

REPORT ON 672877

COWICHAN COPPER CO. LTD.
SUNRO MINE, JORDAN RIVER, B.C.

H.Hill & L.Starck & Assoc. Ltd. Oct.13/64

R E P O R T

on

COWICHAN COPPER CO. LTD.

SUNRO MINE

JORDAN RIVER, B. C.

by: H. Hill & L. Starck & Associates Ltd.

October 13, 1964.

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The following report consolidates and brings up to date our reports of July 11th and 19th, 1963, on the Cowichan Copper Sunro operation.

GENERAL

On December 6th, 1963, the north stope caved up to the Jordan River causing the mine to be flooded, and on that date mine operations ceased.

Rehabilitation work has been underway at the mine since December 1963.

Subsequent to our reports of July 1963, 127,847 tons of ore averaging 1.26% copper were milled. The mill feed grade was below the ore reserve average due to excessive caving in the north stope.

From July to December 6th, 1963, 67,000 tons of new ore was developed, grading 1.66% copper.

No estimate is included in this report of the capital expenditures necessary to complete the rehabilitation and bring the mine back into production at the rate of 35,000 tons per month, nor of the capital expenditures necessary during the two year period covered by the operating forecast included in this report.

Since our reports of July 1963, the New York export price of copper has increased from 28.3¢ to 33¢ per pound. This has increased the net smelter return value per pound of copper in the mill heads, after allowing for recovery, from 24.33¢ to 28.85¢, or an increase of 4.52¢ per pound.

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PART A

Operating profit forecast is based on the ore reserve estimates in the H. Hill & L. Starck & Associates Ltd. report of July 11, 1963, which forms Part B of this report. Operating costs used in this report are based on previous performance coupled with estimates for a future operation.

SUMMARY

Proven and indicated ore reserves at October 1964 are estimated at 1,638,000 tons grading 1.58% copper after allowing for 5% dilution.

During the two year period covered by this forecast tonnage milled, at the rate of 35,000 tons per month, would total 825,000 tons grading 1.80% copper.

Ore reserves after the two year period are estimated at 808,000 tons grading 1.36% copper providing no new ore is developed. Ore of this grade has a net smelter return value of \$7.85 per ton after allowing for the reduced Consolidated Mining & Smelting Company's royalty.

Operating profit during the two year period, after allowing for direct costs and the Consolidated Mining & Smelting Company's royalty, but before allowing for capital expenditures or interest on loans, would amount to \$3,991,300. Details are shown on Table I, which gives a forecast of operating profit for each month for the first six months, and for each quarter for the remaining one and one half years.

To maintain the costs used in the forecast will require maximum effort by all personnel. A close analysis should be made of the performance of all supervisors with a view to obtaining the greatest possible efficiency.

The operating costs are based on the assumption that adequate finances will be available so that management can make the planned, necessary capital improvements when required.

TONS MILLED

The increase in tons milled to 35,000 per month is based on improvements in the crushing plant to provide 1,500 tons per day of minus 5.0" ore to the rod mills.

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MILL HEADS

Estimated mill heads are based on the forecast for ore removal shown in Table 2 and Maps 1, 2 and 3.

Grades shown are based on the ore reserve report by H. Hill & L. Starck & Associates Ltd., dated July 11, 1963, after allowing for dilution by 5% of material assaying 0.1% copper.

NET SMELTER RETURN

The net smelter return per pound of copper in the mill heads was calculated as follows:

Assays: per metric ton (2204.6 lbs.) of concentrate

Copper - 24.12% (average of concentrates produced to June 21, 1963)
 Gold - 4.25 gms. per metric ton
 Silver - 42.5 gms. per metric ton

Quotations:

Copper - E. & H. J. export refinery quotation 33.0c per lb.
 Gold - U.S. Treasury net price quotation \$34.9125 per oz.
 Silver - Handy & Harman, N.Y. quotation for foreign fine silver \$1.2768 per oz. less discount 0.004 = \$1.2728 per oz.

