W.A. No. ....

NAME ....

SUBJECT Geological Data.

82FSW110 COXEY
(RED MOUNTAIN)

PROPERTY FILE
003170

07

M28-1506

THE INTERNATIONAL NICKEL COMPANY OF CANADA LIMITED

J. ROY GORDON, RESEARCH LABORATORY

(BC - ...)

MEMORANDUM

PROPERTY FILE Red Mtn 82FSW110(4W)

TO G.H. Merriam

FROM R.A. Alcock DATE August 1, 1975

SUBJECT BRITISH COLUMBIA: U_3O_8-ThO_2 Level in Red Mountain Mine Molybdenum Ore

In response to your query to J.V. Guy-Bray re uranium content at Red Mountain Mine, seven samples collected by him during his visit to the mine in 1973, were pulled and analyzed. The results are tabulated below.

Sample No.	Location	%Mo	%U_3O_8	%ThO_2
S73-740	Upper A horizon	<0.0001	0.0015	Na
S73-741	Upper A horizon	0.014	0.0009	Na
S73-742	Upper B horizon	1.69	0.021	<0.005
S73-743	Upper E horizon	3.20	0.0013	Na
S73-744	Upper F horizon	0.25	0.0024	Na
S73-746	not specified	1.45	0.0048	<.005
S73-748	not specified	0.36	0.009	.030

Na = not analyzed

The U_3O_8 levels are surprisingly high for this type of a deposit. There is no correlation between U_3O_8 and Mo (correlation coefficient = 0.19 which is not significant at even the 90% confidence level), however, it still would be interesting to see what their concentrate runs.

XC: J.V. Guy-Bray
J.S. Dowsett
H. O. Harju

IAEA
FB
CEC
JD
JSD
JG
JVG-B
HOH
RCH
WAL
KEM
TP
COP
JHPS
JAS
GWT
HEV
Return to: [illegible]

P.O. Box 112
Golden, Colorado 80401

June 18, 1973 Project B30309

Mr. Frank Coolbaugh
President
Mine Finders, Inc.
8700 West 14th Avenue
Lakewood, Colorado 80215

Dear Mr. Coolbaugh:

BC Agmt - Mine Finders

This is a report on "Examination of Red Mountain Mines, Ltd. Tailings for Tungsten Recovery."

The project was verbally authorized by Mr. I. S. Zajac on March 7, 1973.

The project was to investigate the recovery of tungsten from tailings material and was carried out in phases. The initial work consisted of chemical analysis, screen assay tests, and mineralogical examinations. This was subsequently followed by gravity, magnetic, and flotation tests to determine concentration characteristics.

SUMMARY

The average tailings material supplied by the Sponsor and identified as tailings from Red Mountain Mines, Ltd. had the following characteristics.

Grade:	0.105% WO_3		
Distribution:	-10+100M	-100+400M	-400M
Weight %:	10 to 40	30 to 50	30 to 35
WO_3 %:	~5	~50	~45

Liberation of WO_3: Estimated 95%
Tungsten Mineral: Scheelite containing an estimated 0.07 to 1.2% Mo

Beneficiation tests on the tailings gave the following characteristics:

About 60 to 70% of the WO_3 was recovered by gravity, magnetic separation, and flotation in concentrates having grades of about 2 to 7% WO_3. Additional upgrading by cleaner tabling and/or flotation of scheelite from these concentrates was not attempted due to very small amounts of samples available.

whereas the second composite sample was separated at selected sizes. The results are presented in summary form in the following table with selected size fractions combined.

Screen Assay Data

CSMRI Sample No.	-10+100M Wt %	-10+100M WO_3 %	-10+100M % Dist WO_3	-100+400M Wt %	-100+400M WO_3 %	-100+400M % Dist WO_3	-400M Wt %	-400M WO_3 %	-400M % Dist WO_3
1	12.1	0.03	2.3	56.0	0.23	78.2	31.9	0.10	19.5
2	17.5	0.04	11.4	56.6	0.06	50.8	25.9	0.09	37.8
3	5.3	0.03	3.8	46.8	0.05	52.9	47.9	0.04	43.3
4	15.1	0.03	4.7	52.9	0.08	39.8	32.0	0.18	55.5
5	7.9	0.03	2.7	53.6	0.04	25.5	38.5	0.17	71.8
Aver	11.6	0.03	5.0	53.2	0.09	49.4	35.2	0.12	45.6
8(1)	40.6	0.012	4.9	29.5	0.16	45.4	29.9	0.17	49.7

(1) Actual sizes for this sample: -10+150M, -150+400M, -400M.

Most of the tungsten was in the -100 mesh or -150 mesh material. There was, however, a wide variation as to the amount of tungsten in the -400 mesh material. It is this fine tungsten which was expected to be the most difficult to recover, especially by gravity separation.

Two beneficiation tests provided some indications as to recovery of tungsten from the -400 mesh material. Gravity Separation Test 1, Exhibit 3, produced a slime product on which a screen analysis was not made. In Concentration Test 3, Exhibit 4, the final WO_3 concentrate was screened at 400 mesh. The following distributions were computed to indicate the potential recoverable WO_3 from the -400 mesh material.

Test	CSMRI Sample	% of WO_3 in -400M Feed	% of -400M WO_3 Lost in Slimes	% of -400M WO_3 Recovered
Gravity No. 1	7	45.6	36.4(1)	--
Concentration No. 3	8	49.7	--	27.2(2)

(1) Based on 96.4% of WO_3 in -150M material and 17.2% of WO_3 in slimes, CSMRI Sample 7 Exhibit 1, Test 1 Exhibit 3: 96.4 x 17.2 = 16.6% of total WO_3.

(2) Based on 95.1% of WO_3 in -150M material and 14.2% of WO_3 in WO_3 concentrate, Test 6 Exhibit 2, Test 3 Exhibit 4: 95.1 x 14.2 = 13.5% of total WO_3.

The above data from the two tests are not directly correlatable. For Gravity Test 1, the results show that 16.6% of the total WO_3, or 36.4% of the -400 mesh WO_3, was lost in slimes and not recoverable by gravity tabling. It does not indicate that the remaining 63.6% of the -400 mesh WO_3 was recovered in the gravity concentrate, as part may have been in the low-grade concentrate or in the gangue products. The recovery of -400 mesh WO_3 was not determined in this test.

Concentration Test 3 shows that by gravity tabling, magnetic separation, and sulfide flotation processing, 27.2% of the -400 mesh WO_3 was recovered in the final concentrate, which represents 13.5% of the total WO_3 in the original sample.

<u>Four concentration tests</u> were made using tabling, magnetic separation, and flotation as detailed in Exhibit 4. Two composite samples were processed. The samples were first separated at 150 mesh by screening. Both +150 mesh and -150 mesh fractions were tabled, the gravity concentrate magnetically separated to reject magnetite, and the nonmagnetic material subjected to sulfide flotation to remove sulfide minerals. The nonfloat, nonsulfide product was called the WO_3 concentrate. A summary of these concentration tests is shown in the following table.

<u>Concentration Tests</u>

Test No.	Feed		WO_3 Concentrate			
	Size (Tyler) mesh	Weight %	Weight %	WO_3 %	Percent Distribution WO_3	Percent Recovery WO_3
1	-150	72.6	1.07	6.8	92.8	72.8(2)
2	-10 +150	27.4	1.22	0.46	7.2	5.6(2)
1 and 2(1)	-10	100.0	2.29	3.42	100.0	78.4(2)
3	-150	59.4	3.55	1.95	98.4	62.9(3)
4	-10 +150	40.6	3.05	0.038	1.6	1.1(3)
3 and 4(1)	-10	100.0	6.60	1.07	100.0	64.0(3)

(1) Computed.
(2) Based on a total feed assay of 0.10% WO_3.
(3) Based on a total feed assay of 0.11% WO_3.

The two feed samples had approximately the same WO_3 content (0.10% and 0.11%); however, they were significantly different in size distribution (+150 mesh and -150 mesh).

The indications are that the +150 mesh material could be rejected without a great loss in WO_3 recovery. Possibly more important are the indications that it would be difficult to produce a high-grade concentrate from the +150 mesh material.

Tests 3 and 4 were run to increase WO_3 recovery in the tabling operation as compared to Tests 1 and 2. By cutting a larger quantity of concentrate, more heavy gangue minerals were left in the concentrate. Subsequent processing by magnetic separation and flotation resulted in a low-grade WO_3 concentrate of 1.95%.

Based on these two samples it is difficult to predict overall WO_3 recovery, as the samples were quite different.

Sincerely,

Earl L. Rau
Project Manager
Metallurgical Division

Vuko Lepetic
Senior Project Engineer
Metallurgical Division

/nkr
encls.

Jerry

May 13/1970

NOTES ATTACHED TO RED MOUNTAIN MINES LIMITED (N.P.L.)

Manager's Annual Report for 1969
Affecting Continental McKinney Mines Limited (NPL)

82FSW110.

PROPERTY FILE

The following notes are not edited and are typed only because they are hard to read in the present hand-written form.

Scurry has an individided interest in the McKinney of 50% with the right to earn another 20% by going into production.

Scurry - $177,785.82 plus $100,000.00 on property

proven 810,450 - 0.39%
possible 88,000

Scurry has 1,000,000 tons total cut down to 775,000 after drawing the pit design.

Price delivered Vancouver - $1.69 $1.76 - Continental
$1.67 + 2¢ price - subsidy is 7¢

Cascade 27% by Scurry.

Novelty bought for $45,000 by Scurry.

Novelty 100% owned by McKinney.

Scurry-Rainbow to earn a 50% interest and 70% to place the property into production deal with McKinney,plus McKinney's share of the first program $132,865 McKinney expenditures.

St. Elmo, Surprise and Golden Queen paid off in 1968. Novelty - 70% - 30%. Gertrude final payment August 1969. Consolidated St. Elmo and Cliff mining lease between Royal Trust, Lorne Campbell on certain claims not important claims. Minus 8% net smelter return.

Lower C

145,000 tons - 150,000 tons - .42% - before dilution 0.5%.

Waste ore ratio - 5.5 to 1%.

Problem of capacity of the equipment by working 7 days per week $180,000 profit would be to buy another loader - total expenditure $900,000 would require lead time to get waste removed.

Mineralization not delineated - lines up with other hole or Jumbo and could be the start of a big zone.

McKinney ore would require drilling on the Red Mountain ground which could develop more ore - McKinney above the upper - TV adit of the McKinney could be an underground situation on the Red Mountain ground.

