have a nearly east and west strike. These fractures or fissures extended to a depth that opened the way for lava flows, which filled the fractures, and now show as dikes.
3. One of these dikes enters the Union vein and follows for several hundred feet and in cutting through one large lens it split the primary quartz filling, forming two veins of this quartz.
4. The primary quartz was shattered and faulted not only on both sides of the dike but also where the dike material is not in evidence, indicating a fault movement of considerable importance in the later deposition of the ores.
5. The fracturing of the primary quartz and the shrinkage of the lava dike opened new channels for the underground flow of mineral solutions.
6. It is evident that the period of the dike intrusions was later than the great orogenetic volcanism that built up the post Algonkian mountains in pre-Cambrian time, as these dikes do not show disturbance of that upheaval. This situation also includes the Quartz-Diorite stock in which the veins occur.
7. It is also evident that there was a long period of quiet deposition prior to submergence of the region in the Cambrian sea. During this period the deposition of ores was made.
8. The fractured primary quartz was cemented by the deposition of the later quartz and the sulphides. The geology of northern Arizona indicates that the Cambrian formations are unconformable to the pre-Cambrian series--this means a long period of land exposure and erosion.
9. Inspection of the property today reveals data in support of the above statements.
10. It is noted that the sulphides and oxides of the metals are found in the cracks and joints of the primary quartz, and also in the foliated schistose material within the vein walls.
11. The schistose or pulverized material of the vein between the lenses has been silicified and impregnated with the precipitated salts of the metals.
12. Veinlets of the secondary quartz are found in the schistose parts of the fissure vein, and these are highly mineralized with the precipitated metals.
13. In places where large openings were formed in the primary quartz-filling, the sulphide ore is found in mass and disseminated through it is the distinctive secondary quartz of the metallized solutions.
14. In the dike rock, where shrink cracks occur, it is noted that both quartz and calcite filaments have been precipitated.
15. Today the leaching waters percolating downwards through the vein material deposit calcite on the walls. The iron sulphates are

leaching also and are being oxidized.

16. The Quartz-Diorite does not show primary sulphides. This taken with primary quartz-filling of the vein lenses, which also do not show the sulphides, indicates that the source of the metals was another rock formation.

17. The observed fact that when sulphides are found in the primary quartz it proves to be a cementation by the later deposition of quartz from a solution or with a solution that carried the metal salts.

There are cases noted wherein it was difficult to separate the older and the younger quartz, particularly when the older quartz had been crushed fine and then re-crystallized in part with the later silica.

18. In addition; in the contact between the schists and the Quartz-Diorite there are mines that have produced profitable ore.

19. There are operating and producing mines in the Schist area that are far from the intrusive stocks.

20. It is therefore believed that the ore found in the veins of the Quartz-Diorite have had their immediate origin in the Schist formation.

21.- Therefore, wherever a cross fracture or fault crosses the contact, at any angle that will cut the fissure veins, it is probable that there the ore has been deposited.

22. This does not exclude the very probable case of descending solutions or lateral migration from the rock formations that covered the present topography prior to the extensive erosion.

23. It will be noted that the quartz filled fissures did not extend downward to the plastic or molten magma or these fissures would have been closed by dikes. It is therefore believed that the solutions, from which the sulphides of the metals were precipitated, were descending or lateral moving and that they filled the fissures to the depth that the fracture extended.

24. The system of dikes that cut the Quartz-Diorite stock, and those that have intruded the schists, are not faulted so far as observed. They have not been subject to metamorphism, although they are weathered, and insofar as this exposure may have caused alterations they are apparently in their original state.

But it is certain that the extensive faulting which gave rise to these dikes has caused a schistose condition of the rocks cut by the dikes and they were the immediate cause of the open channel ways through which the metal solutions flowed.

25. In the recent but incomplete survey of the ground the contact between the Diorite and Schist was marked out.

It will be seen on the map that this contact has a throw or displacement of about 150 feet and that the fault extended will show a junction with the Union vein at the lens of highest values and largest deposit developed.

26. A volcanic movement that would cause a displacement of 150 feet would necessarily create a system or series of like fractures and faults.

