ONTARIO PROSPECTORS ASSISTANCE PROGRAM

OP 97 - 048 and OP 97 - 047

FINAL SUBMISSION 1997

prepared by

DENIS CHARTRE AND ROGER DUFRESNE

Prospectors

1997 12 20

FARR TOWNSHIP

Claims 1214380 and 1214381

(former Roy Silver Mines Limited, Farr Property)

Table of contents

SUMMARY

As a consequence of having optioned all our ground in Alma, Holmes and Flavelle Townships, Denis Chartre and Roger Dufresne decided to do some work on our Farr Township property and bring the old Roy Silver Mine back to life.

We found gold, silver, cobalt, copper, nickel, lead and zinc. Sample #95 provided the best gold at 0.75 g/tonne; sample #69 provided the best silver sample at 4.12 oz/ton; sample #72 provided the best cobalt sample at 6.08 %; samples #64, #69 and #66 provided the best copper samples at 14.02 %, 13.74 % and 12.44 % respectively; sample #72 provided the best nickel at 0.55 %; sample #98 provided the best lead at .066 % and sample #98 provided the best zinc at 0.041 %. (See pages one and two of assay certificate # 7W-3533-RA1 dated Sept. 22, 1997 at Annex "E-1")

Stripping was completed using an excavator and a high-pressure wajax pump.

9 east-west grid lines 400 metres in length were cut; one base line north-south 825 metres was also cut; the grid lines permitted a control for the geological survey and to facilitate the plotting of stripped areas on the geological map.

A magnetometer survey was completed in order help determine shifts in rock structure.

ACKNOWLEDGEMENT

Denis Chartre and Roger Dufresne wish to express our appreciation to Edouard Chartre, Geologist with Service Exploration and his staff for their part in the preparation of this report.

ACKNOWLEDGEMENT (continued)

Denis Chartre and Roger Dufresne wish also to express our appreciation to Gerhard Meyer, Resident Geologist and Gary Grabowski, Staff Geologist for their property visit. We were explained cylindroidal jointing and were made aware of two papers: Cylindroidal Jointing in Diabase at Gowganda, Ontario by P. R. Eakins and Geology of the Silver Deposits near Miller Lake, Gowganda by B. W. Hester. (See annexes "D-1" and "D-2" respectively.

Description of Property

The 1997 Chartre-Dufresne Property consists of 2 unpatented mining claims outlined in green (see annex "A"). Claims #1214380 and 1214381 have been referred as the Roy Silver Property ((former patented claims Mr. 12898 and 12899 dated 1949 - 1954 and the Hubert Lake (Tormont) Property)).

The complete list of claims is provided at annex "A-3".

Ministry of Northern Development and Mines, using the Erlis Databases, provides us with a compilation map at Annex "A-4".

LOCATION

The 1997 Chartre-Dufresne Property is located on the West shore of Hubert Lake in Farr township in the Larder Lake Mining Division, Cobalt District, in the District of Temiskaming.

The Mineral Deposit Inventory (annex "B", annex "B-1" and annex "B-2") data sheets give us the following for the Roy Silver Property in Farr Township: Lalitude 47 degrees 47'; Longitude: 80 degrees 28'; M D I #: T 0382; U T M Zone: 17; Northing: 5292129; Easting: 540162 in the Cobalt Resident Geologist Area.

The Dufresne - Chartre - 1997 Property is located approximately 7 miles west of the Town of Elk Lake. Kirkland Lake lies approximately 57 mile (91Km.) via Highways 65 and 66 East of the Property.
(See maps at Annex "A-1")

Access to the property can be gained by travelling North from Elk Lake on Highway 65 for 8.5 miles (13.6km); turn West on logging road for a distance of 3.25 miles (5.2K); turn SW on sub-logging road past dirt piles for 1.5 miles (2.4K); turn South toward Hubert Lake to the end of road. (See annex "A-1")

GEOLOGY

The property is underlain by diabase. East of the claims there is a granite contact, and to the west the diabase is overlain by cobalt sediments. The diabase is part of the main sill which cuts through the South Lorrain, Cobalt, Elk Lake and Gowganda areas. Several narrow calcite veins containing silver-cobalt-copper mineralization have been found on the property. (See Annex "A-2")

Near the main shaft, a vein containing erythrite, bornite, calcite and chalcopyrite strikes northeast for about 175 feet.