Scurry 775,000 ton - 0.31 - bismuth and some gold - may be able to

Cascade is controlled by Scurry - Scurry controls Cascade - McKinney deal is between them and Scurry - McKinney bought the Novelty outright - Andy Grubisic -

McKinney must put property into production by December 1970.

The deal on the Novelty needs checking - bought from Rossland - McKinney bought 70% undivided interest - 30% interest retained by Rossland. McKinney has right to deal on full 100% of Novelty.

Talk by
to CIMM Vic. mtg.
Oct. 28 '66.

OPERATIONS OF RED MOUNTAIN MINES LTD.

The property of Red Mountain Mines Limited is situated 1-1/2 miles north and west of the Town of Rossland, in southern British Columbia. The mine is situated on the flank of Red Mountain, famous in pioneer days as the site of a number of profitable gold-copper producers. Mining and milling commenced in May 1966, and by the first of July, the concentrator was treating close to its average design capacity of 400 tons-per-day. The following description of the property and its operations is divided into three parts dealing respectively with geology, mining and milling.

GEOLOGY

All the known ore reserves of Red Mountain Mines occur on the Coxey claim, on the west slope of Red Mountain; and although there are indications of molybdenite mineralization elsewhere on the Company's property, these have not been developed.

The Coxey and adjoinining areas are underlain by the Mount Roberts formation of the Rossland volcanics. This formation consists of an interbedded series of volcanics and sediments, mostly brecciated and silicified near the ore zone, and all intruded by igneous rocks which occur in various forms, and vary in composition from basic to acid. The country rock in the vicinity of the mineralization seems to be mostly a volcanic of about andesitic composition, possibly a surface flow. There is much banding, some of which is undoubtedly due to tuff and agglomerate layers, and some to narrow, siliceous, sedimentary horizons such as the surface exposure of the main "A" orebody, much of which was a thin capping of greyish banded rock that looked like quartzite. The drill holes also intersected occasional layers of black, argillaceous quartzite, sometimes altered to a greenish colour. The whole assemblage has been silicified with varying intensity, sometimes such as to have obscured or obliterated the original characteristics. The mineralized zone has also been strongly brecciated, the fragments varying in size from less than an inch up to large masses, best described as a mega-breccia. Anomalous results obtained in drilling, such as sedimentary sections that do not appear in adjoining holes, may sometimes be due to the presence of these large blocks, no longer in their original position. The whole volcanic unit is thus very complex and confusing. For practical purposes, the ore may be said to occur in a greenstone formation with minor sediments and considerable later igneous material.

Argillites and argillaceous quartzites outcrop 200 to 400 feet south of the ore zone, and since the rake is north, presumably underlie it.

There are many intrusives, from lamprophyres through various dikes and sills of about an intermediate composition, to small acidic stocks that have been called monzonite. The intermediate dikes are called andesite at the mine, and have been separated into several groups for logging purposes. They are less altered and mostly later in age than the volcanic-sedimentary formation; or than even the silicification and brecciation. The monzonite is an exception and is often brecciated and may be mineralized.

The andesite dikes are always barren and when they occur in an orebody, as they do in large amount in some places, reduce the grade appreciably. It may be that some of this material can be eliminated in mining, but initially it can only be accounted for safely by including it as a mass of barren material in the average. An exception is a type of andesite that occurs as a capping, 15-20 feet thick, over the "B" orebody, which appears to be a less-silicified remnant of the volcanic country rock rather than an intrusion, and can be stripped off. The "A" orebody is divided by a north-south lamprophyre dike varying in width from 30 to 75 feet. Such dikes were a characteristic of the old Rossland mines and cut the veins there into blocks and sometimes offset them, though the actual dike material was believed to be older than the mineralization.

The country rock strikes generally north-south and dips flatly to the west. There are many faults, most striking north-south and dipping steeply, and in some cases offsetting the mineralized zone, such as the one that marks the west boundary of the "A" orebody, and has apparently caused a movement of west side north. The Coxey mineralized zone is essentially an east-west structure intersected and offset by north-south faults. The breccia zone referred to above, which is probably associated with the mineralization, is also believed to have an east-west attitude.

Molybdenite is the only mineral of economic importance found to date, and there is comparatively little else, in marked contrast to the Giant zone, a quarter mile south. Pyrite, pyrrhotite and chalcopyrite are common, but minor, constituents except locally. Chalcopyrite does not approach economic significance and fortunately does not occur in sufficient quantity to constitute a serious milling problem. Scheelite in a pure white form is often seen in the core, and while some good assays have been obtained, is not believed to occur in significant amount in the zone. There are no precious metals in any of the sulphides, though a small vein with values in silver, lead and zinc was cut in two holes. There was a gold-copper orebody on the Jumbo claim due west of the Coxey from which 30,000 tons were formerly shipped, and there may be some significance in the fact that it lies on the strike of the Coxey ore zone, though on the opposite side of Jumbo Creek, and had a molybdenite content. The first drilling on the Red Mountain property was done to look for the downward extension of the Jumbo ore, and did find some interesting gold values, though apparently no copper or molybdenite.

The molybdenite in the Coxey zone is fine-grained and often occurs as a dissemination which looks like dust on the surface of the core and is not always easy to detect. Most of it, though, is in seams, fractures and around breccia fragments, often in prominent or even spectacular masses, though never anything in the form of a vein that can be traced for any distance. In general, it favours the greenstone type of rock and is usually scarce or absent in the sedimentary layers. Thus, the surface of the "A" orebody was very low-grade, because much of it was covered by a thin layer of quartzite, the mineralization improving below it within a few feet of the surface.

There is not usually much molybdenite in extremely silicified rock, but neither is there any in the unsilicified capping over the "B" orebody, and it would seem, therefore, that some silicification is favourable. Brecciation is believed favourable though not all brecciated rock is ore, and it is probable that there is a close association between brecciation and mineralization.

To sum up, it may be said that the molybdenite occurs in a brecciated and silicified zone in the Mount Roberts formation, is rare in sediments and absent in most of the intrusives except locally in monzonite. This, plus the fact that none of the orebodies are very far from known monzonite stocks, suggests a relationship between monzonite and mineralization.

The ore zone strikes generally east-west across the Coxey claim from Jumbo Creek to the east boundary of the claim and beyond, and has been traced by drilling for about 1,400 feet. Though essentially continuous, the mineralization has been interrupted by north-south faults, thereby producing a series of distinct or semi-distinct blocks, separated from each other to a greater or a lesser degree by both lateral and vertical displacement. The main "A" orebody was the first discovered and blocked out by drilling. It measures 450 feet north-south and 220 feet east-west, limited on the west by a fault and on the east by a lamprophyre dike. The eastward extension of the "A" orebody was thought to have been displaced both horizontally and vertically, but more recent study suggests that the vertical displacement may be more apparent than real. The actual dimensions of the ore east of the dike are not known, only enough drilling having been done there to prove that there is some. Values have been obtained in drilling on McKinney Gold Mines' ground directly east of the Coxey, so it is probable that the zone continues on up the hill. To the west, or downhill, substantial values reappear 500 feet from the "A" ore, with the area in between mostly barren or very low-grade, though it has not been drilled in detail. Substantial values do appear a few hundred feet farther north in this intervening section as if it had been pushed north by faulting. These two ore areas west of "A" are called the Upper and Lower "B". The Upper section has been indicated by a few holes only, but much of the Lower has been drilled on the standard 50-foot grid, and although full of barren dike material averages about the same as "A", or 0.40% MoS_2. This orebody measures 250 x 250 feet with some possibility of extension. The "A" and Lower "B" are obviously part of the same mineralized zone, differing only in the amount of later igneous material and by the fact that there is a capping over the "B" as described above. The average thickness of both is about 55 feet. There is some association between the present surface and the top of the ore zone, but what it is has not been determined, though it has been suggested that the ore occurs in the upper part of a flat-lying breccia pipe, which might have had something to do with controlling the surface. In that case, the unaltered andesite over the "B" orebody may have acted as a dam, and may originally have overlain the "A" as well.

PIT DEVELOPMENT AND MINING

The initial program was designed to provide optimum site relationship between the three known orebodies and the crusher. More recently a fourth orebody has been partially outlined. This paper will be concerned with the development and mining of the "A" orebody only, which has previously been described as a block of ore 450 feet by 220 feet varying in thickness between 40 and 60 feet, resting on the dip slope of 33 degrees.

Tonnage of this block is calculated at 312,000 tons.

The development plan provided for three roads in waste at the northern approach providing access to three benches which divide the orebody into three equal vertical intervals of 50 feet. From a common junction point in the haulage road, these three roads fan out at grades of plus 10 per cent, horizontal, and minus 10 per cent. The total haulage distance is 3,000 feet or less at a favourable grade as noted above, continuing at 7-1/2 per cent from the junction point to the crusher. More recently the bench interval has been reduced to 25 feet, and all other necessary roads are constructed within the orebody.

The trees and stumps were cleared by a local contractor by using two D-6 tractors connected and operated yo-yo system. Overburden was removed by another contractor who carried the surface as a platform down slope of the orebody and left this platform at the bottom of the ore zone as a salvage berm for fly rock and a development platform for #5 and #6 benches.

Mining commenced on #2 bench with the establishing of a working floor to the centre of the ore zone where a cut was taken at right angles to the eastern limit of the footwall. Mining continues by benching with down holes from each side of the cut. The 25-foot bench interval allows increased performance from the air trac drill and provides safer loading conditions.

Drilling equipment consists of:

One Gardner-Denver S.P. 600 D.B. Rota Screw Portable Air Compressor.

One Gardner-Denver ATD 3100 Air Trac complete with P.R. 123J Drill.

One Copco BBC 16-LH Rock Drill with handles.

One Bitco Pneumatic Bit Grinder.

Sectional Drill Steel, Series 1600 1-1/4" Hexagon Tri-Life.

Couplings and striker bars are supplied by Hard Metals.

2-3/4" T.C. Bits from various manufacturers have been used.

Loading and hauling equipment, which is supplied by a contractor, consists of:

One - 977 Caterpillar crawler type loader.

One - 22 ton tandem axle White truck.

A D-6 Tractor equipped with a D6N Hyster Tractor Donkey is combined with a 48 inch Pacific Scraper to provide a mobile slushing combination for removing overburden, or scaling loose rock on inaccessible steep slopes.

Horizontal and inclined holes were drilled in the early bench development to establish the floor and retain the muck on the bench. Later all drilling is done via down holes in a 6' x 6' pattern, and holes are taken to 3 feet sub grade. Average performance is 250 feet per drill shift for 2-3/4 inch holes. Bit sharpening is done every 25 feet, which attests to the hardness. #1 bench drilling has been done on irregular contoured ground with steep slopes requiring the need of an auxiliary winch on the air trac with anchor cables. At the completion of this bench, all drilling will be done from a flat surface. Calculations have indicated that an average head sample can be maintained from one bench level, avoiding the necessity of operating more than one bench at a time.