27. This is the important point and factor in the present situation, for it is wholly probable that through these faults, which cut and displaced both formations, the circulation of the solutions was maintained--

and by the fact that these faults displaced both formations the circulation would reach the bottom of the primary fissures.

28. Erosion has been extensive. As the surface was worn down, the level of the underground water descended, and oxidation and carbonation would take place. The ferric solutions would form, and both gold and silver would be dissolved and carried in the descending waters.

The sulphates and carbonates of copper and lead, leaching from the zone of oxidation, would be precipitated as sulphide by the pyrite in the zone of cementation below the level of ground water.

The preceding pages will make clear the present situation as regards the ore bodies, their prospective size and values, and point the way to their exploration.

(Signed) W. F. BRADLEY.

Box 27  
Humboldt, Arizona.

June 1, 1932.

Mr. Homer P. Elliott,  
906 Security Bank Building,  
Charleston, West Virginia.

*Copy original  
Sealed. J.M.*

Dear Mr. Elliott:

Yours of May 28th came today. The only claims shown on the itemized list which do not appear on the map are the Ohio, ElCaney, Roosevelt, Teddy and El Tena. All of these claims are separate from the group shown on the map. The Ohio was not considered of sufficient value to keep and the others are held only for their value as a possible source of water. Two claims appear on the map that are not owned by us. They are the Independence and Columbia. The Little' Ore Mill Site, Atlantic, Pacific' and Union Water Rights do not appear on the map for the reason that the above mentioned ones do not. A water right does not have boundaries, hence cannot be mapped.

Now as to the valuation I place on the property of \$250,000.00. My method of valuing this property is exceedingly conservative for the following reasons: First, a purchaser would not be paying out of his funds the full amount. After an amount not to exceed \$50,000.00 had been expended, the mine should pay its way and make all payments on the purchase price. The purchaser would have an investment of \$50,000.00 from which he should win earnings of not less than five times that amount in not to exceed four years time, from ores known to exist. This would not exhaust the future possibilities of the mine which would all belong to the purchaser.

In arriving at tonnage I have not considered any tonnage from any of the other claims and have confined myself to the Jessie alone. All the reports I have show more tonnage than I have shown which is 125,000 tons gross value \$8.00 per ton, or gross value of \$1,000,000.00. Mr. Warwick shows a gross value of \$1,555,000.00.

In reducing the ore I show to cash value I follow the general formula used by all engineers, and the Department of Internal Revenue in valuing mines. This general method is known as the Hoskold Method and is somewhat complicated. It presumes first that there is a willing buyer and seller. The gross value of the ore is first found, then the cost of mining, milling and marketing is found. This reduces the ore to a net value, from which is deducted taxes, county, state and Federal. After these items are determined the amount of return the buyer should expect is considered.

Amortization of Capital is its return with interest, at or before the time of exhaustion or death of the property. If there is to be a genuine profit, total operating profits must include an ultimate profit over and above amortization.

Amortization of property is usually affected by distribution of dividends, without discrimination between amortization of capital and ultimate profits. It is then the stockholders' responsibility to reinvest a sufficient proportion of the dividends to amortize the investment cost. On capital investment it is reasonable to allow 8% and in reinvestment of capital earnings 4%. Deduction of these items from net worth bring us the cash value of a mine and this is, in brief, the exact method used by the government in Washington in valuing mines. It is universally used by engineers, and if you care to submit this to any well informed Mining Engineers, you will find that I am correct.

Were I to use this method in valuing this property, the purchase price would be higher than it now is.

In arriving at cost my figures are as follows:

125,000 tons @ \$8.00 gross		\$1,000,000.00
\$1.50 per ton for mining	\$187,500.00	
\$1.50 per ton for milling and marketing	187,500.00	
\$0.50 per ton for additional equipment & development	62,500.00	
\$0.50 per ton for taxes and unexpected contingents	<u>62,500.00</u>	
		\$500,000.00

Leaving a profit of \$500,000.00 from which the purchase price of the property would be charged, and the net profit would be \$250,000.00 from an investment of not to exceed \$40,000.00. This from only one claim of the group.