The property was mined via the main shaft; 3,007 tons of cobalt were mined and 2,472 tons were processed (assays yielded 7% cobalt and 6% copper). Production in 1964 equalled 1,084 ozs of silver and production in 1966 equalled 804 ozs silver. (See F 500465 D.E.M.R. or MDIR: T 0382)

HISTORY

1909 - South of Farr Township (See Annex "A-4") the Boland-Thomson Property was being developed. Native silver, calcite and argentite were discovered. (See Annex "H-1")

1918 - Charles W. Drury produced Cobalt its Occurrence, Metallurgy, Uses and Alloys explains that the deposits at Cobalt occupy narrow, practically vertical fissures and joint-planes in the metamorphosed Cobalt series. A few productive veins of similar form have been found in the intrusive Nipissing diabase. (See Annex "H-2")

1950 - In his report Robert Thomson made an examination of the Bain - Melisek claims (Mr. 12898, Mr. 12899, Mr. 12900 and Mr. 14960) and reported that the diabase body dips westward under the Cobalt Sediments. (See Annex "H-3")

1950 - M. Reade in Mines of Ontario in 1950 on page 96 indicates the incorporation of Roy Silver Mines, Limited and establishing control over the Farr Property. (See Annex "H-4")

HISTORY (continued)

1951 - M. Reade indicates in Mines Operations in 1951 that Roy Silver Mines suspended ooperations in Haultain Twp. (See Annex "H-5")

1952 - D. J. Field in Mining Operations in 1952 indicates that Roy Silver Mines began operations in Farr Township in the Spring of 1952. Twenty diamond-drill holes, totalling 2,741 feet were drilled from surface. (See Annex "H-6")

1952 - Robert Thomson on page 4 of his report explains that the cobalt (with some silver) occurences in the vicinity of the North Shaft are the object of their work. (See Annex "H-7")

1953 - D. J. Field in Mining Operations in 1953 indicates that Roy Silver Mines continued operations. Underground work continued and eight diamond-drill holes, totalling 835 feet were drilled from surface. See Annex "H-8")

1954 - D. J. Field in Mining Operations in 1954 indicates that Roy Silver Mines completed work from January 1 to May 18, 1954. Underground work continued and two holes totalling 105 feet were drilled from surface. A total of 3,007 tons of cobalt ore was mined. (See Annex "H-9")

1954 - L. J. Cunningham on page two of his letter to Maurice Marcus, one of the directors of Roy Silver Mines, describes the surface diamond drilling. He claims that hole #13, south of the shaft has ore grade. (See Annex "H-10")

1955 - L. J. Cunningham and E. E. Campbell in their Report on Tiara Mines Limited (re Farr Township Property) state that the surface exposure of the diabase measures approximately 1,200 feet in an East-West direction; to the East the diabase is in contact with older granite; to the West it is in contact with older Huronina (Cobalt) sediments. In this area all known cobalt and silver deposits occcur in Nipissing diabase. One strong vein structure in Nipissing diabase strikes North 15 degrees East and dips 72 degrees East. Five hundred feet from

HISTORY (continued)

the shaft Plante Creek occupies a marked topographic depression which roughly parallels the strike of the vein in the mine workings. Two geological possibilities of ore occurences exist within areas immediately adjacent to the mine workings.
(See Annex "H-11")

1956 - Underground drilling records show location and logs. Six inches of core provides us with 4.4% Silver, 0.40% Cobalt and 2.3% copper.
(See Annex "H-12")

1963 - G. S. Riddell in Statistical Review of the Mineral Industry and Mining Operations for 1963 indicates that Tormont Mines Limited (former Roy Silver Mines) proceeded with operations from January to September 7, 1963. (See Annex "H-13")

1964 - E. L. MacVeigh in his Report on a Geological Survey of the Tormont Mines Property in Farr Township explains that the Nipissing diabase sill in the central part of the property strikes north-south and dips flatly west 10 to 15 degrees. (See Annex "H-14")

1968 - A. O. Sergiades produced Mineral Resources Circular No. 10 entitled Silver Cobalt Calcite Vein Deposits of Ontario demonstrates that the Farr Property was the fourth best producer in the Elk Lake Area in the former Montreal River District. (See annex"H -15") Silver and Cobalt Arsenides were the major ore minerals. Chalcopyrite and bornite are the minor ore minerals. Eight diamond drill holes totalling 835 feet were drilled from surface. Ten holes totalling 1,178 feet were drilled from underground.
(See Annex "H-15")

1977 - T. Bell and C. Molyneau did some trenching on claim north of main shaft; no assays are reported.
(See Annex "H-16")

HISTORY (continued)

