I N D E X

1. Letter to Shareholders - Dated June 26, 1964.

2. New Silver-Lead-Zinc-Antimony Potential of Mayo District, Yukon. By Dr. A. E. Aho.

3. Summary Report on Mt. Nansen Mines - Prepared by W. C. Martin, Geologist - Northfield Mines Inc. (Thayer Lindsley).

4. Potential of Mayo Mineral District, Yukon - By Dr. A. E. Aho.

5. F.M.C. Analysis of Peso Silver Development, October, 1963.

FRONT POCKET

1. Annual Report Dated December, 1963.

2. Interim Report - June, 1964.

BACK POCKET

1. Potential Ore Zones & Producers in Mayo Silver-Lead District, Yukon.

2. Rex Vein Development.

3. Geologic Map of Yukon with Districts Outlined.

4. Principal Mineral Areas of Canada.

5. Property Map of Mt. Nansen District.

6. Property Map of Mayo District.

7. Peso Regional Geology Map.

8. G.S.C. Anaysis of Carmacks District, Yukon.

SHOOT "B" UNCUT AVERAGE OF SECTIONS 220'X30' 59.8oz.AG. 5.36%PB, 1.05%ZN, 4.06%SB

27oz. AG./3.5FT.

DDH 35-9
18.2oz.AG./7.5FT
(30.7oz.AG./3.0FT.)

35-15 2'WELL MIN.
35-16 5'WELL MIN.

283oz.AG./2.3FT.
48oz.AG./2.0FT.
5% SB

429oz.AG./1.0FT.
8% SB

MAIN 3550 X CUT

SEVERAL WELL MINERALIZED STRINGERS

14oz. AG. 5.0FT.

NEW SECTION WELL MIN.

35-12
26.6oz.AG./2.5FT.
12% SB

HANGING WALL SHEAR

35-11
17% PB, ZN
80oz./4FT.
(201oz.AG./1.0FT.)

"E" ZONE-OPEN TO EAST
600' explored
500' open to east
as evidenced by surface stripping

78 XC

105 DR

35-4

SHOOT A?
WELL MIN.

75 DR. W.

DDH 35-6

93 DR. W.

3550 DRIFT EAST

124 XC

SHOOT "E"

SHOOT ?

FW SHOOT

"E" ZONE ON SURFACE

OPEN TO WEST

300' under exploration
5000' open to west
as evidenced by surface stripping

3550 DRIFT W.
(ELEV. 3550)

169oz.AG./0.7FT.

74 RAISE

PROPOSED SUB-LEVEL

SHOOT "C"

SHOOT "D"

ORE SHOOT "B"
35.7oz.AG, 6.9%PB, 3.8%SB
over 270'X5.0'
SURFACE ELEV. 3870'

SHOOT "A"

ORE INTERSECTIONS ON REX VEIN PESO SILVER MINES

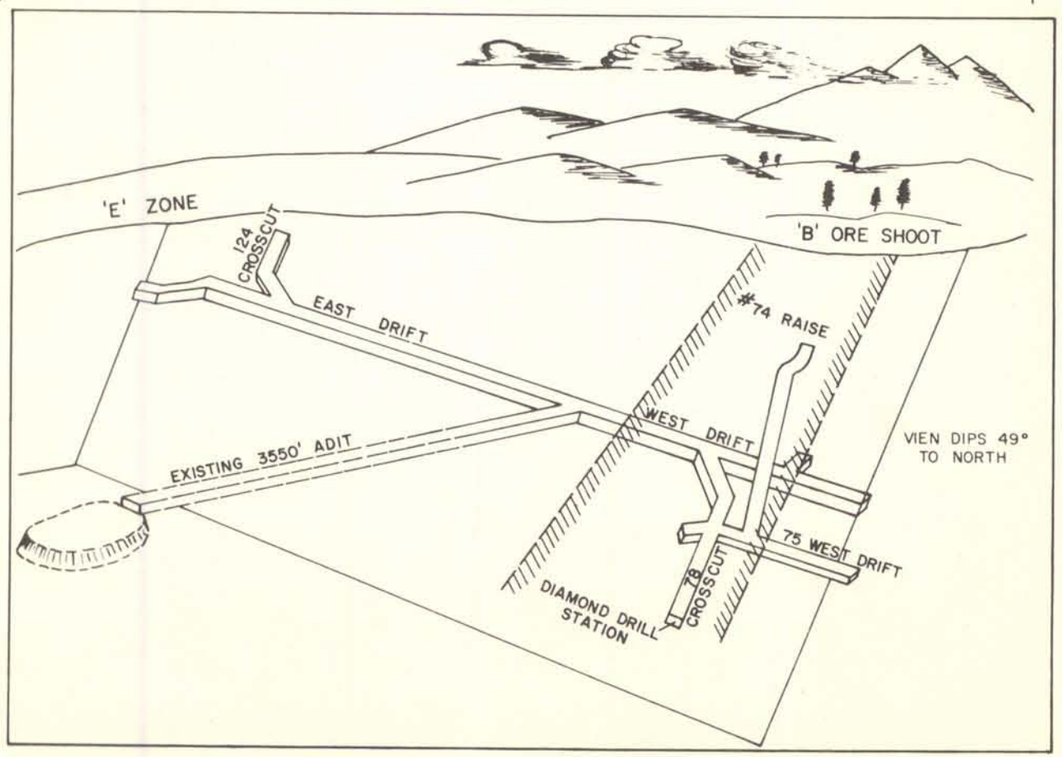
JUNE 18 1964

SCALE OF FEET

0 50 100 200

LEGEND

AG - SILVER
PB - LEAD
ZN - ZINC
SB - ANTIMONY



PESO SILVER MINES LIMITED (N.P.L)

SUMMARY OF EXPENDITURES IN YUKON.

Expenditures on exploration and development in Yukon (exclusive of administration and overhead costs) to December 20th 1963. This expenditure was largely on the Peso Property in the Mayo District.	$470,000
Expenditures made or omitted and now in progress:	
MAYO DISTRICT:	
Rex and Peso development	$615,000
Galena and Keno Hills development	$143,000
Exploration - Mayo District	$120,000
CARMACKS DISTRICT:	
Exploration - Mount Nansen Area	$127,000
Total spent or committed in Yukon	$1,475,000
Probable cost in 1964 of second adit to lower level of Rex Vein in Mayo District.	500,000
Total probable expenditure to December 31st, 1964.	$1,975,000

LETTER TO SHAREHOLDERS

DATED JUNE 26, 1964

PESO SILVER MINES LTD. (N.P.L.)

ADMINISTRATIVE OFFICES:
420 - 475 HOWE STREET
VANCOUVER 1, B.C., CANADA
TELEPHONE MUTUAL 1-1385

REGISTERED OFFICE:
916 - 475 HOWE STREET
VANCOUVER 1, B.C., CANADA

June 26, 1964

NEWS RELEASE

TO THE SHAREHOLDERS:

Following our recent announcements of very gratifying results from the Rex Vein, we are enclosing a diagram with up to date assay data on new ore intersections and recent developments.

Results of diamond drill core and face samples representative of the "B" ore shoot at the new 3550 level are as follows:

East limit of the shoot, D.D.H.4:

42.9 oz Ag/ton, 10.7% Pb, 0.45% Zn, 8.32% Sb over 1.0' true width.

On Section 85E, D.D.H.35-12:

26.6 oz Ag/ton, 14.9% Pb, 11.9% Sb over 2.5 true width, 0.35% Zn.

On Section 80E, D.D.H.35-6:

283 oz/ton Ag, 5.41% Pb, 0.61% Zn, 5.13% Sb over 2.3' true width.

On Section 77E:

Face samples 2647, 2650: 27.1oz/ton Ag, 2.97% Pb, 4.15% Zn, 1.64% Sb over 3.5' true width.

On Section 73E:

Face sample 2626: 18.72 oz Ag/ton, 3.66% Pb, 0.25% Zn, 2.03 Sb.

An average grade for the 220-foot strike length and 3.0' true width, allowing somewhat for dilution and weighting each of the above grades equally, is:

59.8 oz Ag/ton 5.36% Pb 1.05% Zn 4.06% Zb.

A grade calculation for the "B" ore shoot as it appeared on surface assigned a grade of 35.75 oz Ag/ton, 6.9% Pb, and 3.8% Sb to a 270' x 5.0' ore shoot.

These two calculations give a possible ore tonnage and grade for "B" ore shoot of 34,000 tons at 47.8 oz Ag/ton, 6.1% Pb, 1.0% Zn, 3.9% Sb.

It is also reasonable to assume that the "A" and "D" ore shoots can be projected to the 3550 level, and trenching' on the "E" zone is exposing and additional potential ore shoot.

Drifting and raising at the 3550 ft adit level is being extended past the present contract to give more positive tonnage and grade calculations.

It is anticipated that future extensions, additional ore shoots, and sections of better grade will add substantially to the present indications during the course of the next phase of exploration. During this time a decision will be made on driving a major lower level heading to develop the ore-bearing zone at depth.

Recent results have been so encouraging that the previously proposed 1964 budget of $750,000 has been increased to exceed $1,000,000. The ultimate total exploration expenditure for the current year could be as high as $1,400,000 and will depend on the pace of the present project and assessment of results.

The presence of substantial quantities of antimony which would give an important antimonial lead by-product from silver ore production has taken on a new importance. Rising demand for antimony may be expected to place more emphasis upon this metal. Enquiries from several Japanese companies are being pursued and a bulk shipment will be made for smelter tests. In addition, Peso is conducting metallurgical tests on bulk samples from the recent underground work.

Other Projects:

In addition to the main Rex development, work is progressing rapidly on all other Peso controlled projects.

Drilling on Peso's No.2 Vein has shown well-mineralized diamond drill intersections upon which further data will be released as work progresses.

Bulldozer trenching has commenced on the Mount Nansen Mines property, and a crew has started exploration work on the Mount Nansen Gold Mines property several miles north of the main Mount Nansen Mines property.

The Shanghai underground project is progressing favourably and the crosscut is now in approximately 150 ft, with surface trenching commenced on the vein zones. The crosscut is expected to intersect the No.1 vein zone soon at about 300 feet and drifting will be continued along it for about 700 feet.

Work has started on the Duncan-Ladue property adjacent to the main Sadie-Ladue Mine on Keno Hill, and on the Alice claims held under Central McQuesten Mines.

Programs have also started on the Mayo Silver Mines property.

In addition, general prospecting crews are active in select areas of Central Yukon. Exciting developments may be anticipated as a result of the intensive exploration programs now under way.

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All Peso Silver Mines shareholders, with shares registered in their own names, will receive further reports on the Rex Vein development as soon as confirmed.

Copies of the latest Interim Report, containing a comprehensive picture of the wide interests now held by Peso Silver Mines Limited, can be obtained from the Company.

June 26, 1964

NEW SILVER-LEAD-ANTIMONY POTENTIAL OF MAYO DISTRICT YUKON

NEW SILVER-LEAD-ZINC-ANTIMONY POTENTIAL OF MAYO DISTRICT YUKON

SUMMARY

Comparison with other metalliferous regions of western North America shows that mineral districts with productive capacities in excess of a billion dollars in gross value must exist undeveloped in Yukon.

In the Mayo district, recent work is already proving that rich silver mineralization is much more extensive than previously thought and that the total potential could easily exceed a billion dollars.

Up to 1964 the 20-mile length of the original Keno-Calena Hills part of this district had produced a total of about 133 million ounces of silver, 409 million pounds of lead, 233 million pounds of zinc, and 3.0 million pounds of cadmium valued at $275 million at present prices. Most of this has been produced by United Keno Hill Mines in the last 16 years, making this company Canada's largest silver producer and the world's third largest.

Recent work, however, has shown similar rich deposits in similar favourable host rocks for an additional 15 miles farther westward and 10 miles farther northward, thus doubling or tripling the size and potential of the district.

This larger new potential is owned or controlled by Peso Silver Mines and associates, and accelerated exploration this season is starting to prove up this potential according to expectations. Increased development is proposed.

ORE OCCURRENCE

The producing mines occur in northeast-trending vein zones which dip southeast within favourable brittle quartzite host rocks. The main favourable host rocks are 2500 feet or more thick and extend for over 35 miles along both north and south limbs of a broad anticlinal arch. They are cut at varying intervals by the vein zones, which are up to several miles in length. These vein zones have been explored and mined only locally, therefore a much greater potential exists in the known zones and in the newly discovered ones.

The entire vein pattern is now found to be co-extensive with, and related to, the major anticlinal arch. Thus the silver-rich district now appears to be at least 35 miles long and 15 miles wide, with outlying mineralization that could make it even more extensive. This overall district is similar in characteristics and potential to the famed Coeur D'Alene silver-lead district of Idaho, but has remained unrecognized as such until now.

Aside from the main silver-lead mineralization, parts of the Mayo district also have significant prospects of gold, tungsten, and especially tin. Since 85% of the world's tin comes from the circum-pacific region, 20% of it from a geologically similar silver district in Bolivia, the unexplored tin possibilities are also well worth consideration.

PRODUCTIVITY

Since the first small scale mining in 1913, a number of veins were discovered by individuals using hand methods, and between 1921 and 1942 nearly all the mining was done on rich ores near the surface. Between 1942

and 1946 the mines were shut down, but the greatest production was achieved in the last 16 years with improving economics, and with mining extending to deeper levels. Most of the production has come from six vein systems. The mining has been very profitable even on the scale that has been developed to date, as shown by the accompanying summary of operating data:

Comparative Statement of Production by Years

Fiscal Year	Tons Milled	Production			
		Silver Ozs.	Lead lbs.	Zinc Lbs.	Cadmium lbs.
Dec 31, 1947	20,880	735,195	2,157,090		
Dec.31, 1948	37,593	1,908,267	5,089,554		
Dec.31, 1949	29,494	1,403,360	5,330,736	2,272,397	
Dec.31, 1950	77,465	3,349,848	13,916,231	7,040,569	80,585
Dec.31, 1951	88,026	3,480,965	13,036,638	7,174,657	94,608
Sept.30, 1952(9 Mos.)	102,269	3,408,966	14,436,073	10,280,241	139,654
Sept.30, 1953	156,684	6,252,483	27,313,584	21,245,493	304,722
Sept.30, 1954	180,249	6,191,599	30,663,549	26,134,700	312,931
Sept.30, 1955	162,307	5,670,137	26,350,198	24,035,999	302,297
Sept.30, 1956	155,702	5,582,979	25,083,145	24,107,851	322,379
Sept.30, 1957	159,885	5,694,850	22,569,908	18,119,454	236,271
Sept.30, 1958	175,058	5,984,373	22,255,501	18,610,970	229,308
Sept.30, 1959	173,477	7,307,815	22,865,276	17,717,019	220,281
Sept.30, 1960	176,745	7,249,101	21,986,887	14,440,774	181,132
Sept.30, 1961	186,116	7,231,908	17,911,672	15,512,624	202,432
Sept.30, 1962	184,123	7,000,837	17,587,767	13,883,884	184,364
Sept.30, 1963	186,721	5,978,075	16,751,012	14,759,821	199,708
Total	2,252,794	84,430,758	305,304,821	233,338,453	3,010,672

UNITED KENO HILL MINES LIMITED

Eleven Year Summary Of Operating Data

OPERATING RESULTS:	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Sales of concentrates less smelter charges, freight and marketing expenses	$6,143,115	$7,001,730	$7,311,760	$7,691,701	$6,659,348	$6,117,968	$7,416,590	$7,280,964	$7,101,507	$8,301,313	$8,805,518
Operating and administrative expenses	4,206,859	4,984,416	4,089,292	4,310,590	4,533,606	4,804,302	4,980,384	5,306,934	5,327,271	5,440,268	6,004,473
Operating profit before undernoted items	$1,936,256	$2,017,314	$3,222,468	$3,381,111	$2,125,742	$1,313,666	$2,436,206	$1,974,030	$1,774,236	$2,861,045	$2,801,045
Deduct (add)											
Depreciation and amortization charges	$1,107,992	$ 867,349	$ 743,505	$ 700,290	$ 684,150	$ 470,624	$ 515,426	$ 522,131	$ 522,624	$ 519,985	$ 450,629
Expenditures on exploration and development		169,140	255,540	217,434	169,909	278,236	426,258	412,623	441,471	586,616	1,029,639
Other Income	(4,329)	(88,861)	(29,044)	(41,919)	(50,065)	(84,034)	(48,314)	(144,373)	(97,894)	(118,687)	(155,135)
Income Taxes (estimate)	88,000	190,000	650,000	500,000	320,000	62,000	218,000	60,000	70,000	655,000	485,000
Earnings for the year	$ 744,593	$ 879,686	$1,602,467	$2,005,306	$1,001,748	$ 586,840	$1,324,836	$1,123,649	$ 978,035	$1,218,131	$ 990,912
WORKING CAPITAL:											
Current assets	$1,568,983	$2,333,786	$3,598,468	$4,096,601	$3,575,016	$3,196,637	$4,155,269	$4,587,299	$4,804,099	$5,976,401	$5,626,616
Current liabilities	715,615	835,684	1,173,343	1,309,471	1,083,638	855,041	932,559	745,540	654,600	1,426,976	1,096,298
	$ 853,368	$1,498,102	$2,425,125	$2,787,130	$2,491,378	$2,341,596	$3,222,710	$3,841,759	$4,149,499	$4,549,425	$4,530,318

During 1963 the company produced 11,921 tons of silver-lead concentrates, and 12,309 tons of zinc concentrates. After deducting smelting, freight and marketing expenses they received a net value of 8,805,518 for their metals which resulted in an operating profit of $2,801,045. The net earnings for the year were $990,912, compared with $1,218,131 in 1962. In 1963 all of the company's income was subject to tax as none of its operating mines now qualify for the new mine exemption under the Income Tax Act. Provision for taxes amounted to $485,000 in 1963.

The ore treatment plant at Elsa operated throughout the year at an average milling rate of 511.5 tons per calendar day. The metal recoveries were silver 88.03%, lead 82.42%, zinc 84.32%.

Ore reserves as of September 30, 1963 totalled 493,955 tons with an average metal content of 34.58 ounces of silver per ton, 6.59% lead and 5.80% zinc. Reserves of the previous year totalled 445,630 tons grading 38.47 ounces of silver per ton, 7.12% lead and 5.03% zinc.

A more aggressive exploration attitude has been adopted within the last year with gratifying results in several localities.

Much of the profit of previous years has been absorbed by costs of opening up the district, which would not be faced by a new operation. Under present conditions the profitable operations of United Keno Hill Mines would represent a stable mining operation assuming no substantial improvement in new reserves, mining practices, or other cost factors. New operations may expect to start on near-surface orebodies with better metal prices, improved transportation and other favourable factors.

NEW POTENTIAL

A detailed report showing additional new potential in the district, entitled "Potential of the Mayo Mineral District" is enclosed for consideration.

The new potential owned or controlled by Peso Silver Mines and associates consists of claim holdings more extensive than those of United Keno Hill Mines, with a number of new potential ore zones, as shown on the accompanying 3-dimensional map. These have the following possibilities:

1. Original 20-mile long producing area

   Post production plus 1963 reserves (mostly United Keno) $314 million

   Future down dip and depth potential at least equal

   to or much greater (United Keno and others) say $500 million

2. New 15-mile west extension

   Unknown, perhaps comparable say $300 million (?)

3. New north side

   Unknown, perhaps comparable say $300 million

4. Haggart Creek silver-lead-antimony belt

   (peso's Rex vein and others)

   Unknown - may be similar

5. Outlying areas to southeast, east, west and north - unknown.

The potential of any one major productive mine similar to the Hector-Calumet could easily change this "calculated guess" heavily in any area.

PROPOSED DEVELOPMENT

Development should consist of opening up several of the key vein systems to determine their productive potential and then setting up separate mine

operations which would feed into a central mill.

With all the known indications of potential, it is anticipated that with sound and aggressive exploration, a number of new mines would be developed in the high grade part of the district to yield greater and more efficient production than in the past and that lower cost operations might also be expanded to take in outlying areas.

This development could tie in well with an overall plan of proposed mining and metallurgical development of lead-zinc-silver ores in Yukon as a whole.

Respectfully submitted,

Dr. A. E. Aho.

Vancouver, B.C.
June 30, 1964.

SUMMARY REPORT ON MT. NANSEN MINES

PREPARED BY W. C. MARTIN, GEOLOGIST -

NORTHFIELD MINES INC. (THAYER LINDSLEY)

WILLIAM C. MARTIN

Summary Report

M O U N T N A N S E N M I N E S L T D.
Carmacks Area - Yukon Territory

CONCLUSIONS

1. An impressive number of quartz veins have been found on this property carrying high gold and silver values. The veins found to date are mostly narrow but good values have been found by scattered trenching and channel and grab sampling and over a length of 8000 feet and a maximum width of 3000 feet.

2. The combined lengths of the veins will be very large if only a few extend over the 8000 foot distance assuming about 20% of the vein length makes ore. There is therefore an attractive possibility here of developing a medium grade tonnage operation even if the veins average only 2 feet in width, although a much greater width is probable. The ore horizon should have a vertical height of 1000 feet or better. The maximum vertical height for epithermal deposits of this type is probably around 3000 feet, it is important to be able to identify the top and bottom of the ore horizon by the mineralogy, in this case indications suggest the Webber and Huestis zones are in the upper half of the ore horizon.

3. What appears to be the main vein of the Webber vein zone has been stripped and sampled continuously over a length of 500 feet, some good grade ore shoots are indicated averaging out as follows:

Length of vein stripped		500 feet
Total ore length		185 feet
Percentage of vein making ore		37%
Weighted av. cut grade:	gold	0.52 oz/ton
	silver	42.3 oz/ton
(Gold above 1 oz. cut to 1 oz. and silver above 100 oz. cut to 100 oz.)		
Average width of vein		4.2 feet

4. Trenching at 50 foot to 100 foot intervals on strike of the main Webber vein to the southeast uncovered several parallel veins with branches in a zone of 200 feet wide and 800 feet long. Six channel samples taken on some of the veins intersected average out as follows: 0.60 oz/ton au and 19.0 oz/ton ag over 3.7 feet. This sampling indicates that ore potentialities are present for a length of 800 feet southeast of the stripped portion of the Webber vein zone. There is at least 1600 feet of unstripped vein length indicated in the trenching done in the Webber zone and there is possibly several times this amount if complete stripping of the zone is undertaken.

5. The Webber vein zone may be 400 feet wide. Two parallel veins are evident 200 feet and 250 feet north of the main Webber vein. The nearer vein was cut by two trenches 120 feet apart, two channel samples in these trenches average 0.46 oz/ton au and 3.3 oz/ton ag over 2.2 feet, only one channel sample was taken on the more distant vein, this ran 0.84 oz/ton au and 19.7 oz/ton ag over 1.0 feet. These results do not indicate ore but are two veins which if stripped might add appreciably to the ore picture.

6. The trenching on the Huestis vein zone which is an important zone lying 2400 feet southeast of the east end of the Webber zone, the latter is cut off by a fault beyond which its location is uncertain. The veins of the Huestis zone may be better in grade but narrower than those of the Webber zone, its relationship to the Webber zone is uncertain.

7. The Huestis zone has been traced by trenching for 800 feet. There are two parallel veins indicated 200 feet apart. The north vein is probably continuous for 800 feet but disrupted in five places by faulting. Four channel samples taken at unequal intervals along the north vein average out to 1.35 oz/ton au and 56.9 oz/ton ag over an average width of 1.9 feet. The veins of

this zone need to be stripped continuously, they appear to be open at both ends.

8. The Cabin vein is near parallel to the Webber vein and 1300 feet south of it. This vein has been traced for 900 feet and stripped continuously and closely sampled for 550 feet. The silver content of this vein is about the same as the Webber but the gold content appreciably less, an ore shoot is indicated, grading as follows: 0.29 oz/ton au and 41.7 oz/ton ag over 3.0 feet for a length of 110 feet; over a width of 6.1 feet this shoot averages 0.23 oz/ton au and 24.5 oz/ton ag.

9. The Brown-McDade vein zone lies only 4500 feet east of the Huestis zone of Mt. Nansen Mines property. Surface trenching in the vein zone indicated, quoting from a report to J. L. Hough, January, 1947: "high gold values and appreciable silver values for a length of 600 feet. After cutting one assay of 9.4 ozs. plus 1.0 oz. a grade of approximately 0.4 oz. au and 2.5 to 3.0 ozs. ag was indicated across widths of 10 to 25 feet with considerably higher values in some portions".

Underground results were as follows: 365 feet averages approximately 0.40 oz. au and 3.0 ag over 5'0. Percentage of drifting in ore was 26% Averages were calculated from back samples taken at 5 foot intervals. According to Hough "The main shoot has a maximum width of 16 to 18 feet at the main crosscut ----- The north H. W. shoot has a maximum width of 20 feet----".

"Three deep holes were drilled from the west end of the main crosscut ----- No. 101 at 138 feet (115 feet vert.) 6 feet assayed 0.03 oz. au, a stringer of massive pyrite assay 0.24 ozs. at a vert. depth of 40 feet. Hole 102, between footages 140.5 and 151.0 ---for a calculated true width of 7 feet the zone averaged 0.86 ozs. au (uncut) and .55 oz. au (cut). Mineralization consisted chiefly of pyrite with some sphalerite and galena and no significant

silification or vein quartz. Hole 103 --- the main zone was cut between footages 143 - 150.5 (139 feet vert. below adit level) and assayed 0.20 oz. au for core length of 7.5 feet." It is possible that the drifting went off the vein towards both the north and south. Cross-faulting appears to push the vein west going south.

The Brown-McDade may be an upfaulted and northward dislocated extension of the Huestis zone.

RECOMMENDATIONS

1. It is recommended strongly that the Syndicate subscribers option or purchase the Mt. Nansen Mines property.

2. Carry on further surface exploration next season as follows:

   (a) Strip by bulldozing all the veins of the Webber zone carrying ore grade values, sample same at 10 foot intervals.

   (b) Strip by bulldozing both the north and south veins of the Huestis zone.

   (c) Investigate the area between the Huestis and Webber vein systems by further cross-trenching.

   (d) Follow up any other veins presently exposed in trenches, if they carry ore grade values.

   (e) Investigate by geochemical prospecting the porphyry plugs towards the north end of the property.

   (f) Investigate geochemical anomalies by bulldozing.

   (g) Investigate by trial dry drilling the veins with angles using percussion drills with extension steel. The main purpose of the experiment is to establish a cheap method of testing and sampling the veins at shallow depth. If this method works, as it probably will, 10,000 feet of shallow sampling drilling should be laid out.

   (h) Obtain a sampling option on the Brown-McDade, use a percussion drill to thoroughly sample west wall of the main drift and westerly subdrifts.

(i) Allow for 3000 feet of diamond drill core drilling to test the most promising ore sections at 100 feet and 250 foot depth. Use bullnosed bit when possible.