The equipment and improvements are surely valuable as an adjunct to an operating mine and it would not be unreasonable to include them in any valuation.

In your letter you mention a probable life of the mine at from ten to fifteen years with the ores now available. On an average annual extraction of 30,000 tons of ore I can only see four years with the ore I show. It must be remembered that the extraction of these ores would not exhaust the mine's future. In my opinion the mine has not been touched as yet.

I have done my best to explain my position and hope that I have managed to make it clear.

We are going right ahead with the shaft at the Jessie. Yesterday and today we have been getting the compressor engine in shape to unwater the Union, and we started the water out this afternoon. We will keep right after it until the first level is unwatered which should take two more days.

My family is home now for the summer and it is a great joy to me to have them home.

Developments at the mine will determine whether or  
not we will be able to represent this State at the dedication  
of your State Capitol.

Please remember me to your boys, and with best  
wishes, I am,

Very truly yours,

WM. ALLEN NICKERSON.

PRELIMINARY REPORT  
ON  
MILLING BY FLOTATION CONCENTRATION  
AT

18/19  
34/17

Copy of  
original copy  
which is sealed 3m.  
37/29  
16/18

THE UNION MILL OF THE SOUTHWEST MINES DEVELOPMENT COMPANY  
HUMBOLT-----ARIZONA

The purpose of the following tests is to determine the best group of combinations of flotation reagents for use on the dump ores of the Jessie Mine and to extract the greatest possible amount of the values in gold at the least possible cost per ton of ore.

TEST NO. 1

The purpose of this test is to show in which sizes the lost values occur.

TAILINGS ASSAY GOLD .046 oz.  
WEIGHT OF SAMPLE 566 Grams. Containing 26.1733 gms. gold

SCREEN	PERCENT	ASSAY GOLD OZ.	MGS GOLD
On 80 mesh	13.06	0.10	6.830
On 100 mesh	11.58	0.05	3.275
On 150 mesh	20.49	0.145	5.216
On 200 mesh	7.69	0.08	2.682
Thru 200 mesh	48.18	0.03	8.175

Flotation reagents used.

5% Amyl Xanthate, 60 cc per minute.

Soda Ash,  $\frac{1}{2}$  lb. per ton ore.

Pine oil, 0.02 lbs per ton ore

Ratio of concentration 31.15 tons to one  
recovery % 78.00

Head assay oz. gold 0.20  
Concentrates 3.555  
Tails 0.046

Remarks:- From the above it will be noted that 59% of the lost values are in the material that will not pass thru 150 mesh and 69% of the values lost are in the material that will not pass 200 mesh. Therefor I conclude that finer grinding must be practiced.

TEST No. 2

Flotation Reagents Used:-

5% Amyl Xanthate, 60 ccs per minute

Soda Ash,  $\frac{1}{2}$  lb per ton ore

Copper Sulphate 60 cc Sat Sol per min.

Pine Oil 0.02 lbs per ton ore

ASSAYS;

Heads -----	0.20 oz gold	Ratio of concentration	33:1
Concentrates	5.96 oz gold	Recovery %	89.3
Tails -----	0.022 oz gold	Screen analysis	77% thru 200 mesh

REMARKS; This test with finer grinding and the addition of Coppe Sulphate as an activator shows a decided improvement over test #1. This test was run for a period of three hours whên I increas ed the amount of Amyl Xanthate to 120 cc per min and continued the test with the other reagents the same as above for another period of three hours with the following results;

TEST #3

Flotation reagents used:

5% Amyl Xanthate, 120 cc per min.  
 Soda Ash, 1/2# per ton ore.  
 Copper Sulphate 30 ccs sat. sol. per min.  
 Pine oil, 0.02 per ton ore.

Assays;

Heads ----	0.18 oz gold	Ratio of Concentration	38.9 : 1
Coentrates	6.44 oz gold	Recovery percent	91.8
Tailings	0.015 oz gold	Screen analysis	77% thru 200 mesh

REMARKS:- This test indicates that better results are obtained by feeding about 6.40 lbs per ton ore of Amyl Xanthate, or zapprox. 7¢ per ton of ore for this reagent.

