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COPPER CHIEF.

Tucson, Arizona.
March 25, 1913.

Mr. T. H. Leggett,
Consulting Engineering, A.S. & R. Co.
165 Broadway, New York.

Dear Sir:

In the matter of the sampling and survey of tonnages on the Copper Chief mine, I beg to report as follows:

The sampling was followed beginning with first level as sample No. 1 and including 280 foot level with No. 421, as per assay plans herewith, which includes "Wonderful" ore body. Sampling analysis was only run on composite Numbered 1001 to 1032, and showing composites for each level.

Tonnages and average assays and analysis are as follows:

OXIDES.

- Block A. - represents ore body from 100 ft. level to within 15 ft. of shaft collar at surface.
- Block B. - that part of the ore body included between the 160 ft. and 100 ft. levels.
- Block C. - ore body lying between the 220 ft. and 160 ft. levels
- Block C. - 1. small block of oxide ore lying below the 220 ft. level and immediately above the point where the sulphide ore begins. Thickness, 10 ft.

SULPHIDES.

- Block D. - represents ore body from the 280 ft. level to within 10 ft. of the 220 ft. level.
- Block E. - Possible ore between projected horizontal section on the 350 ft. level and the 280 ft. level.

The factor used for calculating tonnages is 19 cubic feet per ton in place.

The following tabulation shows oxides and sulphides location blocks, tonnages and the average assay and analyses calculated from samples taken.

The lime, manganese, zinc and sulphur contents of oxides showing only traces are not given in the assay and analyses.

The possible 20,000 tons of ore that might be obtained from the "Wonderful" ore body, is not taken into consideration in calculations herewith. It can, however, be mined for \$1.50 per ton, when required. It is situated some distance from the main ore body.

OXIDES.

	Level	Block	Tons	Assay (Average) Analysis						
				Au	Ag	Pb	Cu	Insol	SiO2	Fe
Positive Ore	100 ft.	A	50960	.25	5.5	.93	.06	72.5	68.7	13.0
	160	B	40820	.22	5.3	.95	.03	58.7	54.5	19.6
	220	C	49040							
	220	10 C-1	8400	.25	8.1	2.1	.21	56.8	51.6	16.5
Total & Avg.			149220	.24	6.4	1.4	.11	62.7	58.2	16.2
Probable ore										
Probable ore	100 ft.	A	81,840	.25	5.5	.93	.06	72.5	68.7	13.0
	160	B	37,400	.22	5.3	.95	.03	58.7	54.5	19.6
Total & Avg.			119,240							
Total Positive & Probable ore			268,460	.24	6.4	1.4	.11	62.7	58.2	16.2

SULPHIDES.

	Level	Block	Tons	Assay (Average) Analysis							
				Au	Ag	Pb	Cu	Insol	SiO2	Fe	Zn.
Probable	280 ft	D	74,360	.05	2.6	6.8	1.16	13.1	10.1	31.5	33.0
Possible	350 "	E	50,620	.05	2.6	6.8	1.16	13.1	10.1	31.5	33.0
Total Positive and Possible ore			124,980	.05	2.6	6.8	1.16	13.1	10.1	31.5	33.0

Sulphides yielded trace only of lead.

From the foregoing, we have 268,460 tons of positive and probable oxides ore and 124,980 positive and possible sulphide ore.

The average assay and analyses of the oxides are as follows:

Au. 24; 64. Ag; 1.4 Pb; .11 Cu; 62.7 Insol; 58.2 SiO2; 16.2 Fe. This, with silver at 55 cents, copper at 13 cents, gives a gross value of \$8.46 cents per ton. Deducting smelting and charges of \$3.74 leaving a margin of \$4.72 per ton for mining cost and profit. The mining cost of this oxide ore, including tram to Verde Smelter, is taken at \$1.00 per ton, leaving a profit of \$3.72 calculated as follows:-

Treatment		\$2.00		
58.2% SiO2 at .01		.58	.24 Au. at \$20.60	\$4.94
5% Ag. loss		.18	6.4 Ag. at 55 cents	3.52
Cu. absorption 7.8 lbs. at 12 cents		.94		\$8.46
Ag. 1 Au. - R & D		.04	Less	3.74
		\$3.74	Mining, Tram to smelter	1.00
			Profit	\$3.72

The sulphides average assay and analyses as follows:

.05 Au; 2.6 Ag; Cu 1.16; 13.1 Insol; 10.1 SiO2; 31.5 Fe; S. 33.9; 6.8 Zn;

These calculations, on the basis of 55 cent silver and 13 cent copper, show a gross value of \$6.06 with smelting and charges of \$3.61, leaving a margin of \$2.45 for mining cost and profit. The mining cost, including tram on the sulphides is taken at \$1.50 per ton, delivered at Verde-Smelter, leaving a profit of 95 cents per ton, calculated as follows:

Treatment	\$2.00		
10.1% SiO ₂ at .01 cents	.10	.05 Au. at \$20.60	\$1.00
10 lbs. Cu. loss	1.20	3.7 Ag. at 55 cents	2.04
Ag. loss	.10	1.16% Cu. at 13 cents	3.02
Converter	.08		<u>\$6.06</u>
R. & D.	.13		
	<u>\$3.61</u>		
		Less	3.61
			<u>\$2.45</u>
		Mining & Tram to smelter	1.50
		Profit	<u>.95</u>

The smelting charges on the oxides amounting to \$3.74 per ton in contracting with the new Verde Smelter, can be reduced down to a smelting charge of \$1.80 with usual deductions for copper loss and R. & D. so that the total deductions will not exceed \$3.50. The same will apply to the sulphides.

The necessity for the new Verde plant for silica will enable us to make a good trade with the Clark people on the Copper Chief for their new Verde plant, which will be completed within 18 months. Therefore, any new option for lease we take with the Copper Chief Mining Company, should have the time of the option 18 months. This will give us ample time to close contract with the Verde Smelter for the Copper Chief ore, as well as arranging with them to mine their ore on the other side of the compromise line of Copper Chief, and about 9 months prior to the completion of the Verde Plant, we could then start in erecting our tram line to the smelter and such buildings as may be necessary together with getting the mine ready for a production of say not less than 400 tons per day.

