'80 #553 #8760

F I S H

MAGNESITE DEPOSIT

82 K/15 E

-Brisco, Spillimacheen Area

GOLDEN MINING DIVISION

FORT STEELE MINING DIVISION

OWNER : A. Miller

OPTIONEE: Kaiser Resources Ltd.
P.O. Box 2000
Sparwood, B.C.

AUTHOR : R.J. Morris

SUPERVISOR: J.B. Murphy, P.Eng.

DATE : November, 1978

Part 1 of 2

CONTENTS

SUMMARY AND RECOMMENDATIONS

Quantity - Approximately 22,500,000 metric tons of magnesite was measured and indicated on the claims. Figures 4 and 5 are geological maps of the deposit while Figure 6 shows the projected cross-sections. Table 2 summarizes the ore reserves.

- A compass and topofil (chain) survey was established on the deposit.
- Geological mapping was conducted from this survey control. The mapping outlined the magnesite, determined the attitude of the deposit and gave guidelines for sample spacing and quality estimates.
- Geological plan maps and cross-sections were drawn from the field data.
- Outcrop area (m^2) was taken from the maps and field estimates of depth (m) was used to determine volume (m^3).
- A specific gravity of 2.5 was used to determine mass (metric tons, t).
- Two categories, measured and indicated, are used; measured being outcrop area walked over and measured, indicated being estimated limits of outcrop.

- Three categories of coarseness are used; coarse - medium crystalline being the most abundant, fine - medium crystalline being "medium grade" and fine - medium crystalline with limestone or argillite interbeds being "low grade".

Quality - A total of 127 kg of magnesite was removed from the deposit, comprising 13 samples. Geological mapping indicated that 70% of the ore was in one body and of one texture, 72% of the sample weight was from that area.

- Figure 4 shows sample sites and Table 3 describes the samples.
- Figures 7a-g show the variation along strike of 7 metal oxides.
- There appears to be only minor variation in MgO%. This is confirmed with field evidence as no variation was noted.

Recommendations - Geological mapping indicates a large deposit of magnesite. Up to 1 km of cliffs and hills are comprised of magnesite with only minor interbeds of argillite and limestone. The major portion of the deposit crops out with only minor overburden and vegetation cover.

Quality data on the raw material is included. The deposit shows only minor variation in MgO content and random variation of the other metal oxides.

Further work should be based upon metallurgical assessment of 13 sample program - before committing further funds to drilling program. In order to establish proven reserves and better quality estimates a preliminary diamond drill program must be undertaken. The priority area is centered around Station F36. Six holes are proposed, a total of 620 m, to confirm the geological interpretation (Figure 4). If large diameter core is taken, NQ= 47.6 mm core diameter, enough magnesite can be recovered for quality testing.

COST STATEMENT

1978-79

Sparwood Office

Geologist 10 days Oct. @ $100/day	$ 1,000
Geological Assistant 10 days @ $100/day	1,000
Food & Accomodation $20/day/man x 10 days	400
Transportation 4 wheel drive @$40/day x 10 days	400
Drill Rental, Freight & Miscellaneous	2,791
Accounting Costs	229
Report Preparation 4 days Geologist	400
2 days Draftsman	200
sub-total	$ 6,420

Vancouver Office

Management & Engineers review	$ 800
Assay & Metallurgy lab tests	687
Option Payment to A. Miller (Millers' report)	1,000
sub-total	$ 2,487
TOTAL COSTS	$ 8,907

STATEMENT OF QUALIFICATIONS:

Robert James MORRIS
- B.Sc. Geology, U.B.C., 1973
- mineral exploration, Dynasty Exploration, May 1973 - March 1974.
- coal exploration, Kaiser Resources Ltd. March 1974 - September 1976.
- M.Sc. Geology, Queen's, 1978
- mineral exploration, Kaiser Resources Ltd. May 1977 - present.

Fred G. GIETZ
- B.Ed. Earth and Space Science, U.B.C., 1979.
- 1977 field season with B.C. Fish & Wildlife.
- 1978 field season with Cominco.

Richard Donald SCHROEDER
- B.A. Psychology, Carlton, 1973
- B.C. Industrial "B"
- P.E.P. Search & Rescue
- B.C.I.T. Avalanche A,B,C
- Canadian Association Mountain Guides
- C.M.H. Dec. '78 - March '79 Assistant Guide, Heli-skiing

Barry David DEVLIN
- U.B.C. geology student
- 1978 field season with Riocanex

Signed: R. J. Morris

R.J. Morris

JB Murphy

J.B. Murphy, P. Eng.

TABLE 2

FISH MAGNESITE DEPOSIT

FISH 1-3

TEXTURE	AREA	AREA (m^2)	DEPTH (m)	MASS (METRIC TONS) MEASURED	INDICATED	
COARSE-MEDIUM CRYSTALLINE	A (F21-F30)	12,908	90 m	2,904,299		
	A' (F12)	547	90 m	123,036		
	A" (F12-F21)	1,386	90 m		311,907	
	B (F46-F36)	7,694	90 m	1,731,139		
	B' (F18-F20)	1,074	90 m	241,755		
	B" (F20-F48)	2,149	90 m		483,510	
	C (F30-F33)	15,374	90 m	3,459,041		
	C' (F30-F34)	974	90 m		219,091	
	C" (F37-F35)	8,548	90 m		1,923,248	
	D (F36-F45)	20,367	90 m	4,582,555		
	D' (F46,F53)	422	90 m	94,976		
	D" (F45-F53)	9,848	90 m		2,215,729	
			TOTAL =	13,136,801	5,153,485	= 18,290,286
FINE - MEDIUM CRYSTALLINE	STATION F1	1,314	30 m	98,573		
	STATION B	528	30 m	39,573		
	STATION C	384	30 m	28,780		
	STATION F3	441	30 m	33,097		
	STATION F6	504	30 m	37,774		
	STATION F8	1,252	30 m	93,896		
	STATION F13	211	30 m	15,829		
	STATION F17	705	30 m	52,884		
			TOTAL =	400,406		= 400,406
FINE-MEDIUM CRYSTALLINE WITH FINE-[illegible] OR [illegible]	STATION F19	91	30 m	6,835		
	STATION F64	273	30 m	20,506		
	STATION F62	48	30 m	3,598		
	STATION F71	110	30 m	8,274		
			TOTAL =	39,213		= 39,213
					TOTAL	= 18,729,905

FISH 4,5

TEXTURE	AREA	AREA (m^2)	DEPTH (m)	MASS (METRIC TONS) MEASURED	INDICATED	
COARSE - MEDIUM CRYSTALLINE	FIG. 6	16,707	90 m	3,759,075		= 3,759,075 t

22,488,980 tonnes

(24,737,878 ton)

FISH MAGNESITE DEPOSIT

TABLE 3

Sample Description

SAMPLE NO.	WEIGHT (kg)	AREA	STRATIGRAPHIC REPRESENTATION	TEXTURE	TYPE	MgO %	CaO %	Fe_2O_3%	Al_2O_3%	SiO_2%	L.O.I.%	[illegible]
877R	8.4	Sta. F8	E-W 30 m N-S 30 m	Fine-Med. Crystal.	Surf.	43.20	0.82	0.68	0.80	5.95	48.20	83.40
878R	8.4	F22-F23	N-S 44 m	Coarse Crystal	Surf.	42.40	3.92	1.70	0.62	2.20	49.20	83.50
879R	8.9	FISH 4-5	N-S 15 m	Coarse Crystal.	Surf.	42.80	1.12	1.05	0.50	6.10	47.90	82.20
880R	9.5	FISH 4-5	N-S 15 m	Coarse Crystal.	Surf.	43.60	1.40	0.86	0.54	5.40	48.10	84.00
881R	8.4	FISH 4-5	N-S 6 m No Sample 9 m N-S 15 m	Coarse Crystal.	Surf.	43.40	0.98	0.85	0.84	5.90	48.20	83.80
882R	11.4	F70 (30%) F69 (50%) F41 (20%)	N-S 6 m N-S 12 m N-S 6 m	Med. Crystal.	Surf.	43.[illegible]	0.62	1.45	0.48	7.05	47.10	81.30
883R	7.0	F32	31 m along 155°	Coarse Crystal.	Surf.	36.10	11.10	1.45	0.08	4.05	48.20	69.70
884R	6.6	F28	N-S 18 m	Coarse Crystal.	Surf.	44.30	1.98	1.70	0.30	1.65	50.30	89.10
885R	5.5	F49	N-S 21 m	Coarse Crystal.	Surf	37.50	6.90	1.70	0.15	7.10	46.80	70.50
886R	3.2	F60	E-W 6 m N-S 3 m	Med. Crystal.	Surf	41.50	0.52	1.70	0.28	10.20	45.90	76.70
887R	18.2	F38	N-S 23 m E-W 17 m	Coarse Crystal.	Surf. Bulk	42.00	1.25	1.75	0.48	7.85	47.20	79.50
888R	18.6	F36-F37	N-S 12 m E-W 18 m	Coarse Crystal. (Poss. High Si)	Surf. Bulk	43.60	1.32	1.70	0.07	4.65	48.90	85.30
889R	13.0	F36	N-S 6 m E-W 3 m	Coarse Cry. (Poss. High Si)	Core	[illegible]	1.30	1.70	0.34	5.90	48.20	[illegible]

TABLE 4

FISH MAGNESITE DEPOSIT

PROPOSED PROGRAM

HOLE NO. (Priority Rated)	AREA	TOTAL DEPTH	ANGLE OF INCLINATION	AZIMUTH	COMMENTS
1	North of F37	100 m	70°	180°	- Tests the centre of the deposit.
2	South of F56	120 m	45°	0°	- Intersects 85 m of magnesite - Tests the south of the deposit.
3	F39	100 m	70°	220°	- Tests the centre of the deposit.
4	F70	100 m	60°	220°	- Intersects 50 m of magnesite. - Tests the east of the deposit.
5	F67	100 m	55°	200°	- Tests the west of the deposit.
6	F26	100 m	65°	190°	- Tests the west of the deposit.

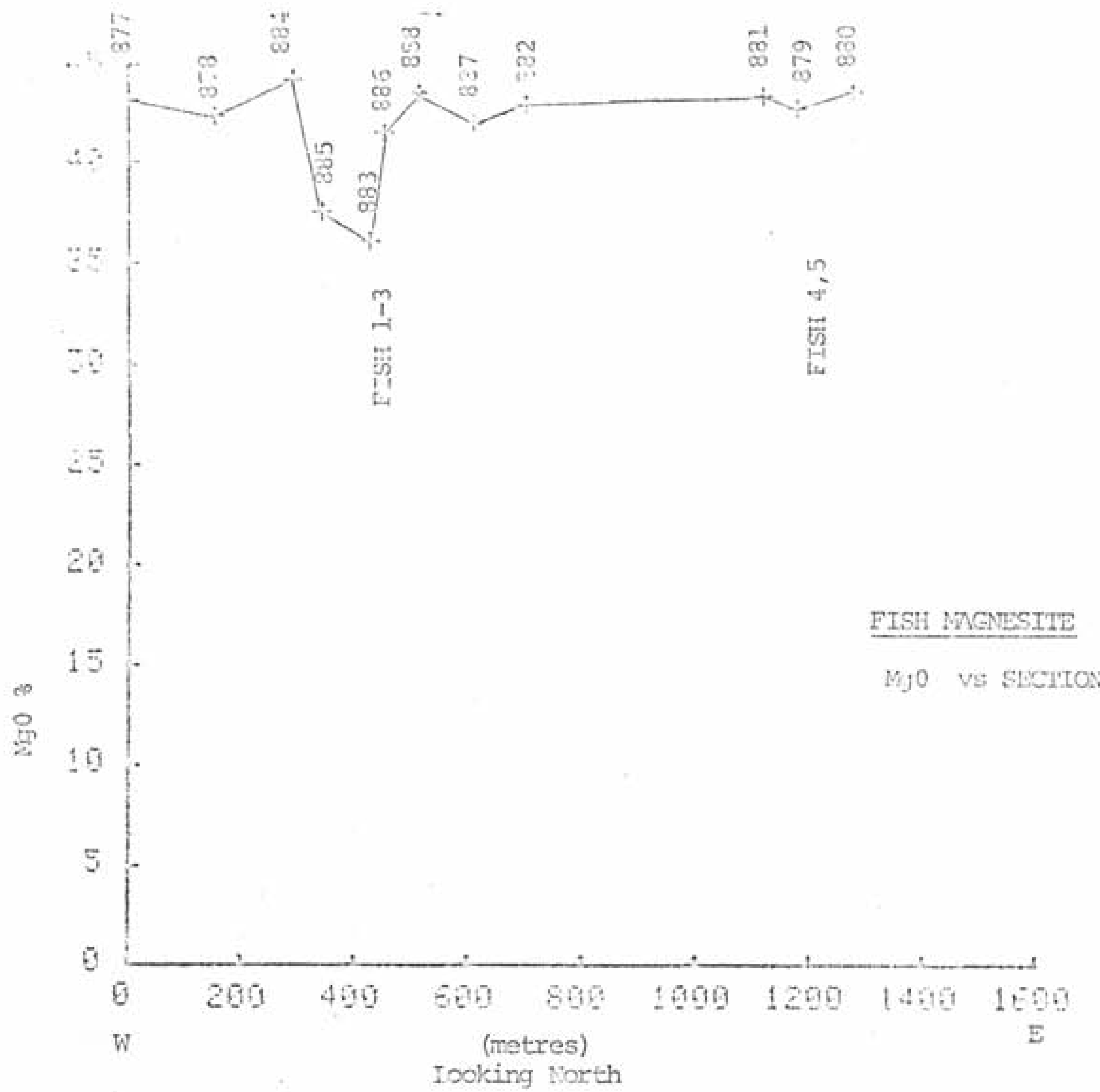

877
878
885
883
886
887
881
879
880
FISH 1-3
FISH 4,5
FISH MAGNESITE
MgO vs SECTION
MgO %
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
1600
W
E
(metres)
Looking North

