EVALUATION OF THE SIERRITA-LOFTON PEAK OREBODIES

By
Bear Creek Mining Company
Southwest District
2601 North First Avenue
Tucson, Arizona

August 14, 1963

EVALUATION OF THE SIERRITA-LOFTON PEAK OREBODIES

History

The Sierrita area is located about 35 miles southwest of Tucson, Arizona, in the Pima-Twin Buttes mining district. Presently operating in the district are the Esperanza (Duval), Mission (ASARCO) and Pima pits and Banner Mining Company's Palo Verde Mine. The Sierrita orebody is an extension of the mineralization containing Duval's Esperanza orebody.

Exploration drilling of NX holes was initiated by the Southwest District of Bear Creek Mining Company on the Sierrita Project in 1960 and continued until May, 1963. During this period, 109 holes totaling 60,243 feet have been drilled. The drill core has been assayed at 10-foot intervals for copper and molybdenum. Periodically, gold and silver assays were made.

Mineralization consists of chalcopyrite, pyrite and molybdenite in diabase, biotite quartz monzonite, and quartz monzonite. In the diabase and biotite quartz monzonite most of the sulfide mineralization is present in quartz veins and fractures, while in the quartz monzonite it is more disseminated.

The Kennecott Copper Corporation Research Department made flotation amenability tests on samples from ten drill holes. The composite of the samples assayed 0.36-percent copper and 0.061-percent molybdenite. The laboratory test results indicated a 93.67-percent copper recovery in a concentrate assaying 29.45-percent copper and an 89.20-percent molybdenite recovery in a concentrate assaying 90.0-percent molybdenite.

Laboratory tests of leaching waste dump material indicated that little copper could be recovered during the first several years of the mining operation. As the waste material becomes altered by exposure to the weather, a leaching operation would become possible. The very preliminary laboratory testing, however, provided no information on the time that might be required before a leaching operation could be undertaken, and on which to estimate capital and operating costs of such an operation. Therefore, income from waste leaching was never included in any of the financial evaluations.

We had hoped originally that the block of ground Bear Creek controlled contained a zone of mineralization carrying sufficient copper to be considered ore by traditional standards. As drilling continued this possibility faded. On the other hand, as drilling progressed, the continuity of low grade credits in copper, molybdenum and minor silver were significant. The gross dollar value of the first two metals taken together would be equivalent to ore grading between 0.55% to 0.6% copper at 30 cents per pound for the red metal*. This is not rich, but such values start right at grass roots. The intercepts of the higher grade material could be projected as gently dipping sheets, or plates, with surprising continuity from hole to hole.

Bear Creek controls rights to the area through six option to purchase contracts covering 190 unpatented mining claims and one State of Arizona Prospecting Permit covering 315 acres. Bear Creek has also staked 16 claims in its own name. The total purchase price of all six options is $2,398,000.00. Of this amount, $54,004.00 has already been paid as rentals, leaving a balance as of August 15, 1963, of $2,343,996.00.

*As a convenience for quick approximation, the grade can be expressed by what the rock would assay if the total metal value were entirely in copper rather than distributed between copper and molybdenum. Molybdenum, contained in molybdenite concentrate, is assumed to be worth $1.325 a pound. Copper, in concentrate form, is considered being worth approximately 23 cents, allowing a deduction of 7 cents a pound for all post-mill costs on the contained copper. On this basis, contained molybdenum metal per pound is worth 5.76 times as much as a pound of copper in the concentrate at the mill ready for smelting. Therefore, if the molybdenum assay is multiplied by this 5.76 factor, the product is the approximate equivalent grade of copper of equal value. If to this is added the actual copper assay, we have a measure of the grade of the rock, expressed as percent copper. We term this "copper equivalent". (In this calculation only copper and molybdenum are used, precious metal values are kept separate.) The "copper equivalent" value cannot be used to estimate gross revenue per ton of ore in financial evaluations because of the difference in recovery of the two metals, and because of differences in post-mill handling procedures and costs.

Five of the options are critical, especially because they have large payments due this year or early next year. (Note that if the C.D. Wilson et al option is exercised and the first annual installment is made, there is no necessity to make the remaining payments. In case of default, title merely reverts back to the optionors.) The five options can be summarized as follows:

Optionor	No. Of Claims	Remaining Rentals Date	Remaining Rentals Amt.	Option Expires	Total Purchase Price
1) Sierrita Mining & Ranching Company	90	11/25/63	$67,500	8/25/64	$1,102,000
2) McGee-Anglin	31	monthly	$ 1,860	6/1/64	270,000
3) C.D. Wilson et al	49	none		3/17/64	749,976; payable in 4 annual installments
4) J.K. McGee	15	8/29/63	$ 7,500	8/29/64	180,000
5) C.B. Myers	4	4/28/64	$ 4,700	4/28/65	48,000
				Total Purchase Price	$2,350,000
				Less Rentals Paid	-54,004
				Balance Due On Purchase Price (if exercised)	$2,295,996

The 1962 Evaluation

In the spring of 1962, 125,000,000 tons, more or less, of rock ranging between 0.55% and 0.6% copper equivalent plus about 25 cents per ton silver and gold credits were estimated. Preliminary calculations indicated that such material could be mined and treated profitably. Much more rigorous economic and engineering studies followed, all of which continued to show similar results. The Hoskold rates of return (at 2% safe rate) varied, depending upon assumptions used, between 9% and 15% with 10% an average valuation at 30 cents copper.

All financial studies assumed the ore would be shipped to Kennecott's Hayden Arizona smelter, Kennecott's Baltimore refinery and sold by Kennecott.

The financial analyses were deemed of sufficient interest that the Sierrita diabase mineralization was transferred to "Development Status" for tax purposes on July 1, 1962, and a more detailed analysis was initiated.

Ore reserves were calculated by several groups in the Kennecott organization and the following were the reserve figures obtained as of November, 1962. (Only ore in the diabase area was considered at that time.)

Table I

Cut Off Grade (% Copper Equivalent)	Average Grade (% Copper Equivalent)	Tonnage	S. R.
.00	----	355,743,470	- 0 -
.34	.559	132,298,000	1.69
.35	.571	125,692,000	1.83
.36	.582	120,080,000	1.96
.37	.595	112,681,000	2.16
.38	.606	107,180,000	2.32
.39	.615	102,926,350	2.46
.40	.627	97,289,800	2.66

The Sierrita orebody is rather unique in that practically no barren rock exists within it or near it. All rock carries some copper and moly credits. In general, the grade drops slowly away from the ore so that even a slight change in cut off grade has a large effect on the tonnage but a slight one on average grade, as shown in the above table.

In November, 1962, the Statistical Unit of Bear Creek analyzed the deposit from a mining and economic viewpoint. The first calculation in column 2 on the attached Table II visualizes mining one of the tonnage-grade combinations listed in Table I. (The other tonnage-grade combinations have not been studied in a similar manner.) This orebody would produce a 12.04% cash flow rate of return and a 9.56% and 2% safe Hoskold return. This same tonnage-grade was then reevaluated by assuming that mining operations would be optimized. By this is meant that "average grade" and "average stripping ratio" were discarded and the orebody mined on paper as it would be in practise. Thus, the mining operation was broken down into short planning periods whereby carefully controlled pit slopes and grade control permitted minimizing the stripping ratio and maximizing the grade. The results of this optimized mining plan are given in the second calculation under column 2, Table II. The optimizing program could go still further and study the effects of varying production rates on the profitability. To be complete, the effects of all production rates should be done for optimized mining plans at all tonnage-grade combinations. The optimized orebody in column 2 was tested at two other production rates (Runs 2 to 3) with all independent variables held constant. The effects were as follows:

Table III

	Run 1	Run 2	Run 3
Production Rate	4.8×10^6 T/yr.	3.6×10^6 T/yr.	6.0×10^6 T/yr.
Total Capital Investment	$27,340,000	$21,340,000	$33,350,000
Total Amortizable Capital	$25,920,000	$19,820,000	$31,800,000
Life of Mine (Years)	23.65	31.44	18.92
Pay Out Time	6.52	6.75	6.11
Total Cash Flow	81,308,000	81,414,000	88,517,000
Cash Flow Rate of Return	13.62%	13.79%	14.16%
Hoskold Rate of Return*	11.99% and 2%	12.53% and 2%	11.79% and 2%

*Based on Non-Uniform Cash Flow. Rate of Return is Determined on Basis of Pay Out and Year Life Only.

Since last November, further testing has gone on; the great bulk of it after January 1, 1963. During this later work the Lofton Peak orebody was recognized and has been included in the 1963 evaluations. A small orebody (8 to 10 million tons) called the Anglin-McGee deposit, has not been included in any of these studies because of its size.