*Original signed by one of the
Field Engineers of the C. S. & P. Co.*

*Copied
J. W. M.*

COPPER CHIEF MINE

Clarkdale,
Ariz.

1913. Examination by engineers of A. S. & R. CO., allows blocked out 200,000 tons of oxidized ore of composition

Au.	0.24	oz.
Ag.	6.4	oz.
Cu.	0.11	%
Fe.	16.2	
Insol.	62.7	

Also about 200,000 tons of sulphide ore approximately

Au.	0.05	oz.
Ag.	2.6	oz.
Cu.	2.0	%
Fe.	31.0	
Insol.	12.0	
Zn.	6.8	

1916. John W. Finch, 730 Symes Building, Denver, Consulting Engineer; J. T. Matson, Superintendent.

Operating 125 ton cyanide plant for treatment of the oxidized ore. Shipped us 30 tons a day in May 1916, until we stopped them. Shipments contained

Au.	0.10	oz. to 0.30	oz.
Ag.	4.4	oz. to 5.5	oz.
Cu.	1.8	% to 3.0	%
Insol.	17.0	%	
Fe.	29.0	%	
CaO	0.5	%	
S	30	%	
Zn.	8	%	

There was a small quantity of oxidized ore mixed in these shipments.

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NOTES REGARDING COPPER CHIEF MINE

near

Jerome, Ariz.

Visited November 3rd and 4th, 1913 in company with Walker. ^{R.T.}
Mine adjoins the Iron King which belongs to W. A. Clark and which was also briefly examined.

Copper Chief Mine is opened up by shaft connected with an adit level 360 ft. below the collar of the shaft. There are levels at 100', 160', 240', 300' and 360'. In the four upper levels the ore is oxidized and there is a sharp line between the oxides and sulphides 6-ft. below the 240' level. This is shown up in winzes.

On the 300' level the primary sulphides are found entirely, and ^{on} ~~under~~ the 360' level there is no ore ^{found} at all probably because the drifts were run in a wrong direction, although the ore-body may have pinched out or been thrown out of place below the 300' level.

Strike of the ore-body is Northeast and the dip of the vein is Northwest while the pitch of the ore-shoot in the vein is to the Northeast.

Samples were taken from different levels as per list appended largely from reject of the owners samples.

A rough estimate of tonnage would show 200,000 tons of oxidized ore and 100,000 tons of sulphide ore. (The ore is too silicious to smelt and the sulphides are too poor to pay for treatment. There will be no possibility of handling this profitably at Humboldt and it would seem to be suitable for cyaniding or possibly leaching.)

Freight from Clarksdale to Humboldt would be about ~~\$10.00~~^{1.00} per/ton

Estimated cost of ropeway transportation to Clarksdale -----	0.20	"	"
-----	20.00	"	"
Mining, say -----	1.50	"	"
Capital expenditure -----	.40	"	"
Repayment purchase price -----	1.00	"	"
Total	\$32.90	"	"

4.10

The cost to equip this mine is estimated at \$60,000.00 for aerial ropeway, and all other equipment \$100,000.00.

N. Y., Dec. 5, 1913.

COPY OF *Samples from*
 ASSAY CERTIFICATE OF COPPER CHIEF MINE
 NEAR
 JEROME, ARIZ.

Humboldt, Ariz., Nov. 6, 1913.

Description	ASSAY			Analysis: %							
	Name	Au. Oza.	Ag. Ozs.	Cu. %	Insol.	Fe.	CaO.	S.	Zn.	Gross Val.	Al ₂ O ₃
Amorphous Silica 1st level		0.54	8.88	Tr.	82.9	4.2				\$15.00	H.S.
Stockpiles Reject 1st level		0.48	7.46	"	74.2	12.0	Nil.			13.50	3.2
Stockpiles Reject 2nd level		0.23	5.75	"	56.2	22.2	"			7.60	1.9
1st level <i>J.M.C.</i>		0.20	4.20	"	60.6	20.2	"			6.50	1.4
Stockpiles Reject 3rd level		0.24	8.16	"	57.8	15.8	"			9.00	7.7
Stockpiles Reject 4th level		0.07	2.10	0.80	7.2	36.2	"	39.3	8.2	5.00	
Manganese Ore		0.04	11.92	3.75	32.4					18.00	H.S.
3rd Level Iron stained ore hand sample by W.		0.24	5.76	Tr.	66.2	9.5	"			8.00	H.S.
Iron King Mine		0.06	1.14	5.20	2.2	32.8		29.4	13.5	18.00	H.S.

A. Scott, Assayer & Chemist.

C O P P E R C H I E F.

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Notes from

Interview with Karl Eilers, American Smelting & Refining Co.

11/3/13.

The rates of freight from Copper Chief to Humboldt were assumed to be \$1.50 on \$15.00 ore and \$1.75 on \$25.00 ore. I believe that for \$10.00 ore or less the rate of \$1.00 per ton should be produced.

Analysis of 300 samples of oxide ore taken by A.S. & R. average as follows:

	Sample. #1	Sample. #2	Sample. #3	Sample. #4	Sample. #5	Sample. #6	Sample. #7
Au.	.22 oz.	.045 oz.	.25 oz.	.22 oz.	.25 oz.	.24 oz.	.05 oz
Ag.	6.1 "	3.7 "	5.50 "	5.3 "	8.1 "	6.4 "	2.6 "
Cu.	.11 %	2.1 %	.06 %	.03 %	.21 %	.11 %	1.16 %
Pb.	1.4 "		.93 "	.95 "	2.1 "	1.4 %	
Insol.	62.7 "	10.1 "	72.5 "	58.7 "	56.8 "	62.7 "	13.1 "
Si O ₂	58.2 "		68.7 "	54.5 "	51.6 "	58.2 "	10.1 "
Fe.	16.2 "	31.5 "	13.00 "	19.6 "	16.5 "	16.2 "	31.5 "
Zn.	Tr.	? 6.8					6.8 "
S.	"	33.					30.33 " 33.

Analysis of 75000 tons of sulphide ore gave average of Sample #2.