The following tests were run with the idea in view to better the recovery with coarser grinding.

TEST # 4

FLOTATION REAGENTS used:

5% Amyl Xanthate, 60 cc per min.  
 Soda Ash, just pink to phenolphthalene.  
 1/2 lb. per ton ore  
 Copper Sulphate, 60 cc sat. sol. per min.

ASSAYS:-

Heads	0.26 oz gold	Ratio of concentration	37.4 : 1
Concentrates	6.34 oz gold	Recovery %	88.8
Tailings	0.05 oz gold	Screen analysis	73% thru 200 mesh

Remarks:- This test is practically a duplicate of test #1, with the addition of Copper Sulphate as an activator which increased the recovery 10.3% on a 4% coarser grind. Indications are that if the Xanthate is increased to 120 cc per min., that the recove will be greater than 91.3% as shown in test #3.

## TEST #5

## Flotation reagents used:

Same as in test #4 with the addition of  
30 cc per min American Cyanamid Co.s  
Flotation reagent #301, 5% solution

## Assays;

Heads	0.23 oz gold	Ratio of Concentration	38.5 ; 1
Concentrates	7.12 oz gold	Recovery %	84.59
Tails	0.035 oz gold	Screen analysis	80% thru 200 mesh

REMARKS:- This test shows that with the addition of reagent #301 the grade of concentrate made is higher than any yet produced, but with slightly less values recovered. It would be well to repeat this test and while doing so, add the 301 reagent to the ball mill, as I understand that it is rather slow in action especially in cold weather.

## TEST #6

## Flotation Reagents Used;

Were the same as in Test #4, with the addition of 30 cc, 5% sol. per min, American Cyanamid Co flotation reagent "Aeroflote" added to the circuit.

## ASSAYS:

Heads	0.20 oz gold	Ratio Conc.	37.6 : 1
Concentrates	11.56 oz gold	Recovery %	85.22
Tails	0.03 oz gold	Screen analysis	87% thru 200 mesh

REMARKS: It may possibly be the fact that we are getting the action of the reagent 301 in this test-- that which remained in the circuit. However, this test shows the possibilities to be had from the use of Aeroflote, which produced a much more tenacious froth than any of the other reagents used. The grind being slightly finer, gave slightly higher extraction.

These are by no means final tests. They indicate fully what can be done with flotation concentration of the ore. they demonstrate fully that the values are in the ore and that they can be extracted at very low cost and a high grade marketable product can be obtained with this method of extraction.

## AVERAGE ASSAYS

HEADS	0.214 oz gold
CONCENTRATES	5.48 oz gold
TAILS	0.02 oz gold

RECOMMENDATIONS:-

That the above tests #3,4,5,& 6 be repeated, and that they be run for periods of not less than six or eight hours each and that the grind be kept as near as possible to 75% thru 200 mesh screen. Special attention should be given to test #6, as it promises to give the best results at the lowest cost for reagents.

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 RESULTS OF FINAL TESTS  
 ON  
 MILLING BY FLOTATION CONCENTRATION  
 AT  
 THE UNION MILL OF THE SOUTHWEST MINES DEVELOPMENT COMPANY  
 HUMBOLT, ARIZONA

The following tests were made for the purpose of checking the results obtained in the preliminary test work. The preliminary test covered a period of only two hours each mill run, while these tests, which are the combinations of those flotation reagents which gave the most promising results in the preliminary test work, were carried over a period of six hours each, as an actual mill run under local conditions.

FINAL TEST #1

Flotation reagents used;

5% sol. Amyl Xanthate, 30 cc per min.  
 Soda ash, 1/2 # ton ore  
 Copper sulphate, 30 cc sat. sol. per min  
 Pine oil, 0.02 # per ton ore

ASSAYS;

Heads;	0.18 oz gold	Ratio of concentration	33.15 : 1
Concentrates	6.36 oz gold	Recovery %	37.39
Tailings	0.02 oz gold	Screen analysis	86% thru 200 mesh

FINAL TEST #2

Flotation reagents used;