ESTIMATED COST OF PROGRAM RECOMMENDED

The cost of the proposed program is roughly estimated as follows:

(a) Webber vein zone stripping	$ 7,500
(b) Huestis zone stripping	2,500
(c) Cross trenching	2,500
(d) Follow up stripping	2,500
(e) Geochemical survey	10,000
(f) Follow up prospecting and bulldozing	5,000
(g) Long hole percussion drilling	10,000
(h) Brown-McDade	5,000
(i) 3000 feet diamond drilling	35,000
(j) Engineering, assaying, etc.	10,000
(k) Camp, incidentals, etc.	10,000
	$100,000

W. C. Martin

Toronto, Ontario

March 10, 1964

POTENTIAL OF MAYO MINERAL DISTRICT, YUKON

BY DR. A. E. AHO

POTENTIAL OF THE MAYO MINERAL DISTRICT, YUKON

SUMMARY

The Mayo mineral district has a much larger indicated silver-lead potential than previously thought, indications being that the total potential could exceed a billion dollars in gross value.

The main control for mineralization is the N70°E McQuesten anticline belt which extends for about 70 miles from Clear Creek east to open out against the northwest-trending, southeast-plunging Mayo Lake anticline in the Davidson Mountains. This structure forms an arch of quartzites and phyllites uniquely transverse to the regional trend followed by the Mayo Lake anticline, a marked characteristic shown by several other major Cordilleran mineral districts such as the Coeur D'Alene and Bingham camps. This anticlinal belt is intruded by a row of granitic stocks along its axial region and its north flank while porphyry occurs throughout the belt. Gold, tin, and tungsten mineralization occur near the granitic stocks. Intervening areas are mineralized with silver-lead-zinc and antimony veins occurring largely in a pattern of NE and E-W fault fractures which, along with N-NW cross faults and E-W longitudinal faults form a major tensional fracture pattern that is genetically related to the anticline and is typical of fracture patterns in elongate domes or anticlines in other productive mining camps, oil fields and scale models. A major longitudinal fault or faults extends for about 40 miles along the axis of the anticline, showing downthrow of the north limb.

Within this anticlinal structure silver-lead-zinc and antimony mineralization occurs chiefly in Keno Hill quartzites and greenstones because of their competence, in phyllites under certain structural conditions, and may occur as limited replacements in limestone bands above the Keno Hill quartzites. These favourable Keno Hill quartzites (2500 to 10,000 feet thick) and other rocks are exposed mostly along the axial region of the McQuesten anticline, plunge westward from the flank of the Mayo Lake anticline, are uplifted again by the major Haldane antithetic fault, and are exposed for some distance westward at Seattle Creek along the south flank of the anticlinal structure.

Up to 1964 the main Keno-Galena Hills part of the district has produced a total of about 133 million ounces of silver, 409 million pounds of lead, 233 million pounds of zinc and 3.0 million pounds of cadmium valued at $275 million, largely in the last 16 years making it Canada's largest silver producer and the world's third largest. This production has come from NE-striking, SE-dipping vein-fault structures which cut the Keno Hill quartzite formation over a distance of 20 miles in the east part of the south limb of the McQuesten anticline. Work in the last couple of seasons, however, has shown that similar northeast vein-faults with high silver values occur in the same favourable host rocks on the north side of the anticline and for 15 miles farther westward, thus doubling or tripling the size and potential of the district. The central silver-rich part of the district

now appears to be about 35 miles long and 15 miles wide, associated with the main anticlinal structure and its major longitudinal fault. Moreover, the overall major structure outlined above, and occurrences of silver-lead mineralization in outlying areas could also add to the potential.

The Haggart Creek area on the north flank of this central district contains considerable silver-lead-antimony mineralization in strong NE- to E-W striking, NW-dipping vein-faults in phyllites. This section may also contain important antimonial silver-lead potential.

The extent and possible potential of outlying parts of the district is entirely unknown though indications generally suggest lower silver content. Larger replacement and vein-type lead prospects with low silver values and some indications of high grade in the Beaver River district and Davidson Mountains north of the producing area may contain important lower grade potential.

Zoning in the district appears to be either a local ore-shoot condition dependent on open space, or a very broad pattern related to the major district structure, therefore similar to the Coeur D'Alene District of Idaho.

The entire framework of major anticlinal doming, with major longitudinal axial faulting, related fracture and fault pattern, closely related mineralization, and its timing and lack of marked zoning, and the large number of indications and widespread type of mineralization strongly suggest that the Mayo silver-lead district is much more extensive than indicated by its present localized production and has much greater overall potential than generally realized before. These characteristics strongly suggest that the district is comparable in potential to the Coeur D'Alene District of Idaho, especially considering expanded possibilities that would enter into the production picture if lower grades could be mined as a result of increased productivity.

Possibilities of economic deposits of gold, tin and tungsten also exist in this district.

The overall potential has not been previously recognized because work has been concentrated almost entirely on Keno and Galena Hills and the other key parts of the district have been neglected in detailed mapping or prospecting, and have not been recognized largely because of residual or glacial overburden and leached outcrops.

Continuing aggressive exploration should lead to further mine development, should give a more accurate indication of the potential in the key central parts of the district, and can be expanded to include acquisition of other outlying prospects and exploration and development of lower grade ores.

* Note:

The term "antiform" can be substituted for "anticline" or "anticlinal" in the case of the McQuesten structure.

POTENTIAL OF THE MAYO MINERAL DISTRICT, Y.T.

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REGIONAL SETTING

Statistical comparison with other parts of the Cordillera on the basis of regional geology and mineral occurrences shows that two or more districts with productive capacity exceeding a billion dollars in gross value may be expected to occur in Yukon, either in districts still to be discovered, or in known districts or prospects whose full potential is yet to be realized.

One of these is the Mayo district which is Canada's foremost silver producer, but whose full possibilities have not yet been explored.

GENERAL

The basic geologic structure of the Mayo district is a N70°E arch of quartzite and phyllite 60 miles wide which extends transverse to regional trends for a distance of 100 miles from Clear Creek to beyond Mt. Patterson (see geologic map of Yukon, G.S.C. Map 1048A). The main structure, which dominates the northern half of this arch, is the N70°E McQuesten anticline which is intruded by two rows of granitic stocks, one along its axial region and another along its north flank. This anticlinal and intrusive belt, extending some 70 miles from Clear Creek to the Davidson Mountains, has been called the McQuesten mineral belt by the writer (see paper "Silver in Yukon", C.I.M.M. Annual Western Meeting, September, 1962). In the vicinity of the Davidson Mountains this mineral belt merges with a major southeast plunging anticline, the Mayo Lake anticline. The very earliest gold rush to the Yukon in 1885, ten years before the Klondike, was directed at gold on the bars of the Stewart River, derived from this mineral belt. Since that date, prospecting for gold has led to the discovery of the Keno Hill silver-lead-zinc deposits, mineralized localities of gold, tin and tungsten near many of the granitic stocks, and of other silver-lead-zinc and antimony prospects near the stocks and in intervening areas.

Several million dollars' worth of placer gold has been mined from creeks in various parts of the area, but exploration, development, and production of silver-lead-zinc ores have been confined to the high grade area of Keno and Galena hills in the eastern part of the district. More widespread exploration and development have been hindered in the past by remoteness and physical conditions, but production has been increasing with improved conditions so that the total to date, based on present metal prices, would be valued at about $275 million. However, only a small part of this mineralized district has been explored or even geologically mapped in detail.

With its distinct and regionally unique large-scale structural unity and its widespread genetically related mineral occurrences and intrusives, this mineral belt or district most probably contains a much larger potential than that indicated by its present localized production.

MINERALIZATION IN WESTERN PART OF DISTRICT

The western part of this mineral district consists of unglaciated ridges mantled by generally thin residual overburden and vegetation, with weathered outcrops which have discouraged uninitiated prospectors so that only a little prospecting was done, mainly in the early placer mining days. Very little published information exists on this part of the mineral district, and virtually nothing has been available on mineral prospects within it. Geologic mapping of this western part of the district has been confined to 1 in. = 4 mi. reconnaissance (Geological Survey of Canada Preliminary Map 48---25A, McQuesten, Yukon Territory) with no structural detail or much of interest on mineralization having been published. The writer's information on structure and mineralization is obtained largely from Bostock's original field manuscripts in Ottawa, from familiarity as an assistant in mapping the area in 1948, from a 1949 B.A.Sc. thesis study of the placer concentrates of several creeks, from collection of information over a period of years from various sources, and from several trips into different parts of the area.

Placer gold and accompanying placer tin (cassiterite) and tungsten (scheelite and wolframite) occur in creeks which drain mineralized vicinities in, or between, porphyritic granitic stocks or granodioritic stocks with characteristic accessory allanite, as at Parker, Clear, Josephine, Big Granite, Arizona, Boulder, Sunshine, Rodin, Highet, Haggart, Duncan, Granite, and the Mayo Lake creeks. Through most of this mineral belt small bodies, dikes, and sills of quartz porphyry occur in intervening areas, in which silver-lead-zinc and antimony veins or indications also occur. A number of localities of known or reported mineralization can be detailed for further exploration but are omitted here.

Only the resistant minerals and the lower grade mineralization tend to be preserved from leaching, especially in unglaciated terrain, and even if bedrock is well exposed, there may be little or no sign of important veins because they are weathered down and thinly mantled with overburden. Since most of this mineral belt consists of such terrain with geology, rock types, structure, and mineralization similar to the producing eastern section of the belt, the western section may have similar potential.

Prospecting is slow and discouraging due to permafrost and overburden; however, advantages due to lack of glaciation are:

(a) Lack of glacial overburden;
(b) The much better opportunity to trace float, panned concentrates, or geochemical indications upstream or upslope to their sources.

Modern methods of geologic mapping, geochemistry, bulldozer stripping, and systematic panning have proven very effective in mineral discoveries in several such unglaciated areas (Klondike, Mt. Nansen, Peso.)

MINERALIZATION IN EASTERN PART OF DISTRICT

The eastern part of the Mayo mineral district is well known because of the rich silver-lead-zinc-cadmium ore deposits of Keno and Galena Hills and because of numerous other prospects, many of them better exposed or un-

leached because this portion of the district has been glaciated. Prospecting has been difficult and incomplete due to glacial overburden and permafrost, as compared to the advantages of the unglaciated area where little can be seen on surface, however.

Haggart Creek silver-lead-antimony area

Along the north flank of the eastern part of the anticline, granodiorite and diorite bodies intrude a belt of gently north-dipping phyllites overlain and underlain by more quartzitic rocks. This section is cut by steeply north-dipping N70-90°E vein-fault or shear zones, and NW-dipping, N45°E vein-fault zones which carry arsenopyrite, pyrite, jamesonite, galena, sphalerite, chalcopyrite, and substantial silver values or even gold depending on the locality. Bismuth is also an important constituent of some of the zones. Placer concentrates contain gold, abundant scheelite (20%) and ferberite (tungsten), cassiterite (20%) and jamesonite with native bismuth, bismuth tellurides, galena-bismutite, galena, and other minerals. Although found to date largely to the phyllitic section, the veins show sufficient strength and continuity to indicate fair tonnage possibilities expecially in lower grades. High silver values due to tetrahedrite have been found on the Peso property (up to 185 oz/ton on No. 1 vein and 1500 oz/ton on the Rex vein) and on the Rio Plata property at Haggart Creek (up to 200 oz/ton). Similar or better veins should occur in the more quartzitic sections on either side of the phyllite, and much closer prospecting is warranted for these.

On the Peso Silver property, Nos. 1, 2 and 6 veins and their vicinity and the Rex vein and its vicinity may contain a few hundred thousand tons averaging 20 to 40 oz/ton silver, 5-10% lead and 2-4% antimony, or a considerable tonnage containing about $20/ton gross values in silver, lead, antimony, bismuth and zinc. Further exploration must be done to establish true potential, and exploration to the west and east should reveal more of this type of mineralization since a number of such vein zones are indicated in this part of the district. Similar vein zones are reported west of Peso, at least three jamesonite-bearing vein zones several feet wide occur at Haggart Creek, several "antimony" occurrences are reported around the head of Haggart Creek, and silver-lead-antimony showings occur at Lime and Eightmile Creeks.

Several veins carrying interesting gold values either in arsenopyrite or as free gold occur near the quartz diorite body at Haggart Creek, Dublin Gulch, and Potato Hills. Little work has been done on these in recent years.

Scheelite occurs in residual overburden on fractured quartz diorite mineralized by scheelite veinlets at the head of Dublin Gulch, and is reported as float at Ray Gulch. Other tungsten possibilities may occur at limestone-quartz diorite contacts in this belt.

Tin occurs as cassiterite in irregular tourmaline veins in schist on Tin Hill between Dublin Gulch and Upper Haggart Creek, and another "tin" prospect has been reported on the north slopes toward East McQuesten River.

Due to the light cover of overburden, the deeply weathered nature

of the vein zones, and the frequent masking of any float by soil or vegetation cover, initial prospecting of this area was difficult and disheartening. However, bulldozer trenching has demonstrated the ease with which a number of strong mineralized zones could be uncovered and drilling and underground work have indicated what values, mineralogy, widths, continuity, and other conditions may be expected on the basis of surface results. Considering the structure, type, and strength of fracture patterns, the distribution of indicated showings, and the limited exploration to date, a much larger amount of silver-lead-antimony mineralization may be discovered in the Haggart Creek area with probable further values in copper, bismuth, and zinc.

Keno - Galena Hills vicinity

The chief known silver-lead-zinc deposits of the Mayo district are localized in the Keno and Galena Hills vicinity where several northeast-striking, southeast-dipping vein systems cut the competent south-dipping Keno Hill quartzite formation along a length of 20 miles on the south limb of the McQuesten anticline. Work in the last couple of seasons, however, has also shown that similar northeast-striking, northwest-dipping vein-faults carrying high silver values also cut the same Keno Hill quartzites on the complementary north limb of the anticline and for 15 miles farther west, opening up a much larger new field for exploration.

Mineralization of pyrite and arsenopyrite, with or without gold values and silver-lead mineralization, exists in early vein fillings, especially in longitudinal fractures; while later silver-rich mineralization of galena, sphalerite, tetrahedrite, and other silver minerals forms the ore mostly in northeast fractures. The ore is localized in or near competent quartzite or greenstone, particularly in or near vein-fault intersections or branches where vein-faults pass upward into less competent schist or thin bedded quartzite, and often near northwest cross-faults.

The major vein-fault systems on both limbs occur at spacings ranging from a few thousand feet to 4 miles apart.

(a) South Limb

On Keno and Galena Hills at least six vein zones have produced well over 2 million ounces of silver, another half dozen or so have produced lesser amounts, and further exploration may be expected to reveal additional ore.

After the initial discovery of the Silver King vein in the canyon of Galena Creek in 1903, production was first attained from 1913 to about 1917, and veins on Keno Hill were first discovered in 1919. During the 1920's most other veins or indications of them were discovered by individuals using hand methods in areas of fairly extensive but relatively shallow overburden, mostly on north-facing permafrost slopes where the favourable Keno Hill quartzites were exposed. Between 1921 and 1942 nearly all of the mining was done on ore shoots found exposed under the overburden, but due to high costs and apprehensions that the rich ores would not extend to depth, no mining was done below about 400 feet depth, and only a minimum of exploration and development was done.

In 1942 the camp was closed largely because of World War II and depletion of visible ore, but it was reopened again in 1946 and the chief production of the district has been achieved in the last 16 years with mining extending to deeper levels. Economic conditions, chiefly transportation costs and metal prices, have improved in this recent period, enabling mining of lower grades than previously possible. Total production of the district to 1964 is approximately as follows:

	Tons	Silver oz.	Lead lb.	Zinc lb.	Cadmium lb.
Treadwell Yukon Corp. 1922-1942	624,370	44,338,696	96,000,000	---	---
Keno Hill Ltd. Yukon Gold 1921-1924	10,000+	2,000,000	4,000,000	---	---
United Keno Hill Mines 1946-1963	2,254,149	84,241,024	305,304,822	233,076,056	3,060,702
Others (estimated)		2,000,000	4,000,000	---	---
	2,900,000	132,600,000	409,300,000	233,000,000	3,060,702
Value at present prices		$1.40/oz. $186 million	13¢/lb. $53 million	13.5¢/lb. $31.4 million	$1.70/lb. $5.2 million

Total value of production at present prices $275 million.

The profitability of the main mining operations in this district are indicated by the following summary:

UNITED KENO HILL MINES LIMITED

Eleven Year Summary Of Operating Data

OPERATING RESULTS:	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Sales of concentrates less smelter charges, freight and marketing expenses	$6,143,115	$7,001,730	$7,311,760	$7,691,701	$6,659,348	$6,117,968	$7,416,590	$7,280,964	$7,101,507	$8,301,313	$8,805,518
Operating and administrative expenses	4,206,859	4,984,416	4,089,292	4,310,590	4,533,606	4,804,302	4,980,384	5,306,934	5,327,271	5,440,268	6,004,473
Operating profit before undernoted items	$1,936,256	$2,017,314	$3,222,468	$3,381,111	$2,125,742	$1,313,666	$2,436,206	$1,974,030	$1,774,236	$2,861,045	$2,801,045
Deduct (add) Depreciation and amortization charges	$1,107,992	$ 867,349	$ 743,505	$ 700,290	$ 684,150	$ 470,624	$ 515,426	$ 522,131	$ 522,624	$ 519,985	$ 450,629
Expenditures on exploration and development		169,140	255,540	217,434	169,909	278,236	426,258	412,623	441,471	586,616	1,029,639
Other Income	(4,329)	(88,861)	(29,044)	(41,919)	(50,065)	(84,034)	(48,314)	(144,373)	(97,894)	(118,687)	(155,135)
Income Taxes (estimate)	88,000	190,000	650,000	500,000	320,000	62,000	218,000	60,000	70,000	655,000	485,000
Earnings for the year	$ 744,593	$ 879,686	$1,602,467	$2,005,306	$1,001,748	$ 586,840	$1,324,836	$1,123,649	$ 978,035	$1,218,131	$ 990,912
WORKING CAPITAL:											
Current assets	$1,568,983	$2,333,786	$3,598,468	$4,096,601	$3,575,016	$3,196,637	$4,155,269	$4,587,299	$4,804,099	$5,976,401	$5,626,616
Current liabilities	715,615	835,684	1,173,343	1,309,471	1,083,638	855,041	932,559	745,540	654,600	1,426,976	1,096,298
	$ 853,368	$1,498,102	$2,425,125	$2,787,130	$2,491,378	$2,341,596	$3,222,710	$3,841,759	$4,149,499	$4,549,425	$4,530,318

UNITED KENO HILL MINES LIMITED

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Comparative Statement of Production by Years

Fiscal Year	Tons Milled	Production			
		Silver Ozs.	Lead Lbs.	Zinc Lbs.	Cadmium Lbs.
Dec. 31, 1947	20,880	735,195	2,157,090		
Dec. 31, 1948	37,593	1,908,267	5,089,554		
Dec. 31, 1949	29,494	1,403,360	5,330,736	2,272,397	
Dec. 31, 1950	77,465	3,349,848	13,916,231	7,040,569	80,585
Dec. 31, 1951	88,026	3,480,965	13,036,638	7,174,657	94,608
Sept. 30, 1952 (9 mos.)	102,269	3,408,966	14,436,073	10,280,241	139,654
Sept. 30, 1953	156,684	6,252,483	27,313,584	21,245,493	304,722
Sept. 30, 1954	180,249	6,191,599	30,663,549	26,134,700	312,931
Sept. 30, 1955	162,307	5,670,137	26,350,198	24,035,999	302,297
Sept. 30, 1956	155,702	5,582,979	25,083,145	24,107,851	322,379
Sept. 30, 1957	159,885	5,694,850	22,569,908	18,119,454	236,271
Sept. 30, 1958	175,058	5,984,373	22,255,501	18,610,970	229,308
Sept. 30, 1959	173,477	7,307,815	22,865,276	17,717,019	220,281
Sept. 30, 1960	176,745	7,249,101	21,986,887	14,440,774	181,132
Sept. 30, 1961	186,116	7,231,908	17,911,672	15,512,624	202,432
Sept. 30, 1962	184,123	7,000,837	17,587,767	13,885,884	184,364
Sept. 30, 1963	186,721	5,978,075	16,751,012	14,759,821	199,708
Total	2,252,794	84,430,758	305,304,821	235,338,453	3,010,672

NOTE 1 - ADDITIONAL INFORMATION

	1960	1961	1962	1963
Gross Revenue (Sales of Concentrates)	$8,793,284	$8,540,143	$9,635,252	$10,110,038
Smelter Charges, Freight & Marketing Expenses	1,512,320	1,438,636	1,333,939	1,304,520
Development, Mining, Milling, & General Mine Expenses	5,142,587	5,163,334	5,202,350	5,834,112
Administrative & General Expenses	164,347	163,937	237,918	170,361

NOTE 2

During 1963 the company produced 11,921 tons of silver-lead concentrates, and 12,309 tons of zinc concentrates. After deducting smelting, freight and marketing expenses they received a net value of $8,805,518 for their metals which resulted in an operating profit of $2,801,045. The net earnings for the year were $990,912, compared with $1,218,131 in 1962. In 1963 all of the company's income was subject to tax as none of its operating mines now qualify for the new mine exemption under the Income Tax Act. Provision for taxes amounted to $485,000 in 1963.

The ore treatment plant at Elsa operated throughout the year at an average milling rate of 511.5 tons per calendar day. The metal recoveries were silver 88.03%, lead 82.42%, zinc 84.32%.

Ore reserves as of September 30, 1963 totalled 493,955 tons with an average metal content of 34.58 ounces of silver per ton, 6.59% lead and 5.80% zinc. Reserves of the previous year totalled 445,630 tons grading 38.47 ounces of silver per ton, 7.12% lead and 5.08% zinc.

A more aggressive exploration attitude has been adopted within the last year with gratifying results.

During the year 22,441 feet of drifting and crosscutting, 4,723 feet of raising, and 387 feet of shaft sinking were carried out.

Underground diamond drilling totalled 25,762 feet and surface drilling totalled 13,040 feet.

Reference: United Keno Hill Mines Annual Reports 1960-1961-1962-1963.

NOTE 3

During the production years of the earlier Treadwell Yukon operation (1922-1942) all of the present productive veins had been found by individuals using hand methods and ore was mined from the surface to about the 400 foot levels with no extensive exploration or development because of the much higher costs and lower metal prices prevalent at the time. Much of the profit in these earlier years was absorbed by costs of opening up the district, which would not be faced by any new operation being established on comparable near-surface discoveries.

In the United Keno Hill operations the first 5 years, 1946 to 1951, were devoted principally to developing reserves with a consequently higher development to profit ratio but this earlier policy of developing tonnage reserves paid off with high gross returns in 1951, 1952 and 1953. However the earlier years were not as profitable as later years due to exploration and development expenditures, and capital writeoffs and initial reopening of the district under generally adverse conditions of transportation and supply following World War II.

Under present conditions the profitable operation of United Keno Hill Mines would represent what should be expected of a stable mining operation in the district, assuming no improvement in exploration and development or mining practices, or other cost or profit factors. Under present conditions, if near surface orebodies similar to those of the Treadwell Yukon operation are located, the ratio of development costs to profit may reasonably be expected to be even better.

If a stable price for silver is taken as being $1.25 per oz. U.S. this would give a stable mining operation an additional profit potential on silver of 36% over previous years when the price was 91¢ per oz.

Reserves held by United Keno Hill Mines in 1963 (493,955 tons averaging 34.58 oz/ton silver, 6.59% lead, and 5.50% zinc) total approximately $39 million in gross value at present metal prices, not including cadmium.

Total past production plus quoted reserves would therefore total about $314 million at present metal prices. Much more potential still exists on the United Keno Hill Mines properties at depth, along extensions of vein zones, and in "blind" ore zones down dip in the Keno Hill quartzite formation.

While low grade mineralization occurs throughout the producing section and beyond it, high values have been found west to Mt. Haldane and fair values occur at May Creek 20 miles still farther west. Much of the first production came from Keno Hill but the bulk of production has come from two major cross-faulted vein-fault systems on Galena Hill, the Hector-Calumet system, and the Elsa-Silver King system. Two or more similar cross-faulted vein-fault systems have been recently found to the west on the Silver Titan Galena Hill property along this favourable section under a cover of overburden that was previously too extensive for individuals to prospect successfully. Found partly by prospecting and largely by geophysics, the existence of these vein systems has been confirmed by drilling and prospect shafts and since they are similar in pattern, spacing, and strength; cut similar favourable host rocks; and carry indications of high silver values, it is expected that further exploration in the most competent quartzite members, untested to date, should reveal similar deposits. This undeveloped favourable section, about 6½ miles long, is similar in extent and possibilities to the entire main productive section of Galena Hill from which most of the district's wealth has come.

In addition similar veins in the same quartzites on Mt. Haldane contain high values, and the Alice Group in the same quartzites still further west may contain similar values, suggesting a much greater potential.

The future potential of the south limb of the district is thus still very incompletely explored and should yield production well in excess of its past record, especially if costs are reduced or metal prices are improved.

(b) North Limb

On the north limb of the McQuesten anticline, recent geologic, geophysical and bulldozer work has shown the presence of northerly dipping Keno Hill quartzite and greenstone identical to the host rocks of the south limb; the presence of several northeast-striking, northwest-dipping vein-fault zones similar to those of the south limb; and the presence of similar high grade silver mineralization.

On the Shanghai property several vein zones have been found. On No. 2 zone bulldozer trenching in 1962 and 1963 revealed oxidized vein material up to several inches wide from which a grab sample assayed 790.5 oz/ton silver and 1.1 oz/ton gold and a select sample assayed 2292 oz/ton silver, indicating rich mineralization similar to that on the south limb. This mineralization occurs on the hanging wall side of a stronger unexposed vein-fault that has not been dug out due to permafrost, but the walls of

this zone have shown several galena stringers which have given assays of 100 to 135 oz/ton silver. On No. 1 zone, which has an indicated length of over 2000 feet and may be an offset section of No. 2 zone, abundant well mineralized vein float has been found with traces of tetrahedrite assaying up to 148 oz/ton silver and 0.42 oz/ton gold. The float averaged 16 oz/ton silver, 0.08 oz/ton gold and 2.8% lead, and its abundance and variety suggest a strong ore shoot with a good silver-lead ratio.

On the UR property a section of Keno Hill quartzite and greenstone, comparable in thickness and character to that on Galena Hill, is cut by a major vein-fault zone that has been traced for about a mile, and from which traces of galena have been panned which assayed 217 oz/ton silver. A similar vein-fault system occurs in schist about 1700 feet to the west and another occurs within the quartzites some 3500 feet to the east. Another silver prospect has also been reported still farther east.

On the divide from the UR property over to Lynx Creek, an area of Keno Hill quartzite and greenstone contains a locality from which zinc and galena assaying 43 oz/ton silver have been obtained. This locality may also contain higher silver values in strong vein-faults.

