Ed N Iron Colonial Mines

Cab 1(4)

ORE RESERVE POSSIBILITIES AT THE IRON HILL MINE AND SURROUNDING AREAS VANCOUVER ISLAND, B.C.

October 1962. A.P. Fawley, Ph.D., P.Eng.

Iron Hill

Notes re reports by Colonial Mines Ltd. (N.P.L.)

Geological: The reports ignore the account in Annual Report 1952, Bacon, which is more comprehensive than what the reports offer. The presumption that more ore may exist in irregularities in the structure probably is valid. There is no indication in the 1952-1957 Annual Report accounts that the ore zone ever was bottomed.

In attempting to assess the possibilities of other magnetite occurrences nearby, the assumption is made that such occurrences are directly allied to the presence of the granodiorite contact and that a continuous contact over a distance is something of a guarantee that other magnetite bodies shall be found. This concept is very definitely open to question; the relationship probably is no more direct than to hypothermal veins in general.

Mining: 1956 Annual Report, page 119: "The economic limits of stripping had been reached, and the mine was worked as a salvage operation."

This would explain why ore deeper in the structure was not mined. It is questionable, considering the sharp increase in all costs since 1957 and the added cost of moving waste dumps from the present pit (Fawley, p. 9, 4th paragraph), that stripping could now be carried beyond the old limits. It is possible that the deeper magnetite is permanently unavailable.

Tailings must be ground to -100 mesh to make shipping-grade concentrate. No estimate of this cost is given. I think it would be appreciable.

Waste dumps would need to be sorted to provide material comparable in grade to the present tailings dumps. No estimate of this cost is provided.

Remarks: There is no cost data to indicate that the operation as outlined would pay its way. Unless it could do so, it could not form a continuing source of concentrates. That would be what the Mitsui Co. wants to know. It would hardly be possible, therefore, for the Department to enthuse on the potential benefits to Campbell River without implying that in the Department's opinion the operation would be a paying one. The reports submitted do not support such a conclusion.

92F075

REGENT 8-7301

ALLAN P. FAWLEY, PH.D.,P.ENG.

CONSULTING MINING ENGINEER AND GEOLOGIST

1947 WEST KING EDWARD AVENUE

VANCOUVER 9, BRITISH COLUMBIA

REPORT ON

ORE RESERVE POSSIBILITIES

AT THE

IRON HILL MINE AND SURROUNDING AREA

VANCOUVER ISLAND, BRITISH COLUMBIA

Prepared for

COLONIAL MINES LIMITED (N.P.L.)

Vancouver, British Columbia

by

ALLAN P. FAWLEY

Vancouver, British Columbia

Field Visits - February, May, August and September 1962

Report Written - September and October 1962

INDEX

IRON HILL MINE

VANCOUVER ISLAND, BRITISH COLUMBIA

(Looking South)

ADDENDUM

The following is a correction of the last paragraph on Page 4.

Calculations by Kie Mines Ltd., based on sections drawn by D. Sangster of the University of British Columbia, show there are 1,350,000 cubic yards of "ore type materials" and 907,000 cubic yards of "barren material" within the syncline bounded by granodiorite. The boundaries of the granodiorite are not definitely known, also from observations at the mine, there are pockets of magnetite in some sections of the "barren material" and there are sections of waste in the "ore type material"; however for ore reserve calculations the above figures by Kie Mines are accepted.

REGENT 8-3144

1718 WEST 5TH AVENUE

COLONIAL MINES LIMITED (N.P.L.)

ADDRESS ALL REPLIES TO
P.O. BOX 4183, STATION D,
VANCOUVER 9, B.C.

October 17, 1962

Mr. J. G. Matthews,
Canadian Pacific Railway Co.,
Land Department,
Calgary, Alberta.