FIG. 7a

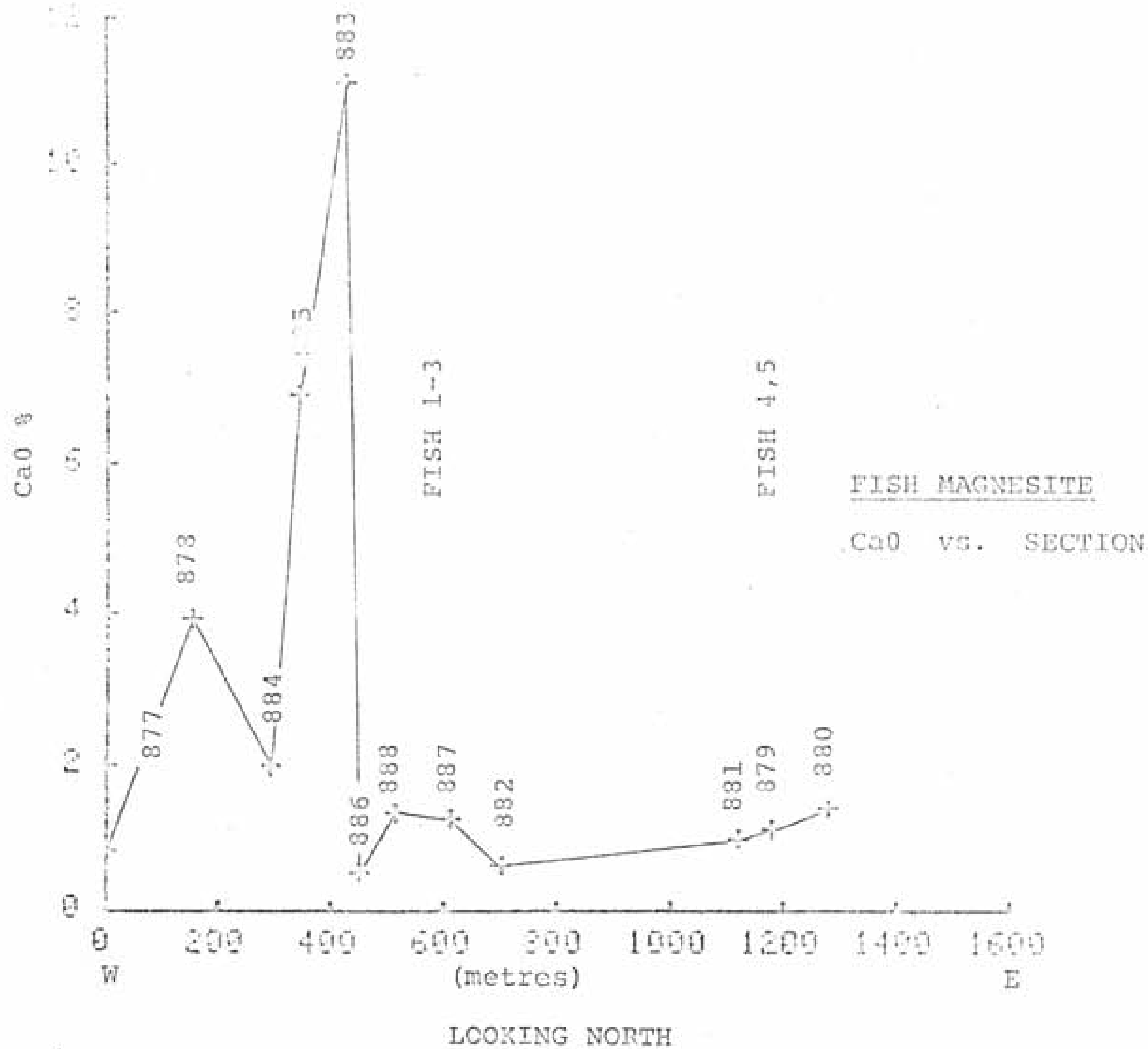
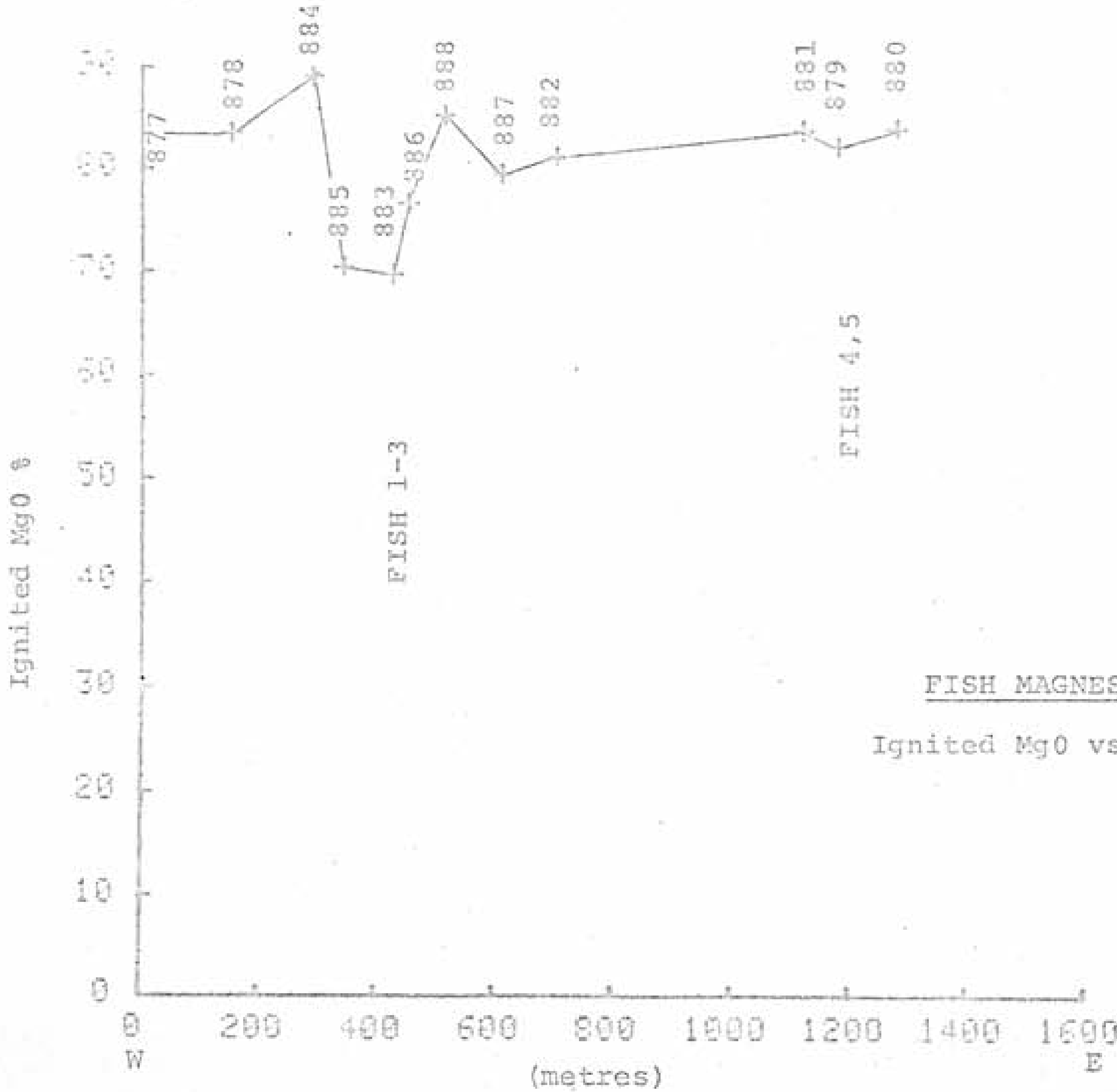

FISH MAGNESITE
CaO vs. SECTION
CaO %
0
2
4
877
878
884
883
886
888
887
882
881
879
880
FISH 1-3
FISH 4,5
0
200
400
600
1000
1200
1600
W
(metres)
E
LOOKING NORTH