About 4 miles west of the Shanghai property two vein-fault zones cut an area of Keno Hill quartzite from which vicinity 250-ounce silver float has been reported. Several distinct air photo lineaments in the vicinity and to the west are strongly suggestive of other northeast vein-fault zones, but these have not even been examined in detail. Part of this area has been staked as the Argent group of claims.

Other than some manual prospecting, very local geologic mapping and geophysics, limited bulldozer trenching, and partial geochemical coverage, no intensive exploration has been done in general on this virgin north limb portion of the district, and the extent of the high grade mineralization is as yet unknown. Underground work is presently being done on the Shanghai No. 1 vein as an immediate target.

Mayo Lake

On Mt. Hinton southeast of Keno Hill, gold- and silver-bearing veins have been found in Keno Hill quartzites, some drifting was done in the 1930's, but no exploration has been directed at this area in recent years. Placer gold occurs in most of the creeks draining the axial region of the southeast-plunging Mayo Lake anticline, and some high grade silver mineralization has been reported but otherwise little is yet known of the possibilities in this section of the district. A tetrahedrite vein low in silver has been reported from Edmonton Creek.

Parts of this area should be very favourable for prospecting.

Davidson Mountains and Beaver River District

North of the producing area, along the northwest projection of the Mayo Lake anticlinal trend, the Davidson Mountains and Beaver River District

form an outlying region of silver-lead deposits of both vein and replacement type, mostly low in silver, but with interesting size and some reported high values.

Davidson Mountains (Refer to G.S.C. Memoir 284)

Several northeast-striking silver-lead vein prospects occur in the Davidson Mountains, on Stand-To Hill, on Mt. Cameron, and on Rambler Hill, with other reportedly mineralized localities, including one on the northwest side of McQuesten Lake. The Stand-To Hill vein is about 2 feet wide and traced for 200 feet, with a silver-lead ratio of 0.9/1; the Mt. Cameron vein is strong and reportedly wide, traced for 2000 feet, with a silver-lead ratio of 1.4/1; and the Rambler Hill vein is 4 feet wide, with a silver-lead ratio of 0.7/1. Not enough has been reported on these prospects to establish grade even across representative widths of the best mineralized sections. The mineralization occurs in and near a section of Keno Hill quartzite. Some higher silver-lead ratios have been reported from this area and from the locality northwest of McQuesten Lake.

Beaver River District (Refer to G.S.C. Memoir 284)

In the Beaver River District, vein and replacement type silver-lead prospects occur on Silver Hill, Grey Copper Hill, McKay Hill, Carpenter Ridge and in other reported outlying localities. Prospects on Silver Hill consist of replacement lenses of massive galena from several feet up to 26 feet in width, traced for distances up to 175 feet, and carrying 6-9 oz/ton silver. On Grey Copper Hill tetrahedrite up to 1100 oz/ton silver has been reported and a vein about 2 to 2½ feet wide with some tetrahedrite and pyrite, carrying about 50 oz/ton silver in one section, is known. On McKay Hill float and vein exposures of galena and tetrahedrite suggest several vein zones, of which the largest exposed prospect showed 12.5 feet assaying 3.25 oz/ton silver and 56.4% lead, with some values up to 62 oz/ton silver being obtained from some of the other galena float, and silver-lead ratios up to 6.5/1. On Carpenter Ridge, considerable float occurs, from which one grab sample gave 8.75 oz/ton silver and 56% lead.

Since the 1920's, little or no exploratory work, even of an examination nature, has been done in the Beaver River District in spite of sizeable galena showings and more local indications of high silver values. These characteristics of the district probably reflect (a) the presence of favourable replaceable limy rocks which produce larger lead deposits with lesser silver where intersected by vein zones and (b) greater irregularity in the silver content of tetrahedrite which may be high or low in silver in this outlying district. With the indicated size of prospects in this district, careful study of its possibilities may be warranted as the Mayo district is developed. If costs can be further reduced for the district as a whole, the Beaver River and Davidson Mountains prospects may contribute some important potential.

At the west end of the Beaver River District, north of Steamboat Lake, minor galena and sphalerite have been found near an area of pronounced limonite seepages from which one piece of gossan yielded 0.5% zinc. Such limonite seepages occur in a number of localities throughout the mineralized portions of the Mayo district and although most cannot be expected to

indicate ore deposits, their occurrence appears to be restricted to mineralized localities, and some may be indicators of hidden deposits. Other silver-lead occurrences are vaguely reported to the west and north of the Beaver River District.

East of the Beaver River District, at Kathleen Lakes, breccia zone replacement of zinc and lead with a few ounces per ton of silver and interesting cadmium content occurs in a section of slates and limestones, with indications of deposition over a strike distance of several thousand feet. This deposit may have size potential but very little work has been done on it or on its general vicinity. The silver and cadmium content of sphalerite in it suggests genetic relationship to the rest of the Mayo district.

Except for scattered reports of silver-lead-zinc, nothing is known yet of the possibilities for these metals to the east of the Beaver River District or of the producing Keno-Galena Hill area. Of particular interest is the reported occurrence of rusty fault zones in the Keno Hill quartzite section of the Patterson Range.

In the Mayo district as a whole the large number, distribution, character, and silver content of silver-lead-zinc and antimony prospects, and of producing deposits alone imply a large metallogenic district. The implications of these deposits in relation to district structure are now outlined.

DISTRICT STRUCTURE

McQuesten Anticline

The McQuesten anticline itself is recognized not only by abundant attitudes (obtained from Geological Survey of Canada manuscripts by H.S. Bostock but not present on published maps) in the schists and quartzites but particularly by the structure of the Keno Hill quartzite formation exposed on both south and north limb on either side of the McQuesten Valley. This quartzite is exposed only near the axial portion of the anticline while several tens of thousands of feet of overlying phyllites and other quartzites form the broader flanks of the anticline which is some 30 miles wide and 70 to 80 miles long.

Stratigraphic Considerations

The stratigraphic sequence, summarized briefly in a paper by the writer on "Silver in Yukon" (1962) and described in more detail by H.S. Bostock, L.H. Green and others of the Geological Survey of Canada, is complicated by very intense overthrusting from north to south, apparently with imbricate thrust sheets and overturned folds. Otherwise the Keno Hill quartzites have been traced for some 130 miles westward, showing remarkable stratigraphic continuity. Because of their competence, these quartzites have been the host rocks for most of the ore produced to date in the district, thus the repetition of these or other competent rocks on the north limb and westward along the McQuesten anticline is a most important factor in exploration for new ore deposits.

The surface trace of this favourable Keno Hill quartzite formation reflects only the present erosion surface - lesser erosion would have exposed Keno Hill quartzites and veins closer to the anticlinal axis, greater erosion would expose them farther back. Since the fracture pattern is known to be more extensive than the limited surface trace of these favourable rocks, blind deposits can also be expected down the dip of the quartzite section.

The presence of limestones in a phyllitic section above this quartzite may also provide favourable loci for limited replacement-type deposits where intersected by vein zones even though no such showings of significance have yet been found aside from the Beaver River District.

The section of Keno Hill quartzites on the north limb is identical to that on the south limb and although the anticlinal structure appears to plunge to the west, these quartzites are brought up and repeated westward on both limbs of the anticline by at least one major antithetic fault. Since the eastern part of the McQuesten anticline is raised or tilted against the Mayo Lake anticline, the westward plunge flattens out to expose these favourable rocks and the overlying limestone-bearing phyllites farther to the west. Other competent quartzite with some limy rocks occurs higher in the structural or stratigraphic section at Boulder Creek, 20 miles west of the section that has been mapped in detail. Favourable host rocks, especially quartzites, may thus recur for some distance westward. Quartzite formations other than Keno Hill quartzites in this overlying sequence form equally competent and favourable host rocks, or if the structural controls

are similar in strength and pattern to those at Peso, the phyllite sections may also prove favourable.

Northeast and southeast of the producing area on Mt. Patterson, and at Mayo Lake, other good possibilities may exist in the Keno Hill quartzites.

Fracture Pattern

The pattern of vein and fault zones in the Mayo district appears to be genetically related to, or affected by, the McQuesten anticline, forming a fracture pattern typical of many other elongate dome or anticline structures mapped in other Cordilleran mining districts and in oil fields, and exhibited by scale model experiments of rising anticlines and domes (see Wisser, E.H., Relation of Ore Deposition to Doming on the North American Cordillera, Geo. Soc. America Memoir 77, 1960). The fracture pattern itself consists of:

(a) Strong longitudinal faults parallel to strike of formations and of the anticlinal axis (N60°E to E-W), commonly mineralized by early arsenopyrite and pyrite, also by silver-lead and antimony minerals.

Examples: Keno and Galena Hills
North Limb
Haggart Creek

Major longitudinal faults are suggested by geophysical indications in McQuesten Valley, and by physiographic features such as Haggart-Lynx creek valley, and McQuesten Valley with the unique prominence of Mt. Haldane as compared with the corresponding north limb. The physiographic development of McQuesten River valley along the anticlinal axis itself suggests control by some such features, perhaps during Early Tertiary rise of the anticlinal structure.

Cross sections drawn across McQuesten Valley strongly suggest a major longitudinal fault along the anticlinal axis from the vicinity of Keno Hill to Boulder Creek (about 40 miles), with down-throw on the north side, in keeping with tensional faulting considering that the anticline itself lies on the north flank of the broader regional arch. Bostock's original McQuesten manuscript and his G.S.C. map 890A show this fault. This major N70°E fault, reminiscent of the Osburn fault of the Coeur D'Alene district of Idaho, and the related major anticlinal structure are probably the major controls for mineralization in the district.

(b) Northeast vein-fault zones with normal movement, dipping moderately to steeply southeast on the south flank of the anticline and moderately to steeply northwest or vertical on the north flank.

Mineralization consists largely of silver-lead-zinc with some antimony (jamesonite, tetrahedrite) in the Keno Hill quartzites on both south and north limb, and of silver-lead-antimony with copper and minor zinc on the north flank at Haggart Creek. Tetrahedrite (freibergite) is the chief silver-bearing mineral in both

localities. Ore in the producing part of the district is localized near or at branches or intersections of vein-faults, especially near NW cross-faults, where vein-faults change direction, or where they pass upward from competent quartzite and greenstone into incompetent overlying phyllite.

(c) NNE to NW cross-faults or a-c faults whose strike, dip and direction of displacement vary considerably in accordance with location and attitude. Some show movement sympathetic to anticlinal doming while others like the Haldane-Haggart fault show major antithetic displacement and eastward dip. On Galena Hill and probably also the north limb, NW cross-faults dip mainly southwest and show right lateral displacement of veins and rock formations.

These cross-fault structures are generally tight, may be locally mineralized, and are apparently pre-mineral to post-mineral in relative age, as are the other fractures of the pattern. In places they appear to exercise important control on localization of ore in their vicinity.

ZONING

Zoning does not appear to result in termination of silver values at any confirmed depth as in more localized districts, but shows the following broad district characteristics instead.

1. No overall zoning has been recognized, except for lower silver values and larger antimony content in outlying parts of the district miles away from the producing area. Without preconceptions as to relationships of ore-bearing fractures to the McQuesten anticline, Dr. J.D. Bateman suggested to the writer in 1961 that if any zoning does exist, it would appear to plunge westward, resulting in greater depth potential westward (in accord with plunge of the anticline).

2. Individual ore shoots may be zoned, bottoming in zinc, but this appears to be a local condition probably related to availability of open space during deposition, since high grade ore occurs beneath some such sections.

3. If any overall zoning exists, individual vein-fault systems may exhibit zoning at different levels according to their individual characteristics.

4. Much of the galena, even in the high grade part of the district, is low in silver the same as in outlying areas with later up-grading having taken place by introduction of silver-rich minerals where open space has been available.

IMPLICATIONS OF MAGNITUDE

The entire framework of anticlinal doming, with a major longitudinal axial faulting, related fracturing and faulting, closely related mineralization and its lack of local zoning, and the type of mineralization indicate that the anticlinal structure is the control underlying a large number of related mineral occurrences. The Mayo silver-lead district thus appears to be much more extensive and to have much greater overall potential than realized previously, for the following reasons:

1. The magnitude of the overall anticlinal structure, over 70 miles long and 30 miles wide.

2. Its transverse trend, similar to the Coeur D'Alene district of Idaho and the Uinta Mountains trend on which Bingham, Utah is localized.

3. The thickness (2500 to 10,000 feet) of favourable quartzite formations, their regional stratigraphic continuity, and their repetition on both limbs and westward along the anticlinal axis.

4. The close genetic relation between anticlinal doming and resultant fracture pattern whose extent is related to magnitude of the anticline but has only been mapped thus far in the eastern part of the district.

5. The close timing of doming, fracturing, and ore deposition and extended period of pre-, intra-, and post-mineral faulting, giving access to favourable structural localities in the numerous fracture systems.

6. The wide distribution of known indications of similar strong mineralization and of related mineralization. For example the Keno Hill type of high grade mineralization is known to occur from Keno Hill on the east to beyond Mt. Haldane 30 miles to the west and from Duncan Creek on the south limb to the Shanghai property 10 miles to the north on the north limb. High grade tetrahedrite is now also known to occur in strong, well mineralized vein-faults of the same general pattern as far as Secret Creek 15 miles farther northwest. Moreover, higher than average silver values reported from Rodin, Boulder, and Arizona creeks suggest that the high grade silver belt may extend 20 miles still farther west along the axis of the anticline, probably related to the axial zone, the main axial longitudinal fault, and other longitudinal faults.

7. The occurrence of high silver values and of occasional gold values in the vein systems in the quartzites on both limbs and along the trend of the anticline vindicates a community of origin postulated previously on the basis of geologic concepts.

Where ore deposition is as widespread as indicated in this district, is related to as large a geologic structure, and shows productivity in a limited part of a larger unexplored district, comparison with other major Cordilleran districts strongly suggests that this is a silver-lead district of first order magnitude, similar to the Coeur D'Alene district of Idaho, with productive potential in the billion dollar gross value range. However, its full potential is only partly discerned at present because so little effective exploration has been done aside from Keno and Galena Hills. The potential in high grade silver ore is probably considerably larger than the total of past production and the potential in lower grade ores is probably larger yet. Areas where moderate or low silver values are reported may also prove, upon more work, to contain high grade ore as on Keno and Galena Hills, on the north limb, and at Haggart Creek.

POSSIBLE POTENTIAL

Silver-lead-zinc and antimony

Preliminary guesses as to possible potential indicate something of the following magnitude:

(A) South limb (producing area)

Past production plus 1963 reserves $314 million.

Future potential, assuming discovery at depth and down the dip of quartzites on known and indicated vein systems, should be at least equal to, and probably considerably greater than, past production.

Total, probably in order of $2/3 billion gross or more.

The frequency with which such mineralized vein-fault systems occur, every one to four miles or less along the anticline, gives some rough basis for estimating potential on the basis of repeated favourable conditions.

(B) North limb (new)

Assuming similar frequency of vein zones and ore in same host rocks, of slightly lesser exposed extent, potential may be similar to that of the Galena Hill section of the district.

Total, perhaps $1/3 billion.

(C) Anticline and related fracture pattern to west as on Mt. Haldane and Seattle Creek. This may have important additional potential.

(D) General Haggart Creek area

May have substantial antimonial potential.

(E) Other outlying areas (eg. Mayo Lake, Mt. Patterson, Beaver District)

May have considerable lower grade silver-lead potential and perhaps antimonial deposits also.

The magnitude of district possibilities can only be guessed at on the basis of mineral occurrences and similarity of geologic structure; however, the foregoing information strongly suggests that the district should have a potential well over the billion-dollar gross value range, especially considering lower grades and including outlying areas.

Although the most widespread mineral possibilities appear to be in silver-lead-zinc and antimony, the possibilities of economic deposits of gold, tin, tungsten, and other metals like bismuth should not be overlooked in view of geology, similar widely occurring mineralization, and the magnitude of the structure with which mineralization is related.

Gold

Place gold possibilities have been largely explored, several million dollars have been produced, but additional placer production may be anticipated, and some important placer potential may still exist. The potential for lode gold prospects is largely unknown, but appears favourable, and should be considered in any prospecting programme.

An unconfirmed report of sylvanite (gold-silver telluride) having been found in an old cabin down the south fork of the Klondike, along with the confirmed presence of bismuth tellurides in many creeks, of chalcedonic quartz, of fine and wire gold in certain areas, of fine-textured sulfides at Peso, of Tertiary volcanism, and of warm springs near Clear Creek, and of other mineralogic textural evidence also suggest the possibility of "bonanza" type epithermal gold-silver mineralization in this general district.

Tin

No efforts have been made to trace placer tin to its source except at Haggart Creek where a small irregular cassiterite-tourmaline deposit, probably not the main source in the area, was found in schist. Cassiterite was also identified in quartz veins at May Creek in 1963. The following reasoning suggests that economic tin deposits may exist in the area:

1. Most of the creeks have not been tested for tin, yet non-magnetic heavy sand concentrates contain 20% or more cassiterite at Haggart, 10% at Highet, 20% at Boulder, 25% at Clear, and about the same percentage at Arizona Creek. Other untested creeks may contain more.

2. About 85% of the world's tin comes from the circumpacific mountain systems, about 25% of it from South America from similar Precambrian quartzites and schists cut by similar intrusives, with Tertiary volcanism and mineralization, and with associated silver mineralization.

Careful investigation of this tin-bearing mineral belt may thus reveal important tin discoveries by tracing of cassiterite into the vicinity of small or moderate-sized granitic intrusives.

Threatened with increasing shortage, tin prices have climbed from about 90 or 95 cents to about $1.50 per pound in the last couple of years, and since reserves are dwindling and lie in politically or economically unstable regions, the price future is very attractive, and tin could become a strategic metal. It is suggested that the economics of tin be closely investigated.

Tungsten

The McQuesten mineral belt appears to form the westward projection of a tungsten- and tin-bearing mineral province corresponding with granitic stocks extending in an arc from the vicinity of Coal River in southeastern Yukon through MacMillan Pass, through the Upper Stewart River, and into the McQuesten mineral belt.

Except for scheelite at Dublin Gulch and Highet Creek little is known of lode tungsten deposits in the area, although scheelite occurs in many of the creeks and is particularly abundant at Dublin Gulch and Clear Creek.

Possibilities of replacement-type mineral deposits, whether of tungsten or silver-lead, appear to be limited largely to limy horizons, which occur in the phyllite and quartzite overlying the Keno Hill quartzites. Such localities in proximity to granitic contacts should be tested for tungsten while testing for tin.

REASONS WHY POTENTIAL NOT PREVIOUSLY RECOGNIZED

It is very difficult to comprehend that such a large mineral district with favourable host rocks and vein-fault structures with high silver values has been left only partly explored next to a major producing mine but this has resulted from a combination of the following circumstances:

1. All reconnaissance or semi-reconnaissance mapping of a type that would lead to full recognition of district structure and its extent had been concentrated to the east of the key anticlinal structure. To the west there is very little published information on structure or mineralization and consequently no attention has been directed toward this mineral belt as such, and few concepts of general favourable locations have been set out for guidance.

2. No one with a background or feeling for district structure has conducted a mining exploration programme with an overall objective of defining the extent and total potential of the district. Even with this approach it has taken time and work to build up any picture at all and to recognize the district structure and its relation to mineralization.

3. All operating companies in the district have concentrated their efforts on extraction of available ore and on limited intensified exploration on their properties, being faced in the past by a constant battle with long range transportation and other difficulties leading to high costs.

4. Exploration is slow, difficult, and costly due to remoteness, short season, permafrost, cold winters, and extensive overburden and vegetation which easily masks vein zones to casual exploration, thus preventing easy discovery and discouraging the traditional Canadian prospector who is used to seeing fresh rock.

5. The western part of the area, mapped only on 1 in. = 4 mi. reconnaissance scale, is gentler in topography near the producing section, is partly unglaciated, and therefore has fewer outcrop areas to map or prospect in spite of the thinner residual overburden which is more favourable for gold-pan methods, geochemistry, and bulldozer stripping. Lode prospects in this part of the district are weathered, obscured by mantle and usually leached of surface values, particularly where pyrite has been present.

6. All of the important past discoveries were made by individuals using manual placer mining methods of ground sluicing and prospect-shaft sinking without modern tools like the bulldozer, but their work on Keno and Galena Hills was so thorough in many places that later stripping has exposed only a few new vein zones. However, this type of overburden prospector had virtually vanished by the 1950's when the last exploration boom was sparked by the United Keno Hill Mines development. Little or no such work has been done in recent years and only in the last few seasons has any amount of local bulldozer stripping been done.

7. Due to the richness of discovery after discovery made in the 1920's and 1930's on Keno and Galena Hills, interest remained centered on these hills while the few discoveries made in outlying areas were largely low in grade, thus leading to the concept that other areas were unfavourable.

8. Virtually all of the intensive exploration has been concentrated on Keno and Galena Hills, and the promotional nature of much of the 1950's boom has been detrimental to subsequent interest in the district. Only brief reconnaissance work has been done in outlying areas and this type of work is apt to be discouraging because veins are easily concealed in this district.

The Mayo district requires experience and perseverence in prospecting. Even in the best mineralized zone unaltered quartzite and phyllite wall rocks may be abundantly exposed and a thin cover of overburden may cover a weathered vein, leaving no surface indication of the presence of mineralization. In three seasons of reconnaissance mapping of the McQuesten area only two surface signs of mineralization were encountered. In addition, the necessity of trenching to a satisfactory depth to establish the presence or absence of mineralization must be experienced in order to be realized. These factors have discouraged mapping and prospecting in the district and will continue to discourage prospectors who are not experienced with unglaciated

terrain and this district in particular, and who are not prepared to work thoroughly and do considerable digging.

Even on Keno and Galena Hills there were only two surface indications of mineralization - a 4-inch vein of galena exposed for 18 inches in the canyon of Galena Creek in 1903, and galena-bearing float found at the head of Faro Gulch on the top of Keno Hill in 1919. If it had not been for these two occurrences, found 16 years apart, the district might still lie undiscovered. The only other signs of mineralization are rusty altered greenstone, manganiferous siderite or manganese stain, breccia, limonite, and "live" quartz.

Due to its remoteness and lack of general interest the district was not recognized as having any real potential until the 1920's, when several veins were found by intensive digging by individuals, and the last main productive discovery, the Hector-Calumet, was made in 1934 on Galena Hill.

The recent discovery of high grade mineralization on the north limb and western part of the district in the last two years has opened up a whole new field for exploration similar to that of Keno and Galena Hills in the 1920's, and modern exploration may be expected to produce results much more rapidly.

EXPLORATION

Silver-lead-zinc and antimony ores certainly appear to constitute the main potential of the district, so exploration should be directed primarily at this type of deposit.

For the most effective overall plan and to protect future expansion possibilities, the strongest financial group doing exploration in the district should explore the entire McQuesten mineral belt in conjunction with work in the heart of the high grade silver-lead-zinc district.

The key to success in the district will be to discover enough high grade ore in the central part of the district in order to justify setting up a profitable operation which will justify expansion and continuation of exploration and development to take in outlying prospects. Exploration at present should therefore be concentrated principally on the main Keno Hill quartzite and greenstone sections that are cut by vein-faults carrying high silver values, with additional geologic mapping, prospecting, and prospect examination being done to the west and in outlying areas to define other favourable sections, particularly to determine to what extent Keno Hill type quartzites or similar competent rocks and associated mineralization occur.

Because of the problems peculiar to the district, personnel must be experienced with local conditions to ensure efficiency and results. Some of these conditions are:

1. An understanding of the characteristics and behaviour of permafrost both in exploration, trenching, and construction.

2. Recognition of true bedrock in place under residual overburden or under smeared bedrock ground moraine which underlies some of the till in the glaciated part of the district.

3. Judging depth to bedrock if possible.

4. Recognition of minor vegetation, topographic, and bedrock features indicative of vein zones.

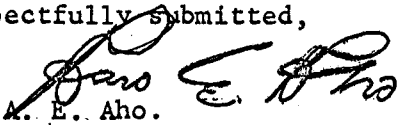
5. Experience in the usefulness of ground sluices, thawed prospect pits and other methods.

6. Recognition of signs of mineralization such as manganese stain, limonite, rusty altered greenstone, "live" quartz, breccia, etc.

7. An appreciation of surface and underground drilling problems and of geologic and ground problems in underground exploration.

Assembling of key properties has been the initial step in an overall plan of exploration for the district. Continued aggressive exploration in various phases on the key new areas should be successful in discovery and development of several new mines.

Respectfully submitted,



Dr. A. E. Aho.

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ACCOMPANYING DATA

McQuesten Mineral Belt

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Cross-sections of McQuesten Anticline

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Geologic Report and Maps on UR Property

Geologic Report and Map on Argent Claims

Geologic Report and Maps on Mt. Haldane Property

Geologic Map of Laysier Claims

Geologic Map of Seattle Creek Area (Alice Group)

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F.M.C. ANALYSIS OF PESO SILVER DEVELOPMENT

OCTOBER, 1963

FMC CORPORATION

INORGANIC CHEMICALS DIVISION

633 THIRD AVENUE, NEW YORK 17, NEW YORK • MURRAY HILL 7-7400

October 18, 1963

Mr. S. E. Cropper, Managing Director
Peso Silver Mines, Ltd.
202-633 Hornby Street
Vancouver 1, B.C., Canada

Dear Mr. Cropper:

As we discussed last week, I have enclosed copies of some of the pertinent information which was put together during our evaluation work on your property. Supplemental data should be forthcoming from the Pocatello office.

One of the enclosures is a listing of foreign silver-lead smelters. The companies we contacted are shown by a check mark. I had not heard from all of them by the end of September. In particular, of the Japanese group we have been approached by Mitsui & Company, Ltd. representing their parent in Japan. N. V. Billiton of the Netherlands, acting through Montonore, Inc., their U.S. agent, still owes us their bid estimates for the concentrate. When I receive these I will forward them on to you. We cancelled all activity with the other smelters for obvious reasons.

In most cases I asked for quotations on the concentrate with and without antimony. This was done to facilitate future discussions because some of the smelters do not have a "Harris antimony plant" to extract the antimony. Most smelters discount the credit for antimony content in a concentrate even if they have a Harris plant. It is difficult to determine at this stage what to do with the antimony. We thought of several possibilities, including the following:

(1) Hydrometallurgically or chemically treat the ore at the mine to separate the antimony. This would add some process cost. However, this could be counterbalanced by obtaining a higher return for the antimony free concentrate and a greater value for the antimony itself by direct selling efforts.

(2) Sell the lead-antimony-silver concentrate as planned, relying on the fact that the smelters would be economically justified in setting up a Harris plant based on the reasoning that his investment would be protected via long-term contract.

We would have undertaken this study ourselves in due course. In any event, I have asked Ken Vincent of our Pocatello staff to send you some background technology on this subject. I believe it is still premature to worry about the antimony. Also, the smelters are not too overly concerned about the antimony content in the concentrate, although in some cases we found this to be the case. One might attribute this hesitancy to the fact that this was their initial response to first discussions with them.