The 1963 Evaluations

The additional data included the drilling of 3720.9 feet to substantiate the ore reserve estimates and projections. Ten diamond core holes were bored to collect samples for metallurgical testing, and three prospect shafts, 36 feet, 32 feet, and 45 feet deep, were sunk for bulk samples for autogenous grinding tests. Real Estate appraisers estimated the cost of land in the area needed for surface plants, dump sites, tailings disposals, rights of way and water well fields. Our legal rights and correct procedures needed to acquire the needed land were reviewed by local legal counsel, Mr. Fennemore. Dr. Harschbarger, ground water consultant, appraised the region for a water supply adequate for the proposed mill. He outlined several possible reservoirs, their capacity, and quality of water. Transportation rates and costs were prepared with the help of general contractors, the Pima County Highway Department, and the Southern Pacific Railroad. Utility rates were submitted by the Tucson Gas and Electric Company. Reagents, materials, and supplies were quoted by local distributors. State taxes are based on the actual published property taxes paid by Duval Sulphur Company for the Esperanza Mine and American Smelting and Refining Company for the Mission Mine.

In July, 1963, capitalization to put the Sierrita-Lofton Peak orebody into production was estimated by Kennecott. It is based on the assumptions listed below.

Diesel trucks, traveling on roads with maximum grades of 7%, are used throughout the operation.

Waste dumps, located near the Lofton Peak pit, are in an area suitable for future leaching operation.

A flood water diversion system of 6,500 second feet capacity, west of the Sierrita pit, is constructed as required during the life of the operation. The system consists of four earth dams, an open channel and a 1,100 foot tunnel. (The tunnel and certain ancillary features are needed only in the late years to protect the southern, deep parts, of the Sierrita pit.)

The concentrator and surface plant are centrally located to minimize ore haulage distances. Tailings from the concentrator are disposed of in an area south of the Sierrita pit. The copper concentrate is trucked approximately ten miles, loaded into rail cars and shipped to the Kennecott smelter at Hayden.

Production cost estimates are based on three shifts per day, using costs of existing operations. The estimates assume a loading rate of 6,500 tons per shift for a six-cubic yard shovel. Capital costs were estimated by preparing rough layout drawings of the plant facilities and from construction cost data of existing facilities.

A breakdown of capital costs follows:

Non-Amortizable Capital Costs

Direct drilling exploration costs through June 1, 1963	$597,000	
Property payments through June 1, 1963	43,000	
Property acquisition (all options plus rights of way, water rights, etc.)	2,435,000	
		3,075,000

Amortizable Capital Costs

Initial Mine Development		$556,000	
Initial Plant and equipment			
Mine Equipment	$3,146,000		
Mill	15,000,000		
Tailings disposal	173,000		
Concentrate Transport facilities	100,000		
Water supply	1,541,000		
Miscellaneous	40,000		
		$20,000,000	
Present value of Future Expenditures		2,701,000	
			23,257,000
Total			26,332,000

Details of the mining equipment are given in Appendix A.

We believe that all needs of the Sierrita Mine have been adequately allowed for; their estimated costs reasonably well substantiated.

The important changes as of July, 1963, compared with November, 1962, follow:

A. Changes increasing the attractiveness

1. Mining cost reduced from an average 25 cents per ton for ore and waste to a range from 15 cents to 24 cents per ton, with 22 cents an average.

2. Milling costs reduced 5 cents per ton.

3. Copper recovery increased from 82% to 90%. Molybdenite recovery increased from 80% to 88%.

4. Copper concentrate averages 29% copper rather than 25% copper.

5. Certain post-milling charges previously used on molybdenite concentrate eliminated.

6. Lofton Peak orebody added to ore reserves; has a low stripping ratio (1:1).

7. Shallow ore, as well as deep ore, added to the Sierrita reserves by new drilling. (This was more than offset by the changes in B (1, 2) below, however.)

8. Overhead decreased 10 cents per ton to 30 cents.

9. Total estimated capital investment decreased $1,000,000.00 to $26,330,000.00.

B. Changes decreasing the attractiveness

1. Sierrita ore reserves decreased some 20 to 30,000,000 tons by using a new method of computation (Regression analysis).

2. Average grade decreased by at least .06% copper equivalent, by using the new method of computation.

3. Precious metal value reduced 18 cents per ton to 8 cents due to more precise assay procedures.

4. State tax increased 3 cents per ton.

Items B1, 2, have changed because of the method used to calculate tonnage and grade (Regression analysis) was substituted for the conventional polygonal weighted arithmetric averaging; the changes are not due to new drilling data.

On these revisions, Kennecott appraised the deposit as having a 8.9 year payout, a discounted cash flow rate of 9.9%, and Hoskold rates of 7.8 and 2% for an open cast mine with a 45° pit slope at a production rate of 15,000 TPD operating 300 days per year (column 3, Table II). These calculations were based on metal values below current market prices, i.e. copper at 30 cents per pound, molybdenite concentrate at $0.795 per pound molybdenite, and silver at $1.00 per ounce.

At 31 cents copper and $.84 molybdenite, the payout is 7.8 years, cash flow rate is 11.84% and Hoskold is 9.35% at a 2% safe rate.

On the basis of these studies the deposit was no longer of interest to Kennecott.

Since these calculations, the original method of ore reserve calculation used in 1962 has been suggested as being more representative, and thus the studies of July, 1963, seem to have used ore reserve figures with too low a grade, too small a tonnage, and too high a stripping ratio. No new rigorous calculations have been completed, but preliminary comparison studies support the contention that the ore reserve figures of 1962 may be nearer correct.

Very recently (August, 1963) two new ore reserve estimates have been made, using different computational procedures. The first of the estimates is a straight weighted arithmetical average of all drill hole assays, in the upper part of the orebody only, with a minimum intercept of at least 0.4% copper equivalent over a thickness of 25 feet. The second estimate, also limited to the upper portions, has been made from north-south and east-west cross sections and level maps through the mineralized body; both assay values and geologic features were used to project the ore from hole to hole and from section to section. Volume of ore and waste were then estimated by planimeter measurements of the areas represented on the level maps. It would seem that this last ore reserve estimate could be the most accurate one yet made; however, it has not been completed, or rechecked carefully for possible arithmetic errors. (The tonnages should also be verified by planimetric measurements of all the cross sections and then weighted and adjusted with the values obtained from measurements made on the level maps.) We suspect these most recent values might be a close approximation of the true orebody; probably more realistic than that obtained by Regression analysis with the computer.

A financial analysis using the first set of August figures gives a payout of 6.8 years, a cash flow rate of return of 13.7% and Hoskold rates of 10.56 and 2% at current metal prices.

The financial analysis using the second August ore reserve figures prepared from the geologic-assay cross sections, yields the following values: payout 6.43 years; cash flow rate of return 13.8%; Hoskold rates of 10.25% and 2%. If this study were optimized, perhaps a more attractive financial picture would emerge, such as was demonstrated last November.

This last mentioned orebody (column 5, Table II) has smaller ore reserves than those considered in the earlier 1963 calculations because only ore above the 3750 level is included. This means that many of the future capital expenditures would probably not be necessary, reducing the "Present Value of Future Expenditures" by $776,000. Column 5a, Table II is a financial reevaluation using this lower capitalization. At current metal prices the cash flow rate of return is 14.2%; the Hoskold rate is 10.6% at 2% safe rate.

The grade of copper used in the Sierrita ore calculations decreases from 0.32% to 0.30% from calculation 3, Table II to calculation 5 and 5a. This is so because the grade of copper increases with depth in this orebody, whereas the calculations progressing from (3) to (4) to (5) consider progressively shallower pits, hence the average grade is lower. If the entire mineralized block of ore, down to the bottom of the deepest drill holes, is considered, the tonnage of the Sierrita orebody is estimated at 170,000,000 tons with a grade of 0.34% copper and 0.071% molybdenite. The estimated over-all stripping ratio is 1.9:1. Even at the bottom of this proposed pit, a quarter of a mile in diameter, all the drill holes that went this deep in the pit area are still in good grade ore. No information is available below this level. A rigorous economic evaluation, using computer analysis, has not been made for these large tonnages. The figures in column 6 and 6a, Table II, have been derived by hand calculator only, but are considered to be a reasonable approximation. The credits of the Lofton Peak orebody have not been included but should be added to the column 6 figures for comparison with the rest of Table II. Obviously, these last-mentioned "No. 6" studies have not been "optimized". Because of the larger tonnages involved, a larger physical plant and production rate have been assumed for case 6a; capital costs were roughly estimated. As the "State Taxes" are largely property taxes, they are not necessarily a constant cost per ton at varying production rates. However, they have been kept a constant 15 cents in the absence of better data because of probable higher assessed valuation on the larger plant needed for the higher production rate.

Enclosures

Appendix A - List of Capital Equipment.
Index Road Map showing Sierrita Location.
Map showing Transportation Routes to Sierrita.
Topographic Base Map with drill hole locations Sierrita and Lofton Peak orebodies.
General Land Status Map.
2 Assay Cross Sections Lofton Peak Orebody.
2 Generalized Assay Cross Sections Sierrita Orebody.
Copy of portion of Kennecott Research Center Report on the Metallurgy of the Sierrita Ore.