The drill and blasting crew consists of one working foreman and one driller who do all the primary and secondary breaking. 70% forcite is employed as a blasting agent in the toe up to 30% of the total column load with the remaining 70% charged with "Amex II" blasting agent supplied by Canadian Industries Limited. Initiation is by E.B. caps, used with primacord; 15 M.S. detonating relays are used between rows of holes. The rows are connected and delayed in a manner to control the throw into the hill. Fragmentation is quite satisfactory due to our employment of a higher powder factor than normal. The resulting fine broken rock has increased the crushing capacity, reduced primary crusher liner wear and reduced secondary breaking in the pit.

MILLING

Mill Building

The concentrator, warehouse, staff offices and analytical laboratory are housed in one building covering about 6,500 square feet and its dimensions are shown along with the locations of the principal items of equipment in the general arrangement plan. The elevation of the flotation floor is 4,314 feet above sea level. Reinforced concrete walls were erected to a maximum height of 7 feet above ground elevation on the reinforced concrete foundation and the remainder of the steel framework is enclosed with corrugated steel panels to form both the walls and peaked roof. The building is designed to withstand the high annual snowfall of the area, which averages 145 inches per year. Design consultants were Wright Engineers Limited of Vancouver.

There are windows in the office and laboratory area, but none in the concentrator itself and this assures constant lighting conditions for flotation. Fluorescent lighting is provided for the flotation and most other areas, but mercury vapour lights are employed for high bay lighting. Sump floors are sloped to sump pump wells at a rate of 0.6 inch per foot.

The grinding mills and flotation machines are serviced by a single one-ton electrically operated crane which moves on a monorail.

Heating for the building is provided by a hot air, oil fired furnace located in the concentrator proper. Electrical power is obtained from East Kootenay Light & Power, and power consumption for crushing and milling operations is 34.0 kw-hours per ton milled.

The total installed cost of the crushing, concentrating and related facilities exceeded $1.5 million, which amounts to $4,000 per ton of daily mill capacity.

Ore Receiving and Crushing

Pit ore is dumped from 20 ton trucks into a 50 ton receiving bin and is fed by a 42 inch wide by 12 foot long Traylor apron feeder across a 42 inch tuning fork grizzly with three inch openings. The plus 3 inch material is crushed to all pass 4 inches by a 42 inch by 36 inch Bacon Farrel jaw crusher. The close setting on the jaw crusher is necessitated by the slabby nature of the broken ore, which tends to block off transfer chutes if the ore pieces are larger than 6 inches in any dimension. The jaw crusher product joins the grizzly fines and the product from the secondary crusher, a 4 1/4 ft. Symons standard cone crusher, on a 24 inch conveyor which in turn transfers to a 24 inch conveyor which feeds a 4 ft. by 12 ft. double deck Dillon vibrating screen. At the transfer point between these two belts, a suspended Eriez magnet removes tramp steel. An interesting problem arose here because of the magnetite content of the ore, and several adjustments on the distance between the magnet and conveyor head pulley were necessary to prevent magnetite from covering the magnet face while still recovering tramp iron and steel.

The lower half of the upper deck of the Dillon screen is blanked off with 1/4 inch thick steel plate to lessen blinding, again due to slabby ore.

The top deck is composed of perforated steel plate 3/8" thick x 2-1/4" diameter perforations on 3" staggered centres and the bottom screen has 3/4" by 4" slots. The screen oversize passes through the 4-1/4 ft. Symons standard crusher which is set at 1/2" and is recycled with new jaw crusher product. The screen undersize is conveyed by an 18" belt to either of two 600-ton capacity wooden mill feed bins by a chute and short 18" shuttle conveyor system. The bins are rather unique in that they are constructed of open laminated planks. Dust collection in the crushing plant is accomplished through hoods and ducts at major transfer points. Suction for the system is provided by a Nelson No. 400 blower operating at 6,000 cfm on a 7 foot diameter cyclone.

Exhaust from the crushing plant has caused some inconvenience on the adjoining Red Mountain ski slope and a bag house is planned to eliminate this problem.

Crushing plant operation is on a day shift basis only with daily throughput of 552 tons or 83.7 tons per hour. This provides sufficient ore in 5 days of crushing for 7 days of milling operation allowing for down time. The crushing operation is under the control of an operator and helper. Sizing analysis of the crusher product is shown in Table I.

Table I

The Size Distribution of the Crusher Product

Screen Opening or Mesh	Product % Wt.	Product Cu % Wt.
0.75 inches	9.2	9.2
0.53	17.6	26.8
0.25	32.3	59.1
6 mesh	15.5	74.6
10	7.8	82.4
20	7.0	89.4
35	2.9	92.3
48	0.9	93.2
65	0.7	93.9
100	0.7	94.6
150	0.6	95.2
200	0.6	95.8
-200	4.2	100.0

Primary Grinding

Control of feed is by three tube feeders in each fine ore bin which discharge onto a 24 inch wide variable speed conveyor which in turn delivers the crushed ore to the primary ball mill 18 inch feed conveyor. It is from the mill feed conveyor that an 18 inch wide by 12 inch long cut of ore is removed each hour by the mill operator and weighed. Calculation of mill input tonnage is based on the weight of sample and conveyor speed.

The mill feed conveyor discharges directly into the ball mill feed chute. The primary mill is an 11-3-6-10 Hardinge Tricone ball mill operating at 19 rpm, 80% of critical speed.

It is driven by a 600 hp motor through an airflex coupling and Hamilton speed reducer. The mill is equipped with water lubricated micarta bearings. If bearing supply water pressure drops below 20 psi the mill is automatically shut down. Mill liners are ni-hard, wave type. Grinding media is 4" forged steel balls and current consumption is 2.28 lb./ton with a power consumption of about 18 kw hr./ton of ore to date.

Mill discharge at 75 per cent solids is diluted with overflow from the adjacent 14 ft. dia. rougher concentrate thickener and is pumped by either of two 8 inch by 6 inch Denver SRLC pumps to a 12 inch FR Dorrclone operating in closed circuit with the mill. The cyclone is equipped with a 1-1/4 inch dia. rubber orifice and 6 inch dia. vortex finder and operates at a feed pressure of 7 psi to produce an overflow of 72.3 per cent minus 200 mesh at 40 per cent solids, which flows directly to rougher flotation.

Rougher-Scavenger Flotation

Rougher and scavenger flotation are carried out in twelve No. 24 Denver "DR" supercharged cells which are the first such cells ever to be employed in molybdenite flotation. The first eight cells produce a concentrate which flows from the collecting launder directly to a 3 inch by 3 inch SRL pump and is pumped to a 14 ft. dia. by 8 ft. Dorr thickener prior to regrinding. The scavenger concentrate is recycled in a similar manner by a 2 inch by 2 inch SRL pump back to cell number five.

The flotation machines are driven in pairs by 10 hp motors at 1200 rpm. Supercharging air is supplied at 16 oz/in^2 pressure by a Denver turbo compressor driven by a 10 hp motor to provide 50 cfm of air per unit. The cells consist of three unpartitioned tanks containing four flotation machines each in which level control and sand relief is achieved mainly through a vertical, about 4 inch dia. orifice which is fitted with a tapered plug whose position is adjusted by a handle with an acme thread. Fine level control is achieved by use of a weir gate.

Regrinding & Cleaner Flotation

Rougher concentrate is thickened to 40 per cent solids and pumped by a 2 inch Denver simplex diaphram pump to the 5 ft. dia. by 5 ft. 6 inch Vancouver iron regrind mill which is driven at 26 rpm, 75 per cent of critical by a 75 hp motor. Mill discharge is pumped by a 3 inch by 3 inch SRL pump to a 6 inch FR Dorrclone where the cone overflow at 20 per cent solids overflows directly to the 4 cell bank of No. 18 special Denver 1st cleaner cells with cone underflow returning to the mill. Grinding media is 1-1/4 forged balls and ball consumption is 0.14 lb./ton.

The 1st cleaner concentrate is pumped by a 2 inch by 2 inch SRL to recleaner flotation which is accomplished in 5 stages in ten No. 12 Denver cells. The concentrate in this system flows countercurrent from the 1st stage of four cells to 2 stages of two cells and finally 2 stages consisting of one cell each. The final cleaned concentrate flows by gravity through a Denver auto sampler to two 6 ft. dia. by 6 ft. agitated, stock tanks which are holding vessels ahead of filtration.

The tailing from the 1st cleaner stage is pumped by a 2 inch by 2 inch SRL to the roughing circuit through a 7 ft. dia. by 7 ft. Denver super conditioner which was designed originally to handle rougher flotation feed. The tailing from the first recleaning stage is returned to the 14 ft. dia. thickener which receives rougher concentrate by a 1-1/4 inch by 1 inch SRL pump. Refer to pictorial flowsheet Figure II.

Filtering

Final concentrate at about 40 per cent solids is pumped from either of the two 6 ft. dia. stock tanks by 1-1/4 inch by 1 inch SRL pumps to a 2 disc, 4 ft. dia. Denver disc filter, with filter overflow returning to the stock tanks. One partially blanked disc is employed to filter all of the MoS_2 concentrate produced.

Agitation of the slurry in the filter tank is necessary to produce uniform filter cake and avoid settling out of concentrate. This is accomplished by using a modified 1/2 hp Lightning reagent mixer. To ensure good filtration it is necessary to eliminate all extraneous dilution such as filtrate and dryer scrubber water from the stock tanks which might have been acceptable in a system where a thickener was employed.

Cotton ST 24 is employed as the filter media and filter cake averages 18 per cent moisture. Vacuum of 22 inches Hg is provided by a Gardner-Denver vacuum pump and air for blow off by a small Roots blower. Filtrate is pumped by a 1-1/4 inch by 1 inch Worthington pump to the 3rd stage of flotation re-cleaning.

Concentrate Drying and Handling

Filter cake is carried to the Joy No. 7 Holoflite dryer by a 10 inch dia. spiral conveyor. The dryer screw, 7 inches dia. by 14 ft. long rotates at 1.2 rpm and handles about 170 lb. per hour of MoS_2 concentrate from an average 17 to a final 3.5 per cent moisture. The dried product, which drops vertically into a 6 inch dia. screw conveyor 17 ft. long, is distributed to any of 5 loadout points. 16 gauge, 45 imperial gallon capacity drums are loaded through 6 inch MUCON valves and flexible pipe with approximately 600 dry pounds of MoS_2 concentrate which is hand sampled during loading. The drums are positioned on a roller conveyor during loading and are readily moved to a Toledo Model 2811 scale for weighing. After appropriate stencilling, the drums are removed to open, outdoor storage by a small overhead electric hoist, which also serves the grinding bay. Final shipment to market is by truck and rail.