When our process people first looked at the question of producing a bulk concentrate they came up with an analysis which is shown in the smelter schedule from AS&R. Some of our economic calculations through the end of July were based on this analysis. Early in August, however, our process people revised their thinking and came up with a new bulk concentrate analysis. This was done because they had found that we could potentially produce about 11,250 tons per year instead of the 8,350 tons as previously calculated. Computing the net smelter return based on the new analysis and in consideration of the AS&R schedule and information from International Smelting, the net smelter return figure increased slightly. As a result of this the operating profit was increased. I should state that all of these figures were based on selling material on a long-term contract to the United States smelters. As I mentioned earlier, the European and Japanese smelters will probably bid a little higher, but as yet we have not received any figures.

I have tried to include as much of the information that would be of value to you. If there is anything that I have overlooked please do not hesitate to contact me.

Best regards.

Yours very truly,

E. W. Hanson

EWH:LB

FMC CORPORATION

INORGANIC CHEMICAL DIVISION

MINERAL DEVELOPMENT DEPT.

SEPTEMBER 20, 1963

PESO SILVER MINES LTD.

TECHNICAL APPRAISAL

WAY, 6WH, KW

TECHNICAL APPRAISAL

1. OBJECTIVE:

The Peso Silver Mines holdings total some 18 square miles, with four known vein structures and the probability of the existence of several additional vein structures. The objective is to develop known vein structures and produce concentrates carrying values in silver, lead, and antimony which are saleable to either domestic or foreign smelters.

2. PLANNED APPROACH:

Information from exploration work performed by Peso Silver Mines indicates that the ore deposits are capable of supporting an operation for the production of 70,000 tpy of crude ore, from which 11,250 tpy of concentrates would be produced. Preliminary cost estimates indicate that this would be a profitable operation, with a payout of 2.4 years and a return on investment of 29 per cent. Development would proceed in stages.

Stage 1. Continuation of exploration

Present information is almost entirely limited to surface exposures of the veins. Initial efforts would be largely directed to driving of underground openings in portions of the veins which are indicated by surface work as having the greatest potential for ore production. Secondary efforts would include metallurgical test work on bench scale, continuance of marketing

studies, continuance of a limited amount of surface exploration, and maintenance of roads and services. Objectives during this stage are development of information on types and grade of ore encountered in the primary ore zone, on physical conditions within the ore bodies, and the taking of samples for metallurgical test work. This stage is designed to provide necessary information for planning succeeding stages of the full program.

Stage 2. Development of Ore Reserves and Detailed Operating Plans

Based on results of Stage 1, mine development would be continued with the objective of developing ore reserves sufficient to insure operations for a sufficient time to cover the payout period and for at least 3 years after payout is completed. This work would consist of the driving of underground openings to prove reserves and provide necessary mine development for sustained operations. Samples for metallurgical test work would be taken as required. Metallurgical work would include both bench and pilot scale work to develop a final flow sheet as the basis for detailed estimates of mill construction and costs. Limited effort would continue on surface exploration and marketing. During the latter part of this stage, detailed plans and cost estimates would be made for the mine plant and camp as well as for the mill.

Stage 3. Construction, Operating Development, and Shakedown

On the basis of final plans and estimates as developed in Stage 2, the mill, mine plant and camp facilities would be constructed and placed in operation. Mine development would continue to the point where sustained production at the rate of 70,000 tpy could be maintained. Marketing arrangements would be finalized. The last portion of this stage would consist of a period of operation for shakedown purposes.

3. NOVELTY, UTILITY AND PATENT SITUATION

This proposal embodies the normal development of a mineral deposit from the prospect stage to the production stage, and has no special or abnormal features. One special feature with regard to profitability is that Canadian tax law provides three years of tax-free operation after the start of production, followed by deduction of all pre-production expenses from profits before taxes are payable.

Silver is the principal metal of value to be produced. For the past decade, world silver production has lagged behind consumption by from 10% to 50%, and no reversal of this trend is foreseeable. Production of lead and antimony would be in amounts which would have practically no impact on world production and consumption.

As all phases of mining and processing are standard and commonplace, no patent situations, favorable or adverse, are anticipated.

4. OUTSIDE KNOW-HOW

Consultants would be retained during Stages 2 and 3 of this proposal. Phases of the program where such services would apply include mine plant and mining practice, mill design, camp facilities design, and cost estimates. Pilot scale metallurgical test work would be performed either by equipment manufacturers or private research organizations. In addition to preparation of detailed plans and cost estimates, consultant service would be extended to include inspection and certification of installations built under contract.

Contractors would be employed for driving of underground openings in Stage 1, and possibly for some underground work during Stage 2. Contractors would be used on all construction.

5. SPECIAL REQUIREMENTS FOR PROJECT

No special equipment or facilities will be required during Stage 1. Any such items necessary during Stages 2 and 3 would be fully usable during regular operations.

6. SAFETY AND TOXICOLOGY

Any such problems would be routine rather than special.

7. LIKELIHOOD OF SUCCESS

Very good. No technical problems for which adequate precedent and practice are not well known are anticipated. Marketing will resolve itself to a problem of securing the most profitable outlet. The one ingredient lacking for assurance of success is developed reserves, and the chances of success in developing such reserves in Stages 1 and 2 appear to be 90 per cent plus.

ECONOMIC APPRAISAL

1. OPERATIONAL ASPECTS

a. Raw Material Availability and Costs

Geological investigations indicate the potential of the Peso property to be in the range of 1.0 MM tons of economically minable crude ore. The development program covered by this proposal is expected to

1. Increase the confidence level of the above estimate.

2. Definitely establish the availability of 70,000 tons of ore in Stage 1, and of 350,000 tons of ore by the end of Stage 3.

Mining cost of the ore is expected to be in the range of $19 to $21 per ton, or about $130 per ton of concentrate produced.

b. Processing Costs

The crude ore will be concentrated by selective froth flotation. Total mining and processing costs expressed as dollars per ton of crude ore mined, are estimated to be $28/ton at the proposed production rate of 70,000 tpy of crude ore.

c. Probable Plant Capacity

Production capacity is projected at 70,000 tons of crude ore per year, processed to produce 11,250 tons of concentrate per year. Minimum economic production rate is estimated to be 35,000 tons of crude ore per year to produce 5,625 tons of concentrates.

Production rates of this type of operation, which are based on a raw material source having finite limits, are usually controlled more by size of ore body than by market size, and are tailored to give maximum return on the capital investment required.

d. Plant Investment and Working Capital

Estimated capital requirements for operation at the

proposed 70,000 tpy of crude ore rate have been estimated by MDD and by Wright Engineers Ltd. of Vancouver, B.C., as shown in the following table:

Item	MDD Estimate	Wright Estimate
Development	$ 750,000	$ 750,000 1/
Fixed Capital		
Mine plant	250,000	338,000
Mill	900,000	803,000
Camp	725,000	873,000
	1,875,000	2,014,000
Working capital	600,000	600,000
Total investment	3,225,000	3,364,000

1/ Not Estimated by Wright Engineers

e. Versatility of Plant

The beneficiation plant required for this operation could be used for the concentrating of other types of ores, since standard equipment for this type of processing would be used throughout. However, the various units would be sized for this particular ore, and their size and sequence of use in the mill would not necessarily be optimum for other types of ore.

All equipment would have a resale value. This might be only nominal due to the rather remote location of the plant.

f. Compatibility with Existing Operations and Product Lines

This operation will be compatible with existing operations of the Inorganic Chemicals Division to the extent that it consists of the mining and processing of mineral raw materials.

It will represent a departure from current divisional activities in that the product will be a high value silver, lead

antimony concentrate sold under long term contract to domestic and foreign custom base metal smelters.

2. MARKET ASPECTS

a. Uses

The end product of the proposed operation is a concentrate containing values in silver, lead, copper, and antimony. Concentrates of this type are readily saleable to either domestic or foreign smelters. Contacts with American Smelting and Refining Company and International Smelting and Refining Company have established that these two companies would enter into contracts for the entire projected output from this operation.

b. Consumption

Concentrates of the type which would be produced are treated by smelters and refineries to produce metals. The projected quantity of concentrates, 11,250 tpy, and the contained quantities of metals, would have little, if any, effect on overall markets. The major values are in silver, and as world consumption of silver has consistently been greater than production by from 20 MM to 150 MM troy ounces annually for the past decade, the anticipated production of some 2.5 MM troy ounces annually would at most only narrow this deficit slightly. Antimony production, projected at 2,450 tpy, would amount to some 4.1% of present world production of about 60,000 tpy. As concentrates are principally

valuable for silver, which is in demand, no difficulty would be encountered due to antimony either in disposal of the product or in securing payment for antimony. In fact, correspondence between Peso Silver Mines and a Japanese firm, C. Itoh and Company, shows a strong demand in the Japanese market for antimony. Lead production at 4,400 tpy and copper production at 600 tpy are too small to have any effect on markets.

c. Probable Sales Price

Smelter schedules and correspondence with the American Smelting and Refining Company indicate a net smelter return, after freight and treatment charges, of $295.66/ton for concentrates delivered to the smelter at Selby, California, and $278.55/ton for concentrates delivered to the smelter at El Paso, Texas. Similarly, net smelter return after freight and treatment charges at the Tooele, Utah smelter of International Smelting and Refining Company would be $302.55/ton. Montonore, Inc., U. S. Agents for N. V. Billiton of Holland, have been contacted by E. W. Hanson and R. E. Bennett of the New York office, and have commented that there would be no problem in disposing of the entire proposed production in European markets at a higher sales price than indicated above. It is therefore reasonable to assume that the above figures represent a minimum probable sales price.

d. Competitive Products, Prices, and Manufacturers

The high silver value of the concentrates and the continuing deficit in silver production as compared to consumption makes these concentrates an item which would be free of competition and price cutting.

e. Estimated Growth Curve and Rate of Obsolescence

Usage of silver has increased about 5% annually for the past 5 years. Usage of antimony is at a stable level, although foreign demand is stronger at present. Usage of copper and lead fluctuates, but shows a small growth on the average. Obsolescence is not a factor.

f. Other Economic Considerations

Contacts with foreign users made by E. W. Hanson and R. E. Bennett indicate that a better sales price for concentrates could well be realized by selling to either European or Japanese firms, and that firm long-term purchase contacts could be entered into. This aspect should be actively pursued.

As previously noted, silver consumption greatly exceeds production, and there is no foreseeable possibility of this trend being reversed. With silver as the major value in concentrates, these concentrates would enjoy a favored position relative to concentrates in which base metals are of major value, especially as the contained amounts of other metals in the concentrates are of small amount relative to total market.

3. PROFIT POSSIBILITIES

According to the contract between FMC and Peso Silver Mines Ltd., "80 per cent of net proceeds from operation of the property shall be paid to FMC until they have been repaid all debentures and interest thereon". Net proceeds are defined as gross receipts less operating expenses.

On this basis, payout on total money invested by FMC for capital items, mine development, and working capital would be paid back with 6% interest in 2.7 years. Payout time without interest is 2.4 years. Profitability data and payout calculations are given in the attached table.

PESO SILVER MINES LTD. PAYOUT CALCULATION

	PRODUCTION YEAR 1	2	3	4	5
GROSS SALES	4,262,000	4,262,000	4,262,000	4,262,000	4,262,000
Freight	687,400	687,400	687,400	687,400	687,400
Smelter Charges	304,800	304,800	304,800	304,800	304,800
NET SALES	3,270,000	3,270,000	3,270,000	3,270,000	3,270,000
PLANT COST					
Mining @ $20/ton	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000
Milling @ $4.20/ton	294,000	294,000	294,000	294,000	294,000
Sales & Adminis.	150,000	150,000	150,000	150,000	150,000
CORP. LEVEL COST	1,844,000	1,844,000	1,844,000	1,844,000	1,844,000
OPERATING PROFIT	1,426,000	1,426,000	1,426,000	1,426,000	1,426,000
DEPRECIATION	-	-	-	575,000	402,000
PREPRODUCTION COSTS	-	-	-	851,000	522,000
BEFORE TAX PROFIT	1,426,000	1,426,000	1,426,000	Nil	502,000
DEPLETION ALLOWANCE	-	-	-	-	167,000
TAXABLE PROFIT	-	-	-	-	335,000
TAX @ 50%	-	-	-	-	167,000
NET OPERATING PROFIT	1,426,000	1,426,000	1,426,000	1,426,000	335,000
CASH FLOW	1,426,000	1,426,000	1,426,000	1,426,000	1,259,000
Repay to FMC @ 80% Net Profit	1,140,000	1,140,000	757,000		

SCHEDULE OF REPAYMENT on $2,725,000 Investment	YEAR 1	2	3	Total
INTEREST @ 6%	164	105	43	312
DEBT RETIREMENT	976	1035	714	2725
TOTAL	1140	1140	757	3037

PAYOUT

On Capital & Interest 2.7 Yrs.

On Capital Only 2.4 "

Return on Investment, Payout Period - 29%

HBFowler
WAYoung
KCVincent
GWHeim

MINERAL DEVELOPMENT DEPARTMENT
INORGANIC CHEMICALS DIVISION
FMC CORPORATION

OFFICE MEMORANDUM

TO O. A. Power DATE October 3, 1963

FROM R. J. Hayden POCATELLO, IDAHO
P. O. Box 1758

SUBJECT: PESO SILVER EXPLORATION

If FMC decides on an active investigation of the Peso silver property, I would recommend the following:

1. That the proposed 650 foot crosscut to intercept the "B" ore shoot of the Rex vein be undertaken as the first step.

2. Investigation by geophysical or geochemical prospecting be continued to establish new targets.

3. Surface dozer exploration continue to establish the validity of the anomalies indicated by the geophysical and geochemical surveys.

I would recommend that Step 1 be carried out in the following manner. That roads, portal site, and portal be constructed with the work force presently active on the property. That the shop and compressor house be constructed at the portal. That air line, ventilation line, and other re[illegible]eable materials be taken from No. 1 drift and stored at the portal site. Mine timbers be purchased and stored at the site. Preferably timber that has had time to dry. Then the operation would be closed down until about the first of February. Mr. Wayland Reed feels it would be advantageous to pay the mechanic, Al Trig and the cook, Patty McGahn a small retainer fee to assure their return in the spring. Estimated time with the present crew to complete the above would be 36 working days or approximately 1½ months. Estimated costs for this project are tabulated on the following page:

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MINERAL DEVELOPMENT DEPARTMENT
INORGANIC CHEMICALS DIVISION
FMC CORPORATION

OFFICE MEMORANDUM

TO O. A. Power - 2 DATE October 3, 1963

FROM R. J. Hayden POCATELLO, IDAHO
P. O. Box 1729

SUBJECT: PESO SILVER EXPLORATION

	Per/Month	Board	Per/Month	1½ Months
Mine Superintendent Est. Recd.	$800.00	$180.00	$980.00	$1470
Mechanic	480.00	180.00	660.00	990
Cook	500.00	180.00	680.00	1020
Surveyor	420.00	180.00	600.00	900
Cat Skiner	480.00	180.00	660.00	990
2 Helpers	360.00	180.00	540.00	810
	360.00	180.00	540.00	810
Labor to prepare Portal Site				$6,990

Camp Maintenance

Portal Power Plant	$100.00	$150.00	
Power Plant/Month	$100.00	$150.00	
3 four wheel vehicles @ $125.00	375.00	560.00	
Water Supply	150.00	225.00	
Road Maintenance 27 miles @ 2 miles/hr = 27 hrs. x 12.00 Two trips $648.00 per month			324.00/per tri
Fuel Oil @ 44 cents		$1,000.00	
2 P plants @ 7 gal. = 14 gal. 14 x 30 x 44 = 185.00			
10 stoves @ 5 gal = 50 gal. 50 x 30 x 44 = 660.00		$1,000.00	
Dozer road - 81 hrs. Portal & mine Rd. 200 hrs. @ $8.50		1,700.00	
Camp Cost Estimate Portal Site		$4,785.00	

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MINERAL DEVELOPMENT DEPARTMENT

INORGANIC CHEMICALS DIVISION
FMC CORPORATION

OFFICE MEMORANDUM

TO O. A. Power - 3 DATE October 3, 1963

FROM R. J. Hayden POCATELLO, IDAHO
P. O. Box 1729

SUBJECT: PESO SILVER EXPLORATION

Capital

Light plant	$3600.00
Repair or replace jeep	2000.00
Timber	500.00
Retain - Engineer Wayland Dec. & Jan.	1600.00
Retain - Cook Patty and Mech Trig Dec. & Jan.	1000.00
	$8700.00
Total portal site preparation	$20,475.00

Total cost of portal preparation and minimum cost to retain necessary personal for the best interest of FMC until contractor take over is estimated at $20,475.00. This does not take in to consideration contingencies discussed later due to the cold weather operation.

Cost amortized against the proposed 650 foot crosscut for portal preparation is $31.50 per foot. A contract may be obtained to drive a crosscut for $70 per foot. This, however, I feel is a very optimistic figure. This figure was the lowest bid obtained by Peso in their efforts to contract a crosscut on the No. 1 vein. It did not include timber and was negotiated down from the original bid of $120 per foot by the way of Peso offering concessions. This bid was presented by a Whitehorse Yukon Territory contractor who would have much less cost involved in mobilization. This bid was to take affect after Peso had installed the portal set. Estimated cost of driving crosscut to the Rex vein should be figured at a minimum of $100 per foot or a total cost of approximately $60,000.

COPY TO | V

MINERAL DEVELOPMENT DEPARTMENT

INORGANIC CHEMICALS DIVISION
FMC CORPORATION

OFFICE MEMORANDUM

TO O. A. Power - 4 DATE October 3, 1963

FROM R. J. Hayden

POCATELLO, IDAHO
P. O. Box 1729

SUBJECT: PESO SILVER EXPLORATION

Some contingencies to be considered during a winter operation that can not be evaluated with the cost figure are:

1. The Government makes the company 100% responsible for all workman's compensation if the men are being worked below -40 degree temperature.

2. The airlines stop flying at -40 below weather. If some mechanical failure causes a shutdown in this weather there is no other supply line. This weather can stay below a minus 40 degrees in the Mayo area for as much as two consecutive weeks.

3. Metal and rubber becomes very brittle below minus 40 degrees.

4. Men become very accident prone and inefficient in this severe cold.

It is true that once the under ground workings are developed the daily routine is not hampered by this severe cold as would normally be on the surface. However, in this particular instance the portal would be some two and one-half miles from the camp. Transportation and other items would certainly be effected by these weather conditions.

Some other items to be considered: If free board or better than the union wages being payed at Keno Hill Mine is not considered a large labor turnover can be expected and/or union troubles. The company must pay transportation charges from place of hiring, must pay both directions if the agreed contract time is completed. Labor source is at Edmonton or Vancouver at approximately $190.00 round trip. Territorial minimum wage for miners is $2.15 an hour. Extimated cost to board a man at the Peso camp is $6.00 a day. A labor contract signed by Peso and mining personnel for the number one crosscut was $17/foot with the minimum of $2.15 an hour and 3½ by 5 foot crosscuts $10.00 a foot. Peso will have to maintain approximately 27 miles of road this winter as

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MINERAL DEVELOPMENT DEPARTMENT

INORGANIC CHEMICALS DIVISION
FMC CORPORATION

OFFICE MEMORANDUM

TO C. A. Power - 5

DATE October 3, 1963

FROM R. J. Hayden

POCATELLO, IDAHO
P.O. Box 1178

SUBJECT: PESO SILVER EXPLORATION

compared to 10 miles in previous years. Lumbering outfits have previously maintained the other 17 miles but are not going to operate in this area this winter. Maintenance of this road and snow disposal will have to be with a D6 Caterpillar tractor. This is an inefficient type equipment for this distance. Some money or help might be obtained from the Territory. The present Peso camp does not have an ambulance. This is required by the Territory mining laws. They do not have an isolation ward and first aid room. They do not presently have a certified first aid man on the property. These are all requirements that can be expected to be inforced at any time. It is estimated that the cost of 300 foot of raise is equal to 75 foot of shaft. The summer operation can carry two shift crew with day light hours for both shifts. The Government estimates 100% increase in the cost of surveying a point in the winter on a surface survey. Very little can be expected to be accomplished between December 15 and January 10. This is more or less of a standard vacation time. An estimated crew of 10 men to man two shifts in doing the development crosscut work is estimated. It would consist of four miners, two laborers, one mechanic, one surveyor, one geologist, and one cook and one mine captain. Late fall and early spring are the best times to move heavy equipment over the unimproved roads. They estimate the first fifty feet of the crosscut could be driven with a front end loader. No mucking machine is known to be available in the area. The previous equipment was rented at Vancouver and has been returned. In a summer program if other geologic exploration were to be considered the cook, mechanic, geologists, and laborers could be utilized for both projects. Timber is available all winter.

General Mining and Construction Company Ltd., Al W. Cropper, Box 473, Whitehorse Yukon Territory, Telephone 72610 Whitehorse was the lowest bidder for the crosscut on the No. 1 vein.

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MINERAL DEVELOPMENT DEPARTMENT

INORGANIC CHEMICALS DIVISION
FMC CORPORATION

OFFICE MEMORANDUM

TO O. A. Power - 6

DATE October 3, 1963

FROM R. J. Hayden

POCATELLO, IDAHO
P. O. Box 1758

SUBJECT: PESO SILVER EXPLORATION

Additonal labor costs would include Workman's compensation which amounts to $4.70 on each $500 salary and a 4% holiday pay. This 4% must be paid the employee on termination or he is entitled to two weeks paid vacation per year. Fifty per cent of unemployment tax is paid by employer. Transportation must be furnished from point of employment to the project and if the agreed contract time is completed his return cost must be covered.

It is 2,000 miles from Mayo, Yukon Territory to Vancouver British Columbia. The freight from Vancouver to Mayo is 62 cents a pound. Heavy large shipments are transported for approximately $5.00 a ton. Gas retails at Mayo for 68 cents regular and ethel 72 cents an imperial gallon. Parcel Post takes approximately three weeks. All first class mail is shipped airmail under 8 ounces.

Some names and addresses for the record:

1. Mr. Taylor - Secretary of Territorial Government Labor Relations at Whitehorse Yukon Territory.

2. The Alberta Northwest Territories Chamber of Mines Employment Service - Mr. Bill James Edmonton Alberta.

Apparently, Mr. James has been the head of this organization for many years and is well known throughout the Northwest.

3. Mr. Tommy Elliot contract supplier and expeditor in Vancouver. Such a person has been recommended as well worth the cost.

4. Jones Tent and Awning, Vancouver, B.C.

COPY TO V

MINERAL DEVELOPMENT DEPARTMENT

INORGANIC CHEMICALS DIVISION
FMC CORPORATION

OFFICE MEMORANDUM

TO O. A. Power - 7 DATE October 3, 1963

FROM R. J. Hayden POCATELLO, IDAHO
P. O. Box 1758

SUBJECT: PESO SILVER EXPLORATION

As for the property I believe it has tremendous opportunities. It is in elephant country and Peso people have uncovered fresh elephant tracks, but one should certainly go hunting with an elephant gun. I feel that this is not a prospect but a virgin district. The length and strength of the No. 3 structure plus the fact that it shows frequent mineralization along the outcrop in itself is a very promising prospect. This is only one of several known and certainly many more to be discovered.

R. J. Hayden

RJH:DL

FMC CORPORATION
INORGANIC CHEMICALS DIVISION
TECHNICAL DEPARTMENT

FMC has entered into an agreement with Peso Silver Mines, Ltd. to carry out the continued exploration and development of mining claims located in the Mayo District, Yukon Territory, Canada. The technical investigation indicates that a bulk lead-silver concentrate of the following analysis will be produced:

Content	Percent
Cu	5.3%
Sb	21.8%
Pb	39.2%
Fe	4.0%
Zn	4.5%
S	16.1%
Ag	229. oz. per ton

Production of the bulk flotation concentrate will amount to approximately 11,000 short tons per year.

Profitability: FMC - Peso Silver Joint Venture

	1965	1966	1967	1968	1969
Operating Year	1	2	3	4	5
Net Sales	$3,156,000	$3,156,000	$3,156,000	$3,156,000	$3,156,000
Operating Cost	1,935,000	1,935,000	1,935,000	1,935,000	1,935,000
Operating Profit	1,221,000	1,221,000	1,221,000	1,221,000	1,221,000
- Canadian Tax Basis -					
Pre-Production Expense	--	--	--	1,221,000	359,000
Depreciation	--	--	--	--	862,000
Net Operating Profit	1,221,000	1,221,000	1,221,000	Nil	Nil
Depletion Allowance	--	--	--	--	--
Taxable Profit	--	--	--	--	--
Tax	None	None	None	None	None
Net Profit	1,221,000	1,221,000	1,221,000	--	--
Cash Flow	1,221,000	1,221,000	1,221,000	1,221,000	1,221,000
- Accounting Basis -					
Depreciation	300,000	300,000	300,000	300,000	300,000
Amort. of Devel. Expense	158,000	158,000	158,000	158,000	158,000
Total	458,000	458,000	458,000	458,000	458,000
Net Operating Profit	763,000	763,000	763,000	763,000	763,000
Tax:					
Add: Book Deduction for Depr. & Amort.	--	--	--	458,000	458,000
Less: Tax Deduction for Devel. & Depr.	--	--	--	1,221,000	1,221,000
Taxable Profit	--	--	--	None	None
Tax	--	--	--	None	None
Net Profit	763,000	763,000	763,000	763,000	763,000
Cash Flow	$1,221,000	$1,221,000	$1,221,000	$1,221,000	$1,221,000

EWH
7/24/63

SILVER PICTURE

Free world silver consumption in 1962 reached a new high of 365.9MM ounces, while production dropped to 199MM ounces, a deficit of 166.9MM ounces. World consumption and production figures for 1958 to 1962 are shown in Table 4.

The increasing gap between supply and demand has been met for the past decade largely by sales of free U.S. treasury silver which was essentially depleted in 1961 when silver was placed on a free trading basis. Prices have continued to climb from 91¢ per ounce to its present quotation of $1.28 per ounce.

About two-thirds of the world's new silver (about 130MM ounces per year), comes as a by-product of lead, zinc and copper mining. These sources cannot substantially increase production because of depressed demand for the metals. The balance of production (about 70MM ounces per year) comes from mines yielding silver as the major product.

Assuming the most optimistic increases in production from existing primary producers, the world deficit will continue to run over 100MM ounces per year. Primary producers would have to increase from 70 to 167MM ounces per year or 240% to keep up with current demand.

Industry sources believe that known silver prospects must be developed into mines and that major new silver producing districts must be expanded. In North America, the Mayo District of the Yukon offers considerable potential. It is in the vicinity of United Keno Mines, Canada's largest and the world's fourth largest producer (7MM ounces annually).

In November 1961, when the President suspended treasury sales of silver and in effect created a free market, it was also recommended to Congress that the Silver Purchase Acts of 1934 and 1946 be repealed. The new silver bill, passed in May 1963, removes the silver backing for $1 and $2 demonination bills, repeals the 50% transfer tax on profits made in trading silver and repeals the Silver Purchase Acts.