Appendix A

Mine Equipment - Original	Number Required
Trucks, 65 ton	8
Rotary drills	3
6-yd. electric shovels	3
Powder trucks	2
Dozers, D-8	5
Dozer, D-9	1
Road graders	2
Crane-30 ton	1
Water Truck	1
Fuel Truck	1
Lube Truck	1
Flatbed Trucks	1
Truck, 3/4 ton	3
Truck, pickup	10
Line Truck	1
Trail cables	3
Cost	$3,146,000.00

Mine Equipment - Future	
Trucks, 65 ton	23
Rotary drill	1
6-yd. electric shovel	1
Trail cable	1
Crane 30 ton	1
Cost	$2,984,000.00

Present Value of Future Expenditures (discounted at 2% compound interest during deferment period) $2,700,000.00

August 29, 1963

Mr. Paul C. Henshaw
Vice President, Exploration
Homestake Mining Company
100 Bush Street
San Francisco 4, California

Dear Paul:

Re: Sierrita-Lofton Copper Property
Twin Buttes Area,
Pima County, Arizona

I have just received Bear Creek's presentation of the above-noted property. Following your request for a horse-back opinion before I leave for Nevada in the morning, the following are my hurried reactions.

The property is nearby to the west of the Esperanza mine and is right in Duval's lap.

There are three things to point out in Bear Creek's analysis:

(1) I see no mention of dilution of ore by waste during open pit mining and presumably this has not been taken into account. From the limited number of sections presented, the ore body appears to consist of several layers of ore separated by layers of internal waste, all gently inclined. These interfaces of waste against ore will cause dilution during mining. The sections indicate about six interfaces for an aggregate ore thickness of around 300 feet. From my experience elsewhere in this district I would expect a dilution of around 20% at a grade of, say, 0.15% of copper. This is approximately equivalent to adding 16 cents to the combined costs of mining and milling and subtracting 40 cents from the value of the ore. This drastically cuts down the margin of profit for an ore as low-grade as this one.

(2) Bear Creek assumes the copper would be refined and sold by Kennecott's own facilities. A buyer would have added costs here.

(3) The exploratory drill holes are spaced at about 500 feet; I feel that this spacing is too wide to "hook-up" the ore layers with certainty, to indicate possible gaps in ore-body continuity, and to give a reliable grade where a small deviation in the metal content of a very low-grade ore is so critical.

Furthermore, a substantial fraction of the value of this ore is believed to be in molybdenum. From the metallurgical standpoint, molybdenite occurs in several forms in this district, even in the same ore body, and its amenability to extraction varies. Consequently I am wondering if the extraction claimed has been fully substantiated throughout these deposits.

My conclusion is that this ore's value is right on the borderline and exceedingly vulnerable to a downward fluctuation in the future price of copper.

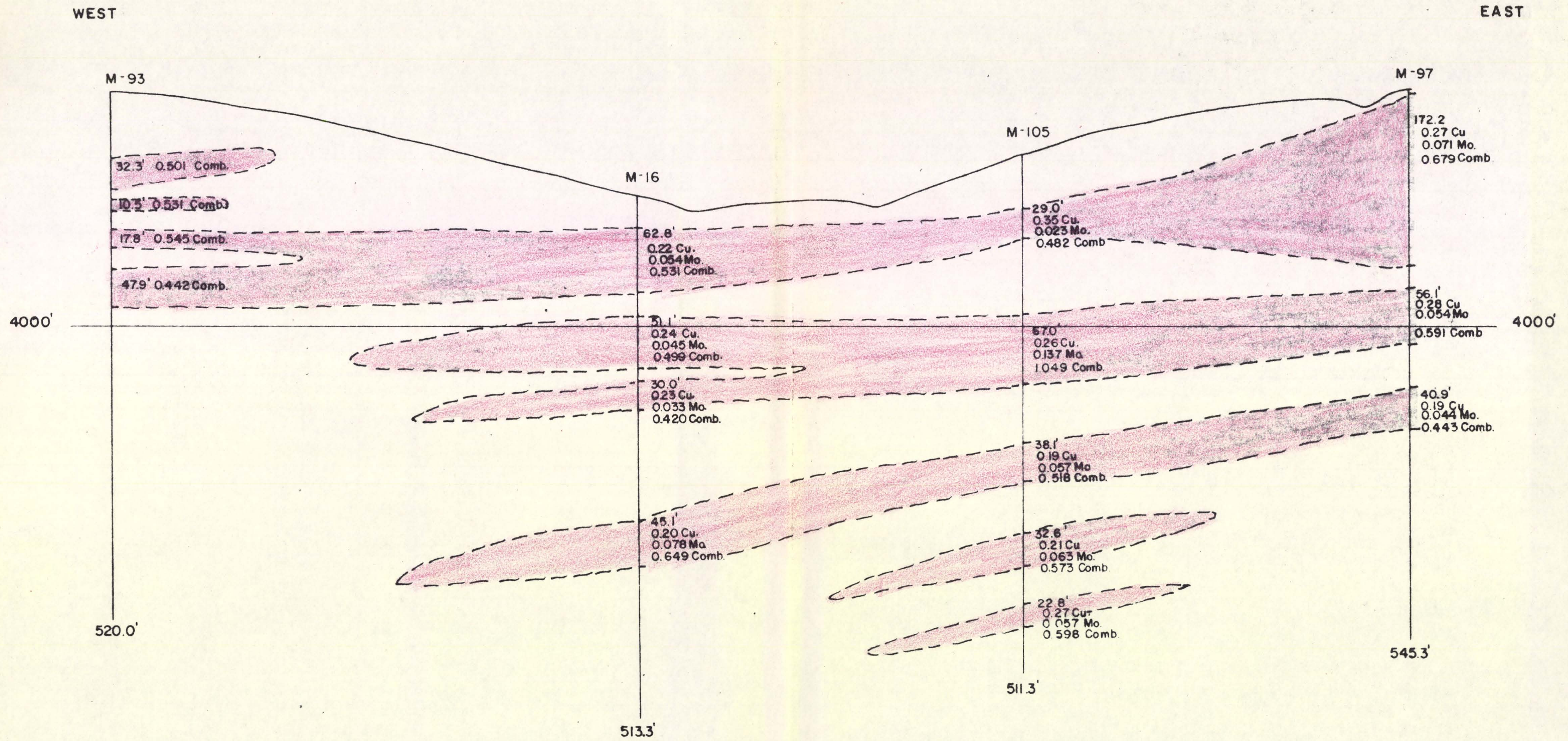
Perhaps the above points have also influenced Kennecott to assume the position of seller.