Off vapours from the drying system are drawn through a 6 inch dia. port under 1/2 to 1 inch water gauge located in the centre of the dryer into a Krebs M20 Medussa scrubber. Water at 30 Imperial gallons per minute is fed to the scrubber, and the lightly loaded scrubber solution which contains virtually all of the entrained solids is returned to the 3rd stage of recleaner flotation. Suction on the system of 5 inches water gauge differential is provided by a 11LS Chicago fan which exhausts to atmosphere.

The drying medium for the Holoflite processor is a recirculating hot oil system containing mobil therm 600 oil, which is capable of 600°F operation. The heat input is provided by a 25 kw electric heater. Operating temperature range of the dryer is 450-to-550°F.

Tailings Disposal

Scavenger flotation tailing is pumped by a 5 inch by 4 inch SRL-C pump to a 12 inch FR Dorrclone on the top at the down slope side of a 50 ft. dia. by 10 ft. Dorr thickener. Cyclone overflow at 20 per cent solids is fed to the thickener, while cone underflow joins thickener underflow at 76 per cent solids and flows by gravity to the tailings disposal area about 100 yards down slope on Red Mountain.

Thickener overflow at about 100 USGM is returned to the mill feed constant head tank as make up water by a 2-1/2 inch by 2 inch Weiman pump. The thickener underflow is discharged by gravity through a 1 inch plug valve located at the side of the normal 6 inch dia. thickener cone outlet.

Separan MGL and alum are added to thickener feed to improve clarification of the supernatent from a very highly dispersed pulp.

The fresh water makeup for the mill is provided from the City of Rossland domestic supply and is pumped 700 feet vertically by two positive displacement pumps. The water is of excellent quality at a pH of about 6.9.

Metallurgy

It must be emphasized that in a plant so new the efforts to improve the efficiency of the operation have put the metallurgical aspect of the plant in a state of constant flux. The constant testing is facilitated in large part by a relatively small plant with a large degree of flexibility.

Rougher and scavenger flotation are carried out on a relatively coarsely ground feed, an average 72.3 per cent passing 200 mesh at the natural pH of the ore slurry, 8.6.

Laboratory studies by others have shown that particles of rock containing only 1 per cent of molybdenite on their surface can be floated satisfactorily. Laboratory testing on Red Mountain ore with no recycle from cleaning operations produced the following results:

Grind % Passing 200 Mesh	Recovery MoS_2 Per Cent
57	94.8
71	95.5
81	95.[illegible]

The initial rate of flotation increased appreciably with finer grinding, but overall recovery was only increased by 1 per cent after grinding to 81 per cent minus 200 mesh compared with 57 per cent minus 200 mesh. From the laboratory results an overall recovery of 90 per cent was predicted.

Plant recoveries of 90 per cent have been achieved, but up till now at the expense of a high copper content in the final concentrate, i.e. greater than 0.5 per cent. Recoveries of 80 to 85 per cent are obtained when producing final product of 0.1 to 0.3 per cent Cu.

In all cases, the coarse grind necessitates the production of a rougher concentrate of about 10 per cent MoS_2 if recoveries of middling particles at any level are to be maintained. This is clearly illustrated in Table II where screen, chemical and microscopic examination of a tailing analysing 0.09 per cent MoS_2 show that 83 per cent of the MoS_2 is in the minus 100 mesh fraction.

The collectors universally employed in molybdenite flotation are of the paraffinic hydrocarbon type, and they provide water repellent coatings by smearing on the sulphide surfaces. This is quite satisfactory for an easily floated sulphide such as molybdenite, but it does not have any selectivity with respect to rejection of undesirable sulphides such as chalcopyrite or galena if they are present in the ore.

The collector most successfully applied so far in the plant has been Shell Carnea 21, a mineral oil of 0.92 specific gravity. It is added at the primary mill to improve dispersion and it is hoped pre-emulsification will provide additional dispersion. When using large amounts of collector, it is sometimes necessary to use a froth stabilizer. One of these that has been found effective is Arctic Syntex L, a sodium salt of sulphated monoglyceride of coconut oil. Its application is variable into the primary mill with results being good on as many occasions as without it. However, it does definitely enhance the rate of flotation in the first four rougher cells. See Table III for typical reagent consumption.

Tests were conducted using Vapour Oil, which is the standard collector at Climax, but it was no more effective than the Carnea, and its cost was twice as great. Also, a collector which is reputed to be selective for molybdenite in the presence of chalcopyrite Cyanamid S3302 was tested briefly, but due to its frothing characteristics, the test was terminated until further lab evaluation is done.

Yarmor F Pine Oil, which tends to produce "tough" froths, is the frother in the rougher-scavenger flotation and methyl isobutyl carbinol is employed in the cleaning circuits when necessary to provide more "selective" froths.

Table II

Screen Analysis, Chemical Analysis and Microscopic Examination of Mill Tailings

Screen Mesh		Average Particle Dia Microns	% Weight	% MoS_2	% MoS_2 Distribution	Grain Size of MoS_2 Locked in Gangue
	+ 48		3.1	0.14	5.0	10-to-90, avg. 40μ
- 48	+ 65		3.3	0.11	4.2	" "
- 65	+100		6.4	0.10	7.5	20-to-40μ
-100	+200		14.9	0.09	15.7	" "
-200			72.3	0.08	67.6	10μ

In all size fractions there were no free MoS_2 grains-only mixed grains.

Table III

Reagent Consumption
August 1966

Reagent	Consumption lb/ton of Ore Milled	Point of Application
Sodium Silicate	0.12	Regrind mill
Sodium Cyanide	0.20	Regrind mill, recleaner flotation conditioner
Shell Cornea 21	0.43	Tricone primary mill
Yarmor F Pine Oil	0.067	Rougher & scavenger flotation
Methyl Isobutyl Carbinol	0.035	Cleaner & recleaner flotation
Separan NP 10	0.004	Tailings thickener
Arctic Syntex "L"	0.013	Tricone Primary mill
Aluminum Sulphate	0.21	Tailings thickener
Sodium Hydroxide	0.077)	Conditioner and regrind mill
Phosphorous Pentasulphide	0.064)	

Dispersion of rock in the cleaning circuit is improved by sodium silicate additions made to the regrind concentrate mill.

In the cleaning circuit as it is presently, regrinding of the coarse, about 30 per cent plus 325 mesh rougher concentrate to about 90 per cent passing 325 mesh is necessary to liberate MoS_2 as fine as 10 microns. Copper as chalcopyrite, $CuFeS_2$ and pyrite FeS_2 are also liberated in regrinding and must be depressed in the cleaning stages of flotation to produce concentrates to meet the buyers' specifications. (See table IV)

Depression of chalcopyrite and pyrite has been achieved in the main by sodium cyanide additions in quantities of 0.15-to-0.4 lb. of original mill feed. These additions are made in the regrind mill and to the final recleaning stage.

The expected content of copper in rougher concentrate is now being maintained at 1 per cent while it was not in the original flow sheet where the 1st cleaner tailing was pumped to a 6 inch FR Dorrclone, with most of the material passing into the cone underflow back to the primary grinding mill. This practice created a large recycle of chalcopyrite and led to rougher concentrate of over 4 per cent copper, which in turn produced final concentrate of above 1 per cent copper.

To improve the recovery of MoS_2 from this material, the 6 inch cyclone has been re-introduced, but the coarse portion is now returned to the regrind mill while the overflow returns to the conditioner and back to rougher flotation.

For future reference, and to test its effect on the depression of copper, bismuth and lead Nokes reagent (causticized phosphorous pentasulphide) was tested over a 27-day period. The points of addition were 1st cleaner tails conditioner, regrind mill and recleaner heads.

On some occasions very much improved Cu depressions were achieved in combination with sodium cyanide and on others no visible effect was evident. However, the depression of Bi was excellent while only fair on Pb as seen in the following table:

Nokes Reagent	Final Concentrate % Pb	% Bi
off	0.044	0.053
on	0.034	0.016
off	0.04	0.06
on	0.02	<0.01

Reagent Handling

All liquid reagents, Shell Carnea 21, methyl isobutyl carbinol (MIBC), Yarmor F pine oil, and sodium silicate are delivered in 45 Imperial gallon steel drums. Sodium cyanide, caustic soda and phosphorous pentasulphide are received as briquettes, flake and powder, respectively, in steel drums. Separan MGL, aluminum sulphate and Syntex L are received as powder in double wall paper bags.

Carnea 21, MIBC and pine oil are fed full strength while sodium silicate, which is received as 41° Be solution, is diluted to about 10 per cent solution. Sodium cyanide is mixed to 12 per cent solution, and separan and alum to 1 and 10 per cent respectively.

Preparation of Nokes reagent is quite sensitive and will not be discussed at length, however, it consists of dissolving phosphorous pentasulphide in a solution of caustic soda in the ratio of 1 P_2S_5:1.3 NaOH under controlled temperature, which must not exceed 80°C.

The reagent mixing and distribution is done from a mezzanine floor located 9 feet above the flotation section.

All reagents are fed from disc and cup stainless steel Clarkson feeders. Reagent piping in the mill was originally "ABS" plastic, but it began failing prematurely and has now been completely replaced with steel pipe.

Sampling and Analytical Practice

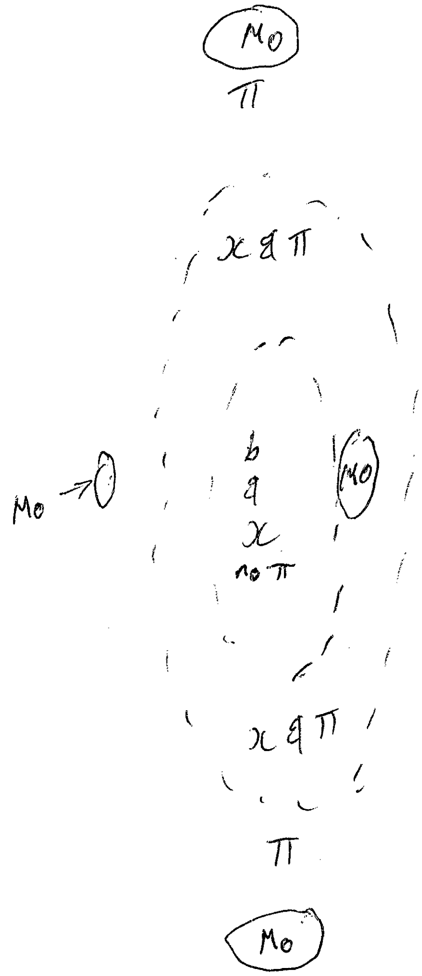
Sampling of flotation feed, rougher concentrate, final concentrate and final tailing is done on the respective slurry products by Denver automatic samplers. All of these products are sampled on a 24-hour basis except flotation tailing, which is sampled on a shift basis. Samples of primary mill feed are taken manually from the mill feed belt over a 24-hour period and are generally used to provide the actual mill "heads" sample as flotation feed is contaminated with recycle products. All slurry samples are filtered by the flotation operators and dried for the sample preparation man. Shift samples of final product filter cake are taken for moisture determinations. Samples of individual barrels of dried concentrate are taken manually as the barrels are being filled and are kept in sealed bottles in order that accurate moisture determinations may be done.