Sample #1 -- The estimate gives 185000 tons of oxide ore and 100000 tons of sulphide ore with an additional 20,000 tons part sulphide and part oxide on the Wonderful Ore-body. Of this estimate 165,000 tons is absolutely blocked out.

Sample #3 -- Referring to 50,000 tons of ore ^{above} below the 100' level. This is Kaufmann's report.

Sample #4 -- Referring to 41,000 tons proved by the 160' level.

Sample #5 -- Referring to 57000 tons developed by 220' level.

Sample #6 -- A total estimate by Kaufmann was 149220 tons ^{oxidized} with the above analysis.

The ~~analysis~~ estimates made by Kaufmann ~~were~~ employed by Leggett whose figures are given in the first two analysis

#7 In the Sulphide ore-body there are 75,000 tons probable and 50,000 tons possible additional. The average of these analysis is #7.

Referring to Analysis #3, this represents the average of 81,000 tons and there is also a probable tonnage of 37,000 tons having the same analysis.

The Wonderful ore-body is a little further up the hill than the Copper Chief. The ore-body of the Copper Chief dips in the vein into the Iron King property and there may be no ore at all below the 300' level.

A.S. & R. would propose to furnish us with mixture of sulphide and oxide ore as may be desired. They assumed that we could smelt about 150 tons of oxide ore together with 75 tons of sulphide ore and 80 tons of Humboldt concentrates plus 75 tons of limestone.

Report of their Engineer gives the following estimate on Copper Chief:

Mining -----	\$1.00
Gen'l. Exp.50
Losses-----	.50
Smelting ---	<u>4.00</u>

	1.00	7.00
	1.00	1.50
	1.00	<u>8.50</u>
Total	<u>4.00</u>	
	7.00	

Total \$6.00. cost, leaving \$3.00 profit per ton on 9.00 ore which he assumed to be the average value of the ore body.

A. S. & R. would consider any proposition which we care to make. Would offer to sell us the ore f. o. b. Humboldt or would allow us to operate the mine on royalty basis, and take charge of all production, shipment, etc., it being understood that they would provide the equipment of the mine and also that they would loan us money sufficient to enable us to erect necessary roasters and reverberatory furnace for smelting this material.

$Cu @ 0.3\% = 10 \text{ gr} = \text{Pd. } 5.70$
 $Ag @ 6.00 = 3.00 = 2.70$
 $Au @ 2.57 @ 15 = 9.00 = 7.13$
15.53

dec. 6 = 46 @ 15 = 7.13

46
 14.1
 230
 230
 460
 713

1.00 fut
3.50
 11.00 net
 8.50 -> 200 cent
 X = 9.00 net

February 12th, 1917

Hayden Development Company,
Clarkdale, Arizona.

Gentlemen: -

CUSTOM ORE
"COPPER CHIEF" MINE

Attention Mr. J.T. Matson, Gen'l. Supt.

It is probable that during the next few months and possibly for many months to come we would be very glad to receive shipments of "Copper Chief" basic ore similar to that shipped this plant last spring and in quantities at the outset of say two or three carloads per week. We are not prepared to enter into any hard and fast contract for a definite period on this ore but would be very glad to make an agreement similar to that under which you shipped last spring, providing for notice of 30-days for the stopping of shipments by either party.

The ore as received last spring was of about the following composition:

Gold	.15	oz.	per	ton
Silver	5.0	"	"	"
Copper	2.2	%		
Iron	30.0	%		
Sulphur	30.0	%		
Zinc	8.0	%		
Insoluble	17.0	%		

Ore of such composition, or preferably with higher copper and *and lower zinc content* iron content we would be glad to receive and purchase on the following terms, F.O.B. Humboldt:-

February 3, 1926.

Mr. D. R. Findlayson, General Manager,
Copper Chief Mining Company,
Clarkdale, Arizona.

Dear Sir:

Since Mr. Reed returned from preliminary examination of the Copper Chief, I have carefully gone over with him the data which he obtained, also the report on your property by Mr. Winchell.

It seems that the great value in your basic sulphide ore is in zinc, and that no profitable use could be made of this material unless the zinc contained could be recovered and marketed. I note that Mr. Winchell estimates 58,700 tons of ore averaging about \$1.50 in gold and silver, 2% copper and from 9% to 11% in zinc, and I understand that you agree with Mr. Winchell's estimate and also believe that a larger tonnage of similar material may be developed by subsequent work.

Our plant at Humboldt is not at present equipped for the separation of zinc from other metals contained in this ore, but inasmuch as the tonnage seems to be so substantial and the mine opened up so that mining can be undertaken without large preliminary expenditure, I believe that we should give serious consideration to the possibility of mining and treating this ore by some method which would separate the zinc and enable treatment so as to utilize the iron, copper, gold and silver, all of which would be very useful to us in connection with our copper smelting operations.

March 19, 1926.

Mr. W. F. Fulton, President,
Copper Chief Mining Company,
Box 273,
Waterbury, Connecticut.

Dear Mr. Fulton:

In further reference to my letter of February 23rd and your letter of March 1st. On the 16th inst. I visited the Copper Chief with our Engineer, Mr. Reed, and in company with Mr. Finlayson we made an examination of the sulphide orebody which has been the subject of our previous correspondence. Since returning here I have been carefully calculating the possibility of mining and treating this ore with profit along the lines previously suggested, and have also been awaiting the results of the tests which are being conducted regarding the feasibility of separating the zinc from the other metals contained, and which I hope will indicate the recovery of zinc that may be expected.

Unless we can recover a substantial quantity of the zinc well in excess of 75%, or could secure substantially better market price for the zinc recovered than seems possible if we market zinc concentrate through regular channels, I am seriously afraid that we cannot hope to close an agreement with you in reference to this sulphide orebody.

Taking as a basis the estimates made by Mr. Winchell, it would appear that the average grade of this ore carries values of approximately \$1.50 per ton in gold and silver, and recoverable values, assuming that we concentrate and smelt the concentrates,

March 19, 1926.

of about \$1.20 per ton. The recoverable value in copper, again assuming concentration, is only about \$4.20, making a total value in these metals of \$5.40 per ton.