1997 - Denis Chartre and Roger Dufresne completed a prospecting program (stripping, trenching and sampling), ~~and~~ line cutting and a magnetometer survey. The main vein was observed for a length of 90 meters; its width varies from a few cm to 30 cm. The 55 samples taken along the vein averaged the following: 0.7 oz Ag/T, 1.64% Co, 3.22% Cu and 0.16% Ni. The magnetometer survey has defined 2 anomalous zones in the vicinity of the base line; these zones are trending north-south more or less and appear to be caused by local increases of dissiminated magnetite within the main diabase sill. (See annex "E-2 "

Statistical Report - 1997

Job-Creation Summary

Type of work	# of days	Money expended
Backhoe operator (float, excavator travel)		$3,929.58 (tax inc)
Power Stripping (water pump operator)	24	2,160.00
Assayer (lab tech) etc		808.92
Geological report and preparation of maps etc.		1,605.00
Total money paid to contractors		$8,503.50

A 10

ONTARIO PROSPECTORS ASSISTANCE PROGRAM (OPAP) FINAL SUBMISSION FORM 1997

INSTRUCTIONS: Please read the guidebook before completing form Please type or print
Submit completed form and supporting documentation
by January 31, 1998 to:
OPAP, Mines Group
Ministry of Northern Development & Mines
4th Floor, 933 Ramsey Lake Rd., Sudbury, Ontario P3E 6B5

TO BE COMPLETED BY SUCCESSFUL GRANTEES AFTER PROJECT COMPLETION AND ACCOMPANIED BY WRITTEN REPORTS, MAPS, ETC.

Applicant DENIS CHARTRE File Number OP97-047

Proposed project area(s) (Twp. or claim map name, latitude and longitude) Completed?

1. FARR TOWSHIP PLAN G-3635 Yes ☒ No ☐
2. SEE ANNIEX "A", "A-1", "A-2", "A-3", "A-4" Yes ☐ No ☐
LATITUDE: 47° 46' 59", LONGITUDE: 80° 27' 47"

Changes to proposed project(s) (if any) SEE ANNIEX "B", "B-1", "B-2"
N/A

List other co-owners of the property with OPAP grants that worked on project
ROGER DUFRESNE OP97-48

I. WORK PERFORMED BY APPLICANT (Summary of Section IV)

1. Project #1 area/name FARR TWP. PROPERTY "ROY SILVER MINE"

		No. days worked by applicant (that's only you)
Traditional prospecting	No. of samples 52+2=26	2
Geological surveys	~~Scale~~ HELP MAPPING	2
Geophysical surveys	~~Type~~ PROPERTY VISIT ~~Miles/km~~	1
Geochemical surveys	Type ____ No. of samples ____	
Drilling	Type ____ Ft./m ____	
Stripping/Trenching	Method CUTTING GRID LINES EXCAVATOR + MANUAL	
Other	~~Type~~ POWER STRIPPING + BRUSHING + MAG	53
	TOTAL	58

Form filled out by ☒ Applicant ☐ Other (please specify) ____
Report prepared by ☒ Applicant ☒ Other (please specify) SERVICE EXPL.
Technical report Filed for Assessment Work Yes ☒ No ☐

I. WORK PERFORMED BY APPLICANT (Continued)

2. Project #2 area/name _____ No. days worked by applicant

Traditional prospecting	No. of samples _____		_____
Geological surveys	Scale _____		_____
Geophysical surveys	Type _____	Miles/km _____	_____
Geochemical surveys	Type _____	No. of samples _____	_____
Drilling	Type _____	Ft./m _____	_____
Stripping/Trenching	Method _____	_____	
Other	Type _____		_____
		TOTAL	_____

TOTAL DAYS (ALL PROJECTS) A. _____
(Attach additional sheets for additional project areas as required)

II. EXPENDITURES (total of all projects) - Summary of I and II

1. Number of working days **by applicant**
(A) x $100/day ..... 58 ..... $ 5800.00

2. Number of report preparation days **by applicant** x $100/day ..... 3 ..... $ 300.00

3. Analyses/Assay costs ..... 50% of 808.92 ÷ 2 ..... $ 404.46

4. Equipment rentals PUMP RENTAL + OPERATOR ..... $ 1080.00
..... $ _____ $ 1080.00

5. Consumable Supplies ..... _____ $ _____

6. Contract services (state type)
# of workers SERVICE EXPL. ..... $ 1605.00 ÷ 2
# of days worked GEOLOGY + REPORT ..... $ _____ $ 802.50
EXCAVATOR ..... $ 3929.58 ÷ 2 $ 1964.79

7. Travel (state method (road) air, etc.)
91 km X 0.30 X 54 DAYS $ 1474.20
..... $ _____ $ 1474.20
..... $ _____

8. Food and Accommodation $20.00 PER DAY X 61 ..... $ 1220.00

9. Other expenses (specify, e.g. typing, printing, shipping of supplies)
OIL, GAS ..... $ _____
+ PROPANE ..... $ 720.47 $ 720.47
10. Helpers SUPPLIES ..... $ 366.77 $ 366.77
# of helpers .....
# of days worked .....