Up until now, all feed and tailing analyses for MoS_2 and Cu in concentrates have been determined colorimetrically with MoS_2 in concentrates being determined gravimetrically. Analysis for Fe, Bi, Pb and SiO_2 have so far been done at other laboratories.

A Geigerflex x-ray fluorescence apparatus is currently being installed and will permit much more rapid determinations for MoS_2 in feed and tailing samples and Cu in concentrates.

Residual oil determinations, which average about 3.5 per cent, are made necessary on the final dried concentrate because at least 85 per cent of the primary hydrocarbon oil collector remains with the concentrate through drying. The residual oil serves a very useful purpose in that it agglomerates the very fine particles and prevents dusting.

Lorney



B.C Agmt - Mining Finder

RED MOUNTAIN MINES LTD.

ROSSLAND, B.C.

see memo - Dec 10/73.

J. V. Guy-Bray
November, 1973

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Mo 652,970 Kg — 3,644,114 lb 93,398 t

31.1034768

SUMMARY

Red Mountain Mines is a small former open-pit molybdenum producer at Rossland, B.C., in the Omineca belt of the Canadian Cordillera. The company is owned and managed by Inco; the 20-claim mining property is held in trust (Inco 37½%, Faraday 37½%, Torwest 25%). From 1966 to 1972, 6,155,342 lbs. of MoS_2 were produced from 1,038,817 tons of ore. The official ore reserve is 118,000 tons @ 0.42% MoS_2 (strip ratio 3.9:1). Between 1891 and 1942, 6,200,000 tons of gold ore (average recovery 0.47 oz/ton Au, 0.6 oz/ton Ag, 1% Cu) were mined from the surrounding Rossland camp. Red Mountain appears to be a centre of mineralization related to a local facies of the Eocene Trail granodiorite batholith.

The molybdenum (+ tungsten) mineralization is of skarn type, and confined to a hornfels megabreccia which may represent a breccia pipe overlying an unexposed stockwork-type Mo deposit with an igneous source at depth. The gold-silver-copper mineralization is in fissure replacement veins that may extend onto the Red Mountain Mines property beneath the pits.

Mine Finders, Inc. of Colorado have been exploring the property since 1972 at their expense, with a view to earning an equity in any resulting finds. Tests have shown that the fine scheelite in the tailings cannot be profitably concentrated, and the current drilling program has largely eliminated the possibility of locating additional near-surface Mo ore. However, the potential for deep Mo-W and Au-Ag-Cu ore is believed to be significant, and has not yet been tested by drilling.

It is recommended that Inco retain its interest in the property, and encourage Mine Finders to complete both shallow and deep drilling programs. A formal agreement should be signed with Mine Finders. If they are unsuccessful in finding shallow ore the mill facilities should be sold. Inco should conduct a financial analysis to better define the objectives of a deep drilling program. Inco should seek other partners if Mine Finders withdraw, and should in any case determine the degree of interest of Cominco in cooperative exploration at Red Mountain, because of their local knowledge and property holdings.

INTRODUCTION

Red Mountain Mines is a small molybdenum property near Rossland, B.C. It was mined from 1966 until 1972, and is partly owned by Inco. This report was prepared in response to a memo from G. H. Merriam to H. F. Zurbrigg (May 29, 1973) requesting that the Exploration Department evaluate the known data on the ore potential of Red Mountain, to "help determine our attitude towards disposal of the existing mill equipment and even the property itself". A review of the current Mine Finders exploration program was also suggested. The writer visited the property on August 6-8.

BACKGROUND

Red Mountain rises immediately northwest of Rossland, B.C., a few miles west of Trail (Figure 1). Between 1891 and 1942 a total of 6,200,000 tons of gold-copper ore (average recovery 0.47 oz. Au, 0.6 oz. Ag, 1% Cu) was mined in the Rossland camp, which still leads B.C. in total gold produced. Most of this ore came from the southeastern portion of Red Mountain (Figure 2), in the form of veins of pyrrhotite-chalcopyrite (+pyrite, quartz and calcite) in augite porphyry and monzonite.

Although traces of molybdenite were known in the gold-copper veins, the discovery of molybdenite deposits on the mountain, in 1964, was accidental and unexpected: they were found during exploration by Torwest for extensions of the old gold-copper lodes. Magnetic and EM (Turam) anomalies were drilled; only pyrrhotite, pyrite and magnetite were found. Additional drilling of the old Jumbo mine area encountered erratic gold values. Finally, in May 1964, surface sampling located a zone of strong molybdenite mineralization in the east half of the Coxey claim (see Fig. 6).

In 1964 Torwest drilled a total of 102 holes (19,253 ft.), outlining the "A" and "B" ore zones in the Coxey claim. In November 1964 management of the exploration program passed to Metal Mines (Faraday) who drilled a further 171 holes (15,266 ft.): by the start of production in 1966 a total of 1,082,000 tons of probable, possible and indicated ore, at an average grade of 0.39% MoS_2, had been located.

Inco's involvement in Red Mountain Mines is well summarized in two Company memos (Appendix III, refs. 1 & 17). From 1964 to 1971 R.M.M. was jointly owned by Canico (20%), Consolidated Canadian Faraday (20%) and Torwest Resources (60%). Since September 1971 Inco has owned all the outstanding Red Mountain shares, and all its assets and liabilities excluding the residential properties and mortgages, and the mining properties which are held in trust (Inco $37\frac{1}{2}$%, Faraday $37\frac{1}{2}$%, Torwest 25%: see ref. 15).

The property was developed and production started at a time when molybdenum was very scarce: Inco's interest was to assure a supply for its own needs. Subsequently molybdenum became more plentiful, the world price dropped, and our total unrecovered costs for the project, when production ceased with no significant ore in sight, were $1.5 million. Between mid-1966 and January 1972 a total of 6,155,342 lbs. of MoS_2 were produced by milling 1,038,817 tons of ore (with an average calculated grade of 0.35% MoS_2, assuming a recovery of 84%).

During 1971-72 the Red Mountain management were approached by Mine Finders, Inc. of Lakewood, Colorado with a proposal (5) to seek new ore on the property. Mine Finders would use their experience in the molybdenum business -

Background (cont'd)

and their own money - to re-investigate and explore Red Mountain, thereby earning an equity in any resulting finds. Mine Finders also approached Scurry-Rainbow Oil, Ltd., who hold land adjacent to our property (21, p. 6-). To date we have still received no draft of the proposed agreement between Mine Finders and Red Mountain Mines - it has not yet been approved by the lawyers of Mine Finders' parent, Bethlehem - but a program of field work was nevertheless initiated in 1972 by Mine Finders. The second season of this work is now over, with few encouraging results reported.

The mining properties are shown in Figure 6, and described in detail in the schedules attached to the Memorandum of Agreement (15). The pits, access roads, tailings dams, mill and related facilities of the mine on the west flank of the mountain, east of Jumbo Creek (Figure 2), have been maintained in excellent condition. The Nancy Greene Recreation Area is adjacent to the mining area: its ski slopes occupy the northern side of Red Mountain.

GEOLOGY AND MINERALIZATION

Regional Geology

Rossland is at the southern end of the Omineca Belt of the Canadian Cordillera (19, and Figure 3), in the Monashee portion of the Columbia Mountains. The Omineca Belt as a whole is characterized by folded, faulted and thrusted Early Paleozoic and older metasedimentary rocks and derived gneisses with minor volcanics, and abundant gneiss domes, batholiths and stocks (mainly Cretaceous). By contrast, in the Rossland area, intermediate to acid plutonic rocks and dykes (see below) intrude a variably metamorphosed sequence of Late Paleozoic and Lower Jurassic volcanics and sediments: a geology more reminiscent of the Interior Belt.

As shown in Figure 3, the Interior Belt is the main locus of porphyry Cu-Mo deposits in British Columbia; W is more common in the Omineca. Regional metallogeny as applied to exploration at Red Mountain is discussed in a later section.

Local Geology

The geology of Red Mountain and vicinity is shown in Figure 2. Westward-dipping sediments and metasediments of the Carboniferous Mount Roberts Formation are intruded by various rocks of Jurassic to Eocene age including serpentine; augite porphyry and monzonite (the principal hosts of the Au-Cu veins); syenite; and quartz diorite (the molybdenite-bearing Rainy Day Stock south of the mine). The molybdenite orebodies are in brecciated Mount Roberts hornfelses on the western slope of Red Mountain.

Geology and Mineralization (cont'd)

Local Geology (cont'd)

These hornfelses are the metamorphosed and hydrothermally altered equivalents of black siltstones and argillites, remnants of which are still present, mainly on the SW slope of the mountain. They are predominantly green, fine grained rocks composed of quartz, subordinate feldspar and green silicates, chiefly pyroxene. Feldspar-rich, biotitic and magnetite bearing hornfelses are locally abundant.

A large, irregular zone of brecciation, referred to as megabreccia (Figure 2) is characterized by randomly oriented blocks of various hornfelses, from a fraction of an inch to 100 feet in size. The breccia extends indiscriminately across all stratigraphic units within the brecciated area; where they can be distinguished, its contacts with the surrounding rocks are predominantly steeply dipping.

Several steep dikes and irregular bodies of quartz diorite breccia extend NE across the widest part of the megabreccia (Figure 2). These intrusions consist mainly of medium grained to porphyritic quartz diorite fragments with scarce hornfels fragments, in a fine grained granitic to hornfelsic matrix. The quartz diorite resembles that from the Rainy Day Stock.

Not shown on Figure 2 are swarms of steep, NW trending diorite and lamprophyre dikes, the only intrusions that clearly post-date the molybdenite. These dikes presented significant dilution and sliming problems during the mining and milling of the ore.