As to the cost of operation, assuming that we would pay you \$1.50 for the ore in place, I estimate the mining at \$2.00, trucking and freight to Humboldt, \$3.00, concentration and differential separation and for recovery of copper and zinc, \$2.00, smelting copper concentrate, \$1.50, converting, freight and refining copper 60¢, total \$10.60 per net ton of ore shipped. From the above calculation, which I think you or Mr. Finlayson will verify, you will see that it will be necessary to recover over \$3.00 value in zinc from each ton of ore in order to make the operation barely cover expenses.

Assuming that we are to produce a 50% zinc concentrate, which is the best that we would dare to hope for, the value of the zinc contained on the basis of such terms as we have been able to secure would only be a little over 3¢ a pound, and, accordingly, we would have to recover better than 150 pounds per ton, or say 75% of the zinc values, in order to break even on treatment of this material.

I do not wish to positively state our position on this matter until metallurgical tests have been completed, and until I have investigated certain other possible methods of disposing of the zinc, but on the basis of the best calculation which I am able to make at present it certainly would not pay us to make the necessary expenditure to provide equipment in our mill for handling this complex ore and making a separation and recovery of the zinc values. We are at present investigating the possibility of securing some

Mr. Fulton, - 3.

March 19, 1926.

other zinc bearing ores with substantially higher values in zinc and other metals, and if we can make a satisfactory arrangement in regard to these, then we would certainly give careful consideration to the Copper Chief, and perhaps might be able to work out some arrangement that would be mutually advantageous and profitable.

I am wondering that if under the circumstances your own Company would care to consider the possibility of installing a concentrator at the Copper Chief, which by flotation could treat the sulphide ore and produce on the one hand a zinc concentrate and on the other a concentrate containing most of the iron, gold, silver and copper contained in the ore. This would have been our plan at Humboldt, but the cost of trucking the ore to the railroad and freight to this point would, as you can see, eat up a large part of the possible profit, and it would certainly be more economical to operate a concentrator at the mine itself and save a large portion of this transportation cost. Under these circumstances we could offer you a very favorable market for the iron, copper concentrate, and the same markets which were open to us for the zinc concentrate would, of course, be open to you by shipping such concentrate direct from the mine to the zinc smelters.

I might further suggest that we ourselves ^{might} follow this plan and put in a concentrating unit at the Copper Chief, which could be installed without great expense in your old mill building, but if, as stated in your letter, it is impossible for you to make any agreement which would extend beyond the year 1926, this fact would naturally make it unfavorable for us to make any substantial expenditure on your property since the mill unit could hardly be

Mr. Fulton, - 4.

March 19, 1926.

in operation before the middle of the year, and probably it would not be possible to mine and treat with advantage more than 100 tons of ore per day.

After your stockholders meeting on the 31st of this month, if you find that you are in a position to consider an agreement which would extend over a longer period and permit the other party to mine and treat the entire tonnage of sulphide ore which you have developed, and which is estimated at approximately 60,000 tons, then we would be glad to take this matter up with you again.

In reference to your suggestion that any such agreement should provide for an increase in the purchase price of the ore provided the values were higher than the average of the estimate made by Winchell, it would be our plan in operating the sulphide ore body to leave a shell of the sulphide below the oxidized zone and not to attempt to break into the oxidized ore, or the narrow ~~band~~^{band} of enrichment which occurs between the oxide and sulphide orebodies. But we would be perfectly willing to agree that the purchase price should be increased whenever the average gross value of the ore produced in any one month exceeded \$25.00 per ton, and conversely, that the purchase price should be reduced whenever the average gross value of the ore produced in any one month should be less than \$20.00 per ton. This would automatically take care of fluctuations in the grade of the ore as well as advance or drop in price of the metals contained.

This provision I think would meet your wishes, and I think that we might be able to get together on some satisfactory

Mr. Fulton, - 5.

March 19, 1926.

arrangement provided you could take off the time limit suggested in your letter which as it stands at present would seem to make it impossible for us to get together.

I am writing you at present so that you will have my letter well in advance of your stockholders meeting on March 31st, and I will write you again after I have received the results of the metallurgical tests on the ore but I cannot anticipate that the results of these tests will in any essential respect change our position as indicated above.

I understand that any lease which may be given on your property would include the right to use all of your mining and other equipment without extra expense.

With best personal regards,

Sincerely yours,

GMC-s

General Manager.

SOUTHWEST METALS COMPANY

HUMBOLDT, ARIZONA

February 23, 1926.

Mr. W. F. Fulton, President,
Copper Chief Mining Company,
Box 273,
Waterbury, Connecticut.

Dear Mr. Fulton:

It is some years since we have corresponded, but I am once more interested in the possibility of securing ore from the Copper Chief Mine, and since it appears from correspondence with Mr. Finlayson that you do not quite understand the proposal which I have in mind, I have suggested to him that I should write you direct, and send him a carbon copy of my letter so that both of you would be fully in touch with the situation.

A preliminary investigation of the Copper Chief property and information received from Mr. Finlayson and the report which he gave us would seem to indicate that there was a positive tonnage of about 25,000, or a probable tonnage of about 60,000 of basic sulphide ore containing low values in gold and silver, 1 - 2% copper and 8 - 10% zinc, and that this material could all be mined at reasonable expense after a certain amount of preliminary work has been done in rendering accessible the old stopes and other workings.

Calculations which we have made and which I am sure Mr. Finlayson will check, indicate positively that there is no chance to work this ore except at a heavy loss unless one were able to make recovery and utilize a substantial part of the values in zinc. Up to the present time we have never made any effort to

Mr. Fulton, - 2.

February 23, 1926.

recover zinc at Humboldt, but have always considered it a nuisance in our copper smelter, but inasmuch as we are anxious to secure the copper, and also the iron in your ore, I think that we might find it advantageous to install in our mill certain additional equipment which would enable us to make a differential flotation and save the greater part of the gold and silver and copper in a heavy iron concentrate, (which we could smelt with advantage at Humboldt) and also save a portion of the zinc in a zinc concentrate, which we would expect to ship to some zinc smelter, very possibly even to Europe.