The domestic use pattern for silver has been estimated by trade sources as follows:

Photochemical	28-32MM ounces
Silver Solders, Brazing Alloys	20-24
Electrical Contacts	19
Batteries	5

Other uses for silver or silver compounds include decorative finishes, electrical conductors, engine bearings, chemical catalysts, germicides, amalgams, etc.

TABLE 4

World Silver Consumption & Production
(Excluding Communist-Dominated Areas)
(millions of ounces)

	1962	1961	1960	1959	1958
CONSUMPTION					
Industrial Uses:					
U.S.	110.0	105.0	100.0	103.0	85.0
Canada	4.6	4.5	4.3	4.5	4.6
Mexico	3.3	3.4	4.0	5.4	4.4
U.K.	20.0	20.0	16.5	17.5	14.8
France	13.5	14.0	13.0	10.6	14.1
Western Germany	41.8	43.5	40.2	33.3	31.1
India	1.5	1.5	1.5	2.0	3.3
Japan	19.6	19.1	21.6	13.6	8.2
Other Countries	25.0	25.0	25.0	25.0	25.0
Total	239.3	236.0	226.1	214.9	190.5
Coinage:					
U.S.	75.6	54.2	46.0	41.4	38.2
Canada	10.9	5.0	7.5	5.7	4.7
France	13.2	23.8	12.2	5.5	-
Italy	3.5	5.5	7.1	5.7	7.2
Japan	1.4	1.4	4.6	10.2	6.5
Other Countries	22.0	22.0	26.5	17.9	22.9
Total Coinage	126.6	111.9	103.9	86.4	79.5
Total Consumption	365.9	347.9	330.0	301.3	270.0
PRODUCTION					
Mexico	41.5	40.3	44.5	44.0	47.6
U.S.	32.0	42.3	40.1	23.2	35.7
Canada	31.0	31.2	34.0	31.9	31.2
Peru	32.0	33.6	30.8	27.2	25.9
Bolivia	5.0	3.9	4.9	4.5	6.0
Other South & Central Amer. Countries	7.5	7.6	7.8	7.8	7.3
Total Western Hemisphere	149.0	158.9	162.1	138.6	153.7
Outside the Western Hem.	50.0	47.0	48.0	50.0	51.0
World Production	199.0	205.9	210.1	188.6	204.7
Deficit:	166.9	142.0	119.9	112.7	65.3

9/23/63

PESO SILVER ASSAY COMPARISON

REX VEIN

	FMC			PESO		
Section	Width	Oz. Ag	%Pb	Width	Oz. Ag	%Pb
904	2.6FW	1.1	0.6	1.3	23.2	10.4
	1.2C	42.0	4.7	0.9	0.44	--
	3.0HW	3.3	3.1	2.0	14.4	2.9
				2.7	1.00	0.4
	6.8	9.3	2.4	6.9	9.0	3.4 3.0*
904+50	2.7FW	2.5	1.0	0.6	201.3	--
	3.2C	11.4	4.8	1.2	10.4	--
	3.0HW	118.3	17.8	2.5	64.0	--
				1.4	8.2	--
				2.0	4.8	--
				1.3	11.9	--
	8.9	44.7	8.0	9.0	35.2	--
905	5.6FW	22.2	6.5	3.1	.14	--
	3.0HW	0.7	0.8	1.2	4.36	7.2
				3.1	6.80	4.8
				2.5	31.9	16.0
	8.6	14.7	4.51	9.9	10.8	10.07 6.92*

*If a zero value is assigned to the lead assay where the lead assay is missing from Peso's analysis then this lower figure would be the average lead content. This appears logical because of the low silver value of the samples where the lead assays are missing.

	FMC			PESO		
Section	Width	Oz. Ag	%Pb	Width	Oz. Ag	%Pb
905+50	5.5FW	13.8	1.3	3.4	10.64	--
	7.0HW	13.6	2.9	2.8	6.26	--
	12.5	13.7	2.2	1.2	35.6	--
				5.2	3.24	--
				12.6	8.99	
906	7.0FW	52.4	9.0	2.8	2.00	1.5
	7.0HW	7.8	5.9	1.3	69.7	15.0
				4.7	2.66	1.6
				1.7	3.00	2.9
				3.3	22.6	6.3
	14.0	30.1	7.4	13.8	13.6	4.12

FMC CORPORATION

REX VEIN (ORE SHOOT - 250' LONG)

ASSAY VALUES

Section	Thick	Au Oz.	Ag Oz.	Pb%	Sb%	Cu%	Zn%
904	4.2	.01	14.1	4.6	3.5	0.7	--
904+10E	4.0	--	21.3	--	--	--	--
904+20E	4.0	.01	8.6	5.84	2.52	--	--
904+30E	4.0	Tr.	71.6	--	--	--	--
904+40E	7.0	.005	122.5	13.4	5.84	--	--
9[illegible]+50E	4.3	Tr.	68.2	--	--	--	--
904+60E	6.4	.01	6.6	6.19	2.96	--	--
904+70E	5.8	--	247.1	--	--	--	--
904+80E	5.0	.005	9.4	3.54	2.51	--	--
904+90E	4.1	--	5.5	--	--	--	--
Ave. 904 Section	4.9	.005+	64.8	7.26	3.65	0.7	--
905	4.0	.02	22.5	13.0	6.4	--	--
905+10E	4.1	--	12.9	--	--	--	--
905+20E	6.5	Tr.	44.6	6.72	4.29	--	--
905+30E	6.4	--	23.4	--	--	--	--
905+40E	4.0	.02	4.8	2.20	0.98	--	--
905 +50E	7.4	--	13.0	--	--	--	--
905+60E	9.0	.02	44.7	6.21	4.15	--	--
905+70E	4.6	--	72.4	--	--	--	--
905+80E	4.4	--	23.3	11.5	6.19	--	--
905+90E	4.2	--	43.34	--	--	--	--
	5.5	.015	31.15	7.51	4.37	--	--

Section	Thick	Au Oz.	Ag Oz.	Pb%	Sb%	Cu%	Zn%
906	4.0	.01	24.4	5.96	2.73	--	--
906+10E	6.3	--	18.3	--	--	--	--
906+20E	4.6	.005	56.2	5.94	3.03	--	--
906+30	6.0	--	13.7	--	--	--	--
906+40	5.1	.005	55.8	15.15	10.22	--	--
	5.2	.005	32.2	9.37			
904-905	4.9	.005	64.8	7.26	3.65	0.7	--
905-906	5.5	.015	31.15	7.51	4.37	--	--
906-906+45	5.2	.005	32.2	9.37	5.62	--	--
	5.2	.01	44.0	7.79	4.35	(0.7)	--

A 10% mining dilution factor was used to calculate heads.

Weight recovery = 16%

16% is sulphides

90% recovery metallurgical

Ratio of concentration - 6.25

Also has 10% SiO_2 + siderite

	% in Heads	% dist. of Sul.	%Pb	%Cu	%Sb	%Fe	%Zn	S Oz	Ag Oz
Heads	16.05	100.0	7.00	0.95	3.90	0.52	0.81	2.88	40.96
Bulk Conc.	--	--	39.2	5.3	21.8	2.9	4.5	16.1	229

SiO_2 and siderite in concentrate gangue.

FMC CORPORATION September 20th, 1963.

PESO SILVER

Planned Expenditures for 1963 & 1964

$75,000 will be spent in 1963 and $25,000 will be spent in the month of January 1964. Rate of spending to start is $25,000 per month for the first stage. On the first of January 1964 another underground crew can be added to drift two ways on the vein with total monthly cost of $45,000. This rate of spending will be continued for February, March, April and May of 1964 at a cost of $180,000. The work will entail underground tunneling and sampling. On the first of June additional work at the surface will be initiated to include geo-chemical or geo-physical surveys, trenching, sampling and possibly diamond drilling. This will require an added expenditure of $25,000 per month or a total of $70,000 per month for the months of June, July, August and September. At that time it is contemplated that we will be ready for an adit on the No. 1 to 6 vein system. This additional underground work is estimated at $20,000 per month.

Total of Anticipated Expenses

October, November, December 1963

Advance in adit 1150'		$ 75,000

January 1964

Rex adit drifting crew (2 shifts)	$ 25,000	
Additional underground crew (2 shifts)	20,000	
Advance in adit 600'		45,000

Feb., March, April & May 1964

Rex adit drifting crew (2 shifts)	$100,000	
Additional underground crew (2shifts)	80,000	
Advance in adit 2400'		$180,000

June, July, August and September 1964

Rex adit drifting crew (2 shifts)	$100,000	
Additional underground crew (2 shifts)	80,000	
Surface exploration	100,000	
Advance in adit 2400'		$280,000

October, November and December 1964

Rex adit drifting crew (2 shifts)	75,000	
Additional underground crew (2 shifts)	60,000	
No. 1 vein system drifting crew (2 shifts)	60,000	
Advance in adit 2700'		$195,000
Metallurgical Process Development		75,000
Total		$850,000

Advance of 9250 feet

By the end of 1964 we should be blocking out ore which is part of development. On the Rex vein development should start on the 1st of June.

Each crew is expected to advance 5 ft. per shift and 2 shifts per day is the most efficient means of tunneling. At 10 feet per day per crew we should expect about 300 feet of drift per month. (Some adjustment may have to be made for a year end vacation).

Feet of drifting in 1963	1150
Feet of drifting in 1964	6400
Feet of raising & X-cutting in 1964	1700
Drifting on Rex Vein	5500
Raising & X-cutting on Rex Vein	1700
Drifting on No. 1-6 vein system	900
	9250

Of this 9250 feet, 5500 would be as drifting along the Rex vein which would be blocking out ore. The estimated ore reserve which could be anticipated would be 370,000 tons on the Rex vein plus unknown reserves from the 1-6 vein system.

FMC CORPORATION

September 20th, 1963.

PESO SILVER

ORE GUESSTIMATES

Specific Gravity Determinations

	S. G.	Est. %
Jamesonite	5.7	8.95
Tetrahedrite	4.8	2.48
Siderite	3.8	40.00
Galena	7.5	3.93
Quartz	2.6	34.00
Sphalerite	4.0	0.69
Argillite	3.0	10.00
		100.05

Average 3.6 S. G.
8.9 cu. ft./ton

Rex Vein System

250 foot outcrop length

5.2= 4.7' true width @ 65°

100 ft. vertical= 111' slope dist. @ 65°

4.7 x 111 x 250 = 130,000 cu. ft. / 100' depth

5.2 x 100 x 250 = 130,000 cu. ft. / 100' depth

$$\frac{130,000}{8.9} = 14,600 \text{ tons/100' of depth}$$

Depth	200 Ton/day Plant Yrs. Operation
100' - 14,600 tons	0.2
200' - 29,200 tons	0.4
300' - 43,800 tons	0.6
400' - 58,400 tons	0.8
500' - 73,000 tons	1.0
600' - 87,600 tons	1.2
1000' -146,000 tons	2.1

1000' in ore along Rex vein

	Yrs. Operation
100' depth - 58400 tons	0.8
200' depth - 116,800 tons	1.6
300' depth - 175,200 tons	2.5
400' depth - 233,000 tons	3.3
500' depth - 292,000 tons	4.2
600' depth - 584,000 tons	8.3

Rex Vein top outcrop Elev. + 3800 feet
Haggart Creek Elev. - 2400 feet

Average depth on Rex vein is estimated at 1000' from an Adit on Haggart Creek. The Rex vein is known to be mineralized for an outcrop length of 6,000 feet.

At the United Keno the Hector-Calumet vein system with a vein length of 2200 feet and developed to a depth of 1200 gave 1,150,000 square feet of ore along the vein as compared to 2,880,000 square feet of total vein explored. This would indicate that 40% of the vein contains ore. Applying this factor to the Rex vein we have an ore potential of:

Potential on Rex Vein

$$6000 \times 1000 = 6{,}000{,}000 \text{ sq. ft.}$$

$$\frac{6{,}000{,}000 \text{ sq. ft.}}{40\%} = 2{,}400{,}000 \text{ sq. ft. of ore}$$

$$\frac{2{,}400{,}000 \text{ sq. ft. of ore}}{5 \text{ feet width of ore}} = 12{,}000{,}000 \text{ cu. ft. of ore}$$

$$\frac{12{,}000{,}000}{8.9} = 1{,}350{,}000 \text{ tons of ore}$$

in a length of 6000 ft. or 225 tons of ore for each foot of length.

At 70,000 tons/yr. (200 tons/day) this would be almost 20 years supply of ore.

Development of a part of the Rex vein - (1964 schedule) in steps of 300 feet vertical distance

Drifting on vein	5500 feet
Vertical depth developed by drifting	300 feet

5500 x 300 x .40 x 5 = 3,300,000 Cu. Ft. of ore
370,000 tons of ore
5.3 years of life

By the end of 1964 on the Rex Vein

Rex Vein costs	$225,000	Exploration
	315,000	Development
	$540,000	

$1.46 per ton of ore

In our mining costs we have an ore development cost amounting to $4.00 per ton of ore mined.

FIRST STAGE EXPLORATION

October 1st to January 31st, 1964

120 days

less 10 days Christmas vacation

less 10 days Portal preparation

and erection of a compressor house

For 15 days in January there will be two crews underground.

115 days tunneling

2 shifts - 7 men
5' advance/shift
10' per day
115 days at 10' = 1150' tunneling

1150' tunneling at $70/ft.	=	$80,500
1 FMC Engineer $75/day 120 days	=	8,000
Assaying 360 samples @ $10.00	=	3,600
Road construction & Portal preparation	=	7,500
		$99,600

At the end of the first stage or the expenditure of $100,000 we should have the following information and reserves developed:

(a) Mineralogical characteristics of the ore underground

(b) Provide a suitable metallurgical sample for process from 500 feet of drifting along the vein.

(c) Some ideas on the continuity of the ore at depth. (300 feet below surface)

(d) Some ideas on the frequency and size of the ore shoots.

(e) Additional geologic information which can be used as a key for finding more ore.

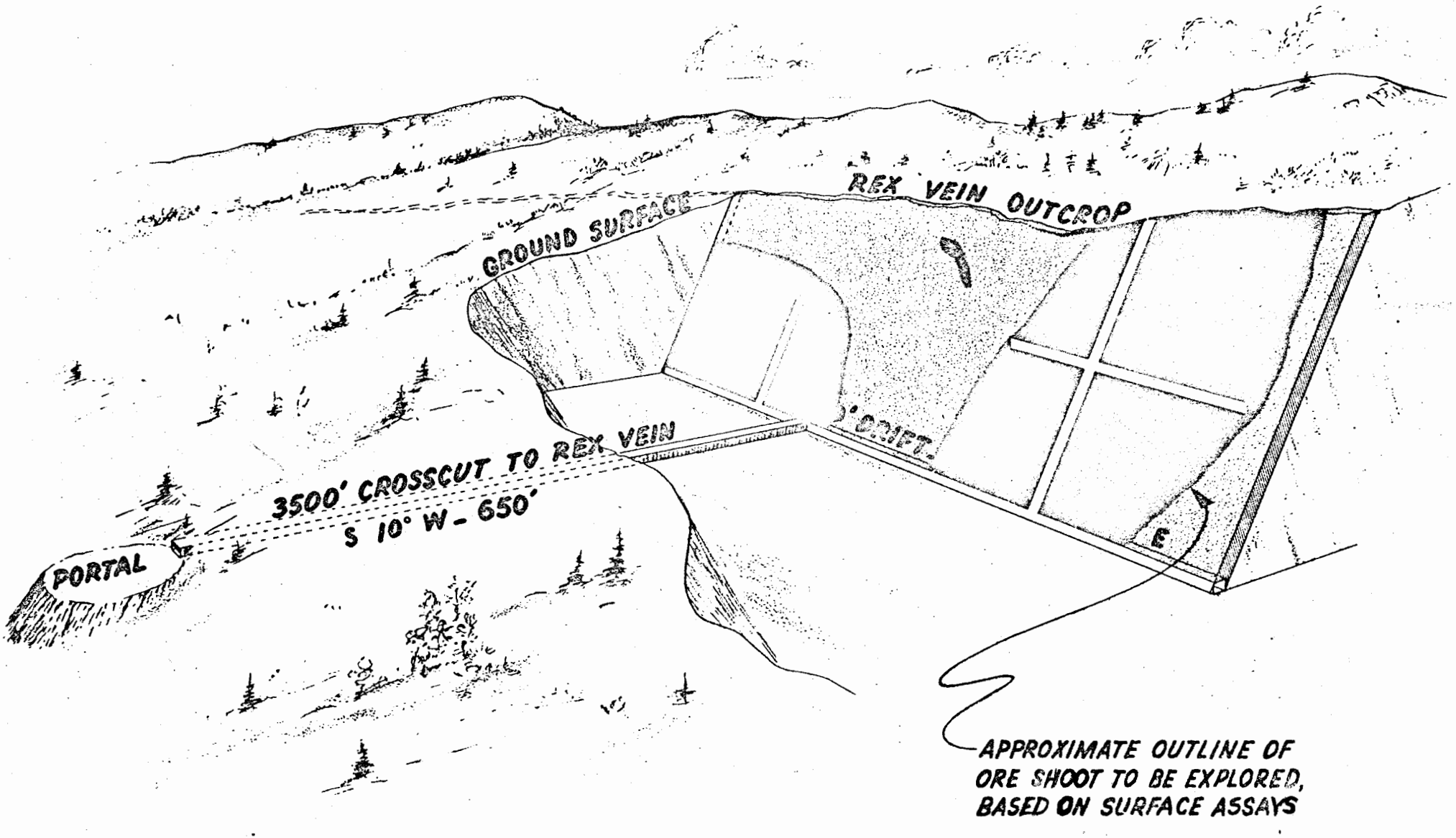
(f) Tell us whether we want to go on to Stage #1.

Reserve Estimates

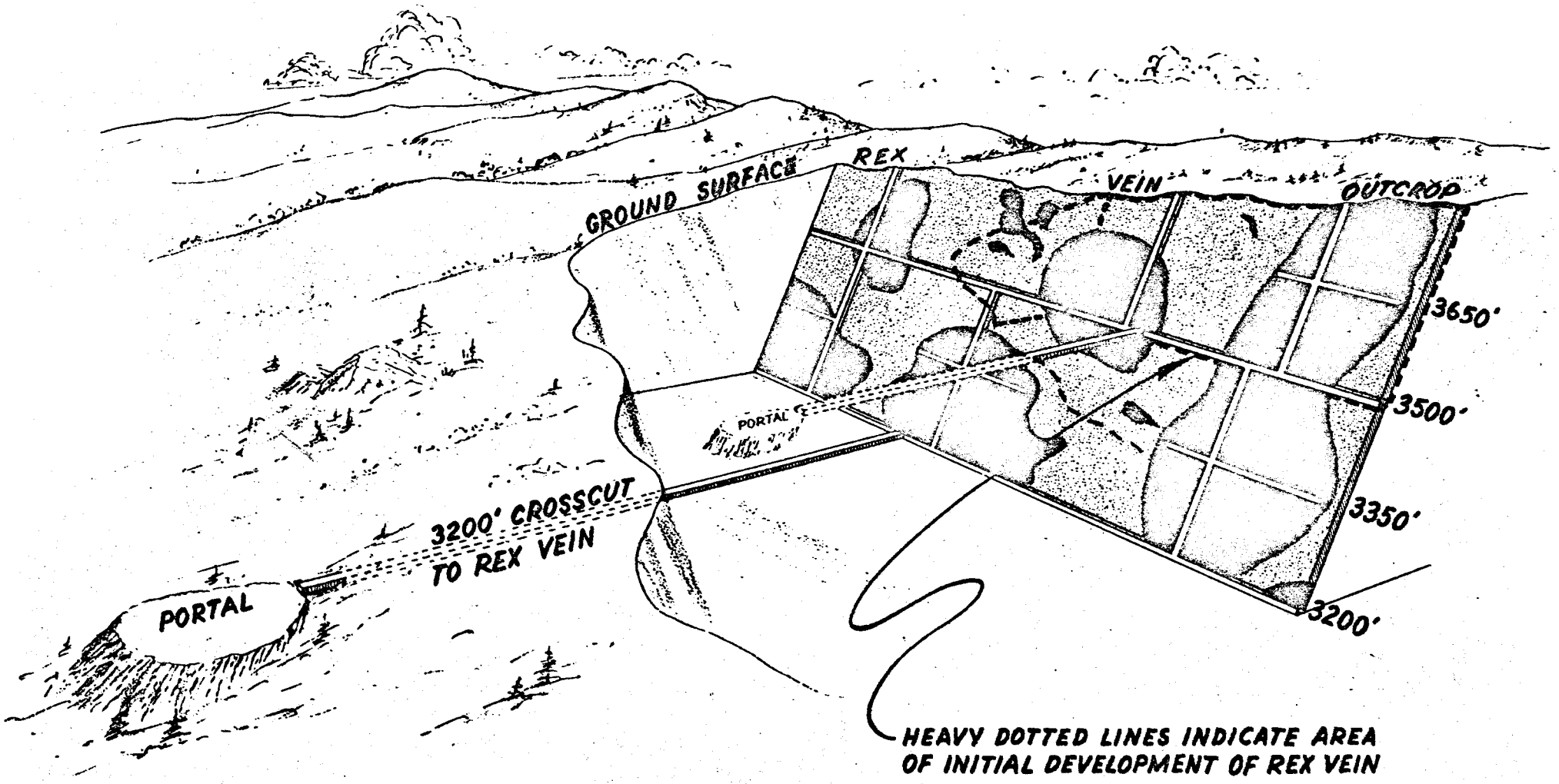
500' of drifting at 300' vertical depth

300 x 500 x .40 x 5 = 300,000 cu. ft. of ore
33,700 tons of ore
0.5 yrs. supply

$2.97 per ton of ore (development cost)



Cut-away sketch of proposed 3500' crosscut to Rex Vein and initial development.



Cut-away sketch of continuing development of Rex Vein.

New York, N. Y., July 16, 1963

PROVISIONAL SMELTER SCHEDULE COVERING SILVER-LEAD ANTIMONY BEARING CONCENTRATES FROM PESO SILVER MINES LTD., YUKON TERRITORIES, CANADA

PRODUCT: Bulk flotation concentrates produced by FMC Corporation from Peso Silver Mines properties in Yukon Territories, assaying substantially as follows:

✓Au	0.1 oz. per ton	Fe	15.5%
✓Ag	240 " " "	S	21.0%
✓Pb	41.7%	As	1.0%
✓Cu	7.3%	✓Sb	22.4%
Zn	0.7%	Bi	1.8%

QUANTITY: Production up to 700 tons monthly; excess at Buyer's option, otherwise excluded.

DURATION: Commencement date of any contract and its duration to be agreed upon.

DELIVERY:

1) Buyer will accept delivery of up to 200 tons monthly in bond, f.o.b. wharf of its smelter at Selby, California.

2) Buyer will accept delivery of up to 500 tons monthly in bond, f.o.b. railroad cars at unloading bins of its smelter at El Paso, Texas.

PAYMENTS

GOLD: Pay for 95% of the gold content at the net U. S. Mint price for gold recovered from imported gold bearing materials, subject to applicable U. S. Governmental regulations pertaining to transactions in gold. Minimum deduction 0.015 troy ounces per net dry ton.

SILVER: Pay for 95% of the silver content at the Handy & Harman New York quotations for refined silver, adjusted to the basis applicable to silver contained in unrefined silver bearing materials as published in the Engineering and Mining Journal, less a deduction of 1.5¢ per troy ounce of silver paid for. Minimum deduction 1.0 troy ounce per net dry ton.

LEAD: Deduct 1.5 units from the wet lead assay and pay for 95% of the remaining lead at the quotations for common domestic lead for delivery in New York City as published in the Engineering and Mining Journal. Minimum deduction 3.5 units per net dry ton.

COPPER: Deduct 1.3 units from the wet copper assay and pay for 100% of the remaining copper at the daily net export refinery quotations for electrolytic wire bars as published in the Engineering and Mining Journal, less a deduction of 8.0¢ per pound of copper paid for.

ANTIMONY: Deduct 10 units from the antimony content and pay for 100% of the remaining antimony at 50¢ per unit, fractions in proportion.

QUOTATIONAL PERIODS: For gold the quotational period shall be the 30th day following date of delivery of product; and for silver, lead, and copper, the calendar month following date of delivery of product.

DEDUCTIONS

SMELTING CHARGE: $15.00 per net dry ton of product.

LEAD REFINING AND HANDLING CHARGE: 1.125¢ per pound of lead paid for.

LEAD DELIVERY CHARGE: 1) Deliveries to Selby: $17.50 per net ton of lead paid for.

2) Deliveries to El Paso: $26.19 per net ton of lead paid for. This is the current published all-rail freight rate, 50-ton carload lots, on lead bullion from El Paso, Texas to New York City via Omaha, Nebraska (for refining). Any changes in said rate concurrent with delivery of product will be for Seller's account to the extent of lead paid for.

COPPER DEFICIENCY CHARGE: Charge 40¢ per net dry ton of product for each 0.1% that the copper content is less than 1.3% by wet assay, fractions in proportion.

PENALTIES: Arsenic: 1% free; charge for excess at 75¢ per unit, fractions in proportion.

Antimony: Charge for the antimony content in excess of 2% at $1.00 per unit, fractions in proportion, up to a maximum penalty of $4.00 per net ton of product, which corresponds to an antimony content of 6%. When the antimony content exceeds 6%, reduce the penalty by $1.00 per unit, fractions in proportion, to a zero penalty at an antimony content of 10%. No penalty will be charged for antimony when the content is 10% or over.

LABOR: Contract to be based on the average hourly labor cost for the first six-month period of 1963 at Buyer's Selby, California plant, based on the wage rates, shift differentials, holiday, vacation and overtime payments and payroll taxes paid to or on behalf of the employees, excluding foremen and other salaried employees and men on construction work at said plant. Any increase or decrease in average hourly labor cost in effect for the calendar month prior to the date of delivery of product shall be for Seller's account and to adjust, charge 8¢ per dry ton for each 1¢ per hour that the said average hourly labor cost shall be in excess of the average hourly labor cost for the first six-month period of 1963, and credit 8¢ per dry ton for each 1¢ per hour that the said average hourly labor cost shall be less than the average hourly labor cost for the first six-month period of 1963, fractions in proportion.

LABOR: (Cont'd.) We expect to realize under our current labor contract at Selby an increase in said labor cost of approximately 10¢ per hour effective July 1, 1963; hence the base charge applicable to deliveries on and after August 1, 1963 will be increased approximately 80¢ per ton.

HANDLING CHARGES: Charge $25.00 per lot for all lots weighing less than 20 dry tons.
Charge $ 1.50 per net dry ton for product shipped in sacks.
Charge $ 2.50 per net dry ton for product shipped in drums.