Dear Mr. Matthews:

Enclosed please find Addendum, which we would ask you to kindly insert in the report dated October 1962 "Ore Reserve Possibilities at the Iron Hill Mine and Surrounding Area, Vancouver Island, B.C." by A. P. Fawley. We regret this omission and hope it has not caused any inconvenience.

Yours very truly,

COLONIAL MINES LIMITED (N.P.L.)

B. McMurray.

/bm
Encl.

ORE RESERVE POSSIBILITIES

AT THE

IRON HILL MINE AND SURROUNDING AREAS

VANCOUVER ISLAND

INTRODUCTION

My preliminary report on the Iron Hill Mine was encouraging and justified further investigation. Since then the mine has been examined several times, a model of the mine has been made, the tailings dumps have been partially sampled, and several mill concentration tests have been conducted on different types of ore and of the tailings.

Sufficient work has not been completed to determine accurate ore reserve figures but, in general, the work done has been favourable and the estimated ore reserves have been increased. Also there is a good possibility of being able to produce a further large tonnage of ore from properties in the vicinity of the Iron Hill Mine.

The following report is based on examinations of the mine on February 10th, May 10th, August 20th, and September 22nd, 1962; on the results obtained when the mine was operating during 1951 to 1957; and on a study of the available geological, drilling and ore concentrations tests.

LOCATION

The Iron Hill Mine is near Upper Quinsam Lake, about 17 air miles south-west of the town of Campbell River. Legally it is in Block 100, Comox District, Vancouver Island. It is connected by a 23 mile

Location - (Continued)

road, paved in part, to the former loading dock near Campbell River. The road has a slight to moderate gradient and is in good condition except near the mine.

TOPOGRAPHY, TIMBER AND WATER

The mine is at the north end of a ridge in mountainous country. Due to quarrying the mine area is now a series of benches at 30 ft. intervals. Mining has been carried out throughout an elevation of 1,400 to 1,890 ft. above sea level. The mine area is almost bare of timber due to logging operations and a fire. Ample water is available from Mine Creek which runs beside the property.

HISTORY

Several adits were driven into the hill in, or prior to, 1914. Coast Iron Company opened two quarries from which 4,886 tons of iron ore were shipped during the period December 1948 to March 1949, then the Argonaut Mine Division of Utah Company of the Americas took over the property and shipped 1,964,247 tons of concentrates during the period 1951 to 1957. The property has been idle since October 1957.

GEOLOGY

The deposit is a typical contact metamorphic type in which limestone and volcanic rocks have been replaced by magnetite and garnet. The deposit is probably synclinal (U-shaped) with a maximum depth of about 600 feet. According to an old report, the deposit is within "an elliptical area whose major axis is about 1500 feet bearing west-northwest and whose minor axis is about 700 feet. This elliptical area contains 18 acres. The north end of the ellipse is bounded by the

Geology - (Continued)

granodiorite intrusive and considerable drift. The south end is bounded by volcanics of the Vancouver group. Inside the ellipse and near the summit of the hill, two large islands of limestone are exposed completely surrounded by an erratic mixture of magnetite and garnetite." However, it must be emphasized that possibilities exist for iron ore anywhere near the rim of the granodiorite intrusive (see attached map) and even at the Iron Hill Mine the ore zone has not been definitely limited as some of the drill holes were stopped in volcanic rocks before reaching the granodiorites intrusive, and other drill holes may have stopped in dyke rocks which are similar to the granodiorite.

ORE RESERVES AT IRON HILL MINE

Two ore reserve estimates have recently been made for the Iron Hill Mine; (1) by a Japanese Company, and (2) by a Canadian Company. The Japanese Company estimates 1,200,000 tons of concentrate are obtainable from mining and milling 5 million tons of ore; 300,000 tons of concentrates from remilling old tailings; and 20,000 from reworking old concentrates, - totaling 1,520,000 metric tons of concentrates averaging 58 percent iron. The Canadian Company estimates a recovery of 1,010,000 tons of concentrates from mining and treating 4,050,000 tons of ore, and 125,000 tons of concentrates from treating old tailings, - totaling 1,135,000 short tons of concentrate containing 60 percent iron.