FIG. 7b

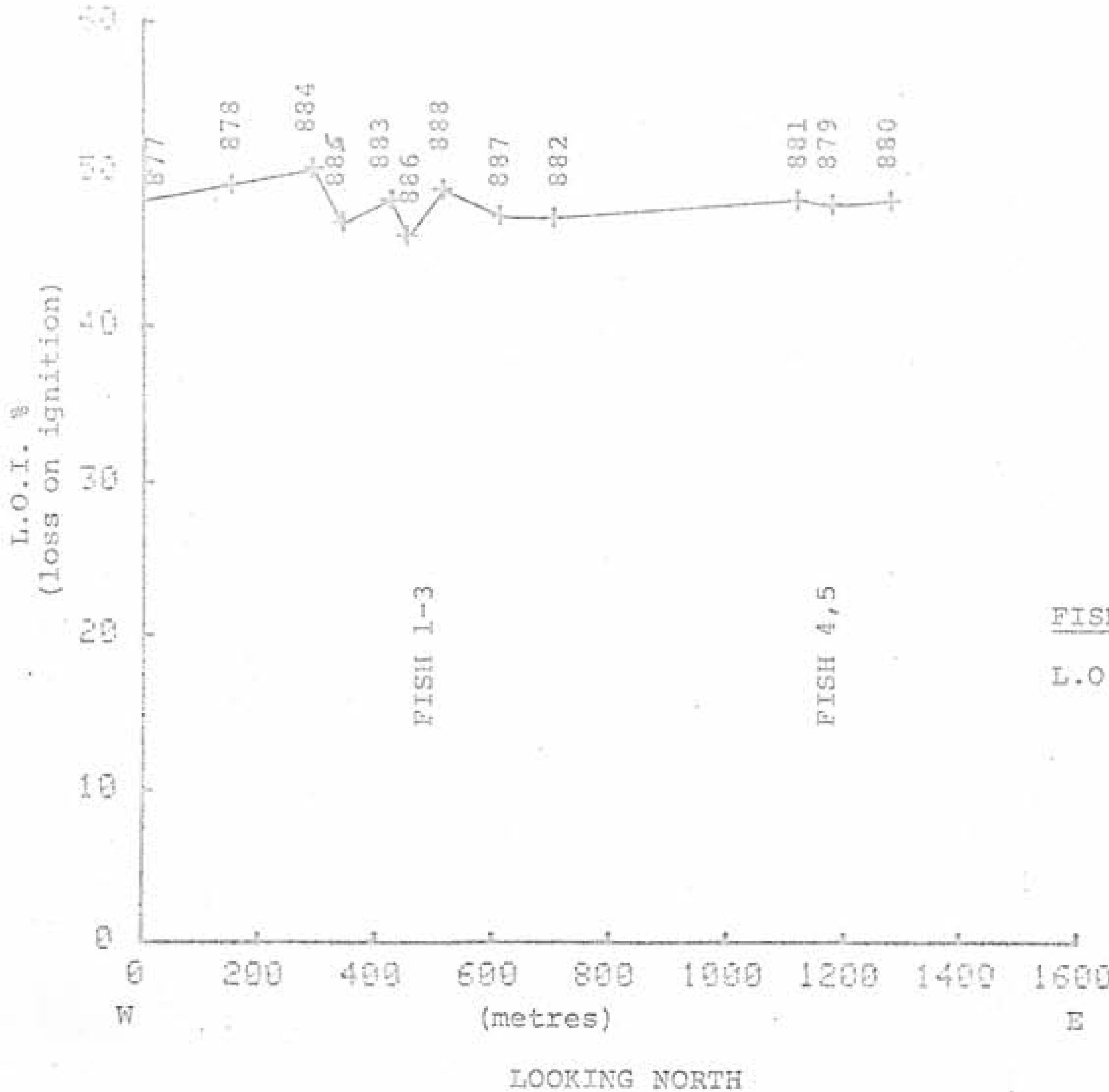


FISH MAGNESITE

Ignited MgO vs. SECTION

LOOKING NORTH

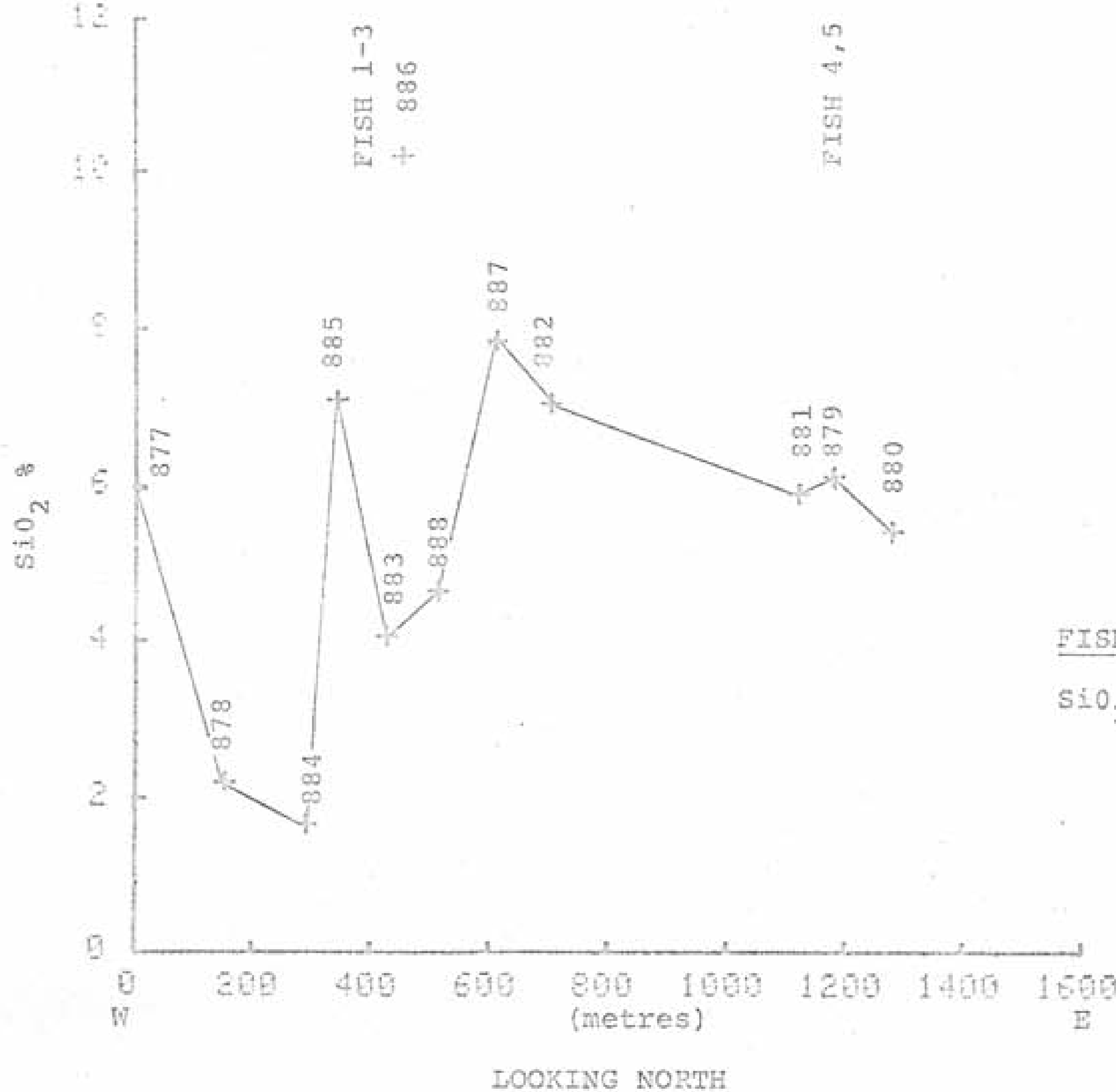
FIG. 7g



FISH MAGNESITE

L.O.I. vs. SECTION

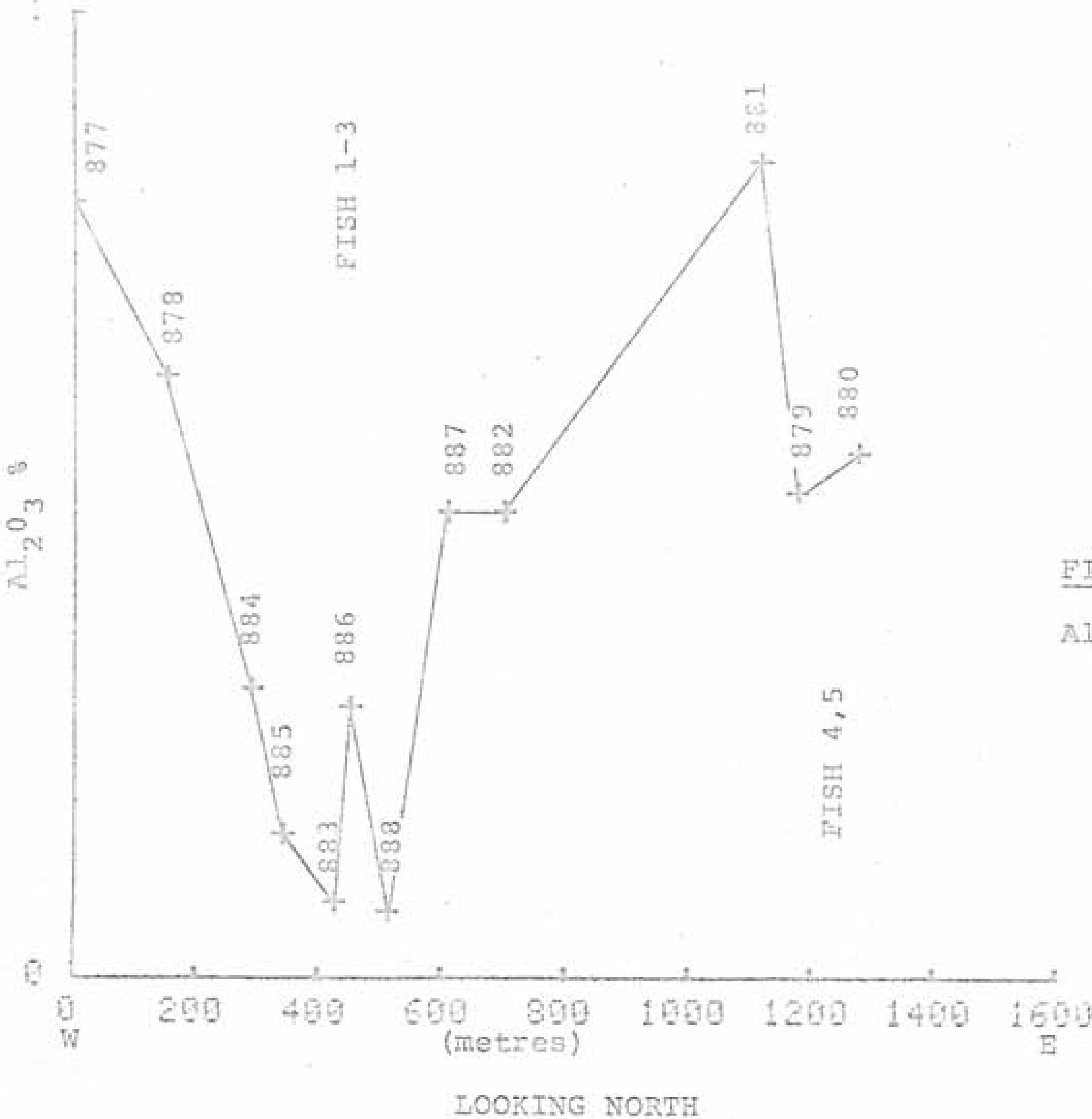
FIG. 7f



FISH MAGNESITE

SiO_2 vs. SECTION

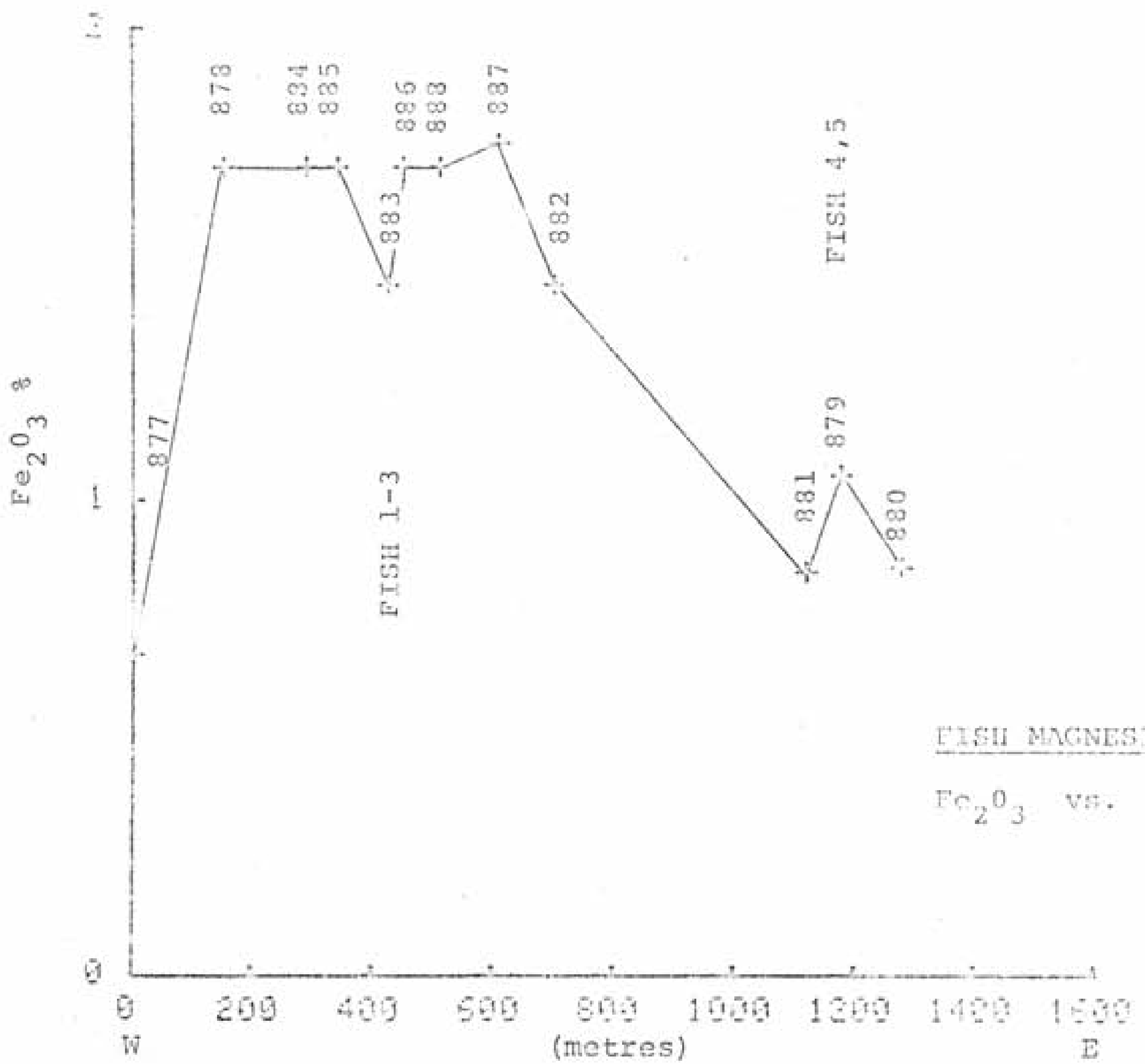
FIG. 7e



FISH MAGNESITE

Al_2O_3 vs. SECTION

FIG. 7d



LOOKING NORTH

FISH MAGNESITE

Fe_2O_3 vs. SECTION

FIG. 7c

APPENDIX 1

FISH - MAGNESITE OCCURRENCE

(Original Report)

FISH - MAGNESITE OCCURRENCE

Mineral Claims

82 K / 15 E

- Brisco, Spillimacheen Area

R.J. Morris
August, 1978

CONTENTS

SUMMARY AND RECOMMENDATIONS:

Quantity: - The FISH magnesite occurrence has the potential of containing a great volume of magnesite ore. A very rough estimate of volume, using a combined strike length of 2,600 feet, width of 100 feet and thickness of 100 feet, would be 1,100,000 cu. yds. or 2,970,000 tons. This volume could be expected from the ridge area along the major outcrops with minor pit development.

Quality:- An estimate of the grade is shown by the five samples collected along the strike (Fig. 3), and by the grab samples collected by Mr. Miller. As shown in Table 1, the maximum grade would be 55% MgO.

Comparison of occurrences: - McCammon (1965) reports nine analyses of magnesite from the Brisco area showing 45% MgO as the highest grade material (Appendix 1). These results compare favorably with the FISH results.

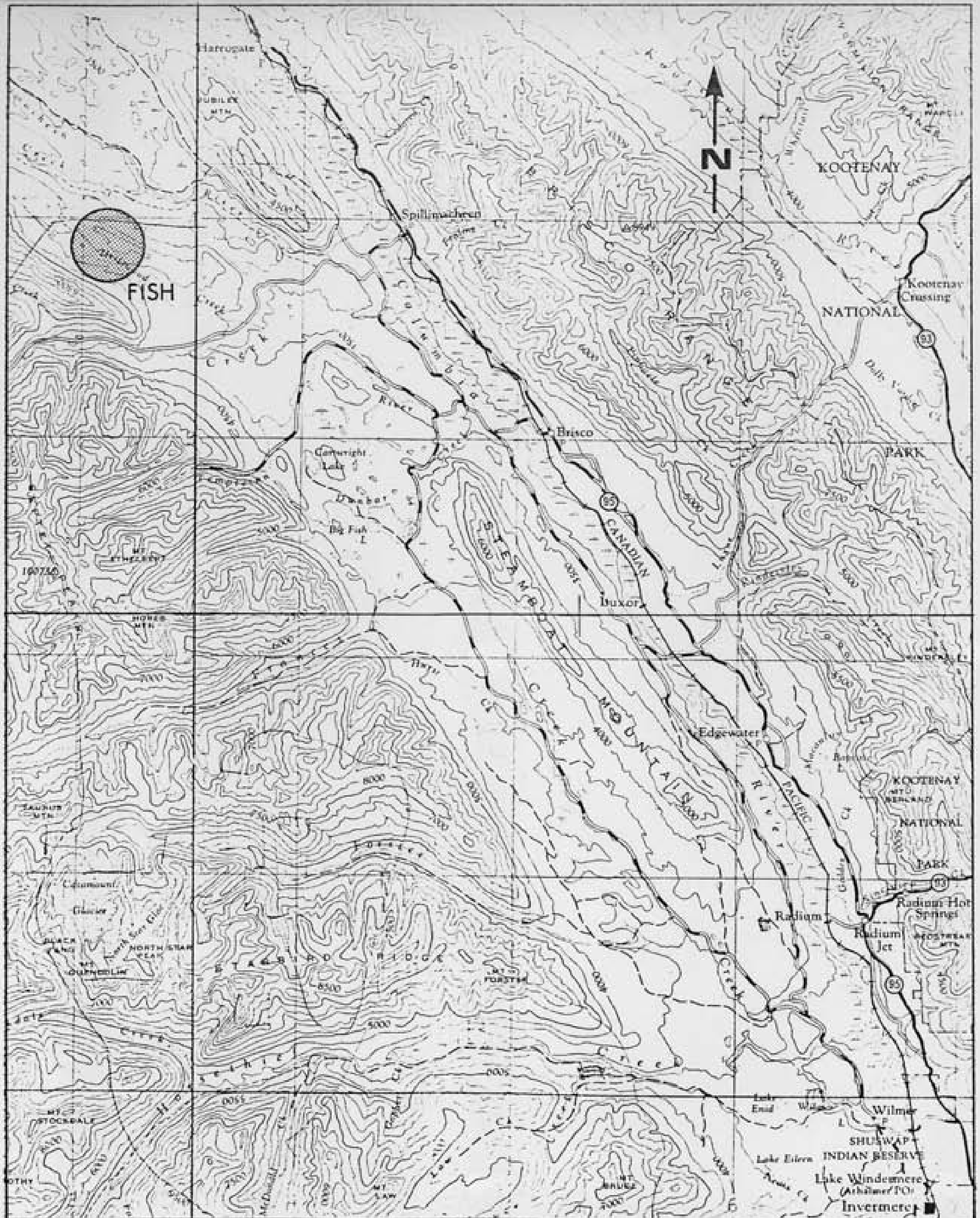
The BAYMAG occurrence has proven reserves of 19 million metric tonnes grading in excess of 90% MgO (Exploration in B.C., 1976).

Recommendations: - A comprehensive commodity review should be conducted to determine resource availability, markets and politics controlling world supply of magnesium.

The BAYMAG occurrence should be investigated to determine why it isn't in production, prior to further work on the FISH occurrence.

INTRODUCTION:

July 28th was spent examining the FISH claim group held by Allan Miller and Harald Bearham of Invermere, B.C..



KAISER RESOURCES

SPARWOOD
B. C.

FISH MAGNESITE 82K/15E
LOCATION MAP

FIG. 1

DESIGNED R. J. M.	DATE JULY, 1978
APPROVED	

48-10-1

The group was staked some 10 years ago and has been held in good standing since then.

LOCATION:

The five claims are located 8 miles west of Spillimacheen, on a ridge northeast of Driftwood Creek (Fig. 1).

ACCESS:

Access by road: west and north from Brisco about 20 miles or south and west from Parson some 20 miles. Both are logging roads and are in good condition.

GENERAL GEOLOGY:

The occurrence is within the Mount Nelson Formation of Helikian age (Pre-Cambrian) (see Fig. 2). The formation is characterized by thick cliff-forming successions of dolomite and dolomitic limestone.

Table of Formations—Proterozoic

ERA	PERIOD OR EPOCH	GROUP OR FORMATION	LITHOLOGY	THICKNESS (feet)
PROTEROZOIC	WINDERMERE (HADRYNIAN)	HORSETHIEF CREEK GROUP	Varicoloured slate, argillite, and phyllite; quartzite, grit, and quartz-pebble conglomerate; minor limestone	3,000 to 8,000
		TOBY FORMATION	Polymictic conglomerate with pebbles, cobbles, and boulders of varied composition; matrix of impure limestone, shale, and quartzite	0–1,500
	UNCONFORMITY			
	PURCELL (HELIKIAN)	MOYIE INTRUSIONS	Metadiorite and meta-quartz diorite sills	
		INTRUSIVE		
		MOUNT NELSON FORMATION	Buff and grey dolomite and dolomitic limestone, slate, argillite, quartzite	∽4,000
		DUTCH CREEK FORMATION	Varicoloured argillite and slate, quartzite, and some carbonate rocks	±4,000
		KITCHENER–SIYEH FORMATION	Very thinly bedded quartzite, black argillite, and some dolomite, sandy dolomite, and limy argillite	6,500
		CRESTON FORMATION	Green chloritic quartzite, grey quartzite with purple laminae, green and grey phyllite and argillite	8,000
		ALDRIDGE FORMATION	Upper division: Sericitic quartzite, argillite, thin-laminated argillite and quartzite	∽9,500
			Lower division: Fine-grained quartzite	unknown
		Base not exposed		

FIG. 2

NOTES ON THE OCCURRENCE:

The five claim units were staked in roughly an east-west direction and cover what appears to be the extent of the magnesite occurrence.

The magnesite occurs in three stratigraphic horizons with average attitude of 110 / 80 SW.

The thickest bed would be up to 250 feet though all three horizons seem to be irregular along strike.

Between claim posts 1 and 2 there are only scattered magnesite outcrops, from position 2 to 4 the best exposures of magnesite occur, from post 4 to 5 there is very limited outcrop and no magnesite was noted, at post 5 there is a good exposure of magnesite.