With very best personal regards,

Yours sincerely

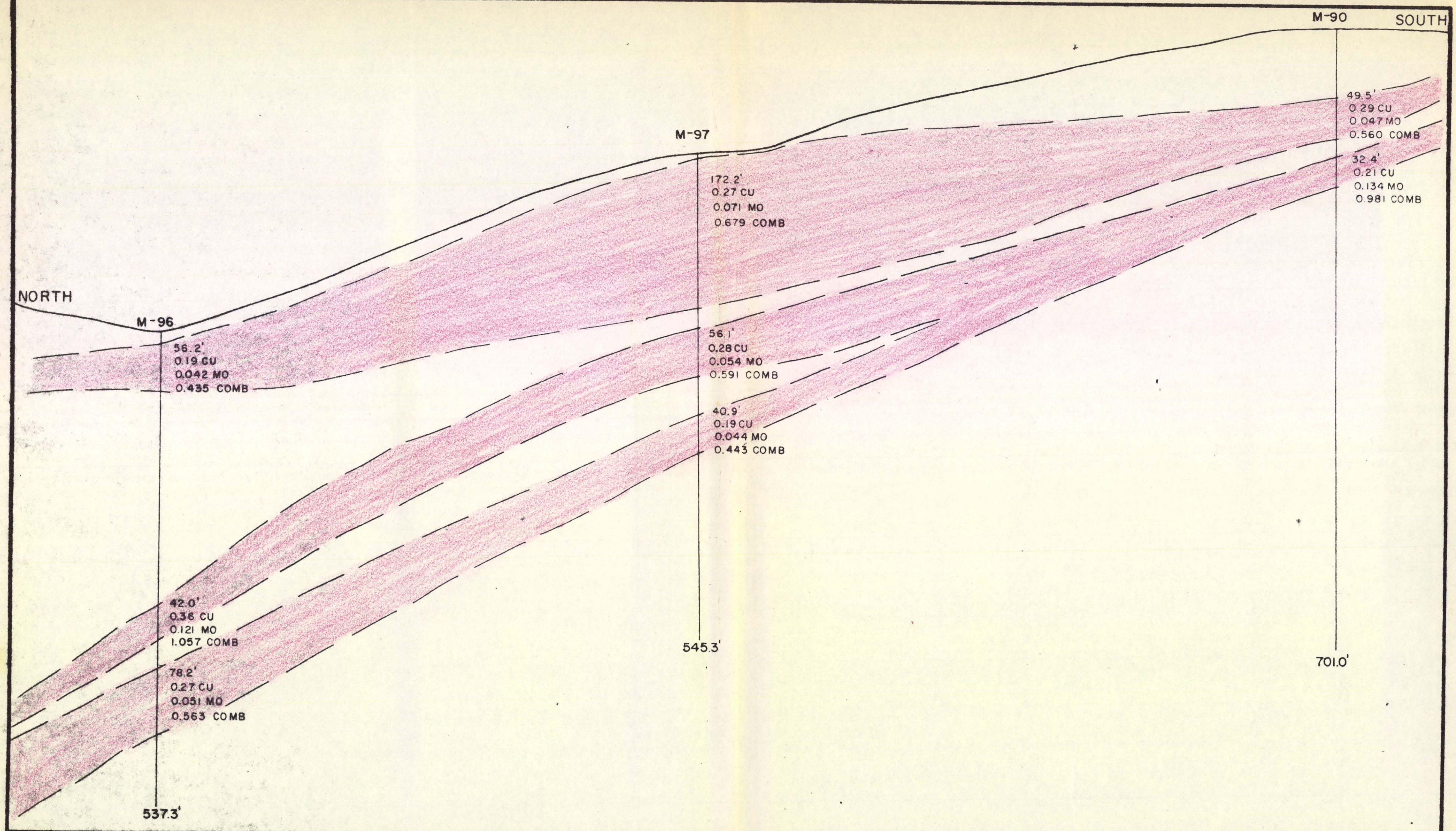
E. N. Pennebaker

ENP:mc



AREA LOFTON PEAK	BEAR CREEK MINING COMPANY — SOUTHWEST DISTRICT		
TITLE CROSS SECTION W-E	DATA BY JL CLARK, J JINKS	STATE ARIZONA	MAP NO 60-250
200 0 200 400	DR. BY SWH / DATE 7-1-63	COUNTY PIMA	B-321
1:2400	REVISIONS	TOWNSHIP, RANGE T18S R12E	PLATE

NOTE: ALL QUARTZ MONZONITE



AREA LOFTON PEAK PROJECT	BEAR CREEK MINING COMPANY— SOUTHWEST DISTRICT			
TITLE CROSS-SECTION, NORTH-SOUTH	DATA BY J.L.CLARK, JIM JINKS		STATE ARIZONA	MAP NO. 60-250
200 0 200' 400'	DR. BY SWH, JK	DATE 7/1/63	COUNTY PIMA	B 324
SCALE: 1" = 200'	REVISIONS		TOWNSHIP, RANGE T.18 S, R.12 E	PLATE

NOTE: ALL QUARTZ MONZONITE

PCH
Please handle as discussed.
I have not acknowledged
receipt of letter & enclosure.
JKG

BEAR CREEK MINING COMPANY

SOUTHWEST DISTRICT

2601 NORTH FIRST AVENUE

TUCSON, ARIZONA

MAIN 4-5547

August 15, 1963

Mr. John K. Gustafson, President
Homestake Mining Company
100 Bush Street
San Francisco, California

Dear Mr. Gustafson:

Mr. Bailly, President of Bear Creek Mining Company, has advised you that Kennecott, through its wholly owned exploration subsidiary Bear Creek Mining Company, owns options to purchase two copper-molybdenum orebodies adjacent to each other located about 35 miles south of Tucson, Arizona. The properties are known as the Sierrita and Lofton Peak deposits. They are now available for purchase from Kennecott. The combined tonnage is large, in the neighborhood of 100,000,000 tons, more or less; the grade is low, but is near surface making it amenable to open pit operation. Neither deposit can be considered a simple copper mine (or a molybdenum mine) because the quantity of each metal, alone, is not ore grade, but, taking the two metals together plus some precious metal credits, the deposits are judged to be profitable.

Bear Creek started exploring these prospects in 1960. Since then, we have outlined by drilling the limits of the best mineralized ground and have made tests on metallurgical characteristics, analyzed production and capital costs, and have estimated profit possibilities.

The strong copper-molybdenum mineralization grades outward very slowly into barren rock. Thus, the tonnage and grade considered as ore will vary widely depending upon cut-off grade used and the way ore zones are projected from drill hole to drill hole. This is discussed at considerable length in the enclosed report because of the importance of tonnage and grade calculations on profitability. As a result of the range in ore reserves, the discounted cash flow rate of return varies from 11.8% to 14.5%, calculated on current metal prices. Some additional drilling is needed to define the ore reserve limits precisely.

Mr. John K. Gustafson, President August 15, 1963

On the basis of the least encouraging of these evaluations, Kennecott in July, 1963, decided the properties were of no immediate interest to it and is now willing to sell its interest in these ore-bodies. Your company, among others, has expressed a desire to look into this possibility.

We are presently negotiating a postponement of all rental payments falling due under our options between now and late November. Most of these options expire during 1964. We hope to arrange for the sale of our rights to a third party by November 15, 1963. We expect that this third party will then assume responsibility for all the postponed and subsequent rentals due on the options for so long as the options are kept in force.

The price to purchase Kennecott-Bear Creek's rights to these deposits is open for negotiation.

If you are interested in discussing this matter further, after reviewing the enclosed summary, we shall be pleased to hear from you. We suggest you or your representative visit us in Tucson so that you can examine all the drill core, discuss the deposit with us in detail, as well as visit the property.

Because of the short time between now and November, we regret we cannot deal with your company alone at present, but must advise all prospective buyers simultaneously.

Looking forward to your reply, I am

Very truly yours,

Thomas N. Walthier

Thomas N. Walthier,
District Geologist.

TNW:jd

Enclosure ([illegible] + large envelope)

HOMESTAKE MINING COMPANY

100 BUSH STREET

SAN FRANCISCO 4, CALIFORNIA

August 27, 1963

Mr. E. N. Pennebaker
P. O. Box 817
Scottsdale, Arizona

Re: Sierrita-Lofton Copper Property, Twin Buttes Area, Pima County, Arizona

Dear Penny:

Accompanying this letter is an evaluation report on the above property. Along with it is a set of maps which gives a very good idea of the distribution of the copper and molybdenum values in the area. We would appreciate it very much if you could evaluate the project and let us know whether or not it could be worked at a profit by Homestake. We do not expect you to run off any further calculations of ore reserves unless you think it vital to do so. We do not expect you to find any flaws in their general assumptions. Here again an old Arizona hand like yourself may note some small error one way or the other.

What I would like, Penny, is your expression on the value of this property or some entirely new point of view. A crucial point may be the statement on the top of page four of the evaluation. There Bear Creek states that, "All financial studies assumed the ore would be shipped to Kennecott's Hayden Arizona smelter, Kennecott's Baltimore refinery and sold by Kennecott." Sitting here in San Francisco I have absolutely no way of judging what price Kennecott smelter might pay for concentrates from their own mines. I note that other producers in the Twin Buttes area shipped to Asarco's smelter in El Paso.

You will note that any purchaser of this property is under fairly heavy time pressure. Accordingly, we would appreciate hearing from you at your earliest convenience.

With warmest personal regards.

Yours sincerely,

Paul

Paul C. Henshaw
Vice President Exploration

PCH/pw
Encls.
cc: ABP

KENNECOTT COPPER CORPORATION
WESTERN MINING DIVISIONS
RESEARCH CENTER
1515 MINERAL SQUARE
SALT LAKE CITY, UTAH

S. R. ZIMMERLEY
DIRECTOR

P. O. BOX 1650

June 14, 1963

Mr. Paul A. Bailly
Bear Creek Mining Co.
407 Surety Life Building
1935 South Main Street
Salt Lake City 15, Utah

Dear Mr. Bailly:

The attached report presents the findings from amenability testing of drill core samples from the Sierrita Development Project, Exploration Lot F-409.

0.061 EDB.

Ten NX diamond drill core samples from the deposit were submitted for test work. Metallurgically, the ten samples respond to grinding and to flotation reagent practice in very similar manners. The composite of the ten samples assayed 0.36 percent Cu and 0.61 percent MoS_2. Laboratory test results indicate that, milling ore of the grade and quality of this sample, 93.67 percent of the contained copper would be recovered in a concentrate assaying 29.45 percent Cu and 89.20 percent of the contained molybdenite would be recovered in a concentrate assaying 90.0 percent MoS_2 and 1.06 percent Cu.

A processing flowsheet has been developed for a 15,000 ton-per-day milling operation and process equipment requirements estimated. This milling facility is estimated to cost $18,250,000. Direct operating costs for milling Sierrita ore is estimated at $0.50 per ton of mill feed.