Concentrate obtainable by open-pit mining at Iron Hill

Ore reserves at Iron Hill Mine are extremely difficult to

Concentrate obtainable by open-pit mining at Iron Hill (continued)

estimate as although considerable diamond drilling has been done, no records showing the amount of magnetic iron (magnetite) in the drill cores are available to the writer and this is the only type of iron recoverable by the milling process that will be used at Iron Hill. To illustrate the difficulty, after crushing and separating the ore into a magnetic and non-magnetic portion, the non-magnetic portion was found to contain 14 to 17 percent of iron which is not recoverable (see September 17, 1962 report by Coast Eldridge in appendix).

Also as the magnetite and magnetite-skarn ore bodies are extremely irregular in outline, they require detailed drilling to accurately determine their size and grade. Considering the cost of drilling, it is problematical whether the cost of detailed drilling to accurately determine the reserves is warranted, but a few well-located drill holes, and determination of their magnetite content, would greatly aid in estimating the reserves.

My own ore reserve estimate and method of obtaining the result is as follows:

Calculations by Kie Mines Ltd., based on sections drawn by D. Sangster of the University of British Columbia, show there are 1,350,000 cubic yards of "ore type materials" within the syncline bounded by granodiorite. The boundaries of the granodiorite are not definitely known, also from observations at the mine, there are pockets of magnetite in some sections of the "barren material" and there are sections of waste in the "ore type material"; however for ore reserve

Concentrate obtainable by open-pit mining at Iron Hill (continued)

calculations the above figures by Kie Mines are accepted.

The specific gravity of magnetite is 5.7; of garnet (the predominant skarn mineral) 3.75; and of limestone and volcanic rocks 2.7; hence there are 7 cubic feet of magnetite, 9½ cubic feet of garnet, or 13½ cubic feet of limestone or volcanic rock per long ton.

Assuming 10 cubic feet of "ore type material" to a long ton, and 13½ cubic feet of "barren material" to a long ton, then the known tonnage to be mined or stripped at Iron Hill is:

3,640,000 long tons of "ore type material"

and

1,810,000 long tons of "barren material"

(It may not be necessary to mine or strip all of the "barren material").

As previously mentioned, it is difficult to estimate the tonnage of concentrates that can be produced from the 3,600,000 long tons of "ore type material" due partly to insufficient drilling, but mainly due to lack of records showing the amount of magnetite present in the drill core. Hence the tonnage estimates must be based on:

1. Visual and magnetometer observations at Iron Hill.
2. Geological plans and sections of the mine.
3. Milling records from the 1951-1957 period of operation.

From visual observations, a large tonnage of good grade ore can be seen on the south-western side of the quarry pond (especially below the 1550 foot level) and there are sections of good ore (and high magnetometer readings) in the south-western benches.

Concentrate obtainable by open-pit mining at Iron Hill (continued)

From the geological sections (with the geology kept up to date until 1953) it is noted that there is generally an irregular layer, or bodies, of ore surrounding the limestone mass, and a considerable portion of this favorable layer at the base of the limestone remains to be mined.

Mill records show:

1. For the period December 1, 1953 to June 1, 1954, the average grade was 34.1 percent iron, and every 10 tons treated yielded 3.1 tons of concentrate averaging 56.2 percent iron (the tailings averaged 22.5 percent iron before retreatment).
2. For the period December 1, 1954 to June 1, 1955, the average grade was 42.6 percent iron, and every 10 tons treated yielded 6.2 tons of concentrate averaging 58.0 percent iron (the tailings averaged 18.7 percent iron before retreatment).
3. For the entire period 1951 to the end of operations in 1957, 1,887,985 tons of concentrates averaging 56 percent iron were produced from milling 3,619,349 tons of ore (i.e. every 10 tons yielded 5.2 tons concentrates). A further 77,762 tons of concentrates were obtained by retreating tailings.
4. In 1956, 437,572 tons of tailings that averaged 16.8 percent iron were retreated after grinding to minus 1/2 inch and yielded 72,862 tons of concentrate (i.e. every 10 tons yielded 1.67 tons of concentrates).

every 10 tons mined (ore + waste) yielded 2 tons conc.