From an air photo of the area, there appears to be several faults which can be recognized on surface by their recessive nature, causing cross-cutting gullies.

McCammon, 1965, noted that near faults the dolomite becomes coarse-grained and is frequently altered to magnesite. Field evidence does not support this idea as between post 3 and 4 there is a continuous ridge of coarse-grained magnesite.

There are two well defined gullies separating the ridges which appear to be argillite bands up to 75 feet thick. The most northerly band weathers a prominant red colour and could be used as a good marker horizon for mapping.

At least one contact between the argillite and magnesite, near sample site 582, shows a noteable increase in chert banding as the argillite is approached. This gradation would probably indicate the change in sedimentary environment from shales to interbedded shale and dolomite - limestone to massive limestone - dolomite. These sediments were then altered, the shale to argillite and the limestone - dolomite to magnesite.

REFERENCES:

McCAMMON, J.W., 1965; The Brisco Magnesite Area; B.C. Minister of Mines Ann. Rep. 1964, pg. 194-199.

REESOR, J.E., 1973, Geology of the Lardeau Map-area, east half, B.C.: G.S.C. Memoir 369.

TABLE 1

Samples from Alan Miller	MgO %
A	47.4
B	42.5
C	48.8
D	50.6
E	52.4
F	48.8
G	43.5
H	14.8
I	48.2
Samples from R.J. Morris	
580	47.2
582	40.2
583	39.0
584	43.4
585	49.2

- Baymag results reported on a dead burn basis (Exploration in B.C., 1976, p. E205)

  dead burn = analysis for MgO after ignition, which drives off CO_2 and reduces sample size.

- Acme Analytical (KRL) results show Mg0 before ignition.
- Alternate Analysis

  A. An analysis for impurities such as Si, Ca should be conducted. (whole rock assay ∴ SiO_2, Ca0 only)
  An investigation of the quantity of impurities allowable in the product and penalty charges for exceeding these should be undertaken.

  B. If you cannot find out what impurities are detrimental to the product, a dead burn Mg0 analysis would be useful so that we can compare our results to Baymag's.

  C. A composite of samples 580-585 should be made for a semi-quantitative spectographic analysis.

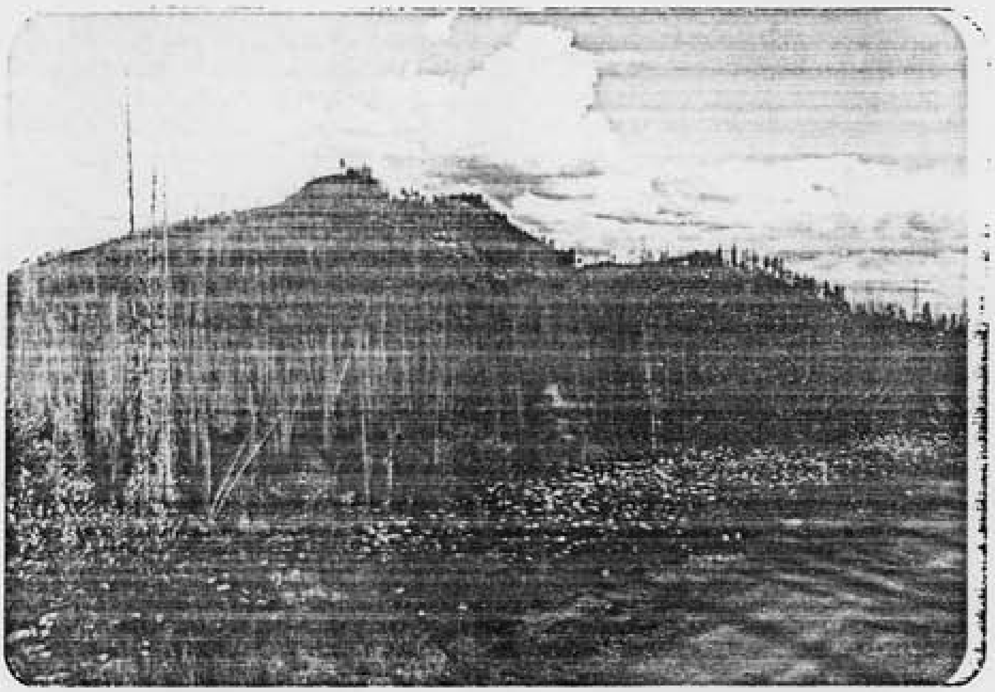


PHOTO 1

- view from logging road west of post no. 1.
- looking east, along strike of occurrence.

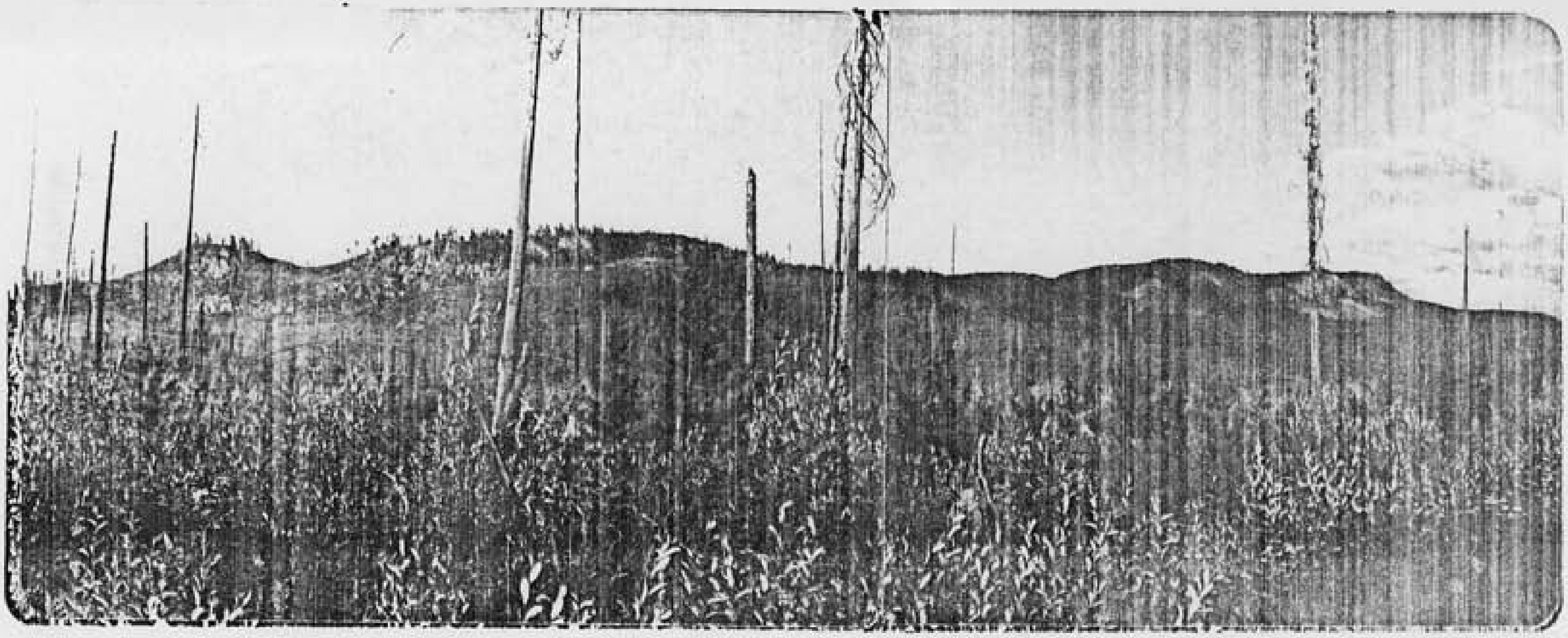


PHOTO 2

- Panoramic view, looking north from logging road south of Driftwood Creek.

- the cliffs average 100 ft. high, the combined strike length within the claim group is 2600 ft. with a combined width of 100 ft.

ACME ANALYTICAL LABORATORIES LTD
Assaying & Trace Analysis
6455 Laurel Street * Burnaby, B.C. V5B 3B4
Telephone: 299-5242

To
Kaiser Resources Ltd.,
P. O. Box 2000,
Sparwood, B. C. V0B 2G0

File No. 9564
Type of Samples Rocks
Disposition

ASSAY CERTIFICATE

No.	Sample	MgO %		LOI %	Ignited MgO %				No.
1	580 R	47.20		45.80	87.90				1
2	582	40.20		48.50	78.10				2
3	583	39.00		38.80	64.20				3
4	584	43.40		45.80	80.80				4
5	585 R	49.20		46.10	93.40				5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20

DATE SAMPLES RECEIVED Aug. 2, 1978
DATE REPORTS MAILED Aug. 16, 1978
ASSAYER Dean Toye

DEAN TOYE, B.Sc.
CHIEF CHEMIST
CERTIFIED B.C. ASSAYER

To Kaiser Resources Ltd.

ACME ANALYTICAL LABORATORIES LTD.
Assaying & Trace Analysis
6455 Laurel Street * Burnaby, B.C. V5B 3B4
Telephone: 299-5242

File No. Re-run 8564
Type of Samples
Disposition

ASSAY CERTIFICATE

No.	Sample	Fe_2O_3 %	SiO_2 %						No.
1	580R	.25	7.60						1
2	582	1.70	1.70						2
3	583	1.25	21.40						3
4	584	2.30	10.40						4
5	585R	1.15	2.10						5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20

DATE SAMPLES RECEIVED

DATE REPORTS MAILED Sept. 11, 1978

ASSAYER Dean Toye

DEAN TOYE, B.Sc.
CHIEF CHEMIST
CERTIFIED B.C. ASSAYER

RECEIVED
AUG 17 1978
DAVID PARKES

ACME ANALYTICAL LABORATORIES LTD.
Assaying & Trace Analysis
6455 Laurel Street • Burnaby, B.C. V5B 3B4
Telephone: 299-5242

Kaiser Resources Ltd.,
1177 W. Hastings St.,
Vancouver, B. C. V6E 2L1

File No. 8546
Type of Samples Rocks
Disposition

ASSAY CERTIFICATE

From Vancouver Office

No.	Sample	MgO %						No.
1	A	47.40						1
2	B	42.50						2
3	C	48.80						3
4	D	50.80						4
5	E	52.40						5
6	F	48.80						6
7	G	43.50						7
8	H	14.80						8
9	I	46.20						9
10								10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20								20

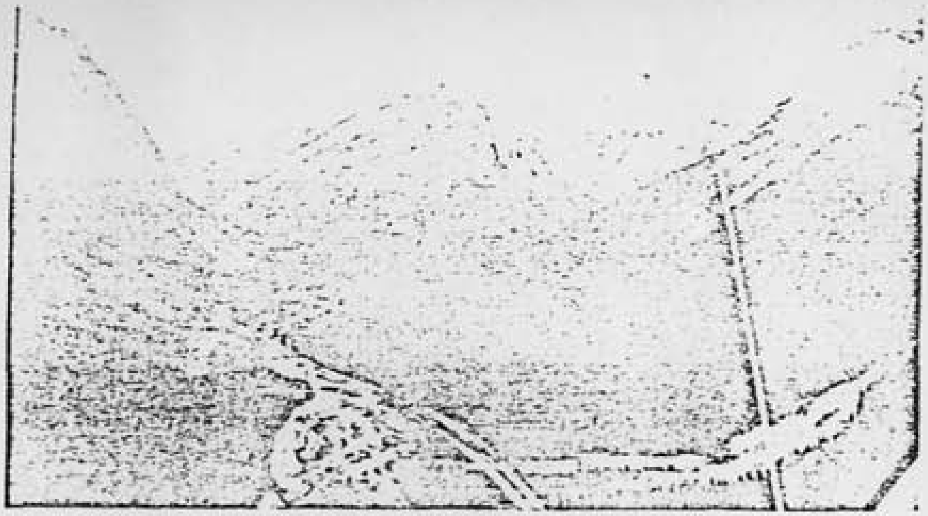
DATE SAMPLES RECEIVED Aug. 1, 1978
DATE REPORTS MAILED Aug. 16, 1978
ASSAYER [signature]

DEAN TOYE, B.Sc.
CHIEF CHEMIST
CERTIFIED B.C. ASSAYER

APPENDIX 2

BAYMAG MAGNESITE DEPOSIT

- Western Miner, November 1977
- B.C.D.M., Mineral deposit map, 1975
- B.C.D.M., G.E.M., 1970
- B.C.D.M., G.E.M., 1972
- B.C.D.M., G.E.M., 1973
- B.C.M.M., Exploration in B.C., 1975



Baymag magnesite project: looking northeast toward Eon Mountain; main magnesite outcrop is indicated

Magnesite has long-term potential in Canada

Among the projects of Mineral Resources International Limited is a 51% interest in Baymag Mines Co Ltd, which has a major magnesite property in British Columbia. (MRI holds more than 50% of Nanisivik Mines Ltd: WM Oct'77 p20). Refractory grades of dead-burn magnesite are used in the steel, cement, and other industries as a furnace or hearth lining.

The Baymag property is some twenty miles east of Radium Hot Springs, BC. It was explored by Canex Placer, under option, during 1972-4. The main deposit outcrops along a strike length of 6000 feet just above the valley floor along the lower flank of Eon Mountain.

Drilling outlined a wedge-shaped deposit open to the north, with a maximum thickness of 450ft. There is little overburden, and the deposit is suitable for open-pit mining. Indicated ore was reported (rounded-off in million-tons): low grade (90-95% MgO) 6.5; medium grade (95-97% MgO) 7.1; high grade (97%+) 7.7. Greater potential is expected.

The world market for dead-burn magnesite is several million tons a year, and in 1974-5 Baymag investigated, with others, the feasibility of a 200,000 ton/year dead-burn magnesite project, for which capital costs would have been of the order of \$75-million. Because of the slow-down in world industrial growth and in the steel industry, Baymag suspended negotiations for bringing the project into production.

A study in 1976 showed a growing demand for non-refractory caustic burn magnesite, and further studies indicated that it may be feasible to bring into production a 30,000 tonne/year caustic burn magnesite operation. This could be followed by a 60,000 tonne/year dead-burn magnesite plant, to be integrated into the project as warranted by markets. The company is pursuing this possibility with other principals.

A longer-term marketing possibility is the supply of material to a magnesium plant. Magnesite (pure) contains 28.84% (wt) magnesium, and there is a potential for greater use of lightweight magnesium alloys in the automotive industry. Volkswagen have used considerable amounts of magnesium in their cars for some years, and demands for better fuel consumption could lead the large US car makers to use more light alloys.

Baymag have suggested a possible plant, in the future, located in Alberta or British Columbia, where there are reliable supplies of coal or coke, electrical power, and chlorine from the petrochemical industry. These materials could be used to produce anhydrous magnesium chloride as feedstock for the electrolytic production of magnesium metal.

Recent work: During the summer of 1977, Baymag worked on a road and bridge for access on the property. A 220-ton sample has been taken for various tests and evaluations.

Baymag magnesite: bulk sample pit

Baymag magnesite: an outcrop

Area[illegible]ss 5[illegible]bilit[illegible]be p[illegible]efir[illegible]n nc[illegible]e b[illegible]es. [illegible]ner[illegible]ud[illegible]s w[illegible] ge[illegible]y u[illegible]alt[illegible]n s[illegible] cases capable) of being mineralized. Because they may have received little attention from exploration companies, the amount of information available on possible mineral occurrences is very limited. They are not considered, at present, worthy of more than reconnaissance mineral exploration.