TOTAL EXPENDITURES $ 14133.19

SUPPLIES

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
MAY 1/97	SERVICE EXPLORATION	FLAGGING TAPE	$36.92
" 5	CANADIAN TIRE	PROPANE TANK	34.49
" 5	" "	SAND PAPER	5.16
" 30	SUPER FRESH	KLEENEX (2)	2.00
JUNE 6	NORTHLAND TIRE	REPAIR TRAILER TIRE	12.08
" 6	DUMAS INDEPENDENT GROCER	BENADRYL LIQUID	6.99
		" CAPSULES	4.99
		FOR ALLERGIES	
JUNE 13	KENOGAMI GARAGE	CHAIN SAW FILE	5.70
" 15	CANADIAN TIRE	HOSE SUPPLIES	4.20
" 16	" "	RAID 5.95 (3)	20.61
" 17	AUCTION AT MNR	ORANGE SNOW FENCE	64.80
		FOR PIT & SHAFT	
		ON PROPERTY	
		+ HOSE PARTS	22.00
JUNE 18	CANADIAN TIRE	SUN GLASSES	14.99
	" "	COOLER	19.99
" 20	SHOPPERS DRUG MART	FILM (POLAROID)	33.34
JULY 4	KENOGAMI GARAGE	CHAIN SAW FILES	
		+ SPARK PLUG	17.13
" 7	CANADIAN TIRE	UTILITY BOX	6.49
		BATTERIES	4.29
" 8	KENOGAMI GARAGE	SPARK PLUG	7.55
AUG 26	CANADIAN TIRE	HOLD DOWN STRAP	4.01
SEPT 15	CANADIAN TIRE	CHAIN SAW OIL	5.98
OCT. 23	CANADIAN TIRE	PADLOCK	5.99
		HASP	3.29
		GARBAGE BAGS	4.69
		PAPER TOWELS	0.99
NOV. 5	ONT. NORTHLAND	RETURN MAG. BY	
		BUS TO SERVICE EXPL.	17.60

Mileage rate claimed _____ km at 30¢/km for use of own vehicle ..... _____

TOTAL 366.77

Attach additional sheets as required.

OIL - GAS - PROPANE FOR PUMP - CHAINSAW & BIKES

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
MAY 22/97	GUY'S ESSO	GAS	$4.60
JUNE 6	CANADIAN TIRE	GAS	70.00
" 6	" "	GEAR OIL	2.99
" 6	" "	GEAR OIL	3.19
" 6	" "	OUTBOARD OIL	15.49
" 6	" "	OUTBOARD OIL	18.99
" 16	" "	OUTBOARD OIL 4L (4)	50.55
" 18	MACPHERSON'S	GAS	23.00
JULY 10	GUYS ESSO	GAS	50.00
" 21	CANADIAN TIRE	GAS	64.00
" 21	SUPERIOR PROPANE	PROPANE	160.71
AUG 11	GUYS ESSO	GAS	44.00
SEPT 12	GUYS ESSO	GAS	30.00
" 15	CANADIAN TIRE	OUTBOARD OIL	32.74
JULY 18	GUYS ESSO	GAS	29.00
19	" "	GAS	31.00
22	SUPERIOR PROPANE	PROPANE	64.20
OCT 1	CANADIAN TIRE	GAS	26.01

Mileage rate claimed _____ km at 30¢/km for use of own vehicle ..... _____

TOTAL $720.47

Attach additional sheets as required.