5% Solution Amyl Xanthate, 30 cc per min  
 Soda ash 1/2 # per ton ore  
 Copper Sulphate 30 cc per min sat. sol.  
 301 reagent, 5% sol 30 cc per min  
 Pine oil 0.02 # per ton ore

Assays;

Heads;	0.17 oz gold	Ratio of Concentration	43.15 : 1
Concentrates	6.04 oz gold	Recovery percent	73.98
Tailings	0.04 oz gold	Screen analysis	85.5 thru 200 mesh

## FINAL TEST #3

## Flotation reagents used;

5% sol Amyl Xanthate 30 cc per min  
 5% sol Aeroflot 30 cc per min  
 Soda ash  $\frac{1}{2}$  # per ton ore  
 Copper sulphate sat sol per min  
 Pine oil 0.02 # per ton ore

## ASSAYS;

Heads 0.335 oz gold Ratio of concentration 29.45 : 1  
 Concentrates 8.040 oz gold Recovery % 95.73  
 Tailings 0.0125 oz gold Screen analysis 84.8 % thru 200 mesh

## SPECIAL TEST # 4

The purpose of this test was to determine the action of reagent #301 in the circuit while using the final test #3 combination of reagents. 30 cc per minute, 5% sol reagent 301 was added to the circuit. The test covered a period of 2hrs only.

Reagents used; same as 3# plus 30 cc 301 per min.

## ASSAYS;

Heads 0.335 oz gold Ratio concentration 21.6 : 1  
 Concentrates 5.900 oz gold Recovery % 95.73  
 Tailings 0.0125 oz gold Screen analysis 84.8 thru 200 mesh

Remarks; The addition of 301 reagent to the circuit as shown in all tests, lowers the grade of concentrate, without increasing the recovery percent.

## CONCLUSIONS

Final test #3, confirming the preliminary test, using amyl xanthate and aeroflot combination with the other conditioning and frothing reagents, seems to be the ideal for use on this ore.

## SUMMARY

The following data was taken from the engineering report and examination of the underground workings of the Jessie Mine, by A.W. Warwick, member of the Montana Society of Engineers, which shows the ore that is "Blocked Out" and contained in the "stope fills" and "dumps" of the mine as follows;

KIND	TONS	VAL PER TON	TOTAL VALUES
Porphyry	111,275	6.80	757,225.00
Quartz	2,135	37.30	79,675.00
Dump	40,000	6.80	272,000.00
Total	153,410		\$ 1,108,900.00

RECOVERY PERCENT 90%  
 TOTAL RECOVERED VALUE \$ 998,010.00

ESTIMATED RATIO OF CONCENTRATION ----- 30 to 1

COSTS

Estimated cost of mining per ton -----	\$2.00
" " " milling " " -----	1.00
" " " marketing " " -----	0.30
" " " overhead " " -----	0.30
<hr/>	
Total cost mine ore per ton -----	\$ 3.50
LESS Less cost of mining -----	2.00
<hr/>	
Total cost dump ore per ton -----	1.50
plus delivery to mill -----	.25

OR \$ 1.75

Mine ore: Total, 113,410 tons at \$3.50 per ton--\$396,935.00  
 Dump ore: Total, 40,000 tons at 1.75 per ton-- 70,000.00

TOTAL COST OF PRODUCTION \$ 466,935.00

TOTAL PROFITS OR BALANCE \$ 532,075.00

That there are 40,000 tons of ore on the surface, in the Jessie dump, available for milling purposes. The average assays of the material milled during the test periods, shows it to carry gold values of at least \$1.28 per ton, and that over 90% of this value is recovered by flotation concentration. This material, alone, should yield a total of over 80,000 dollars clear profit.

Undoubtedly there are many thousands of tons of ore in the mine of higher values than this dump material and it will present a problem of recovery of the values that will be much more easily solved than that of the dump material owing to the highly oxidized condition of the latter. The mine ore freshly broken will be much more easily treated and much better recovery can be expected.

More power is needed in the mill so that it can be loaded up to capacity. It is running slow at the present time. With larger power plant installed, it will easily handle 50 tons to 60 tons of ore per 24 hrs.