Contents & Value:

<u>Contents</u>	<u>Contents Paid For</u>	<u>Price</u>	<u>Value</u>
Copper - 553.80 lbs.	531.75 lb.	32.0c	\$170.16 U.S.
Gold - 4.25 gms. or 0.137 oz.	.130 oz.	\$34.9125	4.54 U.S.
Silver - 42.5 gms. or 1.37 oz.	1.23 oz.	\$ 1.2728	1.56 U.S.
			<u>\$176.26 U.S.</u>
Freight and treatment			<u>18.25</u>
			<u>\$158.01 U.S.</u>
Canadian funds @ 7.75%			\$170.26
Hauling and loading			<u>2.05</u>
			<u>\$168.21 Can.</u>
Net smelter return per lb. copper in concentrate	=	<u>168.21</u>	= 30.37c
		553.80	
Net smelter return per lb. copper in mill heads using a mill recovery of 95%			= 95% of 30.37 = 28.85c

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OPERATING COSTS(a) Mining

During the first three months of the operation about 50% of the mill tonnage will come from "B" lower stops, the remainder from the "C" orebody.

Allowance has been made in the mining cost estimate for the increased cost of mining the "C" ore body and increased wages and supply costs.

(b) Development and Exploration

This item includes stopes preparation, development and diamond drilling to outline the ore bodies, and exploratory diamond drilling. For the River Zone, the cost of already completed development plus an estimate of that still required to complete development of the zone is \$0.60 per ton. This is the figure at which development has been written off over tonnage milled to date, resulting in the deferred development item in the April 30, 1963 balance sheet. In view of the fact that development of the narrower ore bodies, remaining after the River "B" ore body has been extracted, will cost more per ton, a figure of \$1.00 per ton has been used in Table I. Allowance has been made to maintain a workable broken ore reserve ahead of production.

(c) Milling

The reduction of this figure to \$1.28 per ton from the \$2.00 per ton which milling has cost to date, is based on the improvements in the crushing plant which will provide 1500 tons per day of minus 5/8" ore to the rod, and on other improvements in the mill, if found necessary, to maintain a monthly tonnage of 35,000.

ADMINISTRATION

During the fiscal year ending April 30, 1963, the cost of administration was \$0.72 per ton milled for an average of 19,000 tons per month. The figure of \$0.45 per ton, used in Table I, is this cost spread over 35,000 tons per month.

ROYALTY

The current royalty arrangement with Consolidated Mining & Smelting Company per ton of ore milled is based on the following formula:

$(.50 \times \text{grade} \times \text{export refinery price} \div 30)$ converted to Canadian funds.

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Royalty (Continued)

It ends with the milling of 900,000 tons of 1.8% ore. Remaining ore is subject to a royalty per ton calculated by the following formula:

$(.25 \times \text{grade} \times \text{export refinery price} \div 30)$ converted to Canadian funds.

The change occurs in the 6th quarter in Table 1.

CAPITAL EXPENDITURES

Capital expenditures on shaft installation, new crusher and installation, and miscellaneous expenditures during the two year period are estimated at \$250,000.

PART B

The following ore reserve estimate is based on a study of the company maps and records during the week of June 16th to June 22nd, 1963, and an examination of the underground workings by the writer, and was brought up to date by the results of development work to December 6th, 1963, when the mine operations ceased.

SUMMARY

Ore reserves as at October 1964 are summarized below:

	<u>Broken Ore</u>		<u>Proven Ore</u>		<u>Indicated Ore</u>		<u>Total</u>	
	<u>Tons</u>	<u>% Cu.</u>	<u>Tons</u>	<u>% Cu.</u>	<u>Tons</u>	<u>% Cu.</u>	<u>Tons</u>	<u>% Cu.</u>
River Zone	8,527	1.32	959,347	1.80	154,000	1.89	1,121,874	1.81
Cave Zone					340,900	1.23	340,900	1.23
Center Zone					38,300	1.37	38,300	1.37
New Zone					54,600	1.20	54,600	1.20
Total	8,527	1.32	959,347	1.80	587,800	1.41	1,555,674	1.65

No allowance for dilution has been made in these figures.

GEOLOGY

The geology of the Sunro Mine area is described in the 1950 Annual Report of the B. C. Minister of Mines, Pages 180 - 193.