As you will see, entering this business would involve a considerable preliminary expenditure, a small amount of which would be required to open the Copper Chief Mine, and perhaps \$25,000 for milling equipment at Humboldt, and, naturally, we would not be prepared to make this expenditure unless assured that we would obtain at least 25,000 tons of ore (which just about equals your positive tonnage) so that we could charge off the cost of the special equipment against the tons of ore treated.

Even on the basis of the present high price of zinc there is only a very modest profit to be expected in handling the ore from the Copper Chief, which ^{my} estimates indicate would not exceed \$2.00 per ton if we pay you \$1.50 for the ore in place. Of this profit \$1.00 a ton would be charged off to repayment for the special equipment.

I would like to propose, subject to approval of my directors and subject also to the results of more thorough investi-

Mr. Fulton, - 3.

February 23, 1926.

of the mine and experiments in treating the ore, ^{that} we purchase from you up to 25,000 tons of material in the mine, the first 10,000 at \$1.50 per ton, and the balance at \$2.00 per ton, with provision that the \$2.00 price should be increased if copper exceeded 15¢ a pound, or if zinc exceeded 8¢ per pound, but conversely that the price should be less than \$2.00 if zinc sold at less than 7¢ a pound or copper at less than 14¢. We would not guarantee in advance to purchase and treat all of this material inasmuch as the price of the metals might go down to a point that would make it impossible for us to do this with profit, but assuming that prices remain satisfactory, we would plan to mine at the rate of about 100 tons per day, all mining and other expenses to be born by us, and we would want an option on such additional tonnage as might be developed in the mine on terms similar to those indicated above.

Under the circumstances I believe you will agree that the above proposal is fair and should be moderately profitable to both parties. We are looking into three or four different properties which might furnish us material similar to the Copper Chief, but because of the high iron and sulphur content in your basic ore we would like to do business with you if satisfactory terms can be arranged, and I shall be glad to hear from you on this matter at your early convenience. I cannot anticipate that we could possibly reach any definite agreement as early as March 15th inasmuch as our metallurgical experiments and other investigation of this situation are almost sure to require eight to ten weeks time.

Mr. Fulton, - 1/2

February 23, 1926.

With best personal regards,

Sincerely yours,

G. M. Colverson

General Manager.

GMC-s

RUSH T. SILL
ENGINEER OF MINES
HARLEY A. SILL
METALLURGICAL ENGINEER

METALLURGICAL LABORATORY

ORE TESTING
PROCESSES DEVELOPED
MILL DESIGN

SILL AND SILL
CONSULTING MINING ENGINEERS
1011 SOUTH FIGUEROA STREET
LOS ANGELES

April
14
19 26

(S. W. metals)

Simpson Engineering Co.
Long Beach, California.

Description	Ozs. Silver	% Copper	% Zinc
Lot # 201 E 1st Conc.	2.8	2.76	14.2
" " " "	3.3	2.39	17.7
" " Tails	2.1	1.84	13.7

* Charges \$ 12.00

Sill and Sill
Mining & Metallurgical Engineers.

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April
8
19 26

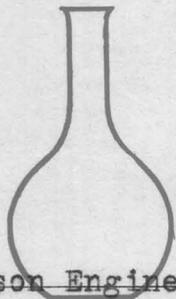
Hampcott

Simpson Engineering Co.
Long Beach, California.

Description	Ozs. Silver	% Copper	% Zinc
Lot # 201 C 1st Conc	4.7	4.1	17.39
" " C 2nd "	3.7	1.9	24.35
" " C Tails	3.1	1.4	9.9
* Charges	\$ 12.00		

Sill and Sill
Mining & Metallurgical Engineers.

ASSAYING
CONCENTRATION
AMALGAMATION
AND
CYANIDE TESTS
CHEMICAL ANALYSES



ASSAY CERTIFICATE

Baverstock & Payne

552 SOUTH FIGUEROA ST.

LOS ANGELES, CALIFORNIA

Telephone VAndike 6044

For Simpson Engineering Co.

Our No. 9395 Entered for Record March 24 1926

A COMPLETE ANALYTICAL TESTING LABORATORY

OWNER'S MARK OR DESCRIPTION	GOLD PER TON		SILVER PER TON		TOTAL BULLION VALUE	BASE METALS	VALUE PER TON
	OZ. TROY	VALUE	OZ. TROY	VALUE			
Lot 201 Heads (S W Metals Co.)	.06	\$ 1.25	1.4	\$.90	2.15	Copper 1.4 % Zinc 7.5 %	\$

All values based on current New York quotations.

Gold \$20.67 per oz. Troy Copper _____ cts. per lb.

Silver 65 cts. per oz. Troy. Lead _____ cts. per lb.

Charges \$ 4.00

Signed Baverstock & Payne
Chemists
This Date March 24, 1926

ASSAY CERTIFICATE

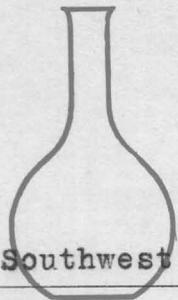
Baverstock & Payne

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A COMPLETE ANALYTICAL TESTING LABORATORY

ASSAYING
CONCENTRATION
AMALGAMATION
AND
CYANIDE TESTS
CHEMICAL ANALYSES



For Southwest Metals Co.

Our No. 9412 Entered for Record Mch 29-26

OWNER'S MARK OR DESCRIPTION	GOLD PER TON		SILVER PER TON		TOTAL BULLION VALUE	BASE METALS	VALUE PER TON
	OZ. TROY	VALUE	OZ. TROY	VALUE			
201-B-1 1st Conc.	.14	\$ 2.90	3.-	\$ 1.95	\$ 4.85	Copper % 5.8 Zink. % 12.5	15.08 18.50
201-B-2 2nd Conc.	.12	2.50	2.6	1.69	4.19	Copper % 5.7 Zink % 16.1	14.82 22.54
Tails.	.12	2.50	2.4	1.56	4.06	Copper % 2.4 Zink % 5.8	1.56 8.12

All values based on current New York quotations.

Gold \$20.67 per oz. Troy Copper 13 cts. per lb.

Charges \$ 12.00

Signed Baverstock Payne Chemists

Silver 65 cts. per oz. Troy. Lead _____ cts. per lb.

Zink \$0.07.