DUTIES: A sum equal to all United States Customs duties which are in effect on the product purchased or metals contained therein at the time product enters the United States shall be for the account of Seller and shall be deducted from the purchase price; provided however, that (1) no deduction shall be made under this clause on account of any metal content of product when no payment is made for any part of that metal content and (2) no deduction shall be made under this clause on account of the copper content of product when the payment for copper is based on the export refinery quotation.

OTHER TERMS

SETTLEMENTS: Buyer will make cash advance to Seller for 75% of the estimated value of each shipment on the 15th day following date of delivery of product. Seller agrees to reimburse Buyer promptly for that portion of any advance payment made hereunder which may be in excess of the amount due in final payment for each shipment. Final settlement will be made on all shipments on the earliest practicable date following the obtaining of all necessary information.

IMPORT QUOTAS: During the period of time when the U. S. Government has in effect a system of quotas limiting the amount of lead contained in ores and concentrates which can be imported into the U. S. from Canada, Buyer may at times accumulate overquota lead from Canada in such quantities that, in Buyer's opinion, such accumulation indefinitely prolonged would establish a burdensome financial risk, particularly since all such accumulated lead will have been priced but does not qualify for sale in the U. S. Market.

In view of the above it would be necessary to make a provision in the actual contract which would give us some relief from accumulating burdensome overquota lead. Such relief may be accomplished by either (1) pricing such overquota lead on the basis of export prices less additional delivery costs involved, if any, or (2) temporarily suspending all or a part of future shipments until the situation has eased.

Under (1) above no U. S. duty would be charged to you on that portion of lead priced on an export basis, and under (2) above you would be free to market any production elsewhere during the period of suspension.

IMPORT QUOTAS: (Cont'd.) As you know, import quotas have been in effect since the latter part of 1958 and to date we have not experienced any undue hardship as a result of our purchases of Canadian lead ores and concentrates. Nevertheless, any formal long term contract must include reasonable escape provisions.

OTHER TERMS: Contract would include provisions of the attached Complementary Schedule except that the clause therein entitled "Duties" would be deleted.

AMERICAN SMELTING AND REFINING COMPANY

J. C. Buck

JCB:DE

AMERICAN SMELTING AND REFINING COMPANY
ORE DEPARTMENT
120 BROADWAY, NEW YORK 5, N.Y.

R. L. JOURDAN
VICE PRESIDENT

July 16, 1963

Mr. Everett W. Hanson
Inorganic Chemicals Division
FMC Corporation
633 Third Ave.
New York 17, N. Y.

Dear Mr. Hanson: PESO SILVER MINES - BULK CONCENTRATES

In the attached I have indicated a tentative schedule applicable to your contemplated production of bulk concentrates from Peso Silver Mines in the Yukon.

Please note that the duration of any contract and its commencement date remain to be agreed upon.

Your projected production rate of 700 tons monthly is the upper limit as far as our ability is concerned to handle high antimony bearing material under present operating conditions, which in turn are consistent with other contractual intake at our domestic smelters and refineries. Accordingly, confirmation of this tentative schedule at some later date will also be subject to review in light of various operating conditions existing at the time.

On the other hand, once you have made the decision to place the property in operation, and we assume it will take 18 to 24 months to subsequently complete mining and milling facilities, we will then consider entering into a formal contract to become effective at some pre-determined date, say, two years hence or at the commencement of production, whichever is sooner.

The limited information available at this early stage makes it difficult to properly assess the overall freight situation regarding deliveries of concentrates to our smelters. However, I presume that the movement will include an ocean-going vessel from an Alaskan port. If sufficient tonnage is involved it is likely that carrying vessels will be willing to discharge directly at our Selby plant wharf. Normally in this connection at least a minimum of 500 tons is required to effect direct discharge. Otherwise, vessels will discharge at commercial wharfs in the San Francisco Bay area in which case reforwarding costs to our Selby plant will amount to approximately $5.00 per ton.

The reason I am pointing this out is that the delivery cost applicable to the El Paso portion via U. S. Gulf ports and thence overland to El Paso will probably be prohibitive. For instance, current overland rates from Corpus Christi amount to approximately $7.00 per ton plus miscellaneous terminal and reset charges. On the other hand, overland rates from San Francisco currently amount to $14.00 per ton plus similar wharfage and reset charges.

Once you have an idea of the transportation alternatives available for effecting Selby and El Paso delivery, we will be glad to explore the possibility of taking discharge at our Selby plant wharf and reforwarding for your account any excess above the 200-ton monthly rate on to El Paso, thereby minimizing overall reforwarding costs to you.

You have mentioned that you were also exploring a means of eliminating antimony and shipping antimony-free residues in lieu of bulk concentrates. We do not foresee any difficulty in treating such a product at our Selby plant either in quantities equivalent to those projected on the basis of your present 200-ton per day milling rate, or for a reasonably higher rate.

If you have any further questions regarding this whole matter, please advise.

Yours very truly,

AMERICAN SMELTING AND REFINING COMPANY

J. C. Buck

JCB:DE
ENC. Provisional Smelter Schedule

AMERICAN SMELTING AND REFINING COMPANY

Complementary Schedule

Taxes: All taxes or other governmental charges, national, local or municipal, now or hereafter imposed in respect to or measured by the product purchased hereunder, or the production, extraction, smelting, refining, sale, transportation, [illegible]portation, proceeds or value thereof, or of the metals derived therefrom, other than income taxes levied upon the [illegible]ER, shall be for account of the SELLER and shall be deducted from the purchase price payable hereunder.

Duties: A sum equal to all United States Customs duties which are in effect on the product purchased or metals contained therein at the time product enters the United States shall be for account of SELLER and shall be deducted from the purchase price, provided however, that any duty in effect on lead shall be measured only by the payable lead content of product and that no deduction shall be made under this clause on account of the copper content of product when the payment for copper is based on the export refinery quotation.

Sampling and Assaying: Weighing and sampling (at which SELLER or a representative may be present) as done by BUYER according to standard practice, promptly after receipt of product, will be accepted as final. The absence of SELLER or a representative shall be deemed a waiver of the right in each instance. After sampling, the product may be placed in process, commingled, or otherwise disposed of by BUYER. In case of disagreement on assays (unless such disagreement shall be within agreed splitting limits), an umpire shall be selected in rotation from a list mutually agreed upon whose assays shall be final if within the limits of the assays of the two parties, and if not the assay of the party nearer to the umpire shall prevail. Losing party shall pay cost of umpire. In case of SELLER'S failure to make or submit assays, BUYER'S assays shall govern.

Force Majeure: Prevention or delay in the performance hereof caused by act of nature, strike, fire, flood, traffic interruption, delay in transportation, war, insurrection or mob violence, requirement or regulation of Government, financial crisis, cessation of operation at smelter for failure of ore supply or other operating requirement, or any disabling cause, without regard to the foregoing enumeration, beyond the control of either party, including, without limitation upon the generality of the foregoing, any cause which would produce a financial loss to either party through performance hereof, in mining, smelting, refining or otherwise, shall entitle the party affected to suspend this contract in respect of the suspension of this contract under this clause by one party for a continuous period of one hun[illegible]ty days, the other party may at its sole option cancel this contract.

Definitions: A ton is 2,000 lbs. and a unit is 1% of a ton, or 20 lbs., unless otherwise specified.

Diversion: BUYER may sell or divert the product to any other smelter, and any increase or decrease in freight as against delivery as provided in the principal agreement to which this schedule is attached shall be for BUYER'S account.

Customs: SELLER agrees to indemnify and save BUYER harmless against any and all customs duties, liability and expense whatsoever incurred in respect to product delivered hereunder by reason of SELLER'S failure to observe or comply with all laws and regulations relating to the importation of merchandise into the United States.

Suspension of Quotations: In the event of a suspension of quotations for any cause, resulting in the absence of quotations for the period or date specified in the principal agreement as applicable to any lot of product, the quotations to be used in the case of each such lot, except in respect to the gold content of SELLER'S product, will be those which would be applicable if the date of arrival of the material at the plant of the BUYER occurred that number of days after the date of actual arrival as shall equal the total number of days during which quotations were suspended; and settlement will be made in respect to any metal or metals so affected as soon as such deferred quotations are available if settlement shall then be due. In case any firm or publication whose quotations are the basis for pricing any metal under the principal agreement shall go out of business, cease publication, or discontinue the making of quotations, then the BUYER shall establish a quotation or quotations which shall be used in making settlement in respect of the metal or metals in question.

Waiver: Waiver of any breach of any provision hereof shall not be deemed to be a waiver of any other provision hereof or of any subsequent breach of such provision.

Succession: This contract shall bind and inure to the benefit of the parties hereto, their executors, administrators, legal representatives, successors or assigns, and shall be a covenant running with the land.

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MINERAL DEVELOPMENT DEPARTMENT

INORGANIC CHEMICALS DIVISION

FMC CORPORATION

OFFICE MEMORANDUM

TO Mr. E. W. Ennen

DATE July 10, 1963

FROM K. C. Vincent

POCATELLO, IDAHO
P. O. BOX 1728

SUBJECT: REMOVAL OF ANTIMONY FROM PECO SILVER MINES CONCENTRATE

Confirming the information given to you by telephone yesterday, there appear to be several possible ways to remove antimony from Peco concentrate.

One method which should be effective is a process developed by Sumshine Mining Company in the late 30's for removal of antimony from their high silver tetrahedrite concentrate. It is described in the Engineering & Mining Journal issue for March 1944, and discussed more completely in U. S. Patent No. 2,331,[illegible]. This method involves leaching of antimony sulfide from the concentrate by means of a concentrated aqueous solution of sodium sulfide at a temperature of around 100° C. Antimony is recovered from the pregnant solution by electrolysis as a metal containing 96% to 97% antimony and, in the case of the Sumshine ore, 2% to 3% arsenic. The anode reaction produces various oxidation products of sulfur including sulfite, thiosulfate and sulfate and diaphragm cells are used to confine these products to the anolyte. They are removed, and the sulfide content of the anolyte regenerated by addition of barium sulfide and separation of the precipitated insoluble salts. These salts are converted to black ash for regeneration of barium sulfide. Supplies required for the process are primarily coal for the black ash reaction, and moderate amounts of make-up caustic and barium sulfate, and of course electrical energy is required for the antimony reduction. It appears that about 2 kwh are required per pound of metallic antimony produced. Steam is also required, since both the leaching and anolyte regeneration are carried on at solution temperatures around 100° C.

I would expect that this leaching process would also be effective for removal of antimony from jamesonite. Liddell's Handbook of Nonferrous Metallurgy mentions the solubility of stibnite in sodium sulfide and also discusses briefly

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MINERAL DEVELOPMENT DEPARTMENT

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FMC CORPORATION

OFFICE MEMORANDUM

TO Mr. E. W. Ronca - 2 DATE July 10, 1963

FROM K. G. Vincent POCATELLO, IDAHO
P. O. BOX 1728

SUBJECT: REMOVAL OF ANTIMONY FROM LEAD SULFIDE METAL CONCENTRATE

the leaching of ores containing mixtures of the sulfides of antimony and lead.

As an alternative to electrolytic reduction of the antimony, the sulfide can be precipitated from sodium sulfide solution by addition of carbon dioxide or sulfuric acid, according to Riddell. I am not sure of the chemistry involved in the solution of antimony sulfide in concentrated sodium sulfide solution, but possibly its solubility is due to the formation of thioantimonates or some sort of complex ion, either one of which may be sensitive to sulfide ion concentration. On paper this variation of the basic process can be shown to require only make-up limestone, bauxite, and some caustic, with coal required for bauxite reduction and fuel required for calcining of the limestone and heating of brine. In this case, the antimony would be marketed as a synthetic stibnite. The only antimony smelter I know of offhand is located in Laredo, Texas.

Another approach which seems to have some chance of working is chlorination and removal of antimony chloride from the other constituents by volatilization. The following table shows the boiling point of the chlorides of the major constituents of the Dove concentrate. The data were taken from a copy of the Chemical Handbook.

Chemical Compound	B.P. at atmospheric pressure
$SbCl_3$	220° C.
$SnCl_2$	623° C.
$SnCl_4$	114° C.
$FeCl_3$	315° C.
$CuCl$	1366° C.
$CuCl_2$	Decomp. 993° C.
$PbCl_2$	950° C.
$FeCl_4$	Explodes 105° C.
$AgCl$	1550° C.

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MINERAL DEVELOPMENT DEPARTMENT

INORGANIC CHEMICALS DIVISION

FMC CORPORATION

OFFICE MEMORANDUM

TO Mr. E. W. Hanson - 3

DATE July 10, 1963

FROM E. C. Vincent

POCATELLO, IDAHO
P. O. BOX 1726

SUBJECT: [redacted]

A literature search would probably turn up other methods of handling the antimony problem, if it is definitely found to be a problem. However, the sodium sulfide leach process is the alternative (assuming that it would be effective on ferrantite) because it has been fully developed and applied on a commercial scale, by both Sunshine Mining Company and Bunker Hill & Sullivan. Bunker Hill applied the process to treatment of a copper antimony matte.

K W

E. C. Vincent

ECV:el

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Pocatello, Idaho

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8/28/63

PESO SILVER - METALLURGICAL CRITERIA

1. PROJECTED HEADS ANALYSIS

a) Only Rex vein data used in estimates

b) Average analysis of surface outcrops:

Ag - 44.0 Oz/T

Pb - 7.99%

Sb - 4.35%

Corrected analysis based on 10% mine dilution:

Ag - 44.0 x 0.9 -- 40.7 Oz/T

Pb - 7.79 x 0.9 -- 7.0%

Sb - 4.35 x 0.9 -- 3.9%

(Zn -- 0.8% estimated)

2. INFERRED MINERALOGY

Basis for Calculations

Item - No copper or Zn. analysis available

Item - Vein minerals said to be:

Abundant siderite & quartz

Moderate jamesonite w. -- 15 to 20 Oz. Ag/T

" galena w. -- 50 Oz. Ag/T

" tetrahedrite w. -- 1500 Oz. Ag/T

Lesser sphalerite

Minor pyrite

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Jamesonite - $Pb_4FeSb_6S_{14}$

	At.Wt.	%
Pb_4 --	830	40.2
Fe --	56	2.7
Sb_6 --	731	35.4
S_{14} --	448	21.7
	2065	100.0

Galena - PbS

	At.Wt.	%
Pb	207.2	86.5
S	32	13.5
	239.2	100.0

Tetrahedrite - $Cu_3SbS_3.x\ ((FeZn)_6Sb_2S_9)$

Assume x -- 0.1

		At.Wt.	%	
1 x	Cu_3	191	38.3	
	Sb	121.8	29.5	
	S_3	96	7.2	
0.1 x	$(FeZn)_6$	36	25.1	Fe 11.3 Zn 13.8 25.1
	Sb_2	24.4		
	S_9	29		
		498	100.0	

Sphalerite - Zn S

	At.Wt.	%
Zn	65.4	67.2
S	32.0	32.8
	97.4	100.0

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Derived Sulfide Mineralogy:-

First Approx.

a) Assume all silver in tetrahedrite -

% Tetrahed. -- $\frac{40.7}{1500}$ x 100 -- 2.71%

% Sb -- 2.71 x 0.294 -- 0.798%

Balance -- 3.9 - 0.80 -- 3.1%

b) Assume balance of Sb as jamesonite -

% jamesonite -- $\frac{3.1}{.354}$ -- 8.75%

% Pb -- 8.75 x 0.402 -- 3.52%

Balance -- 7.0 - 3.5 -- 3.5%

c) Assume balance of Pb as galena -

% galena -- $\frac{3.5}{.865}$ -- 4.05%

d) Assume (FeZn) in tetrahedrite -- 55% Zn, 45% Fe

% Zn(in tetrahed.) 2.71 x .251 x .55 -- 0.37%

Balance -- 0.8 - 0.4 -- 0.4% as ZnS

Therefore %ZnS -- $\frac{0.4}{.672}$ -- 0.6%

e) Distrib. Silver -

	Wt %	Assay Oz/T Ag	[illegible]	Pg % Distrib.
Tetrahed. -	2.71	1500	40.65	91.5
Jamesonite -	8.75	20	1.75	3.9
Galena -	4.05	50	2.02	4.6
			44.42	100.0

Therefore - in heads @ 40.7 Oz/Ag/T, Ag in tetrahed. 40.7 x .915 --

37.2 Oz/T

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Second Approximation

a) 37.2 Oz Ag/T in Tetrahedrite

% Tetrahed. -- $\frac{37.2}{1500}$ x 100 -- 2.48%

% Sb in Tetrahed. -- 2.48 x 0.294 -- 0.73%

% Zn " " -- 2.48 x 0.251 x 0.55 -- 0.34%

b) Sb as Jamesonite -- 3.9 - 0.73 -- 3.17%

% Jamesonite -- $\frac{3.17}{.354}$ -- 8.95%

% Pb in " -- 8.95 x 0.402 -- 3.6%

c) Assume balance of Pb as Galena

7.0 - 3.6 -- 3.4% Pb as Galena

% Galena -- $\frac{3.4}{.865}$ -- 3.93%

d) Assume balance of Zn as Sphalerite

0.8 - 0.34 -- 0.46%

% Sphalerite -- $\frac{0.46}{0.672}$ -- 0.685%

SUMMARY

			ASSAY %							UNITS						
Mineral	% in Heads	% Dist. in Sulf.	Pb	Cu	Sb	Fe	Zn	S	Ag	Pb	Cu	Sb	Fe	Zn	S	Ag
Tetrahed.	2.48	15.4	-	38.3	29.4	11.3	13.8	7.2	1500	-	0.950	0.729	0.280	0.342	0.179	37.2
Jameson.	8.95	55.7	40.2	-	35.4	2.7	-	21.7	20	3.598	-	3.168	.242	-	1.942	1.7
Galena	3.93	24.6	86.5	-	-	-	-	13.5	50	3.399	-	-	-	-	.531	1.9
Sphaler.	.69	4.3	-	-	-	-	67.2	32.8	-	-	-	-	-	.464	.226	-
Calc'd. Head	16.05	100.0	7.00	0.95	3.90	0.52	0.81	2.88	40.9	6.997	0.950	3.897	0.522	0.806	2.878	40.9
" Conc.			39.2	5.3	21.8	2.9	4.5	16.1	229	& 10% $Fe_2CO_3Si_2$ sum -- 100%						

:::..No penalty if less than 8%

Weight recon. @ 90% Hd. recon and 10% gangue dilution -- $\frac{16.05 \times 0.9}{0.9}$ -- 16.05%

70M Ton/yr. crude gives 11,250T/yr. - 940/mo. - 215T/wk.

Milling Criteria

Weight recovery -- 16%

Ratio of conc. -- 6.25/1

350 days/yr, 3 shifts/day opn.

70,000 T/yr. crude (dry wt.)

200 T crude/day

9-10 T/hr. @ 90% availability

11,250 T/yr. conc. (dry wt.)

32 T/day gives 1.5 T/hr. @ 90% availability

Ore texture appears reasonably coarse since we currently visualize making a bulk concentrate, it does not appear that an excessively fine grind is required. For estimating purposes, we could assume a minus 65 mesh grind, or approximately 55% minus 200M.

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Pocatella, Idaho

KW
9/63

Peso Silver

Milling Cost - 350 days/year, 7 days/week

Labour

			$/Yr.	$/T Crude	$/T Prod.
Staff:					
Supt.	- 1 @ $10,000.		$ 10,000.		
Ch. Chemical	- 1 @ $ 8,000.		8,000.		
Lab. Techs.	- 3 @ $ 5,000.		15,000.		
			33,000.		
Operating:					
172 hrs/wk. @ $2.50		Foremen - (4) 3 @ 2.50/hr.	21,500.		
56 hrs/wk. @ $2.25		Crusherman- (3) 1 @ 2.25	6,300.		
" @ $2.00		Helper - (4) 1 @ 2.00	5,600.		
180 hrs/wk.(straight)		Operators - (4) 3 @ 2.25	19,350.		
8 " " @ 1½					
172 hrs/total/3 shifts/d		Packers (4) 3 @ 2.20	17,200.		
= hrs./w/d @ $2.00		Day Crew - (3) 2 @ 2.00	11,200.		
	Total ..		81,150.		
Maintenance:					
Assumed 52 hrs/wk.		Elect. - (4) 1 @ 2.50	6,500.		
" " "		Mech. - 1 @ 2.50	6,500.		
104 "		Helpers - 2 @ 2.25	11,700.		
	Total ..		24,700.		
	Total Labour ..		138,850.		
	Pac. @ 15% ..		20,800.		
	Total P/R		$ 159,650.	2.28	14.20

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9/63

	$/Yr.	$/T Crude	$/T Prod.
Supplies:			
Cr. Media 1#/T Crude @ 16¢	$ 11,200.		
Cr. Parts 0.1# @ 21¢	1,470.		
Screens & Bags @ 4¢/T	2,800.		
Repl. Steel 0.1# @ 16¢	1,120.		
" Elect. @ 2¢/T	1,400.		
Lub. @ 5¢/T	3,500.		
Misc. Parts @ 3% of Equip.	6,240.		
Reagents @ 10¢/T	7,000.		
Total ..	34,730	0.50	3.08
Power:			
Cr. Plant 150 HP x .75 x . x 2800 = 252,000 KWH @ 1.5¢	3,780.		
Mill - 330 x .75 x 0.8 x 8400 = 1,660,000 KWH @ 1.5¢	24,900.		
Total ..	28,680.	0.41	2.55
Unallocated:			
Office	1,200.		
Pickup Truck	2,500.		
Tools	4,000.		
Buildings and Grounds	2,000.		
Heating	4,000.		
Fire and First Aid	1,200.		
Lab. Supplies	4,800.		
Total ..	19,700	0.28	1.75
Total Supplies ..	83,110	1.19	7.38
Total Milling Cost	242,760	3.47	21.58
Plus 15% Conting. & 100S	279,000	4.00	24.80
Direct Cost		4.00	
Taxes, Ins. @ 2% of $900,000.	18,000.	.21	
Depreciation @ 14.5% " "	131,000.	1.87	
Total cost ..		6.08	
Less Depreciation ..		1.87	
Reincl. of cost w/o depreciation		$ 4.21	

FMC CORPORATION
Pocatella, Idaho

KW
8/63 - MDD

PESO SILVER - SMELTER RETURN CALCULATIONS

	Assay, %:						
Conc.	Pb	Cu	Sb	Fe	Zn	S	Ag
	39.2	5.3	21.8	4	4.5	16	230

Value/ton by AS & R Sched. (Selby, El Paso)

Payments:

Ag	-	230 x .95 x $1.265	$ 276.00/T
Pb	-	35.7 x 20 x $0.1125	80.50
Cu	-	4 x 20 x $0.2040	16.33
Sb	-	11.8 x $0.50	5.90
			378.73

Deductions:

At Selby -

Smelting Chg.	$ 15.80/T
Lead Ref. & Handling Chg. - 714 x $0.01125	8.03
Lead delivery Chg. - $\frac{714}{2000}$ x $17.50	6.24
	30.07/T

At El Paso -

Smelting Chg.	15.80
Lead Ref. & Handling Chg.	8.03
Lead delivery Chg.	9.35
	33.18/T

Freight - To Selby - Est. $53/T
- To El Paso - Est. 67/T

Net Value of Conc. at Mine

Shipped to Selby - $378.73 - ($30.07 + $53.00)	=	$ 295.66
" " El Paso - $378.73 - ($33.18 + $67.00)	=	$ 278.55

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8/63 - MDD

Value/Ton by International Schedule:

Payments:

Ag	-	230 x .95 x $1.27	$ 278.00
Pb	-	37.7 x 20 x 0.90 x $0.0869	59.00
Cu	-	106 x 0.8 x $0.1885 (0.2835 - $0.095)	16.00
Sb	-	21.8 x 20 x .75 x $0.325 x 0.25	26.55
		Total ..	379.55/T

Deductions:

Treatment	19.00/T

Freight:

To Toode, Utah, estimated ..	58.00
Total ..	77.00
Net Value, Mini ..	$ 302.55

FMC CORPORATION

PESO SILVER MINES LTD. - CONCENTRATOR MATERIALS LIST - 200 T/Day Crude - 350 D/Yr. 3 sh-D

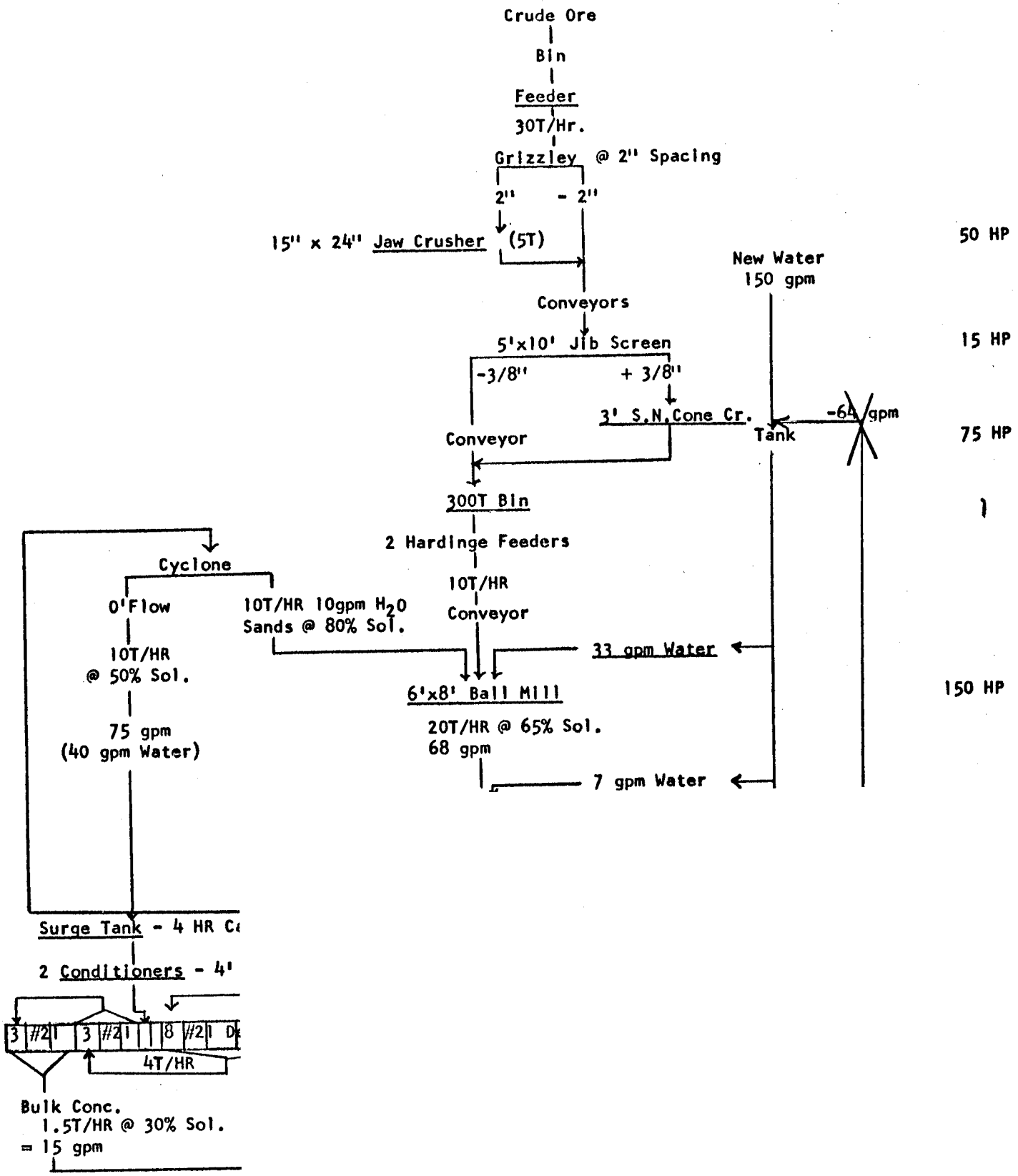
	ITEM	QTY.	TONS	HP.	EQUIP.	MAT.	LABOR	TOTAL	
DIRECT COSTS									
1	Bin - 100 T	1	6			6,000	1,500	7,500	
2	Feeder - 30" x 4'	1	1	1.5	1,500	600	400	2,500	
3	Grizzley - 2' x 4'	1	1			600	200	800	
4	Jaw Crusher - 15" x 24" S.T.	1	7	50	11,000	1,000	1,000	13,000	
5	Conveyor - 18" x 60'	1	3	3	3,200	1,200	1,200	5,600	
6	Conveyor - 18" x 50'	1	3	3	3,000	1,200	1,200	5,400	
7	Vib. Screen - 4' x 10'	1	5	10	3,500	3,000	1,000	7,500	
8	Cone Crusher - 3' Sn.Hd.	1	12	75	25,000	1,000	1,000	27,000	
9	Conveyor - 14" x 150'	1	30	10	7,000	11,000	5,500	23,500	
10	300 T Fine Ore Bin	1	15			12,000	3,000	15,000	
11	Feeders	2	3	4	2,000	800	800	3,600	
12	Conveyor 18" x 25'	1	3	3	2,000	700	1,300	4,000	
13	Ball Mill - 6' x 8'	1	30	150	37,000	4,000	2,500	43,500	
14	Pump - (1½" sand)	1	0.2	5	1,000	150	150	1,300	
15	Hydro Cyclone	1	0.2		1,500	900	500	2,900	
16	Surge Tank - 14' x 14'	1	7	20	11,000	1,000	1,000	13,000	
17	Conditioners - 4' x 4'	2	1.3	6	2,000	300	500	2,800	
18	Ro. Flot. Cells - Deco #21	8	10	30	13,000	1,800	800	15,600	
19	Cl. Rea. Cells - " "	6	7.5	22½	10,000	1,000	600	12,000	
20	Thickener - 30' Diam.	1	14	3	16,000	2,500	1,200	19,700	
21	Filter - 6' x 4L.	1	5	30½	13,000	1,300	1,300	15,600	
22	Conveyor - 18" x 25'	1	3	3	2,000	700	1,300	4,000	
25	Monorails	3	2.0	10	8,000	4,000	1,200	13,200	
26	Reagent System	3	0		1,200	1,000	600	3,000	
27	Concrete - Piles, Gyc. 90 cu. yds. @ $15/yd.					7,000	7,000	14,000	
28	" Slabs - 80 cu. yds @ $11/yd.					6,000	3,000	9,000	
29	" Pie.s. 11s. 450 cu. yds. @ $12/yd.					45,000	10,000	55,000	
NOTE - 23, 24 & 24a crossed out -									
23	Thickener - 80' Diam.	1	50	5	30,000	4,000	4,000	38,000)	
24	Return Water Tank 8' x 10'	1	0.1			200	200	400)39,100	
24a	Pump Ret. Water 1½"	1	0.2	7.5	400	150	150	700)	

		424.5	452	269,300	235,980	100,050	545,900
	ITEM	QTY. TONS	HP.	EQUIP.	MAT.	LABOR	TOTAL
30	Steel, Primary (Mill Bldgs)	100			46,000	10,000	56,000
31	" Sec.(Int. Fr.& Sup.)	30			15,000	3,000	18,000
32	Piping - Pulp & Water	10			7,000	5,500	12,500
33	chutes & launders	5			5,000	1,000	6,000
34	Heating	10		5,000	5,000	3,000	13,000
35	Insulation						
36	Painting				750	1,850	2,600
37	Site Prepn.				15,000	15,000	30,000
38	Elect. Plant Power			6,000	6,000	12,000	24,000
39	" " Ltd.				2,000	2,000	4,000
40	" Substation			20,000	12,000	8,000	40,000
41	Dam 30M cu.yds @$1.25 (Contract)				37,500		37,500
41	Pump - (200gpm @250'Hd.)	2	25	3,000	1,500	1,500	6,000
	Tank				9,500	2,500	12,000
42	6" Pipe 1¼ miles @ $7/ft.	20			23,000	23,000	46,000
	TOTAL DIRECT	346	477	207,900	301,600	138,100	647,600
	INDIRECT COSTS						
	Engineering				3,000	33,000	36,000
	Const. Superv.					17,000	17,000
	Purch. & Account.					14,000	14,000
	Warehouse					8,000	8,000
	Subsist. - Field Off.				4,500		4,500
	" Labor				30,000		30,000
	Travel Exp.				4,000		4,000
	Tel. & Tel.				4,000		4,000
	Off. Supplies				1,500		1,500
	Utilities				2,000		2,000
	Temp. Facilities				6,000		6,000
	Tools Expenditure				5,000		5,000
	Equip. Rentals				25,000		25,000

KW
FMC - MDD

PESO MINES LTD. - Flowsheet (Tentative)

	T/Yr.	T/Mo.	T/D	T/HR
Criteria - Crude Ore	70,000	5,800	200	10
- Conc.	11,250	940	31	1.5
Op Schedule	350 D/Yr., 3 Shift/D			



ITEM	EQUIP.	MAT.	LABOR	TOTAL
INDIRECT COSTS CONT'D.				
Freight @ $7.50/100#		53,000		53,000
Handling			7,000	7,000
P/R Taxes, Ins.		24,000		26,000
Gas, Oil, Oxy - Acct.		5,000		5,000
Start up Costs		3,000	7,000	10,000
TOTAL INDIRECT		172,000	96,000	258,000
Plant Cost	207,900	473,600	224,100	905,600
Eng. Contr. Fee 5%				45,000
GRAND TOTAL				450,600
Office				15,000
Control, Test Lab.				10,000
Repairs & Maint. Shop				24,000
Warehouse				10,000
Change House in Mill				1,000
Auxiliary Facilities				60,000
Total Cost - Mill and Auxiliary Facilities				1,010,000

BY DIRECT FACTORING OF INSTALLED EQUIPMENT COST -

CAPITAL COST - $262,000 x 3 -- $790,000

USE $900,000

TO: R. C. Corwin
R. L. McEwen
E. W. Hanson

The exact same "Silver" letters were sent to:

Stolberger Zink A.G.F. Bergbau
u Zinkhuttenbetrieb
Binsfeldhammer
West Germany
RWB-380-63

Unterharzer Berg und Huttenwerke G.m.b.H.
Oker (Harz)
West Germany
RWB-381-63

Preussag-Harzer Berg und Huttenwerke
Lautenthal
West Germany
RWB-382-63

Metallwerke Unterweser A.G.
Fridrish-August-Hutte
Post Nordenham, West Germany
RWB-383-63

Societe Min. et Met. de Penarroya
Noyelles Godault
France
RWB-384-63

Bolidens Gruv A.B.
Ronnskar
Sweden
RWB-385-63

be agreed upon. Your ideas as to the length of time you would prefer would be appreciated.

Yours very truly,

FMC INTERNATIONAL

Robert W. Bennett, Manager
Industrial Chemicals

RWB/avr

CC:
R. C. Corwin
R. L. McEwen
E. W. Hanson

file

September 24, 1963
RWB-379-63

Preussag-Harzer Berg und Huttenwerke
Clausthal
West Germany

Gentlemen:

FMC has entered into an agreement with Peso Silver Mines, Ltd. to carry out the continued exploration and development of mining claims located in the Mayo District, Yukon Territory, Canada. The technical investigation indicates that a bulk lead-silver concentrate of the following analysis will be produced:

Content	Percent
Cu	5.3%
Sb	21.8%
Pb	39.2%
Fe	4.0%
Zn	4.5%
S	16.1%
Ag	229.0 oz. per to

100% of the material will pass 65 mesh and 65% will pass 200 mesh.

Production of the bulk flotation concentrate will amount to approximately 11,000 short tons per year.

We would appreciate knowing if your firm would be interested in all or part of this material. If you are interested, we would like to have a tentative price schedule based on the above analysis.

The tentative price schedule should specify the following:

1. Percentage of metal content (Cu, Sb, Pb, An and Ag) to be paid for.

2. Basis for establishing value of metals contained. If a non-USA basis is to be used, please show current prices with this basis for the metals concerned.

3. Statement of any deductions or penalties.

The schedule should be calculated on an F.O.B., U.S. West Coast basis.

Your proposed terms of payment should be stated.

It is understood that the contract commencement date and terms are to

RWB-377-63

Robert W. Bennett

September 23, 1963

Roger C. Corwin

EW Hanson

Silver Ore - Brussels

Mr. Henry Blaise of Societe General de Minerais of Brussels called me yesterday to advise that he had heard you would be coming to visit them on the silver ore and while he was here in New York, he would be interested in talking to us about the matter.

I introduced him to Fred Bretschger and we briefly covered the analysis with the opinion being voiced that the antimony contained was quite high but that he would ask his people to advise us on:

1. The value they would assign to the concentrate containing the antimony, and

2. The value they would assign to the concentrate that would not contain the antimony assuming that we are able to remove it.

They have a limited capacity of a few hundred tons for the Harris process antimony remover and consequently would not be able to utilize our ore without making a capital expenditure.

We assured them that we would not go into this business unless it was for a long term and consequently they would be justified in making a capital expenditure if we could come to a satisfactory agreement.

Best regards.

no

Robert W. Bennett

Potential Ore Zones

PESO SILVER MINES

OWNERSHIP

OWNERSHIP

CONTROL

CONTROL

CONTROL

PESO PROPERTY

No. 1

REX

CENTRAL McQUESTEN MINES

BARKER PROPERTY

ALICE

MAYO SILVER MINES

SILVER TITAN MINES
JOINT VENTURES

ARGENT

HALDANE

SHANGHAI

U R

KPO 28

KPO 18

EO 1

GERLITZKI

DUNCAN LADUE MINES

Producers

UNITED KENO HILL MINES

SILVER KING

ELSA

NO CASH

HECTOR CALUMET

GALKENO

SADIE LADUE

LUCKY QUEEN

No. 9, KENO

Keno Hill

Calumet

Elsa

Keno

Mayo lake Anticline

Galena

East McQuesten River

Dublin Gulch

Lynx Cr.

Shanghai Cr.

Red Cr.

Goodman Cr.

Haggart Cr.

Road

Mt. Haldane

Road to Mayo

Rodin Cr.

Seattle Cr.

Ross Cr.

McQuesten Anticline

32 miles to keno hill

N

LEGEND

- Producers
- Potential Ore Zones
- Faults
- Upper Schist
- Keno Hill Quartzite
- Lower Schist

POTENTIAL ORE ZONES AND PRODUCERS IN MAYO SILVER-LEAD DISTRICT YUKON

PESO SILVER MINES LTD (NPL)

REX VEIN DEVELOPEMENT

26 JUNE 1964. B E WILSON

2

LEGEND

SEDIMENTARY AND VOLCANIC ROCKS

CENOZOIC

QUATERNARY

36 — Surficial deposits: *exclusive of glacial till, may include Pliocene (WHITE CHANNEL and KLONDIKE GRAVELS);* **36a**, *includes older glacial till*

TERTIARY AND QUATERNARY

33-35 — Volcanic rocks (mainly basic): **33**, *undivided (SKUKUM VOLCANICS and NEWER VOLCANICS, in part);* **34**, *Paleocene to Miocene (CARMACKS GROUP);* **34a**, *includes sedimentary rocks (NEWER VOLCANICS, in part);* **35**, *Miocene to Recent (MILES CANYON BASALTS and SELKIRK GROUP)*

TERTIARY

32 — Sedimentary rocks (non-marine): **32A**, *pre-Miocene, mainly Paleocene*

MESOZOIC

CRETACEOUS

31 — Sedimentary rocks: *undifferentiated marine and non-marine*

LOWER CRETACEOUS

30 — Sedimentary rocks: *marine, (SCATTER and GARBUTT FORMATIONS);* **30A**, *marine, includes Jurassic;* **30B**, *marine and non-marine (DEZADEASH GROUP);* **30C**, *non-marine, may include Upper Jurassic (TANTALUS FORMATION)*

JURASSIC

LOWER JURASSIC AND (?) LATER

29 — Sedimentary and minor volcanic rocks: *undifferentiated marine and non-marine (LABERGE GROUP)*

TRIASSIC

UPPER TRIASSIC (mainly)

28 — Sedimentary (mainly) and volcanic rocks: *(LEWES RIVER GROUP and BRAEBURN LIMESTONE);* **28A**, *may include Permian or Carboniferous;* **28B**, *may be partly Jurassic*

TRIASSIC

27 — Sedimentary rocks: *(TOAD and GRAYLING FORMATIONS)*

PALÆOZOIC

PERMIAN (MAY INCLUDE PENNSYLVANIAN)

22 — Sedimentary rocks: **22a**, *includes volcanic rocks*

CARBONIFEROUS AND/OR PERMIAN

20 — Sedimentary rocks

CARBONIFEROUS

PENNSYLVANIAN

19 — Sedimentary rocks: **19A**, *may include Permian*

MISSISSIPPIAN

18 — Sedimentary rocks

CARBONIFEROUS

21 — Sedimentary rocks (undivided): **21A**, *possibly includes Permian;* **21B**, *Carboniferous and/or earlier*

DEVONIAN

UPPER DEVONIAN

14 — Sedimentary rocks (marine): *(IMPERIAL FORMATION);* **14a**, *(FORT CREEK FORMATION) locally includes Mississippian*

MIDDLE DEVONIAN

13 — Sedimentary rocks (marine): *(RAMPARTS FORMATION)*

DEVONIAN AND (?) LATER

15 — Sedimentary rocks: *Upper Devonian and Mississippian;* **15a**, *Upper Devonian (?) and/or Mississippian*

DEVONIAN

12 — Sedimentary rocks: **12a**, *includes volcanic rocks*

SILURIAN

11 — Sedimentary rocks (marine): **11A**, *Middle Silurian and Middle Devonian*

ORDOVICIAN

10 — Sedimentary rocks: **10A**, *includes Cambrian;* **10B**, *may include Silurian*

CAMBRIAN

8 — Sedimentary rocks: **8a**, *Cambrian (?);* **8b**, *Cambrian and earlier*

PRECAMBRIAN AND LATER

5, 6 — **YUKON GROUP** Metamorphic rocks of sedimentary, volcanic, and uncertain origins; includes younger rocks: **5**, *mainly quartzite and quartz-mica schist; minor slate, amphibole, chlorite, and graphite schists, limestone, and greenstone* **6**, *paragneiss, quartz-mica, amphibole, and chlorite schists, quartzite, limestone, slate, greenstone (NASINA SERIES)*

PALÆOZOIC AND/OR MESOZOIC

26 — Volcanic rocks (age uncertain but chiefly Mesozoic): *(OLDER VOLCANICS, HUTSHI, LITTLE RIDGE, and MOUNT NANSEN GROUPS, SCHWATKA ANDESITES and NORDENSKIÖLD DACITES);* **26a**, *includes some sedimentary rocks;* **26b**, *Cretaceous*

23-25 — Sedimentary rocks: **23**, *undivided;* **24**, *mainly Permian or Triassic, mainly volcanic rocks;* **25**, *undivided Carboniferous to Cretaceous*

PALÆOZOIC

16, 17 — Sedimentary rocks (mainly): **16**, *undivided (MONTAGUE GROUP);* **16A**, *may include some Precambrian and Mesozoic;* **17**, *pre-Carboniferous (HARVEY GROUP),* **17A**, *Cambrian and later (?)*

PALÆOZOIC AND EARLIER

9 — Sedimentary rocks (including undifferentiated metamorphic rocks): **9a**, *metamorphosed sedimentary and volcanic rocks, mainly pre-Middle Mississippian*

PROTEROZOIC OR (?) EARLY CAMBRIAN

7 — *Quartzite, limestone, slate, greenstone (TINDIR GROUP)*

INTRUSIVE ROCKS

MESOZOIC (MAINLY)

4 — Acidic intrusions: *granite, granite porphyry, quartz porphyry, syenite porphyry, monzonite porphyry and associated extrusions (ACID VOLCANICS);* **4A**, *mainly alkaline. Tertiary, may include Cretaceous and Quaternary*

3 — Acidic intrusions: *chiefly granodiorite, quartz diorite, and granite (COAST INTRUSIONS);* **3A**, *syenite, monzonite. Mainly Mesozoic*

2 — Basic rocks: *gabbro, diorite;* **2A**, *greenstone, schist, gneiss, not all of intrusive origin;* **2B**, *hornblende-rich rocks, diorite, gabbro, amphibolite, commonly gneissic, of uncertain age*

1 — Ultrabasic rocks (mainly): *peridotite, dunite, pyroxenite, hornblendite, serpentine;* **1A**, *basic and ultrabasic rocks; undifferentiated. May not all be of intrusive origin*

PALÆOZOIC (?)

Kg, Ks — Metamorphic rocks of intrusive origin: **Kg**, *granite, orthogneiss (KLONDIKE GRANITE);* **Ks**, *mica, chlorite, and amphibolite schists (KLONDIKE SCHIST)*

Surficial deposits: *glacial, glaciofluvial, alluvial*

Metamorphosed rocks not otherwise differentiated

Limestone not otherwise differentiated

NOTES

Lithological descriptions are given in the legend only for those map-units of characteristic or specific composition. Throughout the legend, too, the term "undivided" applies to age and "undifferentiated" to lithology.

Geology derived mainly from published and unpublished maps and reports of the Geological Survey of Canada. The geology along the Snake and upper Peel Rivers and thence north to 67° north latitude is mainly from information supplied by the Peel Plateau Exploration Limited (R. G. Perry).

Cartography by the Geological Cartography Unit, 1956

CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS
GEOLOGICAL SURVEY OF CANADA

MAP 1048A
(PUBLISHED, 1957)

GEOLOGICAL MAP OF YUKON TERRITORY

SCALE: ONE INCH TO TWENTY MILES = 1/1,267,200

MILES 20 0 20 40 60 80 100 MILES
KILOMETRES 25 0 25 50 75 100 KILOMETRES

INDEX TO PRINCIPAL PRODUCING AREAS

JANUARY, 1963

(WITH NAMES OF OPERATING COMPANIES)

NEWFOUNDLAND

1. Iron Ore Co. of Canada Iron
2. Iron Ore Co. of Canada Iron
3. Maritimes Mining Corp. Ltd. Copper, Gold
4. Atlantic Coast Copper Corp. Ltd. Copper
5. American Smelting and Refining Company (Buchans Unit) Zinc, Lead, Copper, Silver, Gold, Pyrite
6. Dominion Steel and Coal Corp. Ltd., Dominion Wabana Ore Division Iron

1. Atlantic Gypsum Ltd. Gypsum
2. Newfoundland Fluorspar Ltd. Fluorspar
3. St. Lawrence Corp. of Newfoundland Ltd. Fluorspar
3. Newfoundland Minerals Ltd. Pyrophyllite

NOVA SCOTIA

1. Domtar Construction Materials Ltd. (Gypsum Division) Gypsum
1. Domtar Chemicals Ltd. (Sifto Salt Division) Salt
2. Fundy Gypsum Co. Ltd. Gypsum
3. Domtar Construction Materials Ltd. (Gypsum Division) Gypsum
4. Magnet Cove Barium Corp. Barite, Silver, Lead, Zinc
4. National Gypsum (Canada) Ltd. Gypsum
5. National Gypsum (Canada) Ltd. Gypsum
6. Canadian Rock Salt Co. Ltd., The Salt
7. Beckwell Gypsum Co. Gypsum
7. Little Narrows Gypsum Co. Ltd. Gypsum

1. River Hebert Coal Co. Ltd. Coal
2. Dominion Steel and Coal Corp. Ltd., Acadia Coal Division Coal
3. Dominion Steel and Coal Corp. Ltd., Old Sydney Collieries Division Coal
4. Dominion Coal Co. Ltd. Coal
5. Bras d'Or Coal Co. Ltd. Coal

NEW BRUNSWICK

1. Consolidated Mining and Smelting Co. of Canada Ltd., The Copper
2. Heath Steele Mines Limited Zinc, Lead, Copper, Silver

1. Canadian Gypsum Co. Ltd. Gypsum

1. Avon Coal Co. Ltd. Coal
1. Dufferin Mining Ltd. Coal
1. D. W. and R. A. Mills Ltd. Coal
1. McMann V. C. Ltd. Coal
1. Miramichi Lumber Co. Ltd. Coal

QUEBEC

1. Iron Ore Co. of Canada Iron
2. Quebec Cartier Mining Co. Iron
3. Quebec Iron and Titanium Corp. Iron, Titanium
3. Gaspé Copper Mines Ltd. Copper, Gold, Silver, Selenium, Tellurium
4. Continental Titanium Corp. Iron, Titanium
5. Campbell Chibougamau Mines Ltd. Copper, Gold
6. Copper Rand Chibougamau Mines Ltd. Copper, Gold
6. Merrill Island Mining Corp. Ltd. Copper, Gold
7. Opemiska Copper Mines (Quebec) Ltd. Copper, Gold
8. Coniagas Mines Ltd., The Silver, Lead, Zinc
9. Normetal Mining Corp. Ltd. Zinc, Copper, Silver, Gold, Pyrite
10. Elder-Peel Ltd. Gold
10. Noranda Mines Ltd. Copper, Gold, Silver, Selenium, Tellurium, Pyrite
10. Quemont Mining Corp. Ltd. Copper, Zinc, Gold, Silver, Pyrite
10. Vauze Mines Ltd. Copper, Zinc, Gold
11. Marbridge Mines Ltd. Nickel, Copper
12. Barnat Mines Ltd. Gold
12. Canadian Malartic Gold Mines Ltd. Gold
12. East Malartic Mines Ltd. Gold
12. Malartic Gold Fields Ltd. Gold
12. Malartic Hygrade Gold Mines Ltd. Gold
12. Marban Gold Mines Ltd. Gold, Silver
12. Molybdenite Corp. of Canada Ltd. Molybdenum, Bismuth
12. Nortartic Mines Ltd. Gold
13. Akasaba Gold Mines Ltd. Gold
13. Bevcon Mines Ltd. Gold
13. Lamaque Mining Co. Ltd. Gold
13. Manitou-Barvue Mines Ltd. Zinc, Copper, Lead, Silver, Gold
13. Sigma Mines (Quebec) Ltd. Gold
13. Sullico Mines Ltd. Copper, Zinc, Gold, Silver, Pyrite
13. Sullivan Consolidated Mines Ltd. Gold
14. New Calumet Mines Ltd. Zinc, Lead, Silver, Gold
15. Hilton Mines Ltd. Iron
16. St. Lawrence Columbium and Metals Corp Niobium (Columbium)
17. Solbec Mines Ltd. Copper, Zinc, Lead, Silver
18. Beauce Placer Mining Co. Ltd. Gold (placer)

1. Quebec Lithium Corp. Lithia
2. Sherwin-Williams Co. of Canada Ltd., The Iron Oxide mineral pigment
3. Dominion Industrial Mineral Corp. Silica
4. Broughton Soapstone and Quarry Co. Ltd. Talc, Soapstone
4. Carey-Canadian Mines Ltd. Asbestos
5. Asbestos Corp. Ltd. Asbestos
5. Bell Asbestos Mines Ltd. Asbestos
5. Flintkote Mines Ltd. Asbestos
5. Johnson's Asbestos Co. Asbestos
5. Johnson's Co. Ltd. Asbestos
5. Lake Asbestos of Quebec Ltd. Asbestos
5. National Asbestos Mines Ltd. Asbestos
6. Canadian Johns Manville Co. Ltd. Asbestos
6. Nicolet Asbestos Mines Ltd. Asbestos
7. Aluminum Co. of Canada Ltd. Bructic Limestone
8. Blackburn Bros. Ltd. Mica
9. International Minerals and Chemical Corp. (Canada) Ltd. Feldspar
10. Canadian Refractories Ltd. Dolomitic Magnesite
11. Canadian Silica Corp. Ltd. Silica
12. Union Carbide Canada Ltd., Electro Metallurgical Co. Division Silica
12. E. Montpetit et Fils Ltée. Silica
13. Baker Talc Ltd. Talc, Soapstone

ONTARIO

1. Pickle Crow Gold Mines Ltd. Gold
2. Campbell Red Lake Mines Ltd. Gold
2. Cochenour Willans Gold Mines Ltd. Gold
2. Dickenson Mines Ltd. Gold
2. H. G. Young Mines Ltd. Gold
2. Madsen Red Lake Gold Mines Ltd. Gold
2. McKenzie Red Lake Gold Mines Ltd. Gold
3. Nickel Mining & Smelting Corp. Ltd. Nickel, Copper
4. Calalmi Ore Co. Ltd. Iron
4. Canadian Charleson Ltd. Iron
4. Steep Rock Iron Mines Ltd. Iron
5. North Coldstream Mines Ltd. Copper, Gold
6. Leitch Gold Mines Ltd. Gold
7. Consolidated Mosher Mines Ltd. Gold
7. MacLeod-Cockshutt Gold Mines Ltd. Gold
8. Geco Mines Ltd. Copper, Zinc, Silver, Gold
9. Willroy Mines Ltd. Zinc, Copper, Silver, Gold
9. Algoma Steel Corp. Ltd., The Iron
10. Renabie Mines Ltd. Gold
11. Kam-Kotia Porcupine Mines Ltd. Copper
12. Aumar Gold Mines Ltd. Gold
12. Broulan Reef Mines Ltd. Gold
12. Delnite Mines Ltd. Gold
12. Dome Mines Ltd. Gold
12. Hallnor Mines Ltd. Gold
12. Hollinger Consolidated Gold Mines Ltd. (Hollinger) Gold
12. Hugh-Pam Porcupine Mines Ltd. Gold
12. McIntyre-Porcupine Mines Ltd. Gold
12. Pamour Porcupine Mines Ltd. Gold
12. Paymaster Consolidated Mines Ltd. Gold
12. Preston Mines Ltd. Gold
13. Hollinger Consolidated Gold Mines Ltd. (Ross) Gold
14. Kerr-Addison Gold Mines Ltd. Gold
14. Lake Shore Mines Ltd. Gold
14. Macassa Gold Mines Ltd. Gold
14. Teck-Hughes Gold Mines Ltd., The Gold
14. Upper Canada Mines Ltd. Gold
14. Wright-Hargreaves Mines Ltd. Gold
15. McIntyre-Porcupine Mines Ltd. Silver, Cobalt
15. Siscoe Metals of Ontario Ltd. Silver
16. Agnico Mines Ltd. Silver, Cobalt
16. Deer Horn Mines Ltd. Silver
16. Glen Lake Silver Mines Ltd. Silver, Cobalt
16. Langis Silver and Cobalt Mining Co. Ltd. Silver, Cobalt
16. Silver Miller Mines Ltd. Silver, Cobalt, Copper
17. Lowphos Ore Ltd. Iron
18. Temagami Mining Co. Ltd. Copper, Gold
19. Falconbridge Nickel Mines Ltd. Nickel, Copper, Gold, Silver, Platinum metals, Cobalt, Iron
20. International Nickel Co. of Canada Ltd., The Copper, Nickel, Gold, Silver, Platinum metals, Cobalt, Selenium, Tellurium, Iron
21. Denison Mines Ltd. Uranium
21. Rio Algom Mines Ltd. Uranium
21. Rio Tinto Dow Ltd. Thorium
21. Stanrock Uranium Mines Ltd. Uranium
22. Rio Algom Mines Ltd. Copper
23. Dominion Magnesium Ltd. Magnesium, Calcium
24. Macassa Gold Mines Ltd. (Bicroft Division) Uranium
24. Faraday Uranium Mines Ltd. Uranium
25. Marmoraton Mining Co. Ltd. Iron