No major metallurgical problems are indicated for the processing of Sierrita ore. The relatively high capital costs that have been estimated result primarily from the hardness of the diabase host rock and the need for fine grinding for mineral liberation. Operating costs also reflect the ore hardness and fine grinding in terms of relatively high power and grinding steel consumption.

Sincerely yours,

S. R. Zimmerley

Director of Research

SRZ:AWL:al

cc: Mr. C. H. Burgess
Mr. J. C. Kinnear, Jr.
Mr. S. D. Michaelson
Mr. T. N. Walthier (2)

RECOVERY OF COPPER AND MOLYBDENITE
FROM SIERRITA ORE

Report on Metallurgical Testing Conducted
at the Kennecott Research Center
1963

INTRODUCTION

A letter from Mr. Paul A. Bailly to Mr. S. R. Zimmerley, dated January 24, 1963, requested the Research Center to undertake process development studies on the recovery of copper and molybdenite from samples from the Sierrita Development Project. The results of this study were to be incorporated into an economic appraisal of the deposit to be made by Western Mining Divisions Engineering Department for Bear Creek Mining Co. In discussions with representatives of Bear Creek Mining Co. and Kennecott's Exploration Department, it was requested that the study be sufficiently complete to develop a process flowsheet, to establish grades and recoveries of metal values in finished concentrates and to serve as a basis for accurately estimating processing costs.

For the testing, Bear Creek Mining Co. drilled ten NX diamond drill holes intersecting the Sierrita deposit and shipped the freshly-recovered core, intact, to the Research Center. All mineral recovery testing reported herein was conducted with these samples; all projections and estimates from test findings assumes that the samples from the ten diamond drill holes are representative of the mineral deposit as a whole.

Limited preliminary testing of Sierrita samples had been conducted in 1962. A memorandum report on this testing was forwarded to Mr. Paul A. Bailly, accompanying a letter from Mr. S. R. Zimmerley dated July 16, 1962. The results of this preliminary work were sufficiently encouraging, metallurgically, to justify the more extensive study reported here.

SUMMARY OF LABORATORY FINDINGS

The following summarises the findings from the laboratory test program. Detailed metallurgical test data will be found in the following sections of this report.

1. The composite sample of Sierrita drill core provided for laboratory testing assayed 0.36 percent copper and 0.061 percent molybdenite.

2. Laboratory tests showed that the samples from the ten individual drill holes had very similar ore dressing characteristics as regards grinding requirements for mineral liberation and response of sulfide minerals to flotation reagents.

3. Locked cycle tests demonstrated recovery of 91.47 percent of the copper and 93.67 percent of the molybdenite contained in the composite sample as a concentrate assaying 25.4 percent copper and 4.54 percent molybdenite.

4. Locked cycle tests demonstrated that the combined copper-molybdenite concentrate could be processed to recover 95.22 percent of the contained molybdenite in a product assaying 90.0 percent molybdenite, 1.06 percent copper and 2.04 percent Insoluble. By combination of the recovery of molybdenite from the ore and recovery of molybdenite from the combined copper-molybdenite concentrate, an overall 89.20 percent recovery of molybdenite in a product meeting known marketing specifications was demonstrated.

5. Flotation recovery of the copper-molybdenite concentrate from the ore was effected with an Aerofloat collector (Utah Division Reco) at a pH of 8.7 to 9.0. Reagent requirements were 0.50 pounds lime, 0.034 pounds collector, 0.102 pounds frother and 0.02 pounds burner oil per ton of ore.

6. Separation and recovery of molybdenite was effected by roasting the combined copper-molybdenite concentrate at a temperature of 550°F to 580°F to remove reagents and to deactivate copper and iron sulfide minerals, repulping and floating molybdenite with burner oil and methyl amyl alcohol.

7. The metal recoveries cited above were obtained from ore that had been ground to a fineness of 10 percent plus 100 mesh.

8. Regrinding of concentrates was employed in both the Cu-MoS_2 recovery procedure and the molybdenite recovery procedure to obtain the grades of concentrates given above.

9. Locked cycle laboratory grinding tests showed that 33 percent more energy was required for unit production of minus 100 mesh material from Sierrita ore than from Utah ore. On this basis, grinding power requirements for the Sierrita ore is estimated at 13.7 KWH per ton of minus 100 mesh material produced.

Summary of Projections and Estimates for Milling Operations:

Laboratory test data were projected to estimate plant requirements and economics for milling Sierrita ore. These projections and estimates assume a 15,000 ton-per-day milling operation with mill feed of the grade and milling characteristics of the composite sample used in laboratory tests. A summary of these projections follows:

1. A 15,000 ton-per-day mill, operating on Sierrita ore assaying 0.36 percent copper and 0.061 percent MoS_2, will recover 93.67 percent of the contained copper (98,569 pounds per day) in a concentrate assaying 29.45 percent Cu, and 89.20 percent of the contained MoS_2 (18,137 pounds per day) in a concentrate assaying 90.0 percent MoS_2 and 1.06 percent Cu. Ratio of concentration will be 89.6 to 1 for the copper concentrate and 1667 to 1 for the molybdenite concentrate.

2. Direct operating costs for the above milling operation are estimated at $7500 per day, equal to $0.50 per ton of ore milled, distributed as follows:

Operating labor and supervision	$.047 per ton
Power, including natural gas	.184 per ton
Reagents	.039 per ton
Grinding Balls and rods	.130 per ton
Maintenance and repairs	.100 per ton
Total	$.500 per ton

3. Capital cost for a 15,000 ton-per-day concentrator for processing Sierrita ore is estimated at $18,250,000. Included in this estimate were offices, laboratory, repair and maintenance shop, warehouse, change house, and other auxiliary facilities required to support the concentrating operation; not included were costs of providing electric power, water and natural gas to

the plant cite. A separate capital cost estimate is being prepared by Western Mining Division Engineering Department as a part of the economic appraisal of the Sierrita deposit.

4. A concentrator flowsheet has been prepared and the processing equipment requirements estimated. This flowsheet will be found on pages 25 and 26 of this report. The number and size of major process equipment items, as well as the treatment procedure, is indicated on this flowsheet.

SIERRITA METALLURGICAL TEST SAMPLES

Samples for the metallurgical testing reported herein were taken by Bear Creek Mining Co. The samples consisted of NX diamond drill core from 10 sample holes intersecting the deposit. The sample has been designated Exploration Lot F-409 by the Research Center.

The diamond drill core samples were taken during the first quarter of 1963 especially for metallurgical testing. As the core was retrieved, it was washed free of adhering solids, air dried and stored in plastic bags. Handling and exposure of the core was minimized. As each sample hole was completed, all core from that hole was shipped, intact, to the Research Center for sampling, assaying and testing.

Individual designations of the ten core samples and copper and molybdenite assays of composite samples representative of each hole are as follows:

Diamond Drill Hole Number	Sample Intersection	Assay, Percent Cu	Assay, Percent MoS_2
M-52A	182.4 feet	0.36	0.085
M-35A	177.2 feet	0.29	0.056
M-8A	75.6 feet	0.32	0.064
M-5A	125.5 feet	0.40	0.053
M-55A	121.8 feet	0.29	0.054
M-10A	293.9 feet	0.41	0.066
M-22A	330.2 feet	0.38	0.071
M-39A	144.0 feet	0.34	0.042
M-58A	71.1 feet	0.23	0.074
M-67A	353.5 feet	0.46	0.049
Total Composite	1875.2 feet	0.36	0.061

At the request of Bear Creek Mining Co., core samples from DDH numbers M-52A, M-35A, M-8A, M-5A and M-55A were sampled and assayed for each 20 feet of intersection. Appendix 1 presents a tabulation of all assay data, including gold and silver analyses, obtained on the diamond drill core submitted to the Research Center.

Composite samples were all prepared on a "footage" basis for assay and metallurgical testing. That is, the weight of any individual sample entering a composite was adjusted to be proportional to the length of the appropriate diamond drill core intersection, rather than the estimated tonnage of ore represented by the drill core intersection. Because of the manner of preparing the total composite sample, its copper and molybdenite contents differ slightly from the metal contents estimated for the Sierrita orebody.

Host rocks of the Sierrita deposit are diabase and quartz monzonite, with the diabase constituting the bulk of the orebody. Both rocks are dense, hard and relatively unaltered. Chalcopyrite is the principal copper mineral and pyrite the principal sulfide mineral. Microscopic examinations show that chalcopyrite accounts for about 95 percent of the copper content of the ore, with bornite, chalcopyrite and covellite present in minor amounts. Except for near-surface samples, non-sulfide copper mineralization is virtually non-existant. Copper mineralization is fine-grained with appreciable locking with quartz occurring above about 50 microns.