This Date Mch 31-26

I file

Notes by S. M. Colverson

COPPER CHIEF

6/12/37

See Mines file.

As an exploration project the holdings of this company in combination with those of the Green Monster might offer possibilities, but it would be a long shot ^d to involve a lot of money.

The gold silver ore in the upper part of this mine has probably been all worked out and only the sulphide ore under the fault remains and some ore in the "Wonderful" shoot.

Analysis of the sulphide ore is about as follows:

Au, 0.05; Ag 2.6; Zn., 6.8; Cu., 1.16; Pb Trace.

Neglecting the zinc the gross value of this ore is about \$7.00 per ton, which would not pay to mine and ship unless a very low treatment charge could be obtained.

Concentration by selective flotation and separation of a zinc concentrate might offer a solution of this problem, but would involve a larger initial expense for mill etc.

Winchell estimated the average content of the sulphide ore @ \$3.00 gold and silver with 2% copper, and 10% zinc. Again this would not pay to mine and ship.

The only reasonable hope of future profitable operation seems to rest on the chance that the U. V. may later decide to provide facilities for treating the zinc in their own mine in which case they might arrange to handle the ore from the Iron King (which they own) and from the adjoining Copper Chief. Unless and until such a program is assured there would be no incentive to any large scale operations at the Copper Chief and it is not likely that any small quantity of higher grade ore could be mined with profit or that the owners would agree to have the mine operated on that basis.

No interest at present.

COPPER CHIEF

Larson claims that a geophysical survey made in 1918 or '19 by the Southwestern Engineering Company or Radiore Co. under the direction of Jakosky gave strong evidence that the main sulphide ore body had faulted off in depth to the north and west and that they believed that the lower section of this ore, beyond the fault and perhaps lying under the claims of the Green Monster would be larger than anything found in the mine.

A similar conclusion had previously been reached by Fred Brunton and others, and should be studied in the light of the reports by Winchell (which Larson will lend me) and others.

The value of the developed ore at the Copper Chief is only a little over \$5.00^{per ton}/according to Peach which will not pay to mine and ship but Peach thought that he might work it by installing a small smelter near the base of the hill and mixing the ore with his production from the Iron King (Equator). P. D. Co. disapproved this plan.

Copper Chief could now be bought for \$7500 according to Larson and a little higher grade ore might be mined by leasers. Larson has maps.

Worked by Peach & d'Arcy in 42 & 43

Notes on Smelting "Copper Chief" Ore.

R. T. W.

Assays and Analyses Used.

	Copper Chief. Oxidized Ore.	Copper Chief. Sulphide Ore.	Bluebell. Concentrates.	Limestone.
Au:	0.162	0.045	0.06	
Ag:	5.3	3.7	2.0	
Cu:	.11	2.1	8.0	
SiO ₂ :	58.2	10.1	25.0	4.0
Al ₂ O ₃ :	4.5	3.0	1.0	
Fe:	16.2	31.5	27.5	1.0
CaO:	-	-	1.5	52.0 CaO + MgO
MgO:	-	-	2.0	
Zn:	-	6.8	2.0	
Pb:	1.4	?	0.5	
S:	-	33.0	31.0	

Assuming a total desulphurization of 80% in the Wedge roaster and the reverberatory furnace, the Bluebell concentrates would be just about self-fluxing, and consequently their only function in the scheme would be to supply copper, to maintain the grade of the matte sufficiently high for economical converting, and to produce a sufficient amount of matte to prevent the metal losses from being excessive.

Assuming a total desulphurization of 80% on the Copper Chief sulphide ore in the roaster and furnace, also, approximately three tons of this sulphide ore would be required for each ton of oxidized ore, to produce the most silicious slag (oxygen ratio of acids to bases, 1.75:1) that can safely be reckoned upon, without an actual smelting test having been performed; while, for each tons of oxidized ore left unfluxed by sulphide ore, approximately one ton of limestone would be required. Consequently, the amount of limestone required for various mixtures of Copper Chief oxidized ore and Copper Chief sulphide ore can be calculated roughly from the following formula:

Tonnage of oxidized ore - $1/3$ Tonnage of sulphide ore = tonnage of limestone required.

For instance, a mixture of 150 tons of oxidized ore and 75 tons of sulphide ore would require the addition, approximately, of 125 tons of limestone, to yield a slag of 1.75 oxygen ratio. Such a slag would be very nice, from a metallurgical standpoint, but would be rather expensive to make, inasmuch as the lowest price procurable on limestone would be about \$1.15 per ton f.o.b. Humboldt, to which must be added the cost of unloading and crushing it, as well as the average smelting cost per ton of charge. Thus, assuming a minimum unloading and crushing cost of 35¢ per ton and a minimum smelting cost of \$2.00 per ton of charge, the cost of each ton of limestone used would be \$3.50. This cost, as applied to the instance cited above, would cause the fluxing cost, per ton of Copper Chief ore smelted, to attain the prohibitive figure of \$1.53.

1.95 p.t. of C. C. ore only.
1.16 1/2 " " " " as per Morrison's chq.

Hallens notes

Copper Chief

Jerome, Arizona. Jan. 9, 1926.

Mr. G. M. Colvocoresses,
General Manager,
South West Metals Co.,
Humboldt, Arizona.

A. J. 1/20 25

Dear Sir:-

I am desirous of calling your attention to the holdings of the Copper Chief Extension Mining Company. This is in the Verde Mining District, Jerome, Arizona.

This is a compact group of Twenty Eight claims lying between the Pittsburgh-Jerome, Verde Combination and Columbian Copper on the North, the Jerome Copper, Green Monster, Copper Chief and Baltimore (United Verde) to the East and extending past the Shea to the South, to the West is Mingus Mountain.

This group covers the entire "Upper Contact" from "Blow Out" Springs to past the Shea Mine. The largest undeveloped shear zones and gossan and jasper outcrops in the district are here. The shearings extend under the sedimentaries and show copper stain, gold and silver values, high grade copper, where not thoroughly leached and good gossan.

The trend of the Copper Chief ore-bodies is Easterly and Westerly and should extend through this group.

The Green Monster vein extends into this group showing a big leached zone, gold and silver values and some high grade copper. Only shallow surface work has been done.