The gold-silver-copper bearing vein mineralization that supported the old Rossland mining camp is well described by Gilbert (11). The veins, apparently of fissure replacement type, were most abundant on the southeast flank of Red Mountain near what is now the northwest edge of the town of Rossland (see Figures 2 and 6). The richest and most important mines were the Le Roi, Centre Star, War Eagle and Josie in the core of the camp (Figure 6). The mineralization, which appears to favour the Rossland monzonite and the thick augite porphyry sill which dips westwards beneath Red Mountain (Figure 2), seems to die out when followed to greater depths. However, the strong east-west trend of the main veins, and the sporadic occurrence of other areas of Au-Cu veining in the district (some of which are shown on the figure), suggest that economic deposits are not necessarily confined to the red-shaded areas on Figure 2. Specifically, the vein mineralization is an additional target in deeper exploration of the Red Mountain Mines property, where the local easterly structural trend is also reflected in the shape of the megabreccia zone, the strike of the Q.D. breccia dykes, and the distribution of the Mo orebodies.

Geology and Mineralization (cont'd)

Molybdenite Mineralization

The known molybdenite orebodies are confined to the zone of megabreccia, and most of them are within its central, widest part, which also contains most of the quartz diorite breccia bodies (see Figure 2). The mineralization consits of pyrrhotite, pyrite, molybdenite and scarce chalcopyrite. The molybdenite occurs as very fine grained disseminations and veinlets, and as coarse pods, stringers and fracture fillings, mainly in the breccia matrix but also in the blocks. Nearly all of the megabreccia area is mineralized, and any of the brecciated rocks may be the host, but the green and grey-to-white hornfelses appear to be the most favourable. Molybdenite-quartz veining is uncommon.

The most intriguing feature of the distribution of molybdenite at Red Mountain is the apparent restriction of ore grade mineralization to within 80 to 100 feet of the surface: mining extended over a vertical range of nearly 1,000 feet, but the maximum vertical extent of ore mined in any single deposit was about 200 feet (B orebody). In this regard it is significant that almost all the boreholes drilled to date are shallower than 200 feet, and that many bottomed in mineralized material.

A close relationship between molybdenite mineralization, megabreccia and quartz diorite breccia dikes is evident. Note also that B. Fillingham, former General Manager of the mine, observed that "every orebody seemed to have a high grade zone or core". Since Zajac's mapping for Mine Finders indicates that the ore is not confined to a single favourable stratum, it is hard not to conclude that the mineralization should extend to greater depths.

Very coarse scheelite crystals are irregularly and sparsely disseminated throughout the ore zone, but are most common in the magnetite bearing hornfelses on the eastern side of the megabreccia (upper A, E, F pits area). The overall grade is ca. 0.1% WO_3. No attempt was made to recover the scheelite; it forms part of the tailings (see below).

In the southern lobe of megabreccia the molybdenite is associated with arsenopyrite and minor pyrite, pyrrhotite, cobaltite and bismuthinite. In a mill-test of material from Scurry's Novelty claim (Figure 2) the As and Bi caused problems. The Scurry claims also carry gold values (0.1 to 0.4 oz/ton); a little gold and silver were noted in the Red Mountain A pit: ca. 0.005 and 0.1 oz/ton respectively. The copper values are negligible. The 1972 moly concentrate averaged 0.08% Cu and 0.8% Bi (16).

Geology and Mineralization (cont'd)

Alteration

The hornfelses commonly contain fibrous amphibole, epidote and chlorite. These are at least in part the products of hydrothermal alteration, as are the observed bleaching, silicification and feldspathization (both K and Na), all of which are especially abundant near the orebodies. Feldspathization is particularly associated with the southern lobe of megabreccia, and with the quartz diorite breccias, where it is accompanied by fine molybdenite.

EXPLORATION AND DEVELOPMENT

1964-1972

The history of discovery and early development has been summarized above (BACKGROUND). Preliminary development diamond drilling of the ore zones was on a 50 ft. grid, to depths of ca. 200 ft.; exploration holes were more widely spaced. Percussion drills were used in final development and mining.

The mine eventually comprised eight open pits; an extensive system of gravelled access roads (the orebodies extended over some 1,000 vertical feet on the steep west slope of Red Mountain); miscellaneous mining equipment; office space; and processing facilities including a 400 tons-per-day mill (increased to 600 t.p.d. in 1968), an XRF and wet assay lab, ore bins, water tank, tailings thickener, and two tailings ponds.

Ore Reserves

The official ore reserve at close-down in January, 1972, was 118,000 tons of 0.42% MoS_2 within 80 feet of the surface in the partially developed "C" zone: 459,000 tons of waste would have to be removed to mine this. In addition 3,050 tons of miscellaneous broken ore remained on the property (16).

Zajac is currently recalculating the tonnages and grades of mineralization; his preliminary estimate is that, before mining began, there were ca. 8 million tons of 0.15 - 0.16% MoS_2 defined on the property. Since 1 million tons of 0.35% were actually mined, the calculated residuum is about 7 million tons of 0.13%.

Now that the "eyes" have been picked out of it, it is evident that the value - if any - of the Red Mountain property depends primarily on the potential for the discovery of <u>new</u> ore, and on the price of molybdenum.

Exploration and Development (cont'd)

Mine Finders' Program

The purpose of the program undertaken in 1972 by I.S. Zajac was fourfold:

(A) to gain a better understanding of the geology of Red Mountain, particularly the controls of Mo and W mineralization; and subsequently to evaluate the following three "targets";

(B) tungsten in the existing mine tailings;

(C) shallow (open pit) Mo ore;

(D) deep Mo ore.

The field work is outlined here; the objectives and results are discussed in the next section.

Geology: Zajac proceeded by detailed geological mapping and geochemical soil sampling (for Cu, Mo and W) of the mine area, and by re-interpretation of all available existing data. Most of this work is summarized in his report (23).

Tungsten in Tailings: The two tailings ponds contain a total of about one million tons of tailings (23, p. 9). Both ponds were sampled (by 13 shallow pits, 26 drive pipe samples and 6 Becker hammer drill holes) to determine their tungsten content, and its recoverability. Ten samples, totalling about 50 lb., were sent to the Colorado School of Mines Research Institute for testing.

Shallow Mo Ore: The target here is another open-pit orebody of the type already mined, i.e. ca. 10^5 tons @ 0.4% MoS_2, plus some W if ore is found in the eastern part of the property. Zajac is testing the shallow ore potential by drilling to the maximum depth mineable by open-pit methods (400-500 ft.) at sites selected on the basis of surface geology, geochemistry and existing drill results. One hole was drilled in 1972 (23, p. 7), and another thirteen in 1973 for a total of 4,317 ft. (Wallace, pers.comm.).

Deep Mo Ore: Because of budgetary limitations no drilling to probe for deeper zones of mineralization has yet been attempted.

DISCUSSION

Classification and Genesis of Mineralization

Recent K-Ar dating by Fyles et al (10) has greatly clarified the geology of the Red Mountain area. Apart from the Rossland monzonite (> 90 m.y.), all the plutonic and dike rocks, and the mineralization, are close in age (46-50 m.y.). It is now evident that the age of all the sulphide mineralization is about 48 m.y. and that the molybdenite and the Cu-Au veins were deposited in what was probably a single, short period of rapid evolution during the emplacement and crystallization of the Trail granodiorite batholith and the related Rainy Day quartz diorite stock.

The age data corroborate other evidence bearing on the origin of the Mo deposits. For example, they link the molybdenite ore, the quartz diorite breccia dikes, and the Rainy Day Stock with its widespread, low-grade, disseminated molybdenite. They also relate the Mo deposits to the rest of the polymetallic mineralization centred on Red Mountain.

Zajac (23, pp. 11 and 12) states:

> "Our investigations to date have found no geological reason why the ore should be restricted to within 100 feet of the surface. Ore potential should be as good, if not better, at depth". "Geological mapping shows a close spatial relationship of molybdenite mineralization to megabreccia and quartz diorite breccia dikes. More than 95% of all known ore is within the breccia, with more than half of the orebodies located in close proximity to the dikes".

On the basis of existing evidence it seems most reasonable to classify the Red Mountain Mine as a skarn molybdenum (tungsten) deposit, emplaced in a type of explosion breccia of volcano-tectonic origin overlying an igneous source. The zoning of the orebodies with their high grade cores, the collapse structures mapped in the breccias by Zajac, the apparent absence of a "favourable bed" controlling deposition, and the relationship to Q.D. breccia dikes, all suggest that the mineralization should extend downwards. The marked association of the molybdenite with potash feldspar alteration and with quartz diorite (which also forms a nearby molybdenite-bearing stock) suggests that there might be a transition, at depth, to a "porphyry" or a "stockwork" type of molybdenum deposit in a Q.D. cupola or stock, with disseminated Mo (Cu-Au) mineralization.

Because there is no direct evidence for deep ore at Red Mountain, it is necessary to consider what other information bears on the question. Much is known about the nature of molybdenum deposits; Red Mountain can best be discussed in the context of this knowledge.

Discussion (cont'd)

Classification and Genesis of Mineralization (cont'd)

Classification: Primary molybdenum deposits are often loosely grouped as "porphyry-type", but recent workers (3, 12) increasingly distinguish between stockwork Mo deposits (e.g. Climax) which yield most of the molybdenum production, and the porphyry coppers (with by-product molybdenum). Contact deposits, including skarns, are found to be transitional to one or the other type. Stockwork deposits tend to have higher MoS_2 grades (0.1 to 0.5%), less Cu, Au, Ag and Re, and more W, Bi, F, Sn and quartz than "true" porphyries. Similarities include nature of host intrusions and hydrothermal alteration. Complete geochemical data are not available for Red Mountain, but apart from its pyrrhotitic rather than pyritic character, and a relative paucity of quartz, the deposit appears to be of stockwork affinity.

Metallogeny: Recent discussions by both Sutherland Brown et al (19) and Clark (3) have identified the Interior Belt of B.C. as generally more favourable for Mo than the adjacent Omineca Belt which includes Rossland (see Figure 3). However, as Sutherland Brown notes (19, pp. 45-6) the porphyries - especially the stockwork Mo end-members - are not confined to the Interior Belt. Moreover their distribution shows a tendency to strike obliquely to the regional tectonic grain: both sources distinguish the northwesterly B.C. Moly-Endako-Boss Mtn. trend. This trend unites deposits of very different ages; Brown et al also note the association of most major molybdenum deposits in B.C., of whatever age, with younger volcanic centres. Figure 4 displays the ages of the B.C. deposits; Climax, Urad-Henderson and Questa, the big deposits in the Southern Rocky Mtn. belt, are ca. 20-30 m.y. in age.