With the addition of proper handling equipment for the dump material, and a good, reliable power plant for the mill, at a very small outlay of additional capital, it should be made to pay at least \$100 per day net profit from the operation.

CONCLUSIONS :

When one considers the possible and probable ore in the mine that is available and can be made available, figures assume a staggering proportion.

I consider that the metallurgical problem is solved and that when the mill is put in proper running order it can be made to pay a very handsome profit in addition to the costs of repairs to the mine, so that it can be opened up.

I consider this a proven mining venture that will continue to pay large dividends for many years to come.

Respectfully submitted

(signed)

H. H. Montgomery  
METALLURGIST

COPY

## UNION HOLDINGS.

THE LITTLE JACK: This is a full sized location of 1500 feet long by 600 feet wide. Considerable prospecting has been done upon it. Without doubt it is a very good looking prospect, and some very good ore has been taken from the workings. A number of shafts have been sunk upon the main quartz vein, all of which show the continuity of the vein throughout the whole length of the claim. The deepest shaft is seventy-five (75) feet. At the bottom of this shaft is a ten (10) inch streak which assayed forty dollars (\$40.00) per ton. A sample from four feet across the shaft gave a value of twelve dollars (\$12.00) per ton. An average from all the shafts gave a value of eight dollars and twenty-five cents (\$8.25) per ton. This claim is situated near the main zone of disturbance, being close to the junction of the granitic and slate rocks. Accompanying the veins and parallel to them is a system of porphyry dykes. The country rock is of schistose character, and is doubtless a highly metamorphosed slate. There are three main parallel veins; the largest is four feet wide. There is every possibility of these coming together at depth. The veins dip northwest and have a strike of northeast and southwest. Only the center vein has been prospected, and should the other veins open up as well as it, this one claim alone would be capable of keeping a comparatively large mill going with ore. Ore has been milled and shipped from this property. The shipments have yielded 26.00 and 34.18 ozs. gold per ton respectively. Ore that was milled gave a high extraction on the plates, and the concentrates ran 5 ounces gold per ton.

This claim is certainly a most promising prospect. Figures can hardly be given as to ore in sight. Hard and fast rules governing the question of "ore in sight" cannot be applied. It is however, quite safe to figure out that there is 1500 long and 3 wide and 20 feet deep or ore ready for mining, or about 5600 tons which averages \$8.25 per ton, showing a gross value of \$46,200.00.

Very little stoping has been done upon this property.

THE OMAHA: This claim is located upon the same vein as the Little Jack, and the vein does not change in character. Pits have been sunk on the vein at frequent intervals, but no extensive or deep prospecting has been performed. Samples taken from all of the pits averaged \$7.50 per ton and showed remarkable uniformity of grade. The veins, both on "The Omaha" and "Little Jack" are nearly vertical, having a dip of 85° to the northwest.

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S.M.*

This is only a prospect and much cannot be said of it. It is safe to say however, that it is valuable according as the "Little Jack" turns out.

"THE YAVAPAI": This claim is situated south and west from "The Omaha" and "Little Jack", and is very near the junction of the slate and granites. The vein outcrops about 800 feet in length and is strong and wide. It is far more quartzzy than the veins already described. The quartz is white but mineralized with iron pyrites and near the surface is much iron stained. A shaft 100 feet deep has been sunk on the vein and shows that the character of the vein is better at bottom than at the top. A good block of ground is opened up. The vein averaged \$12.00 per ton from top to bottom of the shaft, and the surface ore of the outcropping averaged \$10.50 per ton. Here again hard and fast rules for "ore in sight" can hardly apply. It is certain however, that considerable ore can be obtained for milling purposes, and my judgment is that at least 6000 tons can be obtained absolutely, and there is much virgin ground to be yet opened up. This shows a gross valuation of \$60,000. Everything is admirably arranged for economic handling of the ore. A chute leads from the mouth of the main shaft down to the car track running direct to the mill. It is hardly fair to this claim to class it as a prospect, and yet it can hardly be termed a mine. It shows up too strong to be a mere prospect, and it is not sufficiently worked to be put in the category of a mine with big ore reserves. Some specimens were obtained that ran \$75.50 and \$125.25 per ton, showing promise of high grade shipping ore. The hanging wall of the ore is porphyry, and the foot wall is of highly metamorphosed slate. The vein dips sixty-five (65) degrees to the southeast and strikes northeast and southwest.