This group has enough showings to warrant extensive development. I can offer a very attractive deal and all will be first hand.

We also own the Layman-Washburn and Monster Chief Groups 44 claims in all. The Larramore veins of the Gadsden cross the Layman group as does the big quartz porphyry veins. The Revenue vein of the Green Monster and the big vein cut in the Green Monster Shaft at 320 feet crosses the Monster Chief. These two groups can be easily explored by diamond drilling. These two groups cover the "Main Fault" from the Jerome-Del Monte to the Jerome-Bisbee.

G. M. C. 2.

This ground is East of and along the "Main Fault" and will be attractive in 1925 due to the United Verde Extension opening so much new ore East of and along the "Main Fault".

D. C. Finlayson, Manager of the Copper Chief, will give a very favorable report on the Monster Chief.

When can I meet you in Prescott or Humboldt but much more better in Jerome?

I am fully confident I can show you many very interesting things.

The three groups would make a vast acreage and have great possibilities for one good company or we might consider deal with your company.

Thanking you in advance for an early reply and that you will become interested, I am,

Yours truly,

Harry Colbath

Copied
D. J.

COPPER CHIEF MINE; HAYDEN DEVELOPMENT COMPANY, Lessee.

W. S. Fulton, President; T. B. Stearns and J. W. Finch, both of Denver, Vice-Presidents; Frank M. Mathews, Secretary & Treasurer. Resident at the Mine, J. T. Matson, Superintendent.

23 claims, part patented. 6 miles by trail S E from Jerome and 16 miles by road. Present production 125 tons per day oxidized gold and silver ore. Ball Mills and cyanidation.

Visited underground workings, September 21st, 1916, with Mr. Matson. The shaft is 350' deep. A tunnel level meets the bottom of shaft. Up 60 feet from the bottom is a level exposing sulphide ore, pyrite with a little chalcopyrite, in places, in lenses, usually small. Ore body from which ore was shipped to Humboldt is probably about 250 feet long, but exact extent is not known. Mr. Matson's estimate of the total ore developed below the oxidized zone is about 60,000 tons running about 1 1/2% copper, mostly in heavy sulphides unsuited for concentration. A contact of altered diorite and schist (probably pre-Cambrian) is exposed on this level. Up the shaft 55 feet is a level exposing rich silver oxidized ores with a little copper. Some of this ore is said to carry 60 oz. silver to the ton. Another lift up the shaft reached the 160 foot level, from which the oxidized ore sent to the mill is obtained. Mr. Matson's estimates of these milling ore reserves is 60,000 tons. The ore body is about 250' long and the stoping width and 20 to 40 feet. Square sets are used ~~for~~ the filling is obtained from the surface. "Sand carbonates" and other leached rocks similar to those at the United Verde Mine constitute the outcrop.

It would appear that the copper content of the ore now developed below the milling ore zone is too low for commercial copper ore, but high enough to interfere with cyanidation for gold and silver. While the workings are comparatively shallow, 350 feet, there would appear to be no reason why the copper content of the sulphides should greatly improve with depth, though there may be some improvement.

Copied

COPPER CHIEF EXTENSION COMPANY

E. J. Seeley and R. A. Kelly, promoters. Pre-organization stock has just been taken by Harold Steinfeld, A. Heinemann, E. Kendall, T. Ed. Litt and Mr. White, Treasurer of the Arizona & Eastern Railroad, all substantial residents of Tucson, Arizona. The territory is large and is located about a mile to the west of the Copper Chief Mine. At present it is rather difficult of access.

Inspected the property September 24th, 1916, with R. A. Kelly. Much of the higher ground is capped with limestone and other sedimentaries, generally lying almost flat. On the lower ground are exposures of rocks having a very remarkable resemblance to the outcrops on the United Verde ground, but no commercial ore body has been developed, nor has much prospecting work been done on these claims.

On the Three Angle claim, between the Verde Combination and the Ewing & Hookers' properties are two cuts in schist. One of them 150' long, near the trail, exposes jasper quartz, a very heavy iron gossan, and quartz similar to the United Verde outcrop. At the second cut, "sand carbonates" are exposed, similar to the Copper Chief exposure. After crossing the United Verde Company's pipe line in Blowout Springs Canyon, and around the hill past Ewing & Hookers' short tunnel, is a very strong dike of hematite with plenty of quartz and quartzite, 50 to 100 feet wide, running N W & S E, similar to United Verde outcrops. On the east wall is porphyry, probably altered diorite, iron stained, which breaks easily. On the west wall is a highly siliceous schist. Higher up the hill is a cemented gravel bed resting on limestone, similar to a deposit in Mescal Gulch. (The latter is said to be auriferous and is under option to Ex-Governor Oddie.)

A tunnel about 100 feet long, running about North Magnetic, cuts thru the iron dike in which there are a few copper stains and then into a fine grained greenish siliceous rock, perhaps quartz diorite, the exact duplicate

Copied

PROPERTY: COPPER CHIEF
DISTRICT: JEROME
OWNERS: HAYDEN DEVELOPMENT CO.
MANAGER: D. R. FINDLAYSON
VISITED: January 22, 1926, by D. F. REED.

The object of my visit was to secure as much information as possible about the body of basic sulphide ore in the lower part of the Copper Chief workings from which a few hundred tons were shipped to Humboldt in 1916.

From Mr. D. R. Findlayson, General Manager of the Company, I obtained maps and sections of the property, together with a report by H. V. Winchell, dated November 29, 1916.

I did not go underground as Mr. Findlayson said that it was unsafe to do so with the workings in their present condition. He estimates that an expenditure of \$150 to \$200 would put the workings in the sulphide zone in condition to allow sampling and examination.

Mr. Findlayson estimates the cost of placing the mine in shape for production at \$2000 to \$2500. This will cover the relaying of 1500 feet of track (which is on the property) cleaning drifts and some timbering and chute building. It would also probably be necessary to install a larger compressor. There is a compressor on the property which he claims to be large enough to run two jackhammers. Power costs are \$300 to \$340 per month, running one shift of which the M. & I. charge is \$200 per month.