Areas of alluvium, sand, gravel, or till of Recent or Pleistocene age mask bedrock geology and deposits, yet some mineral deposits may be discerned in underlying bedrock by geophysical or geochemical methods. Placer deposits are enclosed in alluvial material, and such material may provide sand and gravel for local construction needs.

Size is based on the total amount of metal in or removed from the ground portrayed as a dollar value using the following prices. These are not normally the prices received by producers or past producers, but they yield comparative values for geological extrapolation.

copper, 50 cents per pound	mercury, $6.58 per pound	silver, $2.00 per ounce
gold, $100.00 per ounce	molybdenum, $1.50 per pound MoS_2	tungsten, $2.15 per pound WO_3
lead and zinc, 15 cents per pound	nickel, $1.35 per pound	iron ore, $8.00 per ton with 60 per cent Fe

Cut-off grades generally applicable in 1972 are used when possible, yet some calculations for deposits in a preliminary exploration stage are based on 1972 sub-marginal grades. Future cut-off grades of large tonnage properties will likely decrease, a factor which should be considered in terms of future land use.

THE SIZE CATEGORIES ARE:

A – Large – equivalent value more than $500 million
B – Medium – equivalent value $25 million to $500 million
C – Small – equivalent value $0.5 million to $25 million

In most instances, insufficient information is available to make valid calculations and the size must be estimated from comparisons with similar types of occurrences in comparable geological terrains. This method is more commonly used in elevating partially investigated occurrences to the small-size category.

82J – KANANASKIS

MD–LU	NAME	ELEMENTS	TYPE	COMMENTS	REFERENCES
1	MAG	MgO	BEDDED	In Middle Cambrian, Cathedral dolomite. Reserves (1975): 15 to 20 million tons @ 93% MgO.	*B.C.D.M.&P.R.*, G.E.M., 1973, p. 551. Assessment Report 2048.
2	SWANSEA	Cu	VEINLETS	Stringers in brecciated dolomite of Upper Jubilee Formation.	*B.C.D.M.&P.R.*, Bull. 35, p. 65.
3	WESCO	Cu,Ag	VEINS	In dolomite of the Jubilee Formation.	*B.C.D.M.&P.R.*, G.E.M., 1972, p. 68.
4	WESTERN GYPSUM	gypsum	BEDDED	In limestone. Production, 1949–1973: 4,294,760 tons. Quarrying at 400,000 tons per year in 1972.	*B.C.D.M.&P.R.*, G.E.M., 1973, p. 546.

B.C.D.M. Mineral Deposit – Land Use Map 1975 (82J)

Geol., Expl. & Mining in B.C., 1970
B.C.D.M.

NECOSLIE RIVER LIMESTONE

LOCATION: Lat. 54°22′ Long. 124°06′ (93K/8E)
North side Necoslie River road, 8 miles southeast of Fort St. James.
CLAIMS: JOHN 1 to 6.
ACCESS: By road, 8 miles from Fort St. James.
OPERATOR: DOMTAR CHEMICALS LIMITED, Box 7212, Montreal, P.Q.
DESCRIPTION: High calcium limestone.
WORK DONE: Survey for limestone lease; five percussion drill holes totalling 406 feet on John 1 and 2 claims.
REFERENCE: *B.C. Dept. of Mines & Pet. Res.*, G.E.M., 1969, p. 392.

TERRACE CALCIUM PRODUCTS LTD. QUARRY

LOCATION: Lat. 54°30′ Long. 128°28′ (103I/9W)
On Copper Mountain, north of Thornhill Mountain, 4½ miles east of Terrace, at 2,900 to 3,100 feet elevation.
ACCESS: By road, 10 miles from Terrace via the British Columbia Telephone Company road to Thornhill Mountain microwave station.
OPERATOR: TERRACE CALCIUM PRODUCTS LTD., Box 207, Terrace.
WORK DONE: The quarry was not worked during 1970, but 94 tons of limestone products was shipped from stockpile. An Imperial Sawyer-Massey jaw-type rock crusher (8 by 40 inches) and a Geoffrey No. 2 Lime Pulverizer were set up. The plant is now a one-man operation and on a trial run it produced 3½ tons of pulverized limestone (fertilizer grade) per hour.
REFERENCE: *B.C. Dept. of Mines & Pet. Res.*, G.E.M., 1969, p. 392.

MAGNESITE

ROK

LOCATION: Lat. 50°47′ Long. 115°40′ (82J/13E)
At 4,300 feet elevation on west flank of Mount Brussilof, 20 miles northeast of Radium Junction.
CLAIMS: ROK 15, 17, 19 to 22.
ACCESS: By rough road from Kootenay River road, 20 miles.
OPERATOR: BRUSSILOF RESOURCES LTD., 109, 718 Eighth Avenue SW., Calgary, Alta.
DESCRIPTION: Magnesite occurs as a bedded deposit in Lower Cambrian carbonate rocks.
WORK DONE: Exploration to evaluate the deposit.
REFERENCE: *Geol. Surv., Canada,* Paper 66-1, 1966, pp. 65, 66.

MARL

CHEAM MARL PRODUCTS

LOCATION: Lat. 49°11.5′ Long. 121°45′ (92H/4W)
Cheam Lake near Popkum.
ACCESS: Road, 1 mile north off Highway 1 at Popkum.
OWNER: CHEAM MARL PRODUCTS LIMITED, 13 Fletcher Street South, Box 113, Chilliwack.
DESCRIPTION: The material mined consists of a post-glacial deposit of marl that forms the bed of former Cheam Lake, drained several years ago. Marl and topsoil are excavated by two small draglines. The marl is spread on an asphalt

Limestone

OWNER: KAMAD SILVER CO. LTD., 301, 141 Victoria Street, Kamloops.

WORK DONE: The property has been idle for the past two years. During 1972 Laredo Limestone Ltd., the former owner of the quarry, was acquired by Kamad Silver Co. Ltd. At year end, a feasibility study was being undertaken by Thyssen Mining Construction of Canada Ltd. to bring the quarry into operation in 1973.

REFERENCE: *B.C. Dept. of Mines & Pet. Res.*, G.E.M., 1969, pp. 389-392.

TERRACE CALCIUM PRODUCTS LTD. QUARRY (No. 28, Fig. F) By B. M. Dudas

LOCATION: Lat. 54° 30.7' Long. 128° 28.3' (103I/9W)
On Copper Mountain 4.5 miles east of Terrace at about 3,000 feet elevation.

ACCESS: By road 10 miles from Terrace by the British Columbia Telephone Company road to the Mount Thornhill microwave station.

OWNER: TERRACE CALCIUM PRODUCTS LTD., Box 207, Terrace.

WORK DONE: The quarry was worked intermittently by one man to produce 400 tons of limestone. A chip screen is to be added to the crushing circuit.

REFERENCE: *B.C. Dept. of Mines & Pet. Res.*, G.E.M., 1971, p. 468.

MAGNESITE

ROK (No. 130, Fig. A)

LOCATION: Lat. 50° 47' Long. 115° 39.5' (82J/13E)
GOLDEN M.D. At approximately 4,300 feet elevation about 20 miles northeast of Radium Junction, at the confluence of Assiniboine Creek and Mitchell River, chiefly on the west flank of Mount Brussilof.

CLAIMS: Three hundred and seventy-two.

ACCESS: By highway and bush road northeast from Radium, 30 miles.

OWNER: Baymag Mines Co. Limited.

OPERATOR: CANEX PLACER LIMITED, 800, 1030 West Georgia Street, Vancouver 5.

DESCRIPTION: Magnesite occurs as a lens in Lower Cambrian magnesium carbonate rocks.

WORK DONE: Claims and surface workings surveyed; surface geological mapping, 1 inch equals 1,000 feet covering portions of Rok, Joe, Mag, and Don claims; surface diamond drilling, 39 holes totalling 10,557 feet on Rock and Vano claims.

REFERENCES: *B.C. Dept. of Mines & Pet. Res.*, G.E.M., 1970, p. 503; Assessment Report 2048.

Geol., Expl. & Mining in B.C., 1973
B.C.D.M.

MAGNESITE

ROK (82J/NW-1) (Fig. J, No. 44)

LOCATION: Lat. 50° 47′ Long. 115° 39′ (82J/13E)
GOLDEN M.D. About 20 miles northeast of Radium Junction, at the confluence of Assiniboine Creek and Mitchell River and along the west flank of Mount Brussilof, between 4,300 and 4,500 feet elevation.

CLAIMS: ART 1 to 4, ART 5 Fraction, BARABAJACKAL 1 to 6, BILL 1 to 84, BMG 1 to 6 Fractions, DON 1 to 5, 8, 10 to 37, JAN 1 to 4, JOE 1 to 30, 32 to 94, MAG 1 to 27, 29, 31 to 36, NANCY 1 and 3, PAT 1 to 16, ROK 15 to 22, VANO 1 to 70, VANO 63 and 71 Fractions.

OWNERS: Baymag Mines Co. Limited and Canex Placer Limited.

OPERATOR: CANEX PLACER LIMITED, 700, 1030 West Georgia Street, Vancouver.

DESCRIPTION: Magnesite occurs as a bedded deposit in carbonate rocks of the Middle Cambrian Cathedral Formation.

WORK DONE: Road construction, approximately 14 miles (clean up of slash along Cross River access road).

REFERENCE: *B.C. Dept. of Mines & Pet. Res.,* GEM, 1972, p. 603.

MARL

CHEAM MARL PRODUCTS (Fig. J, No. 45) By J. W. Robinson

LOCATION: Lat. 49° 11.5′ Long. 121° 45′ (92H/4W)
Cheam Lake near Popkum.

OWNER: CHEAM MARL PRODUCTS LIMITED, 13 Fletcher Street South, Box 113, Chilliwack; P. C. Woodward, general manager.

WORK DONE: Marl produced, 18,450 tons; marl shipped, 24,123 tons; men employed, four.

REFERENCE: *B.C. Dept. of Mines & Pet. Res.,* GEM, 1972, p. 604.

PYROPHYLLITE

PYRO (92H/SE-131) (Fig. J, No. 46)

LOCATION: Lat. 49° 29.6′ Long. 120° 37.5′ (92H/7E)
SIMILKAMEEN M.D. Approximately 3 miles southeast of Coalmont, 2,000 feet east of the Coalmont-Princeton Highway, at approximately 3,500 feet elevation.

CLAIMS: ASA 1 to 5.

OWNER: DRESSER INDUSTRIES CANADA, LTD., Canadian Refractories Division, 1685 Boundary Road, Vancouver.

Exploration in B.C.

B.C.M.M. 1975

TERRACE CALCIUM PRODUCTS QUARRY (Fig. E-1, NTS 103, No. 17)

LOCATION: Lat. 54° 31′ Long. 128° 28′ (103I/9W)
On Copper Mountain, 9.6 kilometres east of Terrace, at approximately 900 metres elevation.

CLAIMS: FIR 1 to 10.

OWNER: TERRACE CALCIUM PRODUCTS LTD., 66, 4625 Graham Avenue, Terrace.

WORK DONE: Two hundred holes averaging 2.4 metres on Fir 10.

REFERENCES: *B.C. Dept. of Mines & Pet. Res.*, GEM, 1973, p. 550; MI 103I-165.

MAGNESITE

ROK (MAG) (Fig. E-1, NTS 82, No. 108)

LOCATION: Lat. 50° 47′ Long. 115° 39′ (82J/13E)
GOLDEN M.D. Thirty-five kilometres northeast of Radium Hot-springs, at the confluence of Assiniboine Creek and Mitchell River, at approximately 1 300 metres elevation.

CLAIMS: ART 1 to 5, BARABAJACKAL 1, 3 to 6, BILL 1 to 6, 9 to 12, 17 to 20, 25 to 30, 33 to 42, 51 to 61, 67 to 80, BMG 1 to 6, DON 1 to 5, 8, 10 to 21, JAN 1 to 4, JOE 1 to 28, 30, 32 to 54, MAG 1 to 27, 29, 35, 36, NANCY 1 and 3, ROK 15, 17, 19 to 22, VANO 1 to 6, 17 to 23, 33 to 42, 51 to 66, 71.

OWNER: Baymag Mines Co. Limited.

OPERATOR: ELCO MINING LTD., 239 Eighth Avenue SW., Calgary, Alta.

DESCRIPTION: Massive magnesite occurs in the Cathedral Formation of Middle Cambrian age.

WORK DONE: Eighty holes drilled totalling 160 metres; road construction, 16 kilometres (between Cross River and Assiniboine Creek-Mitchell River junction); trenching, 5 600 square metres (bulk sample sites).

REFERENCES: *B.C. Dept. of Mines & Pet. Res.*, GEM, 1973, p. 551; MI 82J/NW-1.

PHOSPHATE

PH (Fig. E-1, NTS 82, No. 109)

LOCATION: Lat. 49° 28′ Long. 114° 40′ (82G/7E)
FORT STEELE M.D. Seven kilometres south of Corbin, on Michel Creek, at approximately 1 710 metres elevation.

CLAIMS: PH 7 to 12, 14, 16, 17.

OWNER: MEDESTO EXPLORATION LTD., 215A – 10th Street NW., Calgary, Alta. T2N 1V5.

DESCRIPTION: Phosphate occurs in an oolitic bed approximately 0.9 to 1.2 metres thick lying at the base of the dark Fernie (Jurassic) marine shales. The

APPENDIX 3

BRISCO MAGNESITE AREA

- "The Brisco Magnesite Area" - J.W. McCammon

B.C. Minister of Mines Report, 1964

p. 194 - 199

McCammon, J. W. 1965

west limb is steep near the floor of the cirque, but flattens to a 40-degree east dip at the top of the cirque wall. Considerable shearing has taken place nearly parallel to the fold axis. Magnesite is exposed for 430 feet along a north 20 degrees east strike in the centre of the cirque floor and then is missing for 380 feet to the foot of the cirque wall, where it reappears and can be traced up the wall to the ridge-top a distance of about 700 feet horizontally and 400 feet vertically.

A small open cut has been excavated in the east limb of the magnesite at the base of the outcrop in the cirque wall. The west limb of the fold is not exposed here, but it must be very close. The cut is 10 feet wide across the strike of the rocks, 5 feet long, and has a 10-foot high face. The magnesite in the cut is badly sheared and fractured and contains abundant quartz in pods and veinlets. It is very coarse grained, pearly grey to buff in colour, and weathers brown. A sample of chips from across the 10-foot-wide face of the cut had the following percentage composition: $MgO=40.47$; $CaO=0.78$; Fe (total) $=2.07$; $SiO_2=5.97$; $Al_2O_3=3.98$; $CO_2=44.02$. A sample that Cairnes had analysed had the following percentage composition: $MgO=42.09$; $CaO=1.79$; $Fe_2O_3+Al_2O_3=5.11$; $SiO_2=5.92$; Insol. $=2.39$.

[References: Cairnes, C. E., *Geol. Surv., Canada,* Sum. Rept., 1932, Pt. A II, p. 103; Rice, H. M. A., *Geol. Surv., Canada,* Mem. 228, Nelson Map-area, East Half, British Columbia, 1941, pp. 29, 57.]