In sum, metallogenic considerations are by no means unfavourable to the Red Mountain area. In any case, metallogenic arguments should not be overemphasized in estimating the potential of this incompletely explored portion of the Cordillera: geology is replete with exceptions, including countless orebodies. The known mineralization at Red Mountain could also be taken as a good omen for regional Mo exploration.

Structure: Evidence linking the Red Mountain Mo ore to an unexposed quartz dioritic source has been given above. The distribution of Cu, Au, Pb, Zn, Bi, Sb, As and W (21, p. 12) also strongly suggest mineralization centred on a hidden intrusion beneath Red Mountain. The proposed model of a mineralized breccia pipe above a stock or cupola is not unlike the observed geology of Boss Mountain, B.C. (Figure 5). The Rainy Day molybdenite-bearing Q.D. stock (the presumed source at Red Mountain) is exposed some 3,000 feet SSW of the pits, and 750 feet lower down the flank of Red Mountain. Sub-surface mineralization might be in the downward extension of the breccia (as at Boss Mountain) and/or in the underlying intrusive mass itself. In this connection it is interesting to note that DeGeoffroy and Wignall (6) find that in the 58

Discussion (cont'd)

Classification and Genesis of Mineralization (cont'd)

commercial deposits studied by them, an average of 54% of the ore was within the intrusive. No estimate of the depth at which a deep orebody might be located can be given: at Boss Mountain the ore has a vertical range of at least 1,000 feet; at Urad-Henderson, Colorado, the lower (Henderson) orebody is more than 2,000 feet below the near-surface (Urad) ore.

The grades and tonnages of these two underground mining operations are also of interest here: Boss Mountain (which ceased production in December, 1971) had ca. 4 million tons of 0.25% MoS_2; Henderson (scheduled to start in 1975) has 300 million tons of 0.49%.

Mine Finders' Program

The current exploration work can now be reviewed in the light of the above information.

Geology: Zajac's work has been thorough and of high quality: much of the information in the present review was obtained from him. The Mo-W-Cu soil geochemical surveys (23) confirm the observed association of breccia and ore: most of the megabreccia and the immediately adjacent hornfelses north of the pits stands out as a prominently anomalous area, although the significance of individual contoured anomalies is uncertain and most of the pit area could not be sampled.

Tungsten in Tailings: The overall grade was found to be about 0.1% WO_3 - i.e., the same as in the ore. Near-surface tailings are slightly higher in grade than deeper ores, reflecting the mining history: the ore milled during the last year of operations came mainly from pits ("E", "F") on the east side of the property, where scheelite is more abundant. The test sample assayed 0.105% WO_3, and gave preliminary recoveries of 60-70% in concentrates grading 2-7% WO_3 (4). It is concluded that the very fine scheelite in the tailings is not a potentially economic prospect. However, this does not imply that it could not be profitable to separate coarse scheelite from ore at an earlier processing stage.

The value of contained WO_3 in the ore was ca. $3-4 per ton: the tailings exercise may serve as a reminder that the polymetallic mineralization at Red Mountain has more than just Mo to offer.

Shallow Mo Ore: As noted by Zajac (23, p. 12): "The megabreccia, particularly the areas near the breccia dikes, is ... the prime target for shallow ore." The 1973 drilling campaign has tested most of the interesting ground outside the pits, and results reported to date (Wallace, pers.comm.) are not en-

Discussion (cont'd)

Mine Finders' Program (cont'd)

couraging: only short and irregular intersections of ore grade mineralization have been encountered. Nevertheless, Wallace is planning some additional shallow drilling in 1974.

One area of high potential for shallow ore that has not been fully explored is the pits themselves. As noted earlier, many of the original exploration holes bottomed in mineralized, even ore-grade, material. And the arguments for mineralization extending downwards obviously apply most strongly to the places where mineralization was heaviest, i.e., the pits. Moreover, it is not known to what extent this mineralization was ever tested. Presumably, during the mining, percussion drilling was conducted to define the lower limit of ore, but apparently no reliable assays were obtained or records kept of the results, and the impression remains that possible ore extensions below the planned pit floor may have been overlooked or ignored. However, unless the grade improves sharply with depth - for which there is no evidence - an orebody immediately below pit bottom would probably be ruled out by its high stripping ratio, as at the "C" pit.

It appears that the prospect of finding a small, mineable, shallow (pit) deposit is not good. Moreover, a larger deposit representing the combined shallow mineralized material remaining around the pits (several million tons @ 0.1% MoS_2) would be too low-grade, its polymetallic character would present extraction problems, and it might be costly to acquire sufficient ground for a big enough pit. Possible side-effects on the Nancy Greene ski hill could also be undesirable.

There is little reason to anticipate a substantially higher Mo price in the near future, although demand does appear to be firming. It is concluded that if a shallow orebody is not indicated by the current Mine Finders' program, further work is unlikely to locate one.

According to Zajac (pers.comm.), Mine Finders do not intend to seek an agreement with Scurry unless or until significant new mineralization is found on Red Mountain Mines ground: the molybdenite mineralization on Scurry's ground would have to be re-drilled to define its grade and tonnage, owing to uncertainties in the existing data. In amount and composition (it is likely to contain significant As and Bi) a Scurry deposit does not seem likely at present to support a successful mining operation on its own.

Deep Mo Ore: It is implicit in the reasoning behind the shallow ore program that the observed molybdenite mineralization must have a source at depth; it follows that there may also exist deeper zones of Mo enrichment of possibly

Discussion (cont'd)

Mine Finders' Program (cont'd)

economic grade. This matter has been discussed in the preceding section: the conclusion in the present report, based on genetic considerations, is essentially that of Mine Finders' - the target would probably be disseminated molybdenite related to a stock or cupola of quartz diorite underlying the hornfels-megabreccia-Q.D. breccia dike complex. Such mineralization might also contain W, Au and Cu values; moreover, there is a chance that a deep hole could intersect Au-Cu-Ag vein mineralization (of the "classic" Rossland type) in the augite porphyry sill that presumably underlies the property (see Local Geology). Drysdale (7) noted that augite porphyry/Q.D. contacts are favourable zones.

With the apparent fading of prospects for additional shallow ore, it is the evaluation of the potential for deep ore that must now determine the interest of Mine Finders' - and Inco - in the property. Both Wallace (21) and Zajac (23) have recommended deep drilling for this purpose; nevertheless their 1973 drill budget permitted only shallow holes. According to Wallace this reflected Mine Finders' opinion of the B.C. Government rather than their evaluation of Red Mountain's potential.

The genetic model presented above clearly suggests the significant possibility of zones of deeper ore. Drilling is the only way to test this suggestion. Steep holes drilled from the area of the pits - presumed to represent the upper portions of a mineralized breccia pipe - could probe the sub-surface extensions of the pit mineralization, the proposed igneous source at depth, and deep extensions of the gold-copper veins as well.

It may be objected that no commercial porphyry Mo mineralization is known locally, and that no specific target exists at present. Nevertheless it is argued that the drilling of one or two deep (3,000 ft.?) boreholes into this very rich mountain, considering the available geological knowledge and industrial infrastructure of the region, is a much more promising exploration gamble than many of our current programs in the Canadian Shield.

Other Considerations

Property: The cost of holding the Red Mountain property is not great: ca. $27,500 in 1974 (see Appendix IIA). Most of this is for maintaining the mill and other surface installations. So long as a significant potential for ore remains it should be in our interest to retain the ground: the mineral rights themselves cost only 37½% of ca. $15,000 in 1973, diminishing by nearly 25% annually.

Discussion (cont'd)

Other Considerations (cont'd)

However, if shallow ore is not found by the current Mine Finders' program it is likely that the existing mill would remain idle for a minimum of several years (until feed became available from a neighbouring property or a deep orebody). Therefore, if Mine Finders' are unsuccessful consideration should be given to selling the mill (whose value must be rapidly diminishing), thereby also reducing our costs.

Environment: After completion of the Mine Finders' surface program there should be little need to maintain the roads, pits and surface installations beyond the minimum required by law. However, the costs of possible environmental rehabilitation and safety measures could be much more onerous than the property payments. Because of the steep mountain slope the east walls of the pits are very high and present a serious hazard, especially as the mountain is used for skiing and the snowfall is too deep for fencing to be effective. The steep slope also favours rapid erosion of exposed soil: the clearings, access roads and banks will become deeply gullied if adequate drainage and/or revegetation is not provided.

The presence of the Nancy Greene Recreation Area on the mountain is an additional factor to be considered in relation to any larger scale mining operations.

CONCLUSIONS

Geology and Mineralization

At Red Mountain, folded Carboniferous and Jurassic sedimentary and volcanic rocks are intruded by a variety of younger igneous rocks; molybdenum, gold-silver-copper, and other mineralization is apparently centred on the mountain and related to local facies of the Eocene Trail granodiorite batholith.

From 1966 to 1972 Red Mountain Mines produced a total of 6,155,342 lbs. of MoS_2 from 1,038,817 tons of ore (average calculated grade 0.35% MoS_2). The official ore reserve is 118,000 tons @ 0.42% MoS_2 (waste: ore ratio = 3.9 : 1). In all, about 7 million tons @ 0.13% MoS_2 remain on the property. All these figures represent mineralization found within 200 ft. of surface.

The molybdenite (+ scheelite) mineralization is of skarn type, and confined to a hornfels megabreccia that may represent a breccia pipe overlying an unexposed stockwork-type Mo deposit.

Conclusions (cont'd)

Geology and Mineralization (cont'd)

The gold-silver-copper mineralization is in fissure replacement veins on claims adjacent to the Red Mountain Mines property. Between 1891 and 1942 a total of 6,200,000 tons of vein ore (average recovery 0.47 oz/ton Au, 0.6 oz/ton Ag, 1% Cu) was mined from this camp.

Mine Finders Exploration Program

In 1972 Mine Finders, of Colorado, began an exploration program, at their own expense, to re-investigate Red Mountain and thereby earn an equity in any resulting finds. The program is fourfold:

(i) Geological mapping, data compilation and evaluation; and geochemical soil sampling (Cu, Mo, W). These have been successfully completed, and the geological model and exploration proposals in the present review are largely based on Mine Finders' work and are in general agreement with their reported findings.

(ii) Tungsten in Tailings. Low grade, disseminated scheelite in the molybdenite ore was not recovered and is now found in the tailings. The dams were sampled to determine their tungsten content and its recoverability. There are ca. 1 million tons of tailings @ 0.1% WO_3, but tests indicate that the fine scheelite cannot be recovered profitably.