AMENABILITY TESTING

Exploratory Tests

Exploratory tests were made on the composite samples from each of the ten drill holes. These 1000 gram, rougher flotation tests were made primarily to obtain data on the grinding requirements for effective mineral liberation. Three grinding levels were investigated; a fine grinding range of approximately 5 percent plus 100 mesh, a medium grinding range of approximately 10 percent plus 100 mesh and a coarse grinding range of approximately 20 percent plus 100 mesh. Reagents employed were Utah collector (sodium dicresyldithiophosphate), Utah frother (75 percent methyl amyl alcohol - 25 percent cresylic acid), cyanide and lime, closely approximating reagent practice with Utah ore. Data from these exploratory tests are presented in Appendix 2.

The exploratory tests show that the samples from the ten diamond drill holes have very similar milling characteristics and that recoveries of copper and molybdenite were not significantly improved by grinding finer than 10 percent plus 100 mesh.

Additional exploratory tests were made with the sample from DDH M-52A, to obtain comparative data on the effectiveness of the Utah collector. Tests were made with Dow Z-200 and with Z-4, sodium ethyl xanthate as collectors. In batch rougher flotation tests, both of these collectors produced slightly higher recoveries of copper than were obtained with the Utah collector.

Test F-1826 Continued

SPECTROGRAPHIC ANALYSIS REPORT

Molybdenite Cleaner Concentrate

Al	Ca 1.0
As	-
B	-
Ba	.01
Be	<.0001
Bi	.001
Ca	3.6
Cb	-
Cd	-
Ce	-
Co	.0002
Cr	.002
Ga	.0008
Ge	-
Hf	-
He	-
In	-
La	-
Li	-
Mg	.3
Mn	.0004
Na	-
Ni	<.001
Pd	-
Pt	-
Rb	-
Sb	-
Si	1.2
Sn	-
Sr	-
Ta	-
Te	-
Th	-
Ti	.06
Tl	-
U	-
V	.002
W	-
Y	-
Zr	.0003

Copper Cleaner Concentrate (Tailing)

As	-
B	-
Ba	.016
Be	<.0001
Bi	.001
Cb	-
Cd	-
Ce	-
Co	.004
Cr	.03
Fe	5.0
Ga	.0008
Ge	-
Hf	-
Hg	-
In	-
La	-
Li	-
Mg	.2
Mn	.0007
Na	-
Ni	.004
Pd	-
Pt	-
Rb	-
Re	-
Sb	.005
Sn	.0006
Sr	-
Ta	-
Te	-
Th	-
Ti	.15
Tl	-
U	-
V	.002
W	-
Y	-
Zr	.01

Semi-quantitative analysis
Values in weight percent

Legend:
- \- Not detected
- < Less than
- Ca Approximately

Elements determined by chemical analysis not included.

QUALITY OF SIERRITA MILLING WATER

Eight samples of water from the Sierrita area were submitted by the Exploration Department for analysis. Partial analyses of the water samples are as follows:

Sample No.	pH	CaO Grams per Liter	MgO Grams per Liter	Total Dissolved Solids Grams per Liter
H 1-1	7.3	0.06	0.01	0.32
H 1-2	7.0	.06	.01	.29
H 1-3	7.0	.06	.01	.23
H 1-4	7.4	.06	.01	.23
H 1-5	7.3	.06	.02	.24
H 1-6	7.5	.13	.03	.42
H 1-7	7.5	.12	.03	.39
H 1-8	7.5	.06	.03	.28

Spectrographic analysis of the dissolved solids recovered by evaporation from each of the water samples is as follows. Due to insufficient volume of samples, no flotation tests were made; however, the analyses of the water samples indicate that water from the same sources would be suitable for use in milling Sierrita ore.

Pilot Mill Grinding Tests

At the suggestion of the Research Center, three samples of Sierrita ore totaling nearly 60 tons were shipped to the Research Center for pilot scale tests. The primary purpose of the planned testing was to obtain a comparison between conventional ball mill grinding of the ore and autogenous grinding. If autogenous grinding were found to be applicable, substantial lowering of both capital and operating costs for a milling operation might be realized. The pilot grinding tests were expected to provide direct data on Sierrita ore hardness that could be extrapolated to size conventional crushing and grinding equipment for a full-size plant.

The three samples were obtained from sample trenches cut into surface exposures of the Sierrita orebody. The samples were identified as follows:

58BSS	Quartz Monzonite
57BSS	Diabase
49BSS	Biotite Quartz Monzonite

Pilot grinding tests were unsatisfactory and yielded no information that could be applied to the design, or the economic estimates of a Sierrita milling operation. The samples, being taken near the surface, had undergone significant mineral alteration and fractured very readily along crystal grain boundaries. This intergranular weakness renders any grinding data acquired on the samples unusable as regards estimating grindability of the total ore in the deposit.

It was not possible to complete autogenous grinding tests on Samples 58BSS and 49BSS. Mill feed broke extremely rapidly to a minus quarter inch size leaving no media with which to make further size reduction. With both samples, an extremely high circulating load of this fine material rapidly developed which rendered the mill inoperative as a grinding device. With Sample 57BSS, it was possible to grind the ore autogenously at a relatively high capacity for the pilot mill. While the data acquired on this sample was promising, it is not considered applicable to the hard unaltered diabase rock observed in the metallurgical test sample.

Short ball mill grinding tests were made on each sample. The data, however, were not used in developing a Sierrita mill flowsheet.

A separate detailed report on the pilot grinding tests will be made to Bear Creek Mining Company's Sierrita project.

DUMP LEACHING OF SIERRITA MINE WASTE

As a part of the over-all appraisal of the Sierrita deposit, the Research Center was requested to evaluate the possible bacterial leaching of waste material that would be produced in mining. Six samples from earlier diamond drilling were received at the Research Center January 28, 1963 for laboratory dump leaching tests. These samples were charged into laboratory percolation leach columns, inoculated with cultures of mine water bacteria and leached in similtude of a mine waste leaching operation. Active bacterial cultures were very rapidly generated in the test samples, however the rate of dissolution of copper has been extremely slow. A summary of data from these tests is presented in the attached table.

The laboratory tests have demonstrated that the Sierrita ore contains no components which will inhibit bacterial growth. However, the Sierrita ore contains copper as chalcopyrite, the copper mineralization is finely disseminated and the rock is relatively unfractured and impermeable to leach solutions. These factors seriously restrict the rate at which copper can be extracted from freshly mined ore.

The laboratory test results indicate that during the first several years of a mining operation, little copper could be recovered by leaching of waste dumps. Later, as the waste material is altered by exposure to weather, a leaching operation would become possible. The laboratory testing, however, provides no information on the time that might be required before a leaching operation could be undertaken.

Simulated Waste Dump Leaching of Sierrita Samples
Leaching Time 117 Days

DDH Number	Footage	Rock Type	Cu(T)	Cu(NS)	Percent of Total Cu Extracted (117 Days)
M-5	151'-171	Diabase	0.32	0.015	5.83
M-10	194-214	Diabase	0.24	0.015	6.46
M-39	164-182	Diabase	0.24	0.020	11.33
M-49	20-41	Quartz Monzonite	0.36	0.115	25.48
M-56	285-300	Diabase	0.21	0.015	6.95
M-58	105-124	Quartz Monzonite	0.24	0.015	4.39

APPENDIX 1

SIERRITA HEADING ASSAYS

NX Core Samples from Drill Holes Lot F-409

DDH M-52A		Ft.	% Ft.	Copper %	Copper Units	Molybdenite %	Molybdenite Units	Gold Oz/T.	Gold Units	Silver Oz/T	Silver Units
16.8 to	36.3	19.5	10.69	.30	.03207	.055	.00588	.0013	.00014	.066	.00706
36.3	58.1	21.8	11.95	.51	.06095	.033	.00394	.0013	.00016	.063	.00753
58.1	79.4	21.3	11.68	.28	.03270	.086	.01004	<.0013	<.00015	.036	.00420
79.4	98.4	19.0	10.42	.35	.03647	.053	.00552	<.0013	<.00014	.049	.00511
98.4	119.4	21.0	11.51	.33	.03798	.167	.01922	.0018	.00021	.063	.00725
119.4	141.6	22.2	12.17	.37	.04503	.114	.01387	.0013	.00016	.054	.00657
141.6	159.6	18.0	9.87	.28	.02764	.071	.00701	<.0013	<.00013	.045	.00444
159.6	180.0	20.4	11.18	.44	.04919	.107	.01196	.0018	.00020	.076	.00850
180.0	199.2	19.2	10.53	.26	.02738	.025	.00263	<.0013	<.00014	.041	.00432
Calc. Comp.											
16.8	199.2	182.4	100.00	.35	.34941	.080	.08007	<.0014	<.00143	.055	.05498
Comp. Assay				.36		.085		.0008		.052	
DDH M-35A											
15.6	34.7	19.1	10.78	.26	.02803	.023	.00248	.0013	.00014	.045	.00485
34.7	54.2	19.5	11.00	.27	.02970	.046	.00506	<.0013	<.00014	.036	.00396
54.2	75.0	20.8	11.74	.20	.02348	.032	.00376	<.0013	<.00015	.029	.00340
75.0	95.7	20.7	11.68	.32	.03788	.024	.00280	<.0013	<.00015	.044	.00514
95.7	113.2	17.5	9.88	.32	.03162	.190	.01877	.0013	.00013	.048	.00474
113.2	135.3	22.1	12.48	.24	.02993	.030	.00374	<.0013	<.00016	.031	.00387
135.3	157.4	22.1	12.47	.39	.04863	.043	.00536	.0015	.00019	.059	.00736
157.4	176.4	19.0	10.72	.26	.02787	.052	.00557	<.0013	<.00014	.035	.00375
176.4	192.8	16.4	9.26	.30	.02778	.033	.00306	.0016	.00015	.050	.00463
Calc. Comp.											
15.6	192.8	177.2	100.00	.28	.28442	.051	.05060	<.0014	<.00135	.042	.04170
Comp. Assay				.28		.056		.0002		.041	
DDH M-8A											
11.0	31.3	20.3	26.85	.39	.10472	.069	.01853	<.0013	<.00035	.055	.01477
31.3	53.2	21.9	28.97	.31	.08981	.116	.03361	<.0013	<.00038	.036	.01043
53.2	72.0	18.8	24.87	.32	.07958	.048	.01194	Nil	.00000	.035	.00870
72.0	86.6	14.6	19.31	.30	.05793	.047	.00908	Nil	.00000	.031	.00599
Calc. Comp.											
11.0	86.6	75.6	100.00	.33	.33204	.073	.07316	.0002	.00073	.040	.03989
Comp. Assay						.064		.0035		.042	