THE BRISCO MAGNESITE AREA (50° 116° N.E.)*

Introduction

Barite has been produced from the area west of Brisco since 1945. In June, 1959, mining interest in the region increased when J. A. Brown, of Calgary, recorded three claims on a magnesite discovery. In August, 1960, more claims were recorded on magnesite by John and Gordon Hart, of Brisco. Later several additional small deposits of the mineral were found. The A. P. Green Fire Brick Company Limited optioned the two original claim groups and did some diamond drilling and trenching on them in 1961 and 1962. There has been no commercial magnesite production yet.

Brisco is a small community beside the Columbia River in the Rocky Mountain Trench, 48 miles south of Golden. Provincial Highway No. 95 and the Canadian Pacific Railway branch line from Crowsnest Pass to Golden both pass through the village.

Reconnaissance geological reports accompanied by maps that cover this area sketchily were published by J. F. Walker in 1925 and C. S. Evans in 1932. A preliminary geological map by J. E. Reesor in 1957 also included the region. Brief reports on two of the magnesite deposits were published in the Annual Report of the Minister of Mines and Petroleum Resources for 1962. The barite has been mentioned in several Annual Reports since 1945, particularly in 1952 and 1958.

This account is based on work carried out during one-month periods in each of the 1963 and 1964 field seasons. An area 4 miles wide and 6 miles long was mapped geologically. It is bounded along the northeast by the Columbia River, on the north by Bugaboo Creek, and on the south by Dunbar Creek. Geology was plotted on a map-sheet scaled at 1,000 feet to the inch, specially prepared by the Topographic Division of the Surveys and Mapping Branch of the British Columbia Department of Lands, Forests, and Water Resources. Air photographs taken by the Provincial Government in 1960 were used in conjunction with the map.

* By J. W. McCammon.

[References: Evans, C. S., *Geol. Surv., Canada,* Sum. Rept., 1932, Pt. A II, pp. 106–176; Reesor, J. E., *Geol. Surv., Canada,* Map 12-1957, Lardeau, British Columbia, 1957; Walker, J. F., *Geol. Surv., Canada,* Sum. Rept., 1925, Pt. A, pp. 222–229; *Minister of Mines, B.C.,* Ann. Repts., 1945, p. 130; 1952, pp. 246–248; 1958, pp. 84–85; 1962, pp. 156–157.]

General Nature of the Area

The map-area is in the western part of the Rocky Mountain Trench in a hummocky, lake-pocked region between the ends of the intravalley ridges formed by Steamboat and Jubilee Mountains. The lowest part of the Trench at this latitude is 2,600 feet above sea level. It consists of a mile-wide flat through which the Columbia River meanders in several channels. On the west side, from the flat there is an abrupt rise to a hummocky bench with an average elevation of 3,200 feet. A steep northwest-trending fault scarp through the centre of the area separates this bench from a higher one to the southwest. The surface of the second bench is broken up by numerous hills and knolls. Its elevation ranges from 3,600 feet in the lower parts to over 4,500 feet on the peak of Red Mountain. Bedrock outcrops are absent in the bottom of the Trench, scarce on the first bench except in the valleys of Templeton River and Dunbar Creek, and fairly numerous but generally small on the higher parts of the upper bench.

Glaciation has left the area mantled with drift. Crag-and-tail drumlins and striations indicate the last movement of the glaciers was toward the southeast.

Some of the area is semi-open park-like country with well-spaced lodgepole pine or fir trees and little underbrush. Much of it has been burned over, however, and is now covered by a jungle of young pine or a tangle of old windfall.

A good network of gravel roads built and maintained by loggers and fishermen provides easy access to all parts of the map-area.

General Geology

The exposed rocks are all sedimentary. They consist of Proterozoic dolomite, quartzite, conglomerate, and argillite, folded into a large anticline which is thrust up against a syncline of Palæozoic dolomite, quartzite, and limestone. Many minor folds and numerous faults are associated with the major fold. The magnesite occurs in the Proterozoic dolomite. The main barite showings are in Palæozoic dolomite, although small veins of it also are found in Proterozoic rocks.

Proterozoic Rocks

The Proterozoic rocks include the top part of the Upper Purcell Mount Nelson Formation and the Windermere Toby Formation and Horsethief Creek Group.

Rocks thought to belong to the Mount Nelson Formation are shown on the accompanying map divided into five members. The oldest member, No. 1, consists of flesh to light-grey or cream-coloured, very fine-grained dolomite that typically has a sandy medium- to dark-brown weathered surface. The rock is thin bedded and breaks into sharp angled fragments. A distinctive feature of many, but not all, outcrops is the presence of circular " bull's-eyes " up to 10 inches in diameter that consist of concentric layerings 1 to 3 millimetres thick. These may be some form of stromatolite. Scattered quartz grains are present in all beds, and in a few places cherty zones have developed. One layer near the bottom is mainly chert and contains numerous 1- to 3-millimetre oval shapes that closely resemble certain foraminifera. Near faults this member becomes light cream in colour, coarse grained, and frequently altered to magnesite in irregular masses. No lower contact was seen, and all nearby rocks in the direction of the base belong to much younger formations.

Member No. 2 consists of very fine-grained dark reddish-brown argillaceous dolomite that weathers lighter reddish-brown. Normally it contains irregularly scattered ellipsoidal cream-coloured spots that range from one thirty-second of an inch to 2 inches in diameter. The ellipsoids tend to be slightly flattened parallel to the bedding and have their long axes parallel to the strike of the rocks. A strong foliation, probably a regional cleavage, is well developed in most outcrops. This causes the rock to break into thin platy pieces. The foliation is usually nearly parallel to the bedding but may have a different dip. Microscopically the rock is seen to consist of grains of dolomite, quartz, sericite, iron oxide, and unidentified fine-grained material. The only visible difference between the light spots and the dark groundmass is that iron oxide particles are scarce in the former and abundant in the latter. No explanation was found for the formation of these bleached " eggs." At one location in the south central part of the area, magnesite has developed in the rock. No contact between the dolomite and No. 1 member was seen. It is thought the contacts within the area are probably all faulted ones.

Member No. 3 consists of fine-grained, siliceous, pale-grey to buff, or mottled dolomite that weathers to a rough light-grey or buckskin coloured surface. Silica is conspicuous as criss-crossing veinlets and irregular gobs of white quartz. This member appears to lie conformably on top of member No. 2.

Member No. 4 consists of quartzite. Most of the rock is in thick pale-grey to white beds composed of fairly well-rounded clean quartz grains, one-quarter to one-half millimetre in diameter, with a few flakes of sericite cemented with quartz. Near the bottom of the member the beds are a few inches thick and quite brown, while near the top of the member they are argillaceous, thin and platy, and weather reddish. No good contact between members 3 and 4 was seen, but the beds appear to be conformable.

Member No. 5, the top of the Mount Nelson Formation in this area, is a 250-foot-thick band of very fine-grained, siliceous, dark blue-grey dolomite that weathers to a rough light-grey surface. The rock is thin bedded and finely laminated. The laminæ range from hairline to 1 millimetre thick and consist of layers of different shades of colour. Silica is present as lenses and discontinuous thin layers of dark chert parallel to the bedding, as angular quartz grains scattered through the dolomite, and as curved fine-grained chips and segments as large as an inch in diameter. The chips are restricted to a narrow zone at the top of the member. In this zone the laminæ, when present, are contorted and display minor faulting and slump structures. Where continuous laminæ are absent, the rock has the appearance of a breccia that originally had large spaces between fragments and the spaces became filled with concentric layers of dolomite in sheaf-like radial growths. Nothing similar was seen in any of the other dolomites. The bottom part of this dolomite is very similar to the rock of member No. 3, and in isolated outcrops the two cannot be distinguished with assurance. The most numerous and largest deposits of magnesite are in the No. 5 member. The contact between this member and the underlying quartzite is gradational over a few feet, within which are several interbeds of quartzite and dolomite.

Next oldest after the Mount Nelson Formation is the Toby Formation. This consists mainly of conglomerate with a little argillite. The matrix of the conglomerate is dark-grey sandy argillite in which a strong foliation has developed. The pebbles are most commonly quartzite, but a few are dark-grey dolomite and some are chert. They range in diameter from half an inch to 10 inches. Some are well rounded, but others are angular with rounded corners. The pebbles are not abundant, and in some exposures much searching is required to find any of them. The main contact between the Toby and Mount Nelson rocks is in a brushy east-west trending gully 20 feet deep and 50 feet wide across the top of Red Mountain. Mount Nelson dolomite forms the steep south wall of the gully. To the north is a covered zone 10 to 20 feet wide and then an exposure of 20 feet of thin-bedded sandy argillite that grades into typical conglomerate. As near as can be seen, the rocks on both sides of the gully have the same attitude, and neither dragfolding nor brecciation was found, but the gully indicates differential erosion along a weak zone, and it is thought that the contact is probably faulted here.

Overlying the Toby Formation with apparent conformity is the Horsethief Creek Group. Included in the group are quartzites, grits, and conglomerates consisting of closely packed ¼- to ½-inch quartz pebbles, shales, and a few thin limestone beds. These rocks are folded into several small anticlines and synclines nearly parallel to the main fold.

Palæozoic Rocks

At the southeast corner of the map-area, in the lower parts of Templeton River and Dunbar Creek, the eastern half of a syncline composed of Palæozoic rocks is exposed. The older rocks must be thrust up and to the northeast against these rocks along a fault, F3, about as indicated on the map.

The oldest Palæozoic rocks are mapped as part of the Cambrian-Ordovician McKay Group. They consist of 1- to 3-inch-thick beds of flesh to dark-grey limestone separated by films and paper-thin layers of black shale. The uppermost 250 feet of beds are dolomitic and contain thin lenses and occasional thin layers of dark chert. Micro- and macro-fossils are abundant in the limestone beds.

Above the McKay rocks is a 130- to 200-foot-thick bed of white quartzite. It is composed of well-rounded clean quartz grains three- to eight-tenths of a millimetre in diameter cemented by quartz. This corresponds lithologically and stratigraphically with quartzite mapped as Wonah Formation on the east side of the Trench. Although other mappers have stated that no Wonah Formation is found in this area, for the present report the quartzite is considered Wonah Formation.

Overlying the quartzite is light- to dark-grey dolomite that weathers to a light-grey powdery surface. This is considered to be part of the Ordovician-Silurian Beaverfoot-Brisco Formation.

Structure

The Proterozoic rocks have been folded into a large northwest-plunging anticline with its axial plane striking a little north of west and dipping steeply to the southwest. The anticline has been thrust northeastward to override part of its own northeast limb and also the west limb of the adjoining syncline of Palæozoic rocks. Several smaller folds lie southwest of the large fold and parallel to it.

Much faulting accompanied the deformation of the rocks. However, except in the canyons of Templeton River and Dunbar Creek, no fault surfaces are exposed. Where visible, the faults consist of sheared zones several feet wide that do not give much positive indication of the directions of movements. Most of the faults shown on the map and their relative movements are inferred from stratigraphic relationships. At least four of the faults, F1, F2, F3, and F4, must be thrusts and appear to be nearly vertical at the surface. Faults F2 and F3 probably also had right-hand lateral movement. Most of the rest of the faults are best interpreted as normal ones, although some such as F5 also show apparent right-hand lateral movement.

The rocks are badly sheared and disturbed in Dunbar canyon at the point where faults F1 and F3 should intersect. Outcrops are too small and scarce to show clearly what has happened there. It would appear that the Palæozoic block to the northeast has been pushed clockwise around this point, which acted as a hinge. Fault F2 or a similar one probably extends southeastward across the northeast front of Steamboat Mountain.

A regional cleavage that strikes northwest and is vertical or dips steeply to the southwest is well developed in the argillaceous members of the Horsethief Creek Group, in the matrix of the Toby conglomerate, and in parts of the No. 2 and No. 4 members of the Mount Nelson rocks.

Magnesite

Patches of magnesite occur scattered widely throughout the area underlain by Mount Nelson dolomites. The largest and most numerous deposits are at the top of the uppermost or No. 5 member. No good explanation for the origin of these occurrences was found. The magnesite is coarse grained or occasionally porphyritic. It shows definite replacement characteristics, boundaries being quite distinct but gradational over a narrow zone. Most deposits are adjacent to faults, but usually appear to be older than the faults. Probably the magnesite formed early in the tectonic history of the region by the replacement of dolomite as a result of some reaction associated with movement of the Toby conglomerate over the top of the Mount Nelson Formation during folding.

At outcrop M1 magnesite forms a 40- to 90-foot-thick zone 1,200 feet long at the top of the Mount Nelson No. 5 member. At each end magnesite grades on strike into cherty light-grey weathering dolomite. At the contact coarse-grained magnesite appears to replace dolomite. Underlying the magnesite is fine-grained dolomite with irregular ½- to 2-inch-thick layers of dark chert. No rock was seen in contact on top of the magnesite. The next stratigraphically higher outcrops consist of lower thin-bedded argillites of Toby Formation; these are separated from the magnesite by a 10- to 20-foot covered area in the bottom of a narrow ravine. Most of the magnesite is in 1-centimetre-long crystals that are pearl grey when fresh but buff when weathered. In some places, crystals 1 centimetre long are scattered through a groundmass of grains one-half millimetre long and the rock has a marked porphyritic appearance. Considerable silica is present in the form of scattered remnants of partly replaced quartz grains and cherty patches. A sample composed of chips collected at 3-foot intervals across 90 feet of exposed magnesite at the east end of the showing had the chemical composition shown as M1 in the accompanying table.

The magnesite at M2 forms an apparently thin dip-slope surface layer 200 feet long and 200 feet wide across the end of a low hillock. It overlies fine-grained dolomite of the top Mount Nelson member, in which are abundant curved siliceous chips. The magnesite shows features which indicate it has replaced dolomite. A sample consisting of chips collected at random from the surface of the exposure had the composition shown under M2 in the table.

Locality M3 is the site of the Whitehorse 1 to 6 mineral claims on the original magnesite discovery in this part of the area. The deposit consists of a central main mass and six smaller ones, two in a downfaulted block to the northeast, and four in a downfaulted block to the southwest. The main mass is exposed in a right-angled triangular shape 1,400 feet long on the hypotenuse and 600 feet wide at the widest spot. If forms the trough of a syncline that plunges northwestward. Diamond drilling has shown it to be 50 to 100 feet thick, and it is underlain by fine-grained cherty dolomite. The magnesite is light- to pearl-grey rock that weathers to a rough rusty-brown surface. Most is coarse grained with crystals ranging from 2 to 12 millimetres long. The chief visible impurities are quartz, in scattered veinlets and grains, and talc in minute shears. A sample consisting of chips picked up at random from the surface of the main exposure had the composition shown as M3A in the table. A grab sample from the centre outcrop in the gully southwest of the main showing had the analyisis shown as M3B in the table.

At M4 medium- to coarse-grained magensite is exposed as a dip-slope layer 10 to 20 feet thick, 600 feet long, and 100 feet wide on the western side of a low ridge. It overlies fine-grained dolomite typical of the top member of the Mount Nelson Formation. A chip sample cut across a 10-foot stratigraphic thickness of the outcrop had the analysis shown as M4 in the table.