Part of the 3,600,000 long tons of "ore type material" will be of too low a grade to be worth milling, but part will be almost pure magnetite, and in balance the overall recovery should be at least as good ?

Concentrate obtainable by open-pit mining at Iron Hill (continued)

(especially as finer grinding will be used when the mine is re-opened) as during the period December 1, 1953 to June 1, 1954 when recovery was only 3.1 tons of concentrates per 10 tons milled (vs. an overall average of 5.2 tons concentrates per 10 tons milled, and 6.2 tons per 10 tons during December 1, 1954 to June 1, 1955).

The estimated yield of concentrates from mining at the above recovery rate is 1,100,000 long tons of concentrates averaging 56 percent iron, which is equivalent to 1,000,000 long tons averaging 61.5 percent iron.

Concentrates obtainable by retreating old mill tailings

Argonaut Mine obtained 1,887,986 tons of concentrates from milling ore from the open pit, then retreated 437,592 tons of tails; hence about 1,200,000 tons of tailings that were not retreated should remain. These tailings are in two stacks (see enclosed photo) - a western stack of about 800,000 tons, and an eastern stack of about 400,000 tons.

The western stack was sampled by Mr. W. Ollinger who obtained heads of 22.31 percent soluble iron, and by the writer who obtained heads of 20.8 percent soluble iron (21.9 percent total iron). Concentration tests were also made on the samples and the results are tabulated in Table I.

TABLE I

	SAMPLES BY		
	A. P. Fawley	W. Ollinger	W. Ollinger
Concentration tests by	Coast Eldridge	J.W. Britton	J.W. Britton
Ground to	-10 mesh	-10 mesh	-100 mesh
Head Sample - total iron	21.9%	--	--
Head Sample - soluble iron	20.8%	22.31%	22.31%
Concentrate (magnetic)	* 30.09%	23.6%	15.8%
Ratio of concentration	3.3/1	4.2/1	6.3/1
Concentrate assays - total iron	36.85%	--	--
" " - soluble iron	37.45%	47.01%	64.76%
Tails (non magnetic) assays: -total iron	15.21%	--	--
-soluble iron	13.93%	--	--

* The "concentrate" reported by Coast Eldridge - Fawley, is the magnetic material recoverable after grinding to -10 mesh.

The results indicate that, after grinding to minus 10 mesh, more than two-thirds of the material can be discarded and the remainder must be ground to minus 100 mesh; then every 6.3 tons of the original tailings will yield 1 ton of concentrates averaging 64.76 percent iron. (Tests should be made to determine if the non-magnetic material can be discarded after crushing to minus 1 inch, minus 1/2 inch, or minus 1/4 inch).

Concentrate obtainable by retreating old mill tailings (continued)

On the above basis, the 660,000 tons of tailings in the western stack will yield 127,000 tons of concentrates averaging 64.8 percent iron.

The eastern stack has not been sampled, it appears to be of lower grade than the western stack, but may be worth retreating. Part of the eastern side of this stack appears to have been removed by Argonaut for retreatment.

Concentrates obtainable by treatment of waste from former stripping operations

During former operations 2,660,000 cubic yards of rock were stripped and discarded as waste without milling. This yardage is equal to at least 5,300,000 long tons and is comprised of a variety of rocks varying from barren limestone and volcanics, to magnetite-skarn-volcanic-mixtures, and to blocks of pure magnetite. Some sections of these waste dumps are barren, others are of as high a grade as the old mill tailing dumps.