The Iron King property, which adjoins the Copper Chief on the East, on a continuation of the Copper Chief ore body, and the workings of which connect with those of the Copper Chief, should be investigated in connection with this property. The Iron King is owned by the United Verde Copper Company

ORE BODY & ORE RESERVE.

The ore seems to be a replacement along the footwall of a rather shattered zone of igneous intrusion (to quote from Winchell's report), Winchell estimates 58,780 tons of sulphide ore running \$1.50 in Au. and Ag., 2% Cu., and in excess of 9% Zn. He gives no list of samples nor is there anything in his report to indicate that he did any sampling.

in appearance of some of the United Verde outcrop. On the dump ~~is~~ a little bornite shows in the green rock.

In a little tunnel below the trail is leached altered diorite. There is here a heavy iron gossan at the edge of the iron dike.

Up hill are two shallow pits in siliceous schist, stained with copper. Mr. Kelly said his samples ran 3-3/4% copper. The rock is so similar to the United Verde outcrop from which I broke pieces at the locomotive pit between the old shaft and #3 shaft, that they cannot be told apart. I do not think that Seely and Kelly are aware of the similiarity of the outcrops or they probably would have mentioned it to me.

At the bottom of the gulch is a quartz vein in greenstone, running N W - S E, showing a few specks of chalcopyrite.

From surface indications, the Copper Chief Extension property would appear to be one of the best prospects in the district, but it is undeveloped and it will take considerably money, probably, to make a mine of it. --

Neither is there any basis given for his tonnage estimates except that he says he has used eight cu. ft. as a ton of the sulphide ores. The ore as above would have a value in Au., Ag. and Cu. of about \$5.00 per ton. The gross value of the Zn. would be more than \$15.00 per ton.

From the plan and sections it would appear that this ore was exposed over a length of 260 feet on the top, a length of 65 feet on the bottom (Findlayson believes that it extends the full length of 260 feet on the bottom also), has a depth of 120 feet on the dip of the vein and an average thickness of 10 feet, using 8 cu. ft. as a factor this would give:

$$\frac{260 \times 65}{8} \times 120 \times 10 = 24450 \text{ tons of probable ore.}$$

Some 420 tons of this ore were shipped to Humboldt in 1916.

The average analysis of 240 tons shipped in May of that year was: Au. 0.18; Ag. 5.90; Cu. 2.20%; Ins. 17%; Zn. 8%; S. 30%; CaO. 0.3% Fe. 29%, a gross value in Au., Ag. and Cu. of \$12.00 per ton. The zinc in this ore has a gross value at present price of \$14.00. This was basic in character, carrying an excess of 12 units of Fe. over Ins.

The average analysis of 180 tons shipped in June, 1916, was Au. 0.35; Ag. 9.5; Cu. 3.00%; Ins. 25.0%, Zn. 7.3%; S. 24%; Fe. 25%. A gross value in Au., Ag., and Cu. of \$18.00 per ton, with an additional gross value of \$12.40 in Zn. This ore was neutral, having same amount of Fe. and Ins.

All of this ore may have been picked or sorted for shipment. The records do not state if this was the case.

COST ESTIMATE.

To produce 1500 tons per month or 50 tons per day on a one shift basis:

MINING:

3 Miners @	\$5.20	\$15.60
2 Muckers @	4.40	8.80
1 Timberman @	5.20	5.20
1 Trackman and Pipeman @	4.96	4.96
1 Trackman Helper @	4.40	4.40
1 Blacksmith @	5.52	5.52
1 " Helper @	4.16	4.16
1 Compressor & Pumpman @	4.96	4.96
<u>11</u>		<u>\$53.60</u> per day.
		30

\$1608.00 per month

Forward	\$1608.00
Superintendent's Office	450.00
Power	350.00
Powder, supplies, etc.	500.00
Total	<u>\$2908.00</u>

$\frac{\$2908.00}{1500} = \1.94 per ton.

Add to this ten cents per ton for preliminary work makes cost \$2.04 per ton.

Should it be found desirable to increase the production to 100 tons a day, even on a two shift basis, this cost could be cut to \$1.50 per ton, as the overhead and general expense would be the same.

TRUCKING.

E. H. Moores, trucking contractor, has quoted a price of \$2.25 per ton for hauling to Clemenceau. This might be lowered on a 50 ton a day basis, possibly to \$2.00 per ton.

FREIGHT.

Freight to Humboldt from Clemenceau ^{Humboldt} ~~is~~ 50¢ per ton on this low grade material.

ROYALTY.

Findlayson thought that his company would not consider a royalty of less than \$1.50 per ton. As he had not received any advice from his home office on this point it is possible that some lower basis might be agreed upon.

Accepting the above estimates the total cost, f.o.b. Humboldt would be:

Mining	\$2.04
Hauling	2.25
Freight	.50
Royalty	<u>1.50</u>
Total	\$6.29 per ton, f.o.b. Humboldt.

Should the lower rate on the haul be secured and a royalty of 50¢ per ton be secured, this would become

Mining	\$2.04
Hauling	2.00
Freight	.50
Royalty	<u>.50</u>
Total	\$5.04 per ton, f.o.b. Humboldt.

If Winchell's estimate of \$1.50 in Au. and Ag. values and 2% Cu. is accepted, the value of the ore is as follows:

Au. and Ag.

\$1.50

Au. and Ag.		\$1.50
2% copper = 40# - 8# slag loss =		
32# Cu. @ 14-1/8 - 3¢ = 11-1/8¢ =	<u>3.56</u>	

Total \$5.06 per ton.

This makes the value of the ore exactly the same as the cost delivered to Humboldt with no smelting charge against it.

CONCLUSIONS.

It would seem that there were only two possibilities of profit in mining this ore, even though the low royalty and hauling charge could be secured, First; that ore of a higher grade than that considered could be mined. This would seem, from the shipments made to this plant in 1916, to be possible, although whether this could be done on a 50 ton a day basis or not would have to be determined by further investigation.

Second: That it could be found possible to recover values in zinc in the ore, by differential flotation or other means, and put the production on a 100 ton a day basis. The gross value of the zinc in any ore running 11% Zn. would be @ 8.5¢ \$18.70 per ton.

Copied
D.F.

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