The first recorded magnesite discovery in the area was made on the Jab 1 to 3 claims at site M5. Here the magnesite forms a bare isolated 50-foot-high knoll 400 feet long and 100 to 170 feet wide. Most of the knoll consists of medium- to coarse-grained structureless pale-grey to white rock. However, at the southeast corner thin layers of magnesite separated by slickensided films of talc and serpentine suggest bedding. This layering indicates the outcrop to be on the west limb of a small anticline with its axial plane oriented northwest. Patches of coarse white dolomite, films of talc, discontinuous stringers of quartz and chalcedony, and scattered crystals and small lenses of pyrite make up the megascopically visible impurities. No rock was found in contact with the magnesite. Dolomite outcrops 200 feet to the east and 100 feet to the west. A sample of chips collected at random over the top of the knoll had the composition shown as M5 in the table.

Three other small isolated patches of magnesite believed to be at the top of the No. 5 member are also shown on the accompanying map. All are too small to be of potential economic interest.

At M6 dolomite of the No. 2 member of the Mount Nelson Formation is altered to impure magnesite. This magnesite contains considerable calcite and quartz. It is fine grained and very white. The exposure is 100 feet wide and 400 feet long on strike. In the table, the analysis shown as M6 is for a hand specimen of rock from this showing.

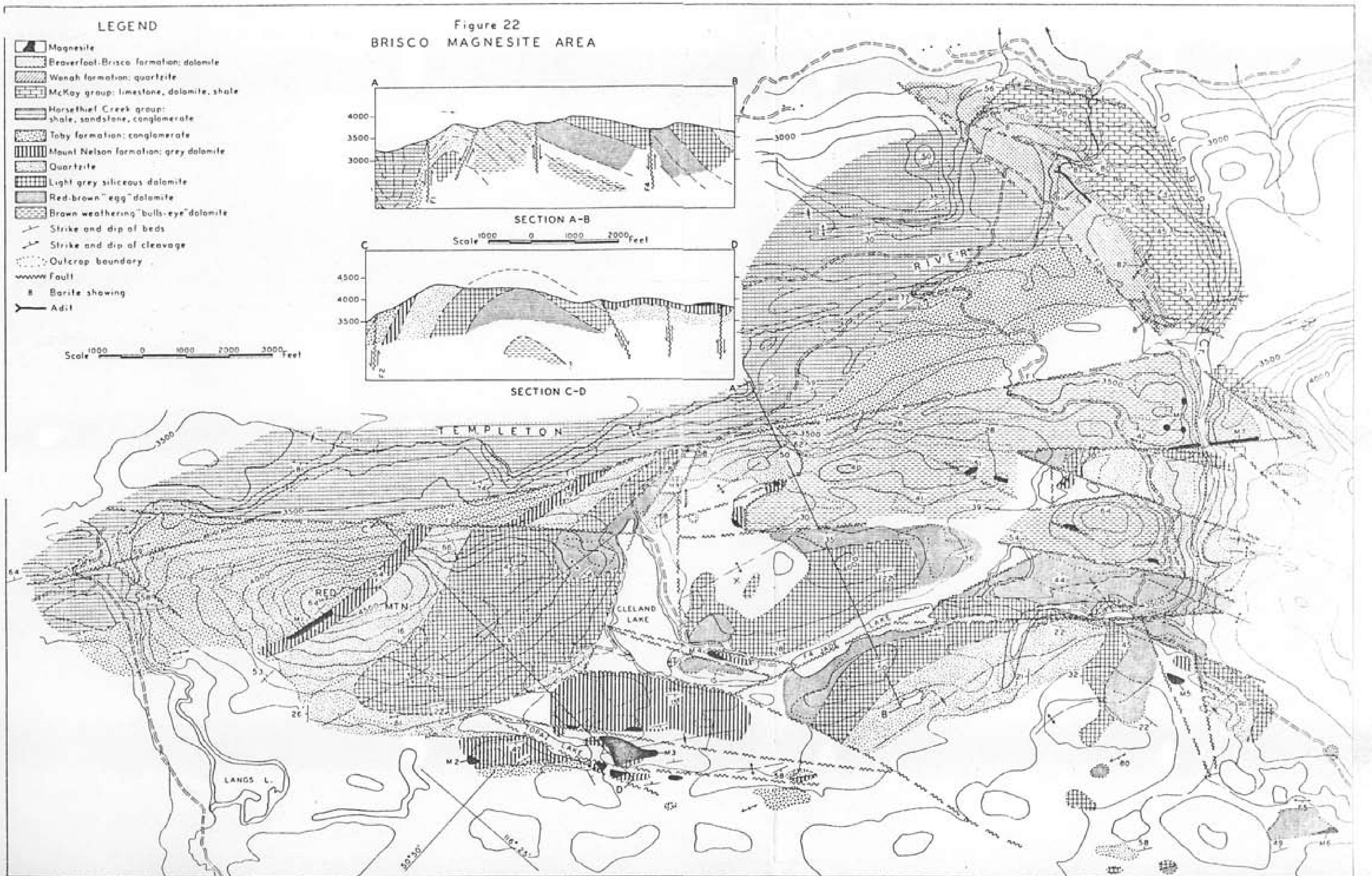
In the bottom member of the Mount Nelson Formation, alteration to magnesite was found in six places, all along or close to known faults. At M7 a near vertical, northwest-striking fault surface forms the cliff face in high dolomite bluffs. For distances of as much as 100 feet northeast of the fault the dolomite has been altered to coarse-grained magnesite. The northeast boundary of the magnesite is very irregular. At M8 the entire hill is at least partially altered, but irregular patches are completely changed to magnesite. Hand specimens from the two localities had the compositions shown in the table as samples M7 and M8. Two small showings of similar alteration are exposed on the west side of the hill three-quarters of a mile west of M7 and two more are on the hillside 1 mile northwest of M7.

A limited amount of exploration work was done on the magnesite deposits at M3 and M5 by the A. P. Green Fire Brick Company Limited in 1961 and 1962. At M3 about 28 diamond-drill holes between 50 and 200 feet long were drilled and several bulk samples were collected for testing. At M5 several holes were diamond drilled, some trenches were dug with a bulldozer, and bulk samples were collected.

Aanalyses of Magnesite Samples from Brisco Area

Sample	MgO	CaO	CO_2	SiO_2	Fe (Total)
M1	39.50	0.76	43.40	14.72	0.88
M2	42.79	1.04	46.72	6.48	0.87
M3A	43.34	0.51	47.60	5.54	1.02
M3B	44.85	0.73	49.20	3.47	0.95
M4	38.20	7.89	47.74	4.51	1.00
M5	44.02	0.47	43.82	8.99	0.99
M6	35.97	8.57	46.02	8.69	0.12
M7	41.41	2.84	47.48	3.97	2.07
M8	42.28	2.67	48.28	3.22	1.03

Figure 22
BRISCO MAGNESITE AREA



APPENDIX 4

REFERENCES

- Society of Mining Engineering Handbook, Vol. 2
- Elements of Mineralogy
- Mineral Claim Map
- Geological Map

1973 SME Mining Engineering Handbook, Vol. 2

preferably a low-lying tidal area with an impervious clay soil. The number of suitable sites is limited. The evaporation rate or, more properly, the net excess of water evaporated over rainfall must be sufficiently high. Rates of evaporation range from 150 in. per yr in arid tropical countries to a useful minimum of 20 in. A value of 40 to 50 in. per yr normally is considered to be the lower limit for commercial production.

Magnesium Metal—Seawater is the principal source of magnesium metal. About 61% of the world's production comes from the only two plants which process seawater. These are the Texas Div. of the Dow Chemical Co., Freeport, Texas, and the facilities of Norsk-Hydro-Elektrisk, Heroya, Norway.

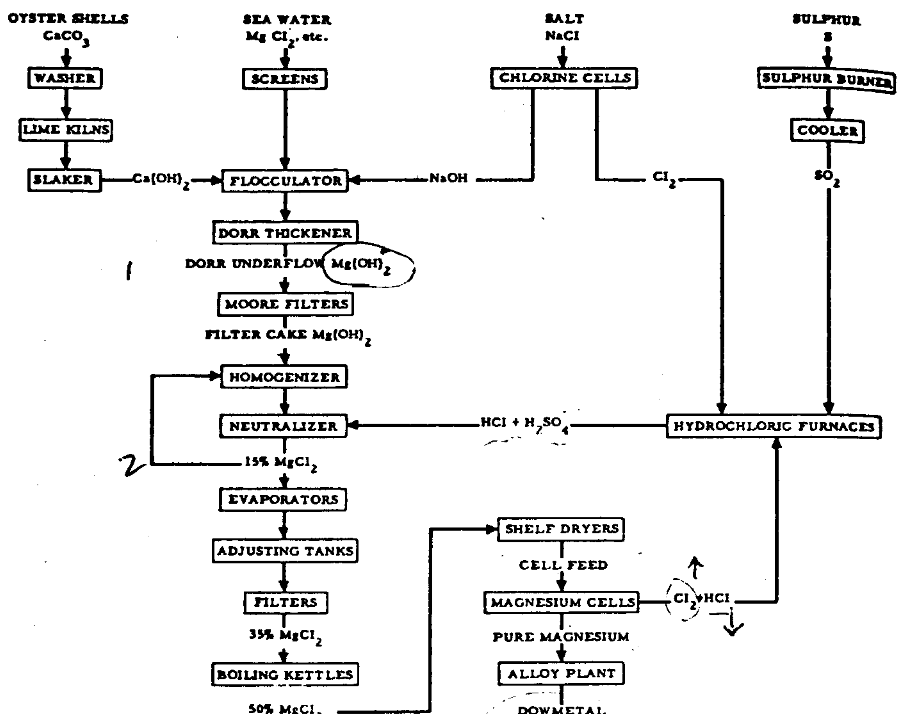


Fig. 20-37—Flow diagram of Dow Chemical Co. magnesium extraction plant (after C. M. Shigley, 1951; reproduced by permission of *Journal of Metals*).

The electrolytic magnesium production processes used in Texas and in Norway are considerably different, but both depend upon an initial precipitation of magnesium hydroxide from seawater (Fig. 20-37). Oyster shell is used in Texas and dolomitic limestone in Norway. The process used in Norway was developed before World War II in Germany. In this process, the precipitated hydroxide is calcined to magnesium oxide, which is chlorinated with returned chlorine from the electrolytic cell to produce an essentially anhydrous $MgCl_2$, which is electrolyzed in a refractory-lined cell to produce magnesium metal.

In the Texas plant, seawater is taken in from the bottom of the harbor to obtain dense, cool concentrated water, which is screened, chlorinated and pumped into one of several central plant flumes. It is pumped from the flume into a concrete flocculator and mixed with a slurry of lime produced by the slaking of calcined oyster shells. The resultant magnesium hydroxide precipitate is settled in large 500-ft-dia Dorr thickeners and separated from the spent seawater.

The settled hydroxide is filtered, washed and neutralized with hydrochloric acid to produce a concentrated solution of magnesium chloride. The magnesium-chloride solution is purified and dried in fluosolid dryers to produce a free-flowing granular solid of the approximate composition $MgCl_2 \cdot 1 \cdot 5H_2O$.

This granular cell feed is added to a fused-salt bath in large bathtub-shaped steel pots. High-amperage electric current is passed through the bath, using anodes of compacted graphite. During electrolysis, elemental magnesium and chlorine are generated. The magnesium is lighter and rises to the top of the bath, where it is collected and cast into ingots.

Magnesium Compounds—All seawater magnesium, whether destined for magnesium metal or for magnesium compounds, is precipitated from seawater by an alkali. Calcined dolomite, a widely available double carbonate of magnesium and calcium, often is used as the source of alkalinity. In this case, roughly half of the magnesium in the hydroxide product originates from the dolomite and half from the seawater. Lime, produced by calcining shell or limestone, and caustic soda also are used as commercial precipitants. Oyster shell is the principal source of lime for magnesia production on the Texas, Louisiana and Alabama coasts.

In a typical seawater magnesia plant (Fig. 20-38), the incoming water is screened and treated to prevent calcium contamination of the magnesium-hydroxide product.

TABLE 20-51—U.S. Government Classification of Waters Having Varying Salt Content (USDI[227])

Fresh	Water containing less than 1,000 dissolved parts of salt per million parts of water (ppm)*
Brackish	Water ranging from 1,000 ppm up to the dissolved salt content of seawater Mildly brackish, 1,000 to 5,000 ppm Moderately brackish, 5,000 to 15,000 ppm Heavily brackish, 15,000 to 35,000 ppm
Seawater	Water containing approximately 35,000 ppm
Brine	Water containing more dissolved salt than seawater, such as the Great Salt Lake or the Dead Sea

* Parts per million.
Office of Saline Water, The Department of the Interior.

The calcined limestone or dolomite is added in a water slurry to the seawater in a reactor. Magnesium hydroxide is precipitated and the resultant slurry settled in a series of thickeners. The spent seawater is discharged and the concentrated magnesium hydroxide washed with a countercurrent stream of water and filtered.

Three types of magnesia normally are produced: a dense periclase for refractory use; a chemically active finely divided magnesium for chemical and physical uses; and a dense very high-purity chemically inactive magnesia grain.

Water—In arid regions, water is a necessary and valuable resource. Desalting plants now in use range in capacity from a few thousand to 7.5 million gpd (USDI[227]). These plants produce a combined total of more than 125 million gal of fresh water daily. The cost of water ranges upward from 85¢ per thousand gallons, except where fuel is available at very low cost.

Several factors influence the cost of water produced by desalting plants, including the size of the plant, the cost of energy and the concentration of salt in the saline water (Table 20-51). A study for a very large combination plant designed to produce both electricity and desalted water indicates that such a dual-purpose plant with a capacity of 150 million gpd and a power capacity of 1,800 mu of electricity could produce fresh water at a cost in the range of 22 to 27¢ per thousand gal at the plant site. Costs this low are not now attainable in small plants.

There are four basic processes for desalination (Table 20-52). The effectiveness of the various processes varies widely insofar as cost and rate of conversion are

"Elements of Mineralogy" Mason & Berry, 1959 (W. H. Freeman & Co.)

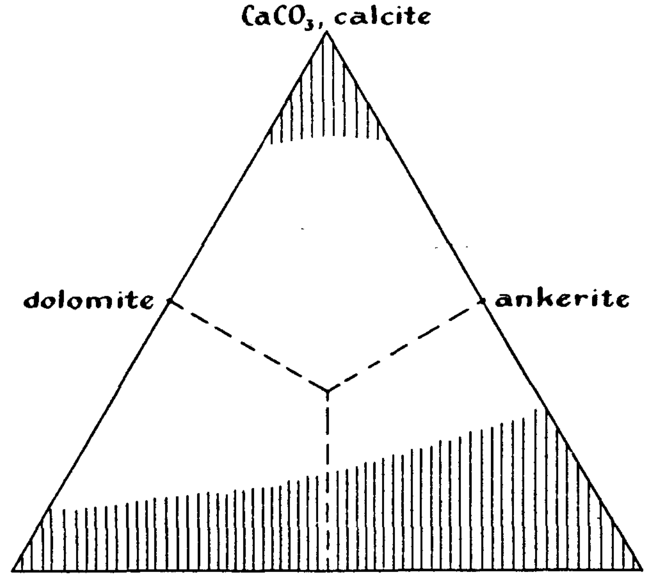


Figure 12-8 Triangular diagram showing the compositional variations of calcite, magnesite, and siderite. Shaded areas indicate the limits of solid solution observed in nature.

calcite or limestone has been burned to quicklime (CaO), slaked to hydrated lime $Ca(OH)_2$, and mixed with sand to make mortar. It also finds wide use in chemical industries and as a fertilizer. Portland cement, now widely used in concrete for building purposes, is made by burning a finely ground mixture of 75 percent $CaCO_3$ and 25 percent clayey material. Limestone is the raw material for some rock-wool insulating material. Limestone and lime find varied uses in the metallurgical processes for smelting both iron and nonferrous metals, where they are usually used as a flux to help remove impurities in the slag. Finally, limestone of many types is widely used in building, both as dimension stone for actual construction or as a facing or veneer on concrete walls, as interior ornamental finish stone, or for carvings and statuary. Crushed limestone is also widely used as the coarse aggregate in concrete and as railroad ballast, and is mixed with asphalt for road surfacing.