"THE INDEPENDENCE:" #2. This is a very fine looking claim with at least one very strong vein. The character of the vein is white quartz with eyes of pyrites and zinc blended. A number of pits show a vein of at least four (4) feet wide, and at places six (6) feet. The ore from the surface assayed on the average \$13.20 per ton and the ore from the shafts went higher. The deepest shaft is seventy-five feet deep, and numerous assays gave results from \$4.00 to \$68.80 per ton with a safe average of \$18.00. A drift near the collar of the shaft gave a large amount of ore of good milling grade.

The vein dips 85° to the northwest and strikes northeast and southwest. There is a tram line which runs from the main workings to the mill, insuring cheap handling of material. The property can be safely be called a mine, although future work must determine how big or how rich. I would estimate that 10,000 tons of ore can be obtained which would safely average \$15.00 per ton or a gross valuation of \$150,000. Next to the Little Jessie it is the most promising and best developed claim.

"THE UNION." This claim and the Blaine are on the same vein. This property is being worked by leasers at the present time who are sinking a shaft, with very slow and inadequate appliances, for the ore that is being taken out. As the shaft is 105 feet deep and only 4 feet by 6 feet, it can readily be seen that the ore must be very rich. The vein is of a greyish white porphyry with seams of quartz, and pyrites lenses of pyrites from 8 to 18 inches wide are found and these run as high as from \$200 to \$400 per ton. Practically no stoping has been done. At the bottom of the shaft an 8 streak of pyrites gave an assay of \$150.00 per ton and two feet six inches (2' 6") of quartz porphyry gave an assay of \$7.25. A good body of milling ore is exposed all the way up the shaft. The outcroppings nearly their entire length have been scarped and worked either in the present stamp mill or in the old Ticonderoga arrastras. There are several veins in this claim, but only one has been prospected to any extent. This claim makes a splendid showing, and will undoubtedly make a very good remuneration for any work expended. I dare hardly state my opinion of this property, but my impression is most favorable. It might turn out to be as good as the Little Jessie. The dip of the vein is similar to the Little Jessie, i.e., southeast, and has about the same incline, viz: 75°. I would estimate that 10,000 to 12,000 tons of ore can be readily obtained averaging about \$15.00, this not inclusive of any shipping ore. A gross valuation of \$150,000 to \$180,000 may be assigned to this claim.

"THE BLAINE." This property abuts the Union, and the vein is of the same character. A great deal of work has been done, but all the ore has been milled. The workings were not in shape for sampling, but the outcroppings gave an average assay of \$8.25 per ton. Here again a great deal of ore can be obtained, and in order to be very conservative, I have placed the amount at 5,000 tons of ore as immediately available. A gross valuation of 41,000 is thereby shown.

A point not alluded to and one of great importance is the existence of a cross cut tunnel through the "Union" and "Paymaster" claims. This tunnel cuts all the veins, and the "Union" and the "Blaine" have been drifted upon for several hundred feet. The showing made, quite confirms the good opinion already expressed. The veins keep their value, and eyes or lenses of quite high grade ore are met with, although the main ore shoots discovered at surface are not yet reached by these drifts. The tunnel and drifts are comparatively dry, and are well equipped with steel rail for cars. The material can therefore be handled very economically.

"THE PAYMASTER": This claim adjoins the Union, and is in a highly mineralized country. The veins are strong and of fair value, averaging at least \$8.75 per ton. The veins are from 2 feet to 6 feet wide; but very little work has been done upon them. The claim however, is well worth developing, as it is a goodlooking prospect.

"THE MIZPAH & ARIZONA": These claims may be dismissed with the statement that practically no work has been done upon them, and have evidently been located more for the purposes of mill sites, etc., than anything else. Good "float" has however, been found upon them and as the claims are in good mineralized country eventually something may be found upon them.

Report By  
A. W. Warwick E.M.