Geology (Continued)

The ore bodies occur in shear zones in the Hetchosin volcanics near a sill-like intrusion of gabbro. The Hetchosin volcanics, which are of Tertiary (Eocene) age, are predominately basalt in the mine area. The basalt is a fine grained, dark greenish-grey rock consisting of plagioclase and dark green hornblende. Near the mineralized zones the plagioclase has been largely altered to hornblende.

The gabbro is a coarse grained, dark greenish-grey rock of Tertiary (Oligocene) age, with conspicuous plagioclase crystals. The ferro-magnesian mineral in the gabbro, near the mineralized zones, is principally hornblende with some augite.

About one and a half miles to the north of the mine workings the Leach River overthrust fault outcrops and separates the Tertiary rocks of the mine area from the overthrust, pre-Tertiary, metamorphic rocks to the north. The fault strikes east and dips 45° to 75° to the north. Northwest trending shear zones in the Hetchosin volcanics, including those in which the ore bodies are found, may be related to the Leach River fault.

The sulphides in the ore zones are, in order of abundance, chalcopyrite, pyrrhotite, pyrite, and small amounts of molybdenite. Very small amounts of pentlandite have been noted in the pyrrhotite. The ore sulphides form a pattern of gash-like veinlets and lenticular masses in the hornblendized rock of the shear zones. A small amount of chalcopyrite occurs as disseminated grains.

Twelve zones of mineralization have been recognized. The River, Cave, Center and New zones have received the most attention, and contain the ore reserves shown in this report.

The River zone, which is currently being developed and mined, is in basalt, and strikes N 20° W with an almost vertical dip. It is characterized by numerous, steeply dipping slips, which converge at the northwest end, and form an ore body up to 100 feet wide. To the southeast the slips diverge with ore lenses along the stronger slips, and persist for several hundred feet before the mineralization dies out. Four ore bodies are recognized in this zone:

- (1) The "B" ore body, which includes the wide northwest end of the zone and has been developed between elevations 4600 and 5550;
- (2) The "C" ore body, which diverges to the southeast of "B", and has been developed between elevations 5200 and 5950;

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Geology (Continued)

- (3) The Lower "C" ore body, which lies 100 feet east of the "B", between elevations 5000 and 5400;
- (4) The "A" ore body, which diverges to the southwest from the "B", and lies between elevations 5130 and 5350. Below elevation 5130 this ore body merges with the "B".

The River zone has been developed to date over a length of 800 feet and a depth of 1150 feet.

The Cave zone has been roughly outlined by the Cave edit and by limited diamond drilling. It lies 600 feet to the southwest of the River zone between elevations 5080 and 5550, strikes N 40° W, and dips vertically. It is in hornbländized basalt at the contact with a body of gabbro.

The Center zone has been indicated between elevations 5250 and 5625 by the Center edit, and two drill holes. It lies some 400 feet west of the River zone on the north side of the Jordan River, is in basalt, strikes N 15° W and dips steeply to the east.

The New zone has been indicated by seven drill holes over a length of 300 feet between elevations 5080 and 5550. It lies on the north side of the Jordan River, 100 feet northeast of the Center zone, and is in basalt. The strike indicated is N 30° W and the dip is steep to the northeast.

PROVEN AND INDICATED ORE RESERVES - Table 1General

The ore reserve calculations are based, for the most part, on diamond drill hole intersections. In the River zone there are flat holes drilled on approximately 50 foot spacing from levels about 100 feet apart. Where they exist, channel samples and up and down holes intersecting the ore body between levels have also been used in the calculations.

In the Cave, Center and New zones the indicated reserves are based on more widely spaced holes, and on channel samples taken in the Cave and Center edits.

Assays used and calculations are shown on Maps 1 to 20 inclusive:

Map 1 is an index plan showing the location of the ore blocks in plan. Maps 21, 22 and 23 are longitudinal sections showing the location of the ore blocks in elevation.

Proven and Indicated Ore Reserves (Continued)

River Zone

"B" South: The broken ore tonnage shown is for the part of the block already mined between the 5215 and 5300 levels. The grade for the broken ore is that calculated for the unmined portion of the block.

The proven ore in place for this block lies between the 5300 and the 5515 level. Calculations are shown on Maps 5, 6, 7 and 17, and are based on diamond drill holes on the 5515, 5405 and 5300 levels.