(iii) Shallow Mo Ore. To date fourteen boreholes totalling 4,317 ft. have been drilled in the mineralized megabreccia area, in search of another open-pit orebody of the type already mined, i.e. ca. 10^5 tons @ 0.4% MoS_2. Preliminary results are not encouraging - some ore grade mineralization has been encountered but it is in short, irregular intersections - nevertheless Mine Finders plan some additional shallow drilling in 1974.

(iv) Deep Mo Ore. The near-surface Mo mineralization is believed to have sub-surface extensions towards a source at depth. Such deep mineralization might also contain W, Au and Cu values; moreover, deep Au-Cu-Ag veins may be present. Because of doubts raised by the B.C. Government's legislative proposals, Mine Finders budgeted no funds for deep drilling in 1973, but may provide them in 1974.

Conclusions (cont'd)

Mine Finders Exploration Program (cont'd)

The failure of the tungsten program and the diminishing prospects of the shallow ore program must now focus Mine Finders' efforts on testing the potential for deep ore at Red Mountain. This is their last remaining chance to recover their investment, and it can only be done by drilling some deep holes. As long as Mine Finders' wish to continue their exploration program at their own expense, it is in our interest to accommodate them. However, a formal agreement should be signed.

Ore Potential

No commercially mineable mineralization is currently known to exist on the property: the official ore reserve has too high a stripping ratio for profitable exploitation. The price of molybdenum is not expected to increase sufficiently during the next few years to change this evaluation.

The present stage of Mine Finders' exploration program is designed to locate near-surface Mo (W) ore in the area of the existing pits. Their results to date have not been encouraging; note, moreover, that the mine was operated at a loss throughout its life.

It is concluded that the value of the Red Mountain property depends on the potential for the discovery of new ore at depth. The present review has suggested that economic Mo mineralization (with W, Au, Cu and Ag values) could be present below the existing pits on Red Mountain, in a skarn-breccia pipe and/or in a subjacent igneous mass. The known geology indicates a stockwork type of Mo deposit; the regional geology and metallogeny are not unfavourable. Red Mountain appears to be a major centre of mineralization for Mo, Au, Cu, W and other metals. The anticipated grade (ca. 0.4% MoS_2)is sufficient to support underground mining; there is no reason to expect the molybdenum mineralization to be confined to near-surface rocks. Moreover, there is evidence to suggest that the known gold-copper-silver vein mineralization may extend onto the property beneath the pits. The current prices of these metals considerably enhance the exploration prospects.

Additional surface work can do little to quantify the probability of finding ore at depth, although a financial analysis would be useful in providing estimates of the rise and grade of deposit that is required. But, as already recognized by Mine Finders, the existence of a deposit can only be determined by deep drilling, and this should be the next step.

Property and Agreements

Inco owns all the outstanding Red Mountain Mines shares, and all its assets and liabilities excluding the residential properties and mortgages, and the mining properties which are held in trust (Inco 37½%, Consolidated Canadian Faraday 37½%, Torwest Resources 25%). The net book value of the mill and other buildings and their contents, on October 31, 1973, was $29,516 (the market value is expected to be considerably greater). The mining property consists of twenty mineral claims. The current cost to Inco of holding this property is less than $6,000 in 1973, diminishing by almost 25% annually.

We have no agreement with Mine Finders, Inc., aside from their original letter of intent.

The sources of these and other relevant data are listed in Appendix I.

Environment

The costs of maintaining the property and facilities in their present condition are about $21,500 per annum. However, strict enforcement of safety and environmental rehabilitation regulations could be much more costly, because of the siting of the pits and access roads on a steep mountain slope. Moreover, the Nancy Greene Recreation Area with its popular ski trails shares Red Mountain, and could be affected by future mining operations.

Further Work

It is concluded from the present review that the ore potential of the Red Mountain Mines property has not yet been adequately tested. Additional work in 1974 should include:

(i) Completion of Mine Finders' shallow-drilling program for near-surface molybdenite-scheelite ore bodies in megabreccia. Details of this work can best be supplied by Mine Finders, who will almost certainly finish it at their own expense.

(ii) A program of deep drilling to probe the downward continuations (and source?) of the Mo (W) mineralization, and at the same time seek for deep extensions of the Rossland Au (Cu,Ag) lode deposits. A proper estimate of the work involved here will require careful consideration of available geological information from the molybdenum and gold producing claims, and a financial analysis to indicate the required size and grade ranges for a deep mineable deposit. It is suggested here that a minimum of two holes, each ca. 3,000 ft. deep, will have to be drilled from the

Conclusions (cont'd)

Further Work (cont'd)

area of the pits. The estimated cost is ca. $90,000. Considering the rich mineralization of the mountain, and the excellent economic infrastructure of the region, it is contended that this is a more attractive proposition than many current programs in the Canadian Shield. Moreover, Mine Finders are known to have included it in their 1974 draft budget.

RECOMMENDATIONS

1) Inco should retain its interest in the Red Mountain Mines property because the ore potential has not yet been adequately explored.

2) The potential for near-surface Mo (W) ore should be evaluated by completing the current Mine Finders' program of shallow drilling. Mine Finders will almost certainly do this themselves in 1974.

3) If near-surface ore is not found - as seems probable - the mill and ancillary facilities should be sold. Even if deep ore is subsequently found they will remain idle for a minimum of several years, and their value is rapidly diminishing. The sale would substantially reduce our maintenance costs.

4) The potential for deep ore (Mo (W) and Au (Cu, Ag)) should be evaluated by a program of deep drilling. An initial, minimum program of two 3,000 ft. holes costing ca. $90,000 is suggested. Mine Finders may include a provision for deep drilling in their 1974 budget. If they do not, or if such drilling is unsuccessful, Inco should seek alternative partners (see 7, below).

5) Inco should conduct an in-house financial analysis designed to provide estimates of the minimum size and grade of underground deposits that could be profitably mined at Red Mountain, so that a deep drilling program to test the existence of such mineralization (4, above) can be better outlined and evaluated. This should be done before deep drilling begins.

6) Mine Finders should be encouraged to continue their exploration program at their own expense. A formal agreement should be signed, preferably before drilling recommences.

7) Inco should seek other partners to explore the Red Mountain Mines property if Mine Finders withdraw, or are unsuccessful in a deep drilling program. In any case Inco should now determine the degree of interest

Recommendations (cont'd)

of Cominco in exploration at Red Mountain. Because of their extensive holdings and geological knowledge of the Au-Cu-Ag vein mineralization Cominco would be the ideal partner to replace Mine Finders on the same terms, or to engage in a joint venture with Inco, or perhaps to add their property to Inco's for exploration by Mine Finders. Scurry-Rainbow is another potential partner, also with property and mineralization (Mo-W) on Red Mountain. Cominco and Scurry are also potential buyers for the mill (3, above).

JGB/st.
November 29, 1973

APPENDIX I

DATA SUMMARY

Red Mountain Mines, Ltd.

Location	20 claims on Red Mountain, Rossland, B.C., 45°05' N., 117°50' W. (Figs. 1,2,3,6).
Ownership	Inco 37½%, Faraday 37½%, Torwest 25% (see Memorandum of Agreement, ref. 15, Appendix III).
Production	(1966-1972): 6,155,342 lbs. of MoS_2 from 1,038,817 tons of ore.
Ore Reserves	118,000 tons @ 0.42% MoS_2 (stripping ratio 3.9 : 1)
Facilities	8 open pits; access roads; miscellaneous mining equipment; office; processing facilities including 600 t.p.d. mill, XRF and wet assay lab, ore bins, water tank, tailings thickener and 2 tailings dams. Net book value of mill and other buildings including contents: $29,516 (Appendix II A).
Costs	To hold and maintain property: ca. $27,500 in 1974 (see Appendix II B). This figure includes cost of holding the mineral claims (37½% of ca. $15,000 in 1973, decreasing by ca. 25% annually - see W.J. Cavalluzzo).
Reference Information	Maps and sections: complete sets in Inco Exploration files, Toronto; Faraday office, Toronto; and partial set at Red Mtn./Mine Finders office. BH logs: complete sets in Faraday office, Toronto and Red Mtn./Mine Finders office. Property records: Inco Exploration files, Toronto; see also Fig. 6, and ref. 15, Appendix III. Production, Legal and Financial records: Inco files, Toronto (see G.H. Merriam). Mine Finders, Inc.: letter of intent (Ref. 5, Appendix III) Other reference data: see Appendix III.

APPENDIX IIA

INCO - RED MOUNTAIN DIVISION

STATEMENT OF NET BOOK VALUE

AS AT OCTOBER 31, 1973

	Cost	Accumulated Depreciation	Net Book Value
As at August 31, 1971	$2,063,747	$2,029,187	$34,560
Disposals during the period from Aug. 1971 to Oct. 1973	252,205	247,161	5,044
As at October 31, 1973	$1,811,542	$1,782,026	$29,516

NOTE:

1) The $29,516 represents book value of the mill and other buildings, including the contents and associated equipment.

2) The disposal of assets that cost $252,205 realized about $105,000 and so the market value of the remaining assets is appreciably more than the book value of $29,516.

G.H. Merriam

APPENDIX II B

1974 PLAN AND 1975/1976 FORECASTS

INCO - RED MOUNTAIN DIVISION

(Expressed in whole dollars)

Account No.		1974						
		10	20	30	40	Total	1975	197
	Revenue	$ nil	$ nil	$ nil	$ nil	$ nil	$ nil	$ nil
	Expenditures							
824-100	Maintenance & Repairs	$1,800	$ 1,800	$1,800	$1,800	$ 7,200	$ 7,200	$ 7,20
826-300	Utilities - Water	75	75	75	75	300	300	30
820-102	Communications - Telephone	90	90	90	90	360	360	36
826-100	Utilities - Electricity	630	630	630	630	2,520	2,520	2,52
828-000	Insurance	-	3,300	-	-	3,300	3,300	3,30
812-000	Dues & Memberships	100	-	-	-	100	100	10
826-400	Utilities - Fuel	300	-	-	300	600	600	60
831-100	Legal fees	-	-	-	300	300	300	[illegible]
850-100	Property Taxes	135	12,135	286	200	12,756	12,756	12,75
		$3,130	$18,030	$2,881	$3,395	$27,436	$27,436	$27,43

RED MOUNTAIN MINES LIMITED

There will be no revenue or expenditures for Red Mountain Mines Limited.

NOTE: Capital appropriation and expenditures - nil

Submitted by: [illegible signature]

Approved by: [illegible signature]

APPENDIX III

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