Much of the old waste dumps will have to be moved to enable mining of underlying ore bodies, and the parts of the dumps that contain magnetite should be passed over a magnetic separator to extract the magnetite and magnetite-skarn rocks.

A grab sample (by R. Campbell and W. Ollinger) of lumps of skarn from the upper levels of the open pit assayed 31.89 percent soluble iron, and a sample of fines dug from the same locality (by A. P. Fawley) assayed 24.78 percent soluble iron (25.82 percent total iron). The results of concentrating these samples at minus 10 mesh are given in Table II.

TABLE II

Sample of minus 1/2 inch material (skarn, magnetite, limestone and greenstone) from dump formed by stripping (never milled) near top of Iron Hill.

	SAMPLES BY		
	A. P. Fawley	R. Campbell & W. Ollinger	W. Ollinger
Concentration tests by	Coast Eldridge	J.W. Britton *	J.W. Britton **
Ground to	-10 mesh	-10 mesh	-10 mesh
Head Sample - total iron	25.82%	--	--
Head Sample - soluble iron	24.78%	31.89%	--
Concentrate (magnetic fraction)	24.68%	39.4%	22.9%
Ratio of concentration	4/1	2.5/1	4.4/1
Concentrate assays - total iron	47.23%	--	--
- soluble iron	47.13%	51.90%	--
Tails (non magnetic fraction) assays - total iron	18.77%	--	--
- soluble iron	17.39%	--	--

* Concentration magnetically in a Davis tube tester.

** Concentration in a Sala wet magnetic separator.

The results indicate that of the sample collected by A. P. Fawley (Table II) about three-quarters of the material can be discarded after grinding to minus 10 mesh and passing over a magnetic separator, the remainder should be ground to minus 100 mesh. If the remainder is

ground to minus 100 mesh, then each 5.6 tons of original material treated should yield 1 ton of concentrates assaying at least 60 percent iron.

Assuming that one-third of the 5,300,000 ton waste dump is similar to the sample collected by Fawley (Table II) then that 1,770,000 tons should yield 300,000 long tons of concentrates containing 60 percent or more iron.

Further ore reserve possibilities at Iron Hill

The Iron Hill Mine is shown by D. Sangster as being a basin-shaped assemblage of magnetite-limestone-volcanic-skarn rocks enclosed in granodiorite. This description is probably basically true, but sufficient diamond drilling has not been completed to definitely determine all the ore boundaries and there are possibilities of finding more ore at depth along the boundaries of the deposit.

ORE RESERVES IN NEARBY PROPERTIES

The Iron Hill Mine is at the southern end of a granodiorite intrusion, and possibilities for other iron ore deposits exist along the entire margin of this intrusion which is about 5 x 7 miles in size. The enclosed map shows the location of mineral claims in the area, most of which are located on iron prospects. One of these claim groups, the Iron River property, 6 miles north-east of the Iron Hill Mine, is available for purchase and is reported to contain sufficient reserves to produce 900,000 tons of concentrates

Ore Reserves in Nearby Properties - (Continued)

averaging 64 percent iron, as well as about $2.00 worth of copper concentrates per ton milled.

ANALYSES OF ORE

An average analysis of numerous specimens of drill core containing more than 50 percent iron is as follows:

	%
Fe	60.14
S	0.08
P	0.0064
SiO_2 & Al_2O_3	9.35

The analysis of a dry concentrate of ore prepared by J. W. Britton and analyzed by Coast Eldridge is as follows:

	%
Fe	67.07
SiO_2	3.41
Al_2O_3	0.55
Mn	0.13
Cu	0.011
P	0.010
S	0.03

SUMMARY AND CONCLUSION

The ore reserves at the Iron Hill Mine cannot be accurately stated at present due to the very irregular shapes of the ore bodies, to the wide intervals between the drill holes, and, mainly, because records showing the content of magnetite (which is the only iron mineral to be recovered) in the drill core are not available. However, an estimate of the ore reserves, based on: (1) geological cross-sections; (2) observations at the mine; and (3) on past mining and milling records is as follows:

Summary and Conclusion - (Continued)

1.	Concentrates obtainable from open pit mining	1,000,000 long tons assaying 60 - 65 percent iron
2.	Concentrates obtainable from retreating the western stack of old mill tailings (Also 50,000 tons of concentrates may be obtainable from the eastern stack of old tailings)	125,000 long tons assaying 60 - 65 percent iron
3.	Concentrates obtainable from treating magnetite-skarn sections of the old waste dumps	300,000 long tons assaying 60 - 65 percent iron
	TOTAL	1,425,000 long tons assaying 60 - 65 percent iron

Possibilities exist of finding further extensions to the ore at Iron Hill; there are other known occurrences of iron ore in the vicinity of the Iron Hill Mine that are available for purchase (the largest known deposit, that of Iron River is reported to have sufficient reserves to yield 900,000 tons of concentrates averaging 64 percent iron); and there are possibilities of discovering further iron deposits around the rim of the granodiorite intrusion which adjoins the Iron Hill Mine (see enclosed map).

Respectfully submitted

Allan P. Fawley,
B.A.Sc., M.Sc., Ph.D., P.Eng.
Consulting Mining Engineer
and Geologist.

Vancouver, B.C.
October 10, 1962.

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE., VANCOUVER 10, B.C. TELEPHONE: TRINITY 8-4111
CABLE ADDRESS: "ELDRICO"

REPORT OF: Iron Ore

AT Vancouver Laboratory

ORDER No.

PROJECT:

DATE September 19, 1962

REPORTED TO:

FILE 2772

Dr. A. P. Fawley
1947 West King Edward
Vancouver, 9, B. C.

We have made magnetic concentration tests on the samples of iron ore submitted by you. The material was sized to - 10 mesh for the test. Our results are as follows:

Marks	Magnetics %	Non Magnetics %
576 (TAILINGS)	30.09	69.91
577 (WASTE DUMP)	24.68	75.32

The above products were ground to - 100 mesh and analysed for total and acid soluble iron.

	Hcl Acid Soluble Iron (Fe)	Total Iron (Fe)
576 Magnetics	36.85	37.45
576 Non Magnetics	13.93	15.21
577 Magnetics	47.13	47.23
577 Non Magnetics	17.39	18.77

COAST ELDRIDGE

H. Sharples

H. Sharples
PROVINCIAL ASSAYER

*ps

N

Becher Lake

Dam

Reginald L.

Beavertail Creek

Campbell Lake

Beavertail Lake

QUINSAM

Echo L.

Mirror L.

Bacon Lake

Forestry Lookout △

Miller Cr.

Snakehead Lake

Lukwa Lake

Granodiorite

Gooseneck Lake.

Quinsam River

Nickie Cr.

Campbell Lake

Granodiorite

Volcanics

River

Middle Quinsam Lake

IRON RIVER PROPERTY

Iron River

Quinsam

Wokas Lake

River

Gentian Lake

Upper Quinsam Lake

Creek

Moh Cr.

IRON HILL MINE

Iron

Chute

Mine Cr.

Creek

Hawkins Creek

Sihun Cr.

CAMPBELL RIVER

Roads,

Trails,

Map showing location of

IRON HILL MINE

Vancouver Island, B.C.

and

MINERAL CLAIMS IN THE AREA

Scale: 1 inch = 1 mile.

Mineral Claims from B.C. Department of Mines, January, 1961.

Roads from maps by Army Service Establishment, 1957 & 1958.

Approximate contact between granodiorite and volcanic rocks from Map by the Geological Survey of Canada.

To accompany report by

Allan P. Fawley, P.Eng.

Consulting Mining Engineer & Geologist.

Drawn by, L.M.E.

9-62.