B South - South End: This is a narrow high grade body lying between elevations 5940 and 5330, marking the south end of the "B" ore body. Calculations are shown on Maps 5, 6 and 18.

B Service Pillar: This block contains the main service raise for the B and C workings, and lies between the B North and B South stopes, and between elevations 5561 and 5215. Calculations are shown on Maps 5, 6, 7, 8 and 17, and are based on drill holes on the 5515, 5405, 5300 and 5215 levels.

B Sill Pillar: This block lies between the 5215 screen level and the 5130 haulage level, and below the B North Stope and B Service Pillar blocks. Calculations are shown on Maps 9, 10 and 14, and are based on drill holes and channel samples on the 5130 and 5215 levels, and down holes just below the 5130 level.

B Ore Below 5130: This ore lies below the main haulage level, and will be serviced by the shaft now nearing completion. Calculations are shown on Maps 9 to 12 inclusive and 16, and are based on flat holes on the 5130, 5022, 4904 and 4800 levels.

C - Above 5215: This ore lies between the 5215 and 5940 levels and is on the comparatively narrow southeast split of the B ore body. Calculations are based on up holes above the 5770 level, on flat holes on the 5770, 5670, 5605, 5515, 5405, 5300 and 5215 levels, and on holes between the 5500 and 5605 levels, the 5405 and 5515 levels, and the 5300 and 5405 levels, and on channel samples on the 5670 level. Calculations are shown on Maps 2 to 7 inclusive, and Maps 15 and 16.

C Lower: This ore body lies to the east of the B ore body, and is an eastward dipping split of the B ore body between elevations 5000 and 5485. Calculations are based on down holes between the 5300 and 5405 levels, between the 5305 and 5130 levels and below the 5130 level, and on flat holes on the 5305 and 5130 levels. The southeast end of this ore body passes through the mill excavation. Calculations are shown on Maps 7 to 10 inclusive and on 13.

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Proven and Indicated Ore Reserves (Continued)

A Ore Body: This is a southwest split from the B ore body, diverging from it above the 5022 level, and carries through to the 5350 level. A zone of low grade material and three high grade stringers occupy the position of the A ore body on the 5405 and 5515 levels respectively. Calculations are shown on Maps 7, 8, 9 and 18.

Cross Fault: This ore body shows in drill holes on the 5130 level. There is some indication from drilling below this level that it exists there also and occupies a shear zone almost at right angles to the B ore body. Calculations are shown on Maps 9 and 19.

Cave, Center and New Zones: These ore zones lie to the southwest of the River zone, and are indicated by limited drilling from the surface and the 5130 adit, and by channel samples in the Cave and Center adits. Calculations are shown on Maps 19 and 20.

H. HILL & L. STARCK & ASSOCIATES LTD.


Henry L. Hill

HLH/mjr



COWIGHAN COPPER CO. LTD. (N.P.L.)

BLOCK	BROKEN ORE			PROVEN ORE			BROKEN & PROVEN			INDICATED ORE			TOTAL		
	Tons	% Cu	TX %	Tons	% Cu	TX %	Tons	% Cu	TX %	Tons	% Cu	TX %	Tons	% Cu	TX % Cu
B North															
B South	4,200	1.02	4284	41,000	1.26	51,660	45,200	1.24	55,944				45,200	1.24	55,944
B South End	1,528	2.69	4110	15,360	2.47	37,939	16,888	2.48	42,049				16,888	2.48	42,049
B Service Pillar				108,800	1.62	176,256	108,800	1.62	176,256				108,800	1.62	176,256
B Sill Pillar				37,300	2.24	83,552	37,300	2.24	83,552				37,300	2.24	83,552
B Lower				303,500	2.12	643,420	303,500	2.12	643,420	35,100	2.00	70,200	338,600	2.11	713,620
A				105,700	1.31	138,467	105,700	1.31	138,467				105,700	1.31	138,467
C Upper	2,799	1.03	2883	291,087	1.68	489,026	293,886	1.68	491,909				293,886	1.68	491,909
C Lower				56,600	1.85	104,710	56,600	1.85	104,710				56,600	1.85	104,710
Cross										56,500	2.08	117,520	56,500	2.08	117,520
C South										62,400	1.66	103,584	62,400	1.66	103,584
Total River	8,527	1.32	11277	959,347	1.80	1,725,030	967,874	1.79	1,736,307	154,000	1.89	298,304	1121,874	1.81	2027,611
Cave										340,900	1.23	419,307	340,900	1.23	419,307
Centre										38,300	1.37	52,471	38,300	1.37	52,471
New										54,600	1.20	65,520	54,600	1.20	65,520
Total			11277			1,725,030			1,736,307			828,602			2,564,909
Total	8,527	1.32		959,347	1.80		967,874	1.79		587,800	1.41		1,555,674	1.65	