(Continued on next page)

Sierrita Heading Assays
NX Core Samples from Drill Holes Lot F-409, Continued:

			%	Copper		Molybdenite		Gold		Silver	
DDH M-5A		Ft.	Ft.	%	Units	%	Units	Oz/T	Units	Oz/T	Units
514.5 to	534.8	20.3	16.18	.30	.04854	.054	.00874	<.0013	<.00021	.041	.00663
534.8	555.2	20.4	16.26	.42	.06829	.054	.00878	<.0013	<.00021	.049	.00797
555.2	576.6	21.4	17.05	.52	.08866	.077	.01313	.0013	.00022	.055	.00938
576.6	598.4	21.8	17.37	.44	.07643	.030	.00521	.0013	.00023	.053	.00921
598.4	618.9	20.5	16.33	.38	.06205	.043	.00702	.0013	.00021	.054	.00882
618.9	640.0	21.1	16.81	.24	.04034	.048	.00807	Nil	.00000	.026	.00437
Calc. Comp.											
514.5	640.0	125.5	100.00	.38	.38431	.051	.05095	<.0011	.00108	.046	.04638
Comp. Assay				.40		.053		.0027		.050	
DDH M-55A											
22.0	42.4	20.4	16.75	.25	.04188	.033	.00553	<.0013	<.00022	.038	.00637
42.4	61.1	18.7	15.35	.33	.05066	.108	.01658	<.0013	<.00020	.048	.00737
61.1	82.4	21.3	17.49	.44	.07696	.058	.01014	.0013	.00023	.063	.01102
82.4	101.3	18.9	15.52	.21	.03259	.017	.00264	Nil	.00000	.035	.00543
101.3	125.0	23.7	19.46	.31	.06033	.034	.00662	<.0013	.00025	.045	.00876
125.0	143.8	18.8	15.43	.26	.04012	.060	.00926	Nil	.00000	.035	.00540
Calc. Comp.											
22.0	143.8	121.8	100.00	.30	.30254	.051	.05077	.0009	.00090	.044	.04435
Comp. Assay				.29		.054		.0002		.041	
DDH M-10A											
816.3	1110.2	293.9		.41		.066		.0004		.046	
DDH M-22A											
69.8	400.0	330.2		.38		.071		.0006		.059	
DDH M-39A											
626.0	770.0	144.0		.34		.042		.0003		.047	
DDH M-58A											
26.3	97.4	71.1		.23		.074		.0002		.033	
DDH M-67A											
646.5	1000.0	353.5		.46		.049		.0006		.061	

Sierrita Lot F-409 Master Composite

D. D. H.	Footage	Percent Footage	Pounds	Assay % Cu	Assay % MoS_2
M-39A	144.0	7.68	77	.34	.042
M-22A	330.2	17.61	176	.38	.071
M-67A	353.5	18.85	188	.46	.049
M-10A	293.9	15.67	157	.41	.066
M-58A	71.1	3.79	38	.23	.074
M-5A	125.5	6.69	67	.40	.053
M-55A	121.8	6.50	65	.29	.054
M-52A	182.4	9.73	97	.36	.085
M-35A	177.2	9.45	95	.29	.056
M-8A	75.6	4.03	40	.32	.064
Calculated Master Composite	1875.2	100.00	1000.0	.374	.061

Master Composite Heading Assay:

% Cu(T)	% Cu(NS)	% MoS_2	% Fe	% S	Au Oz./T.	Ag Oz./T.
0.36	0.030	0.061	5.75	1.30	.0004	0.051

TABLE II

CHRONOLOGY OF FINANCIAL ANALYSES, SIERRITA-LOFTON PEAK OREBODIES

	1	2		3		4		5		5a		6		6a	
DATE	July, 1962	November, 1962		July, 1963		August 2, 1963		August 7, 1963		August 7, 1963		August 13, 1963			
AUTHOR ( ) Advisor	S.W.D. S.U. (W.M.D.)	S.U. (S.W.D.)		S.U.		S.W.D. (S.U.)		S.W.D. (S.U.)		S.W.D. (S.U.)		S.W.D.			
ORE RESERVES (tons)															
Sierrita	110,000,000	112,681,380		81,000,000		90,700,000		60,300,000		Same figures as in calculation of August 7, 1963 (Column #5) except for capitalization.		170,000,000		170,000,000	
Lofton Peak	none	none		22,500,000		22,500,000		22,500,000				not included		not included	
ORE GRADE															
Sierrita %Cu	0.36	0.38		.32		.31		.30				.34		.34	
Sierrita $\%MoS_2$	0.075	0.079		.069		.076		.075				.071		.071	
Lofton Peak					.306%Cu .075%MoS_2		.299%Cu .081%MoS_2		.286%Cu .081%MoS_2						
Lofton Peak %Cu	--	--		.25		.25		.25				not included		--	
Lofton Peak $\%MoS_2$	--	--		.097		.097		.097				not included		--	
STRIPPING RATIO															
Pit Slope	45°	45°		45°		45°		45°				45°		45°	
Sierrita	1.55:1	2.16:1		2.2:1	1.75:1	1.66:1	1.589:1	0.9:1	0.927:1			1.9:1		1.9:1	
Lofton Peak	--	--		1:1		1:1		1:1				--		--	
		non-optmd.	optmd.												
MINE LIFE (years)	23	23.6	23.6	23		25.15		18.4				37.8		28.4	
Capacity TPD	16,000	16,000	16,000	15,000		15,000		15,000				15,000		20,000	
RECOVERY %															
Cu	82	82	82	90		90		90				90		90	
MoS_2	80	80	80	88		88		88				88		88	
Ag-Au	82	82	82	90		90		90				90		90	
METAL VALUE															
¢ Cu/lb	30	30	30	30	31	30	31	30	31	30	31	30	31	30	31
¢ MoS_2/lb	84	84	84	79½	84	79½	84	79½	84	79½	84	79½	84	79½	84
$ Ag/oz	.90	.90	.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$ Precious Metals/ton	.25	.25	.25	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
CAPITAL INVESTMENT $	25,160,000	27,340,000		26,332,000	26,332,000	26,332,000	26,332,000	26,332,000		25,556,000		26,332,000		33,350,000	
COSTS ¢/ton															
Mining	25	25	25	22	22	22		22				22		22	
Milling	55	55	55	50	50	50		50				50		50	
Overhead	40	40	40	30	30	30		30				30		30	
Post Milling	42	39	39	40	40	37		37				40		40	
State Tax (Prop. + Inc. Tax)	15	12	12	15	15	15		15				15		15	
ANNUAL CASH FLOW $	3,400,000	3,599,000	non-uniform	2,960,000	3,376,000	3,270,000	3,640,000	3,653,000	3,949,000	3,632,000	3,924.000	3,257,000	3,650,700	4,420,000	4,940,000
TOTAL PROFIT $ (Net after Taxes plus depletion)	54,270,000	56,460,000	55,388,000	44,840,000	54,400,000	67,150,000	78,200,000	43,963,000	49,412,000	44,351,000	49,730,000	99,800,000	115,200,000	93,000,000	107,900,000
PAYOUT (years)	7.25	7.72	6.52	8.89	7.80	7.53	6.83	7.02	6.48	6.85	6.32	8.1	7.2	7.54	6.75
CASH FLOW RATES															
Rate of Return	13.06%	12.04%	13.62%	9.9%	11.84%	12.2%	13.7%	12.43%	13.81%	12.9%	14.2%	12%	13.5%	13%	14.5%
Hoskold: at 2% Safe	10.1 %	9.56%	11.99%*	7.77%	9.35%	9.22%	10.56%	9.16%	10.25%	9.5%	10.6%	10.5%	12%	10.6%	12.1%
at 3% Safe	10.3 %	10.17%						10.1%	11.18%	10.5%	11.7%	10.9%	12.4%	10.9%	12.5%
COMMENTS	Ore calculated as polygons centered on drill holes	July, 1962 ore reserve calculation refined by polynomial surface computer analysis (same basic method of computation). *Non-uniform series; based on Payout + life only		Ore reserves at Sierrita calculated by regression analysis (slightly adjusted to conform to geologic projections).		Grade down to 3325 level equal to weighted aver. of drill hole intercepts; the regression analysis tonnage (above 3750 level only) adjusted upwards in same ratio as grade change.		Ore reserves calculated from geologic cross sections and mine level maps; grade is weighted average of all drill holes. Only upper part of Sierrita orebody (to 3750 level) used in calculation. Deeper, higher grade ore not included.				Ore reserves calculated from geologic cross sections and mine level maps; grade is weighted average of all drill holes. Sierrita ore included down to bottom of drill holes.			