Magnesite, $MgCO_3$

Common forms and angles:

$(10\bar{1}1) \wedge (\bar{1}101) = 72° 33'$ $(0001) \wedge (10\bar{1}1) = 43° 06'$

Habit: Crystals rare, rhombohedral $\{10\bar{1}1\}$ or prismatic along c; commonly massive, coarse- to fine-grained, or very compact, earthy to chalky, lamellar, or coarsely fibrous.

Chemistry: In $MgCO_3$, Fe^2 may substitute for Mg, and a complete series extends to siderite. Mn and Ca substitute for Mg to a small extent (Fig. 12-8).

Density: 3.00 (pure), increasing with substitution of Fe for Mg.

Color: Colorless, white, grayish white, yellowish to brown.

Streak: White.

Luster and opacity: Vitreous; transparent to translucent.

Diagnostic features: Infusible; scarcely affected by cold hydrochloric acid, but dissolves with effervescence in hot hydrochloric acid. The addition of excess ammonia and sodium phosphate to the solution will give a white precipitate of ammonium magnesium phosphate.

Occurrence: The compact massive forms of magnesite may contain SiO_2 or magnesium silicates as impurities, and they resemble chert in appearance but are inferior in hardness. Magnesite is much less common than calcite and only rarely occurs as a sedimentary rock. It may be formed in a variety of ways: through alteration of rocks consisting largely of magnesium silicates (serpentine, olivine, pyroxene) by carbonated waters, usually producing cryptocrystalline material; as crystalline stratiform beds of metamorphic origin with talc-chlorite- or mica-schists; through replacement of calcite rocks by magnesium-bearing solutions (dolomite is found as an intermediate product).

The replacement deposits are usually distinctly crystalline and are found associated with, or in, dolomite. Extensive deposits of this type are mined in Washington, and in Austria, Manchuria, Czechoslovakia, and Quebec. Veins, and masses resulting from alteration of magnesian silicates, are mined extensively in California, and in Greece, India, the USSR, and Yugoslavia. Magnesite is calcined for the manufacture of refractory bricks, cements, and flooring, and it is used for making magnesium metal.

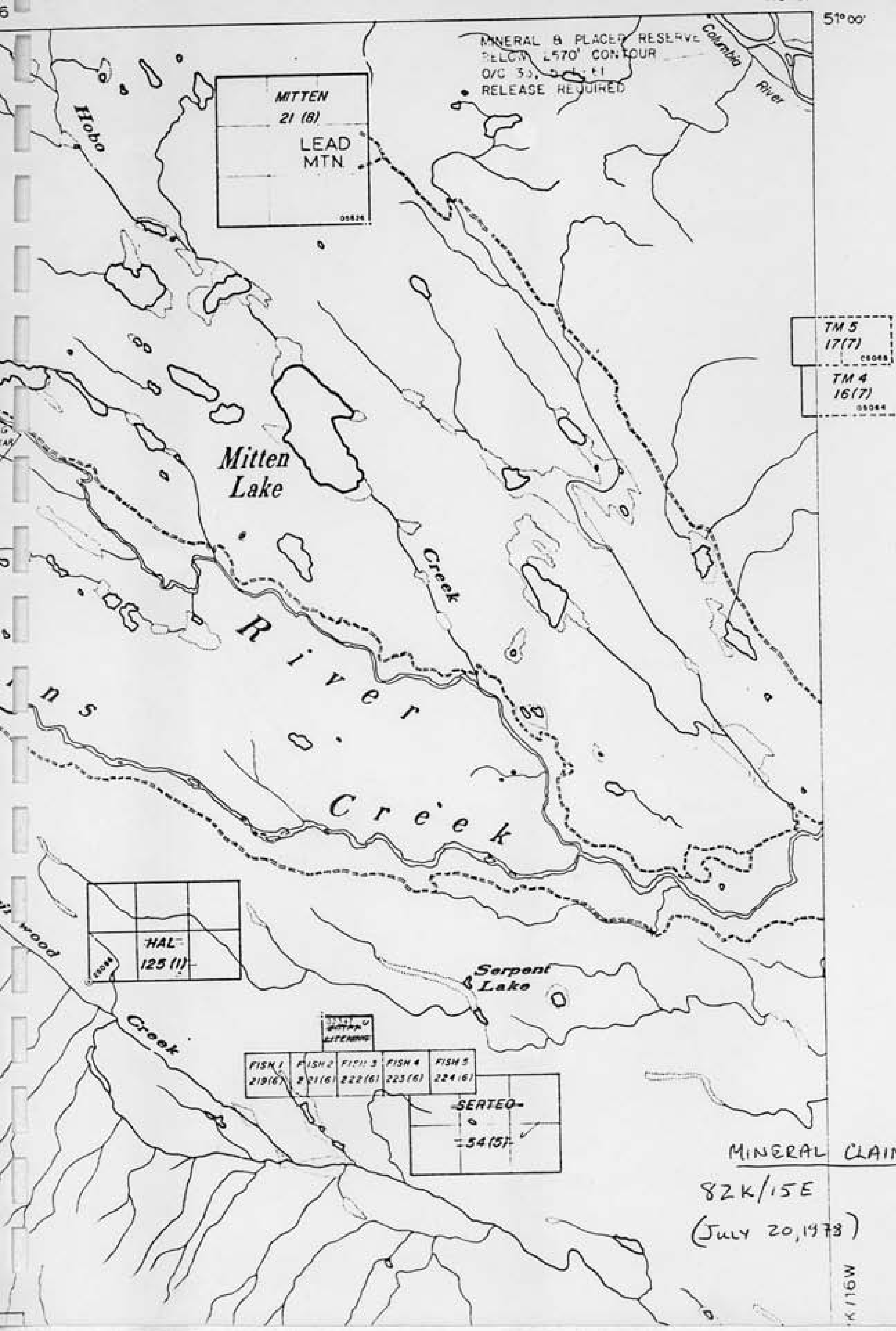
Siderite, $FeCO_3$

Common forms and angles:

$(10\bar{1}1) \wedge (\bar{1}101) = 73° 00'$ $(0001) \wedge (05\bar{5}1) = 78° 03'$

Habit: Crystals commonly rhombohedral $\{10\bar{1}1\}$, less often $\{01\bar{1}2\}$, $\{02\bar{2}1\}$, $\{40\bar{4}1\}$; also thin to thick tabular on $\{0001\}$; crystal faces often curved or composite; massive, coarse- to fine-grained, botryoidal or globular, oolitic, earthy, or stony.

Chemistry: Mg may substitute for Fe^2 to form a complete series to magnesite (Fig. 12-8), and Mn^2 may also substitute for Fe^2. Ca may substitute for Fe^2



MINERAL CLAIM MAP
82K/15E
(JULY 20, 1978)

...atic cross-sections along A-B, C-D, E-F, G-H, I-J, K-L, M-N, O-P, Q-R

G.S.C. Mem. 369

"Geol. of the Lardeau Map-Area" J.E. Reesor, 1973

APPENDIX 5

PHOTOGRAPHS

- moving water barrels to drilling site, <u>Station 36</u>.
  Looking west across Driftwood Cr.

- drilling in progress, <u>Station F36</u>.

- looking west from Station F13. Shows low relief of outcrops F8 and F1 (left and centre); cliff face of F5, F6 outcrop. To the north of F6 is the prominent red weathering argillite.

- contact south of Station F1, red argillite on the left, magnesite to the right. Rule shows from 25 cm to 75 cm.

- from Station F4, looking northeast, far left contact is F5. The magnesite bed is about 6 m thick here.

- drill core; the core boxes are 2.5 ft. long. Shows coarse crystalline material, rust along fractures; the slight colour variation is from different crystal faces.

- looking to the northeast from below Station F11. Shows the prominent cliff of F22 to F28.

- magnesite at <u>Station F8</u>. Shows surface oxidation up to 5 mm, crystal size 1 mm, massive, mottled texture. Representative material of <u>Sample 877R</u>.

- looking east from <u>Station F21</u>. Two resistant white beds in the centre are silicious siltstone of the north contact from <u>Station F23-F25</u>.

- taken at Station F22. Shows very coarse crystalline magnesite, up to 3 cm. The white surface is a fresh surface while the brown is weathered.

- taken at Station F36. Shows large $MgCO_3$ crystals, brown-pink weathering, granular surface texture. The white is quartz with a rosette form.

- taken at Station F36. Shows the north contact of the white quartz vein with the massive magnesite.

- view from F35 looking to the northeast. Shows, far left the white quartz vein, photo 16, the typical rugged landscape, minor tree cover, fault scarp forming the south contact from F41-F43. Samples 888R and 889R were taken from the far left outcrop; 887R was taken from the centre knob. In the distance to the right is the FISH 4,5 deposit, a very small slash in the middle of the far hill.

APPENDIX 6

ASSAY CERTIFICATE

To Exploration,
Kaiser Resources Ltd.,
P. O. Box 2000,
Sparwood, B. C. V0B 2G0

ACME ANALYTICAL LABORATORIES LTD.
Assaying & Trace Analysis
6455 Laurel Street • Burnaby, B.C. V5B 3B4
Telephone: 299-5242

ASSAY CERTIFICATE

File No. 8948
Type of Samples MgO Rocks & Cores
Disposition

No.	Sample	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	LOI %	Ignited MgO %	No.
1	877 R	43.20	.82	.68	.80	5.95	48.20	83.40	1
2	878	42.40	3.92	1.70	.62	2.20	49.20	83.50	2
3	879	42.80	1.12	1.05	.50	6.10	47.90	82.20	3
4	880	43.60	1.40	.86	.54	5.40	48.10	84.00	4
5	881	43.40	.98	.85	.84	5.90	48.20	83.80	5
6	882	43.00	.62	1.45	.48	7.05	47.10	81.30	6
7	883	36.10	11.10	1.45	.08	4.05	48.20	69.70	7
8	884	44.30	1.98	1.70	.30	1.65	50.30	89.10	8
9	885	37.50	6.90	1.70	.15	7.10	46.80	70.50	9
10	886	41.50	.52	1.70	.28	10.20	45.90	76.70	10
11	887	42.00	1.25	1.75	.48	7.85	47.20	79.50	11
12	888	43.60	1.32	1.70	.07	4.65	48.90	85.30	12
13	889 R	43.00	1.30	1.70	.34	5.90	48.20	83.00	13
14									14
15									15
16									16
17									17
18									18
19									19
20									20

DATE SAMPLES RECEIVED Nov. 2, 1978
DATE REPORTS MAILED Nov. 7, 1978
ASSAYER Dean Toye

DEAN TOYE, B.Sc.
CHIEF CHEMIST
CERTIFIED B.C. ASSAYER

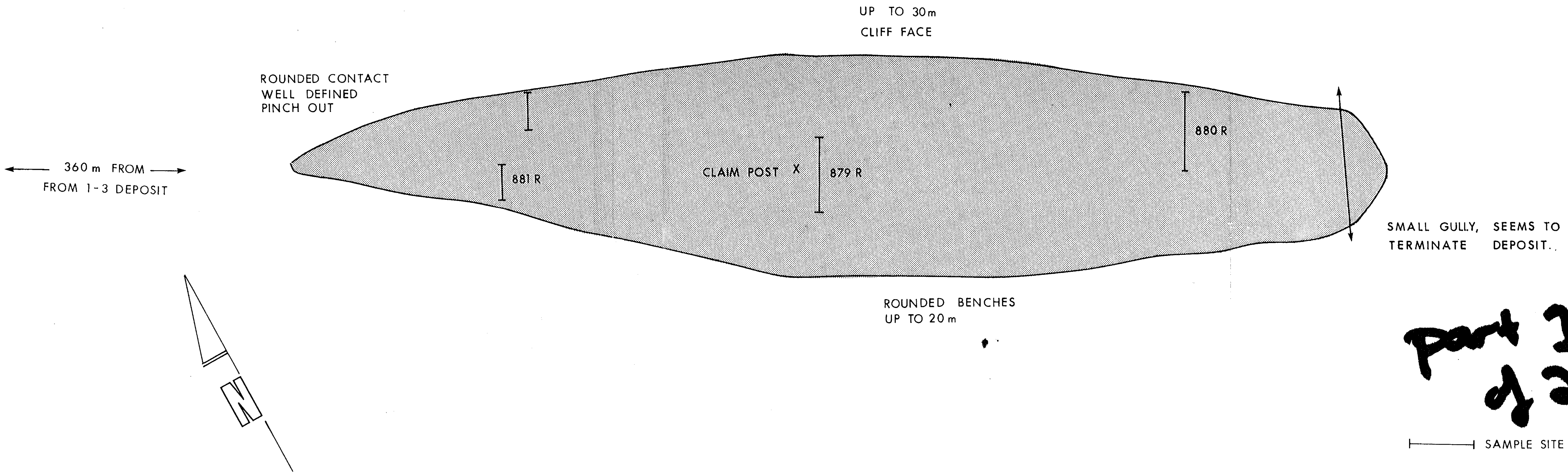
KAISER RESOURCES

SPARWOOD B.C.

FISH
MAGNESITE DEPOSIT
GEOLOGICAL MAP - FISH 1-3 FIG. 4

DESIGNED	R. J. M.	DATE	NOV., 1978
DRAWN	R. J. T.	SCALE	1 : 1000
CHECKED			
APPROVED		MAP NO. 144-10-4	

part 1 of 2



part 1 of 2

⊢—⊣ SAMPLE SITE NO.

KAISER RESOURCES SPARWOOD B. C.

FISH
MAGNESITE DEPOSIT
GEOLOGICAL MAP - FISH 4-5
FIG. 5

DESIGNED R.J.M.	DATE NOV., 1978
DRAWN R.J.T.	SCALE 1 : 1000
CHECKED	MAP NO. 144-10-5
APPROVED	

0 25 50 100
METRES

O SURVEY CONTROL
| GEOLOGICAL CONTACTS
MAGNESITE
AGRILITE & LIMESTONE
MAGNESITE & QUARTZ VEINS

KAISER RESOURCES	SPARWOOD B. C.
FISH MAGNESITE DEPOSIT FISH 1-3 CROSS SECTIONS	FIG. 6
DESIGNED R. J. M.	DATE NOV., 1978
DRAWN R. J. T	SCALE 1: 1000 NO VERT EXAGGERATION
CHECKED	MAP NO. 144-10-6
APPROVED	

0 25 50 100
METRES