NOTES: 1. The above ore reserves estimate is based on our detail estimate of ore reserves at July 1, 1963 with deductions made for tonnage milled from July until December, 1963 and additions made by new ore developed.

2. No allowance made for dilution.

H. HILL & L. STARCK & ASSOCIATES LTD.

OCTOBER 7, 1964

GOWICHAN COPPER CO. LTD. (N.F.L.)

OPERATING FORECAST FOR THE TWO YEAR PERIOD FROM RE-COMMENCEMENT OF PRODUCTION

PERIOD	1st Month		2nd Month		3rd Month		4th Month		5th Month		6th Month		3rd Quarter	4th Quarter	5th Quarter	6th Quarter	7th Quarter	8th Quarter	Total					
	Per Ton	Per Month	Per Ton	Per Month	Per Ton	Per Month	Per Ton	Per Month	Per Ton	Per Month	Per Ton	Per Month								Per Ton	Per Period	Per Ton	Per Period	Per Ton
TONS MILLED	25,000		30,000		35,000		35,000		35,000		35,000		105,000	105,000	105,000	105,000	105,000	105,000	105,000	825,000				
MILL HEADS - Percent Copper	1.86		1.92		1.91		1.80		1.95		1.91		1.88	1.70	1.76	1.81	1.79	1.66	1.80					
NET SMELTER RETURN	\$10.73	\$268,250	\$11.08	\$332,400	\$11.02	\$385,700	\$10.39	\$363,650	\$11.25	\$393,750	\$11.02	\$385,700	\$10.85	\$1,139,250	\$9.81	\$1,030,050	\$10.16	\$1,066,800	\$10.44	\$1,096,200	\$10.33	\$1,084,650	\$9.58	\$1,005,900
OPERATING COSTS																								
Mining	\$0.85		\$0.85		\$0.90		\$1.00		\$1.20		\$1.30		\$1.45		1.45		1.45		1.45		1.45		1.45	
Development & Exploration	0.85		1.00		1.00		1.00		1.00		1.00		1.03		1.03		1.03		1.03		1.03		1.03	
Milling	1.55		1.40		1.25		1.25		1.25		1.25		1.28		1.28		1.28		1.28		1.28		1.28	
Administration	0.63		0.52		0.45		0.45		0.45		0.45		0.45		0.45		0.45		0.45		0.45		0.45	
Total	3.88		3.77		3.60		3.70		3.90		4.00		4.21		4.21		4.21		4.21		4.21		4.21	
OPERATING PROFIT	6.85		7.31		7.42		6.69		7.35		7.02		6.64		5.60		6.23		6.12		5.37		5.37	
ROYALTY	1.98		2.05		2.04		1.92		2.08		2.04		2.01		1.81		0.64		0.53		0.49		0.49	
OPERATING PROFIT LESS ROYALTY	4.87	121,750	5.26	177,800	5.38	188,200	4.77	166,950	5.27	184,450	4.98	174,300	4.63	486,150	3.79	397,950	4.07	427,350	5.59	586,950	5.59	586,950	4.88	512,400
CUMULATIVE OPERATING PROFIT LESS ROYALTY		121,750		279,550		467,850		634,800		819,250		993,550		1,479,700		1,877,650		2,305,000		2,891,950		3,478,900		3,991,300

NOTE: The above forecast is based on the following:

- Suitable improvement in the crushing plant to guarantee 1,500 tons per day of minus 5/8" ore to the Rod Mills to maintain minimum of 35,000 tons/month.
- Close supervision of all operations.