S.W.D.= Southwest District, B.C.M.C.
S.U.= Statistical Unit, B.C.M.C.
W.M.D.= Engineering Dv.,Kennecott

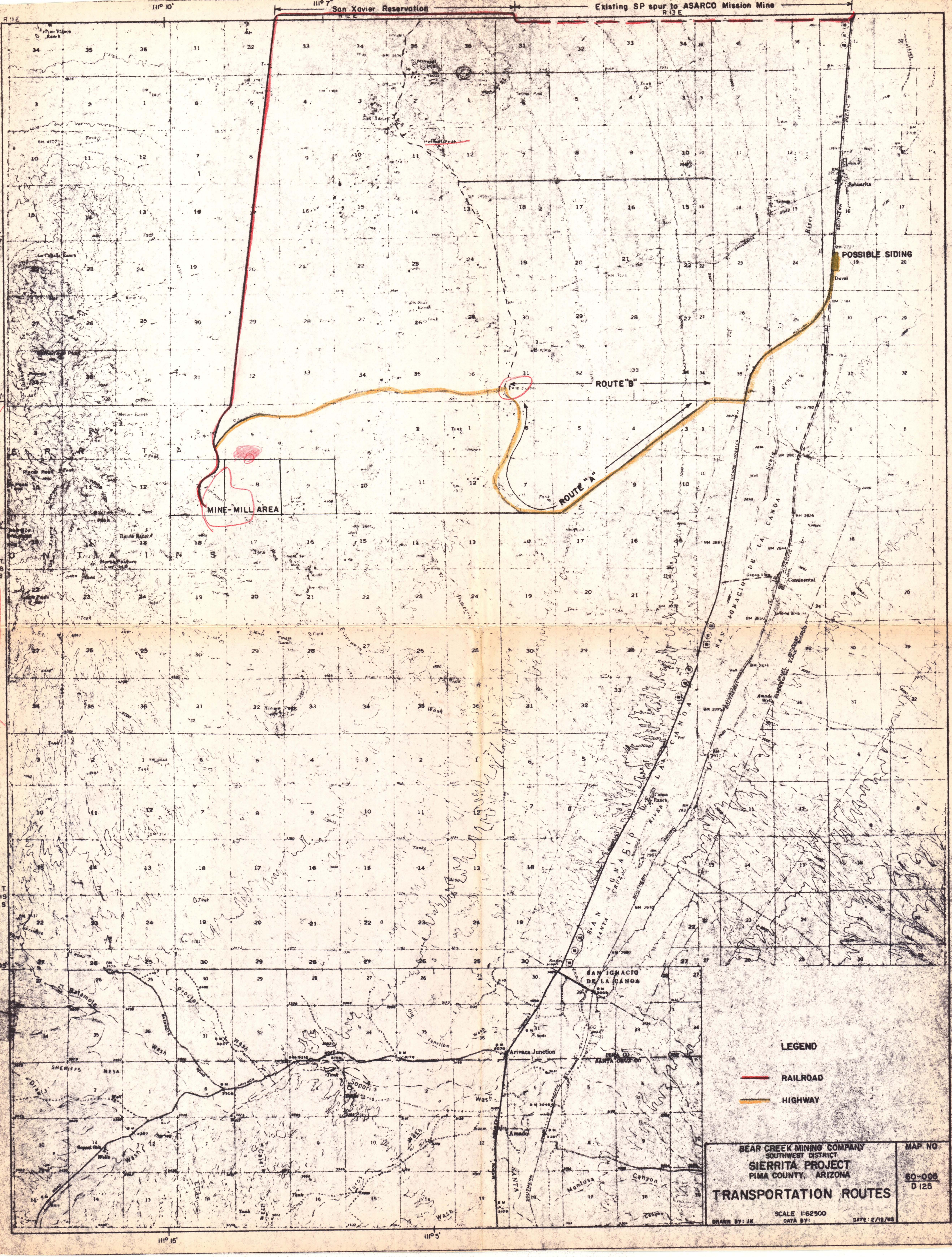
LEGEND

- DIABASE
- BIOTITE QUARTZ MONZONITE
- QUARTZ MONZONITE

BEAR CREEK MINING COMPANY—SOUTHWEST DISTRICT			
PROJECT-AREA: SIERRITA PROJECT			STATE: ARIZONA
TITLE: NORTH-SOUTH CROSS-SECTION			COUNTY: PIMA
			TOWNSHIP, RANGE: T.18S. R12 E.
GEOLOGIST-ENGINEER: J.L. CLARK J. JINKS		REVISIONS BY / DATE	MAP NUMBER: 60-005 / B 322
DATE: 7/1/63	DRAFTSMAN: T.L. MAYHALL		
100' 0' 100' 200' 300' SCALE 1" = 100'			PLATE

BEAR CREEK MINING COMPANY—SOUTHWEST DISTRICT

PROJECT-AREA: SIERRITA PROJECT	STATE: ARIZONA
	COUNTY: PIMA
TITLE: EAST-WEST CROSS-SECTION	TOWNSHIP, RANGE: T.18 S, R.12 E
GEOLOGIST-ENGINEER: J.L. CLARK, JIM JINKS — REVISIONS BY — DATE	MAP NUMBER: 60-005 B 323
DATE: 7/1/63 — DRAFTSMAN: JK	
100' 0 100' 200' 300' SCALE: 1" = 100'	PLATE



San Xavier Reservation
Existing SP spur to ASARCO Mission Mine
POSSIBLE SIDING
ROUTE "B"
ROUTE "A"
MINE-MILL AREA
Sahuarita
Continental
SAN IGNACIO DE LA CANOA
Arivaca Junction
LEGEND
RAILROAD
HIGHWAY
BEAR CREEK MINING COMPANY
SOUTHWEST DISTRICT
SIERRITA PROJECT
PIMA COUNTY, ARIZONA
TRANSPORTATION ROUTES
SCALE 1:62500
MAP NO
60-005
D 125


R.11E
R.12E
T 18 S
MC GEE ROAD
ALMO McGEE
EBARRO
RAINBOW
Demetrie
WILSON-BLUE BELL
WILSON-PENA BLANCA
McGEE ANGLIN
WILSON-PANA BLANCA EXTENSION
Esperanza
Wash
SIERRITA MINING & RANCHING CO.
WILSON-HOPE
DUVAL
MYERS
STATE PERMIT
1
3
4
5
6
7
8
9
10
12
13
16
17
18
APPROXIMATE OUTLINE SIERRITA OREBODY
APPROXIMATE OUTLINE LOFTON PEAK OREBODY
NOTE: CLAIM BOUNDARIES AND PIT OUTLINES GENERALIZED
BEAR CREEK MINING COMPANY
SOUTHWEST DISTRICT
SIERRITA AREA
PIMA COUNTY, ARIZONA
LAND STATUS
MAP NO.
60-005
A 408
PLATE
DRAWN BY: JK, BA
DATA BY: DL


PROPOSED MILL AND
SURFACE PLANT AREA
PROPOSED TAILING DISPOSAL AREA
APPROXIMATE PIT OUTLINE SIERRITA OREBODY
APPROXIMATE PIT OUTLINE LOFTON PEAK OREBODY
PROPOSED DUMP AND LEACH AREA
BEAR CREEK MINING COMPANY
SOUTHWEST DISTRICT
SIERRITA PROJECT
PIMA CO., ARIZONA
TOPOGRAPHIC BASE MAP
Scale: 1" = 500'
DRAWN BY:
DATA BY:
DATE: 3/6/63
MAP NO
60-005
A 77
94,000N
92,000N