1. Canadian Johns-Manville Co. Ltd. Asbestos
2. Union Carbide Canada Ltd., Electro Metallurgical Co. Division Silica
3. Canadian Silica Corp. Ltd. Silica
4. Industrial Minerals of Canada Ltd. Nepheline Syenite
4. International Minerals and Chemical Corp. (Canada) Ltd. Nepheline Syenite
5. Minnesota Minerals Ltd. Roofing Granules
6. Canada Talc Industries Ltd. Talc
7. Domtar Chemicals Ltd. (Sifto Salt Division) Salt
8. Domtar Chemicals Ltd. (Sifto Salt Division) Salt
8. Domtar Construction Materials Ltd. (Gypsum Division) Gypsum
9. Canadian Gypsum Co. Ltd. Gypsum
10. Canadian Rock Salt Co. Ltd. The Salt
10. Canadian Salt Co. Ltd., The Salt

MANITOBA

1. Sherritt Gordon Mines Ltd. Nickel, Copper, Cobalt
2. International Nickel Co. of Canada Ltd., The Nickel, Copper, Precious metal residue
3. Hudson Bay Mining and Smelting Co. Ltd. Copper, Zinc, Gold, Silver, Cadmium, Selenium, Tellurium
4. Hudson Bay Mining and Smelting Co. Ltd. (Chisel Lake) Zinc, Lead, Copper
4. Stall Lake Mines Ltd. Copper, Zinc
5. Forty Four Mines Ltd. Gold
5. San Antonio Gold Mines Ltd. Gold

1. Domtar Construction Materials Ltd. (Gypsum Division) Gypsum
2. Western Gypsum Products Ltd. Gypsum
3. Canadian Salt Co. Ltd., The Salt
4. Pembina Mountain Clays Ltd. Bentonite

SASKATCHEWAN

1. Eldorado Mining and Refining Ltd. Uranium
1. Gunnar Mining Ltd. Uranium
2. Hudson Bay Mining and Smelting Co. Ltd. Copper, Zinc, Gold, Silver, Cadmium, Selenium, Tellurium

1. Domtar Chemicals Ltd. (Sifto Salt Division) Salt
2. Midwest Chemicals Ltd. Sodium Sulphate
3. International Minerals and Chemical Corp. (Canada) Ltd. Potash
4. Saskatchewan Minerals (Sodium Sulphate Division) Sodium Sulphate
5. Saskatchewan Minerals (Sodium Sulphate Division) Sodium Sulphate
6. Ormiston Mining and Smelting Co. Ltd. Sodium Sulphate
7. Sybouts Sodium Sulphate Co. Ltd. Sodium Sulphate

1. Great West Coal Co. Ltd. Coal
1. Manitoba and Saskatchewan Coal Co. Ltd. Coal
1. Utility Coals Ltd. Coal
1. Western Dominion Coal Mines Ltd. Coal

ALBERTA

1. Baroid of Canada Ltd. Bentonite
2. Canadian Salt Co. Ltd. The Salt
3. Magcobar Mining Company, Ltd. Bentonite

1. Alberta Coal Ltd. Coal
2. Star-Key Mines Ltd. Coal
3. Battle River Coal Co. Ltd. Coal
3. Forestburg Collieries Ltd. Coal
4. Amalgamated Coals Ltd. Coal
4. Century Coals Ltd. Coal
5. Great West Coal Co. Ltd. Coal
6. Canmore Mines Ltd., The Coal
7. Coleman Collieries Ltd. Coal
8. Lethbridge Collieries Ltd. Coal

BRITISH COLUMBIA

1. Cariboo Gold Quartz Mining Co. Ltd., The Gold
1. Jedway Iron Ore Limited Iron
3. Empire Development Co. Ltd. Iron
4. Consolidated Mining and Smelting Co. of Canada Ltd., The Copper
5. Nimpkish Iron Mines Ltd. Iron
6. Zeballos Iron Mines Ltd. Iron
7. Bralorne Pioneer Mines Ltd Gold
8. Texada Mines Ltd. Iron
9. Brynnor Mines Ltd. Iron
10. Cowichan Copper Co. Ltd. Copper
11. Anaconda Co. (Canada) Ltd., The Copper, Zinc, Gold
12. Giant Nickel Mines Ltd. Nickel, Copper
13. Craigmont Mines Ltd. Copper
14. Bethlehem Copper Corp. Ltd. Copper
15. Sheep Creek Mines Ltd. Zinc, Lead, Silver, Barite
16. ViroMac Mines Ltd. Lead, Silver, Zinc
16. Western Exploration Co. Ltd. Silver, Lead, Zinc
17. Consolidated Mining and Smelting Co. of Canada Ltd., The (Bluebell) Lead, Zinc, Cadmium, Silver
18. Consolidated Mining and Smelting Co. of Canada Ltd., The (Sullivan) Lead, Zinc, Gold, Silver, Antimony, Cadmium, Bismuth, Tin, Indium, Copper, Iron
19. Mastodon-Highland Bell Mines Ltd. Silver, Lead, Zinc
20. Phoenix Copper Co. Ltd. Copper, Gold
21. Canadian Exploration Ltd. Zinc, Lead, Cadmium
22. Consolidated Mining and Smelting Co. of Canada Ltd., The (H. B. Mine) Zinc, Lead, Cadmium
21. Reeves MacDonald Mines Ltd. Zinc, Lead, Cadmium

1. Cassiar Asbestos Corp. Ltd. Asbestos
2. Georgian Mineral Industries Ltd. Mica
3. Mountain Minerals Ltd. Barite
4. Baroid of Canada Ltd. Barite
5. Mountain Minerals Ltd. Barite
6. Western Gypsum Products Ltd. Gypsum
7. Pacific Silica Ltd. Silica

1. Comox Mining Co. Ltd. Coal
2. Crow's Nest Pass Coal Co. Ltd., The Coal

YUKON TERRITORY

1. Yukon Consolidated Gold Corp. Ltd., The Gold (placer)
2. United Keno Hill Mines Ltd. Silver, Lead, Zinc, Cadmium

1. Yukon Coal Co. Ltd. Coal

NORTHWEST TERRITORIES

1. Canada Tungsten Mining Corp. Ltd. Tungsten
2. Consolidated Discovery Yellowknife Mines Ltd. Gold
3. Consolidated Mining and Smelting Co. of Canada Ltd., The (Con and Rycon Mines) Gold
3. Giant Yellowknife Mines Ltd. Gold

NOTES

1. Most of the lode gold mines as shown also produce some silver
2. Most non-ferrous base metal mines yield small quantities of precious metals
3. Producing areas of clay products and construction materials are not shown on map
4. 1962 statistics are preliminary

NONFERROUS SMELTERS OR REFINERIES

17. ARVIDA: Aluminum ingots and alloys, Aluminum Oxide
18. BAIE COMEAU: Aluminum ingots
13. BEAUHARNOIS: Aluminum ingots and alloys
7. CONISTON: Copper Nickel matte
7. COPPER CLIFF: Nickel Oxide (sinter), Nickel Sulphate; Copper (cathodes, wire bars, ingots, cakes, billets), Gold, Silver, Selenium, Tellurium; Iron Oxide (pellets), Platinum metals (in residues)
7. FALCONBRIDGE: Copper-Nickel matte
6. FLIN FLON: Blister Copper, Zinc, Cadmium
1. GRASSY NARROWS: Nickel, Copper, Cobalt; Ammonium Sulphate, Iron Oxide
11. HALEY: Magnesium; Magnesium alloy ingots, Calcium, Titanium, Zirconium, Thorium
17. ISLE MALIGNE: Aluminum ingots and alloys
17. KITIMAT: Aluminum ingots
14. MONTREAL EAST: Copper, (cathodes, wire bars, ingots, cakes, billets), Gold, Silver, Tellurium, Selenium, Nickel Sulphate, Copper Sulphate, Selenium Salts
16. MURDOCHVILLE: Copper anodes
8. NORANDA: Copper anodes
10. OTTAWA: Refined Silver
9. PORT COLBORNE: Nickel (cathodes, shot, and ingots); Nickel Oxide, Nickel Sulphate, Copper (cathodes, ingots), Nickel-Copper-Chromium Iron ingots, Nickel-Copper-other alloy ingots, Platinum metals (in residues), Cobalt Oxide, Electrolytic Zinc
2. PORT COQUITLAM: Tungsten, Titanium and Tantalum, Niobium (Columbium) metal powders and carbides
22. PORT HOPE: Uranium metal, refined uranium compounds
8. PORT MAITLAND: Zinc
19. SHAWINIGAN: Aluminum ingots and alloys
10. SOREL: Titanium Dioxide slag, Iron
6. THOMPSON: Nickel, Precious metal residue
3. TRAIL: Lead, Zinc, Gold, Silver, Cadmium, Bismuth, Indium, Antimonial Lead, Ammonium Nitrate, Ammonium Phosphate, Ammonium Sulphate

PIG IRON PLANTS

BLAST FURNACES

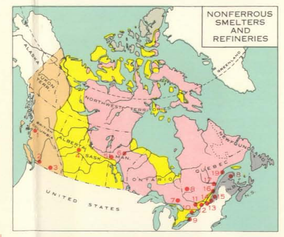
1. Sydney, Dominion Steel and Coal Corp. Ltd.
2. Hamilton, The Steel Co. of Canada, Ltd.
3. Hamilton, Dominion Foundries and Steel, Ltd.
4. Sault Ste. Marie, Algoma Steel Corp. Ltd.
4. Port Colborne, Canadian Furnace, Ltd.

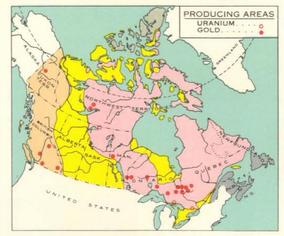
ELECTRIC FURNACES

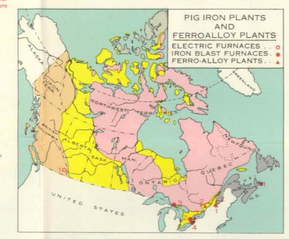
1. Kimberley, The Consolidated Mining & Smelting Co. of Canada Ltd.
2. Sorel, Quebec Iron and Titanium Corp.

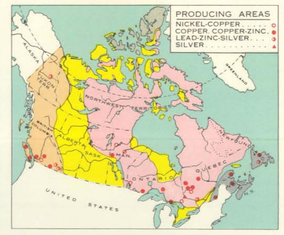
FERROALLOY PLANTS (Primary)

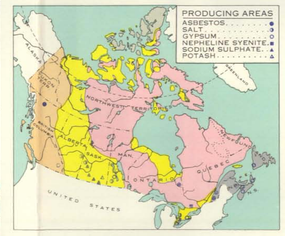
1. Beauharnois, Chromium Mining and Smelting Corp. Ltd.
1. Varennes, Electric Reduction Co. of Canada, Ltd.
1. Beauharnois, Union Carbide Canada Ltd., Metals and Carbon Division
1. Ottawa, Geo-Mat Reactors Limited
3. Welland, Union Carbide Canada Ltd., Metals and Carbon Division

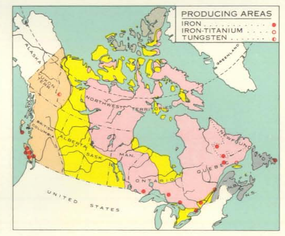












LEGEND

- Intrusive and undivided rocks of the Canadian Shield
- Sedimentary and volcanic rocks of the Canadian Shield
- Interior Plains, St. Lawrence Lowlands, Hudson Bay Lowland, and Arctic Lowlands and Plateaux
- Innuitian Region
- Appalachian Region
- Cordilleran Region
- Intrusive rocks within the Cordilleran Region

- Metal mine
- Mining area PORCUPINE
- Industrial mineral mine or quarry
- Coal mine
- Oil field
- Gas field
- Oil and Gas field
- Oil pipe line
- Gas pipe line

MINERAL PRODUCTION OF CANADA, 1962

	DOLLARS
METALLIC MINERALS	
NICKEL	385,224,707
COPPER	283,133,249
IRON ORE	264,608,450
GOLD	155,446,407
URANIUM	151,425,006
ZINC	110,628,845
LEAD	37,816,785
SILVER	34,897,604
PLATINUM METALS	28,085,528
FUELS	
CRUDE PETROLEUM	583,592,912
NATURAL GAS	97,912,950
COAL	68,527,159
INDUSTRIAL MINERALS	
NON METALLIC MINERALS	
ASBESTOS	132,060,710
SALT	23,185,423
SULPHUR, all forms	13,383,696
GYPSUM	9,033,148
TITANIUM DIOXIDE	7,779,329
SODIUM SULPHATE	4,040,000
QUARTZ	3,556,724
MAGNESITE DOLOMITE AND BRUCITE	3,395,824
NEPHELINE SYENITE	3,383,700
CONSTRUCTION MATERIALS	
SAND AND GRAVEL	118,228,032
CEMENT	113,864,118
STONE	62,808,131
CLAY PRODUCTS	37,738,098
LIME	17,628,000

MINERAL PRODUCTION OF CANADA, 1942 TO 1962

YEAR	DOLLARS PER CAPITA	DOLLARS TOTAL
1942	48.63	566,768,672
1946	40.91	702,816,293
1952	88.89	1,285,342,353
1953	90.02	1,336,353,503
1954	97.36	1,455,382,901
1955	114.36	1,795,310,796
1956	129.65	2,084,905,554
1957	131.87	2,190,322,392
1958	122.99	2,100,739,038
1959	137.79	2,409,020,511
1960	139.48	2,492,509,981
1961	141.59	2,582,300,387
1962	153.10	2,842,984,195

MINERAL PRODUCTION OF CANADA BY PROVINCES, 1962

Province or Territory	Metals	Fuels	Industrial Minerals	Total for Prov. or Territory	Per Cent of Total
	$	$	$	$	
Newfoundland	90,745,388	—	7,516,425	98,261,813	3.4
Prince Edward I.	—	—	796,043	796,043	0.03
Nova Scotia	1,729,857	41,984,088	19,145,094	62,859,039	2.2
New Brunswick	5,226,708	6,889,090	12,789,193	24,904,991	0.9
Quebec	284,736,972		234,608,624	519,145,596	18.3
Ontario	723,238,237	9,809,820	169,095,651	902,133,708	31.7
Manitoba	128,150,347	9,590,325	21,297,687	159,038,359	5.6
Saskatchewan	67,452,161	150,591,723	18,533,756	236,577,640	8.3
Alberta	4,052	538,903,213	39,914,467	578,821,732	20.4
British Columbia	149,025,872	38,047,668	42,353,807	229,427,347	8.1
N. W. Territories	16,783,145	918,000	—	17,701,145	0.6
Yukon Territory	13,199,623	117,159	—	13,316,782	0.5
CANADA	1,480,282,362	796,851,086	565,850,747	2,842,984,195	100.00

CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS
MINERAL RESOURCES DIVISION AND GEOLOGICAL SURVEY OF CANADA

MAP 900A
THIRTEENTH EDITION, 1963

PRINCIPAL MINERAL AREAS OF CANADA

SCALE: 1 INCH TO 120 MILES = 1/7,603,200

MILES 100 0 100 200 300 400 MILES

PUBLISHED, 1963.
COPIES OF THIS MAP MAY BE OBTAINED FROM THE DEPARTMENT OF MINES AND TECHNICAL SURVEYS, OTTAWA, CANADA.

PREPARED IN THE MINERAL RESOURCES DIVISION
GEOLOGY AND CARTOGRAPHY BY THE GEOLOGICAL SURVEY OF CANADA
PRINTED BY THE SURVEYS AND MAPPING BRANCH

INDEX TO PRINCIPAL OIL AND GAS FIELDS

JANUARY, 1963

NORTHWEST TERRITORIES

Fields producing more than 400,000 bbls. of Oil in 1962

1. Norman Wells Oil

BRITISH COLUMBIA

Fields producing more than 100,000 bbls. of Oil and 5,000,000 Mcf. of Gas in 1962

1. Laprise Creek Gas
2. Laprise Creek East Gas
2. Beg Gas
2. Bubbles Gas
2. Jedney Gas
3. Blueberry Oil
4. Nig Creek Gas
5. Buick Creek Gas
5. Buick Creek West Gas
6. Kobes-Townsend Gas
7. Stoddard Gas
8. Beatton River Oil
9. Milligan Creek Oil
9. Wildmint Oil
10. Pesay Oil
11. Boundary Lake Oil and Gas
12. Fort St. John Gas, Sulphur
13. Fort St. John Southeast Gas

ALBERTA

Fields producing more than 1,000,000 bbls. of Oil and 5,000,000 Mcf. of Gas in 1962

1. Pouce Coupe Gas
2. Gordondale Gas
3. Pouce Coupe South Gas
4. Storgeon Lake South Oil
5. Kaybob Oil and Gas
6. Virginia Hills Oil
7. Swan Hills Oil and Gas
8. Windfall Oil and Gas, Sulphur
9. Judy Creek Oil
10. Carson Creek North Oil
11. Pine Creek Gas
12. Redwater Oil, Sulphur
13. Alexander Gas
13. St. Albert Big Lake Gas
14. Acheson Oil
15. Fort Saskatchewan Gas
16. Pembina Oil and Gas
17. Golden Spike Oil
18. Leduc-Woodbend Oil and Gas
19. Joarcam Oil
20. Minnehik Buck Lake Gas
21. Wizard Lake Oil
22. Bonnie Glen Oil
23. Westerose Oil
23. Viking-Kinsella Gas
24. Willesden Green Oil
25. Homeglen Rimbey Gas, Sulphur
25. Westerose South Gas
26. Gilby Oil and Gas
27. Joffre Oil
28. Nevis Gas, Sulphur
29. Stettler Oil
30. Fenn-Big Valley Oil
31. Provost Gas
32. Sundre Oil
33. Innisfail Oil, Sulphur
34. Harmattan East Oil
34. Harmattan Elkton Oil
35. Crossfield Oil and Gas, Sulphur
36. Carstairs Gas, Sulphur
37. West Drumheller Oil
38. Wildcat Hills Gas, Sulphur
39. Jumping Pound Gas, Sulphur
40. Wayne-Rosedale Gas
41. Turner Valley Oil and Gas, Sulphur
42. Okotoks Gas, Sulphur
43. Hussar Gas
44. Cessford Gas
45. Bindloss Gas
46. Savanna Creek Gas, Sulphur
47. Medicine Hat Gas
48. Waterton Gas, Sulphur
49. Pincher Creek Gas, Sulphur
50. Pendant D'Oreille Gas

SASKATCHEWAN

Fields producing more than 1,000,000 bbls. of Oil and 5,000,000 Mcf. of Gas in 1962

1. Coleville-Smiley Oil and Gas
2. Dodsland Oil
3. Battrum Oil
4. Fosterton Oil
5. Success Oil
6. Instow Oil
7. Dollard Oil
8. Midale Oil
9. Weyburn Oil
10. Steelman Oil and Gas, Sulphur
11. Parkman Oil
12. Alida Oil
12. Queensdale Oil
13. Nottingham Oil
14. Camduff Oil
14. Hastings Oil
15. Workman Oil

MANITOBA

Fields producing more than 500,000 bbls of Oil in 1962

1. North Virden-Scallion Oil
2. Virden-Roseau Oil
3. Daly Oil

ONTARIO

Fields producing more than 100,000 bbls. of Oil and 1,000,000 Mcf. of Gas in 1962

1. Gobles Oil
2. Haldimand Gas
3. Norfolk Gas
4. Rodney Oil
5. Dawn 156 Gas
6. Bickford Gas
6. Seckerton Gas
7. Tilbury Gas

NEW BRUNSWICK

Field producing more than 10,000 bbls. of Oil and 75,000 Mcf. of Gas in 1962

1. Stony Creek Oil and Gas

KLAZA RIVER

NANSEN CREEK

VICTORIA CREEK

LONELY CREEK

MT NANSEN GOLD MINES LTD
MT NANSEN MINES LTD
CENTRAL NANSEN MINES LTD
NORM EDGAR & ASSOC.
SILVER STANDARD MINE
BROWN McCADE
FROBEX

-N-

MINING CLAIMS
MT NANSEN AREA

20 April 1964 BEW

0 1 2 3
MILES

EAST
McQUESTEN RIVER
CHRISTIE CREEK
MAYO SILVER MINES (366)
HAG (32)
GAR CREEK
DUELIN GULCH
BARKER (95)
SILVER
DOLLAR
PESO (106) 20)
PESO-WAY FRACTIONS (20)
RIO PLATA (68)
REX (8)
LYNX CREEK
BUB (6)
UP (31)
SHANGRI (69)
ARGENT (8)
LAYSIER (5)
GALENA HILL
DAVID (8)
ALICE (50)
McQUESTEN LAKE
McQUESTEN RIVER
HANSON LAKES
LADUE LAKE
KENO
LADUE RIVER
NOYS (18)
CONCAVE (6)
SILVER BASIN GROUP
FORMO (13)
CALUMET
ELSA
AZTEC (4)
CARIBBEAN GROUP (4)
LIGHTNING CREEK
KENO
CAPRICORN (3)
DUNCAN CREEK

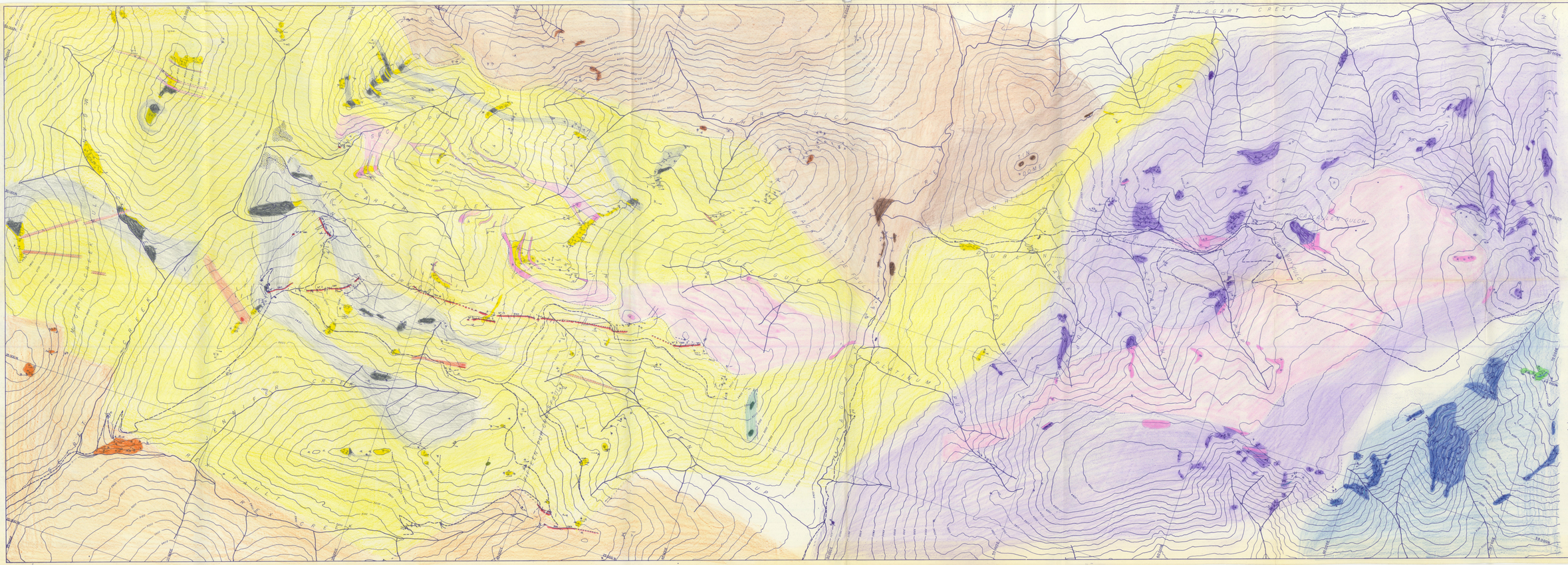
PESO SILVER MINES
BARKER ESTATE
MAYO SILVER MINES
RIO PLATA MINES
SILVER TITAN MINES
DUNCAN LADUE MINES
CENTRAL McQUESTEN MINES

N

PESO CONTROLLED
MINING CLAIMS
MAYO MINING DISTRICT

18 APRIL 1964 BEW

0 1 2 3 4 5
MILES


HAGGART CREEK
FISHER GULCH
TIN DOME
STANLEY GULCH
SECRET CREEK
GARTER CREEK
LIVINGSTON CREEK
ROCKY TRAIL CREEK
GUTKUM
LEGEND
Cemented gravel
Porphyritic amygdaloidal basalt
Quartz and/or feldspar porphyry
Biotite diorite to quartz granodiorite
Aegirite
Medium to dark grey, massive, quartzite (minor micaceous laminations)
Medium to light grey, massive quartzite (minor black argillite and rhombic limestone)
Black phyllite
Micaceous quartzite, quartz mica schist and grey phyllite (minor pyrite, carbonate)
Grey phyllite (minor quartz-mica schist)
Micaceous quartzite, andalusite hornfels
Micaceous quartzite, quartz staurolite hornfels (minor andalusite hornfels)
Quartz diopside skarn
Marble
Outcrop area, individual outcrops marked by stippling
Foliation, inclined (strike and dip)
Foliation, horizontal
Foliation, vertical
Bedding
Mineral vein
Fault
Geological contact
Claim
Contour (interval 100 feet)
Road
Trail
Power line
Railroad
Pipeline
PESO SILVER MINES LTD. (NPL)
Mayo Yukon
REGIONAL GEOLOGY