STRIPPING 27 Days OP97-047

IV. DAILY REPORTS (Summarize work activity in Section I)

Day	Project Area	Date	Work Performed
1	CLAIMS 1214380-1214381	MAY 17/97	LOCATING AND MARKING AREAS
2	" "	18	LOCATING AND MARKING AREAS
3	" "	22	CUTTING TRAILS TO CREEK FOR AMP
4	" "	23	" " " "
5	" "	24	" " " "
6	" "	JUNE 7	MANUAL & POWER STRIPPING
7	" "	8	" " "
8	" "	12	" " "
9	" "	13	" " "
10	" "	14	" " "
11	" "	19	CUTTING GRID LINES
12	" "	20	" " "
13	" "	21	" " " FOUND PIT
14	" "	JULY 9	SUPERVISING CONTRACTOR + MANUAL STRIPPING TOOF SAMPLES
15	" "	10	" " " "
16	" "	11	" " " "
17	" "	17	MANUAL & POWER STRIPPING
18	" "	19	" " "
19	" "	20	" " "
20	" "	22	" " "
21	" "	23	" " "
22	" "	24	" " "
23	" "	25	" " "
24	" "	26	" " "
25	" "	AUG. 9	MANUAL & POWER STRIPPING
26	" "	- 10	" " "
27	" "	11	" " "
28	" "	12	" " "
29	" "	13	" " "
30	" "	14	" " "
31	" "	15	" " "
32	" "	16	" ALSO " "
33	" "	17	" MADE " " FENCE " " FOR SHAFT
34	" "	AUG 23	MANUAL & POWER STRIPPING
35	" "	24	" " "
36	" "	25	" " "
37	" "	29	" " "
38	" "	30	" " "
39	" "	31	TAKING SAMPLES
40	" "	SEPT 1	" "
41	" "	4	CUTTING GRID LINES

Attach additional sheets as required.

Penn

IV. DAILY REPORTS (Summarize work activity in Section I)

Day	Project Area	Date	Work Performed
42	CLAIMS 12143 80-12143 81	SEPT 7/97	CUTTING GRID LINES
43		12	" " "
44		13	" " "
45		19	" " "
46		20	" " "
47		26	" " "
48		27	" " "
49		28	" " "
50		OCT 2	" " "
51		3	" " "
52		4	HELP MAP WITH SERVICE EXPL
53		5	" " " " "
54		10	DID MAG. SURVEY
55		11	" " "
56		25	" " "
57		26	" " "
58		NOV. 4	PROPERTY VISIT BY GERHART MEYER GARY GRABOWSKI
59		JAN 9	REPORT PREPARATION
60		10	" "
61		11	" "

Attach additional sheets as required.

V. SIGNIFICANT RESULTS (please complete)

Project Area	New Showings and/or Anomalies	Commodity	Best Analyses
FARR TWP PROPERTY 1997	90 METERS OF THE MAIN VEIN AVERAGED (0.70 OZ OF Ag/T) (1.64% CO) (3.22% CU) (0.16% Ni) SEE ANNEX (IE-2)		

VI. CLAIMS STAKED DURING/AFTER PROSPECTING ACTIVITY (please complete)

Project Area	Claim Numbers	Number of Claim Units
	N/A	

VII. OPTION AGREEMENTS RESULTING FROM OPAP PROJECT (please complete)

Optionee	Property/Claims	Dollar Value of Work Commitment
	N/A	

The Ministry of Northern Development and Mines may verify all statements related to and made herein this application.

1. I am the person named in the Final Submission Form under the Ontario Prospectors Assistance Program.
2. I am ordinarily a resident of Canada.
3. I have complied with all the requirements of the said program.
4. I understand that it is an offence under the Ontario Mineral Exploration Act, R.S.O. 1990, to make a false or misleading statement and that all statements and all other information submitted in support of the said application are true and correct.
5. I was not employed by the Mines and Minerals Division of the Ministry while in receipt of the OPAP grant.
6. I am aware that any other Provincial or Federal Government financial assistance received for said application will be deducted from the amount of incurred "Total Eligible Expenses".

It is an Offence under subsection 8(1)(A) of the Ontario Mineral Exploration Act, R.S.O. 1990 to knowingly furnish false or misleading information.

Personal information on this form is obtained under the authority of the Ontario Mineral Exploration Act, R.S.O. 1990, sections 2, 3 and 4 and the Ontario Prospectors Assistance Program Regulation, sections 4, 5 and 6. The financial and technical information will be used for the purpose of determining the eligibility of the applicant to have a program designated for financial assistance and the amount of such assistance. Other information, such as statistical information about the individual projects will be used for the purpose of determining the overall effectiveness of the program. It may be disclosed for those purposes and I consent to its disclosure for such purposes. Questions about this collection should be directed to Senior Manager, Mines Group, Ministry of Northern Development and Mines, 5th Floor, 933 Ramsey Lake Road, Sudbury, Ontario P3E 6B5, Toll free 1-800-265-0834.

Signature of Applicant Denis Chartre Date JAN 11/98

Name (print) DENIS CHARTRE

ONTARIO PROSPECTORS ASSISTANCE PROGRAM (OPAP) FINAL SUBMISSION FORM 1997

INSTRUCTIONS: Please read the guidebook before completing form Please type or print
Submit completed form and supporting documentation
by January 31, 1998 to:
OPAP, Mines Group
Ministry of Northern Development & Mines
4th Floor, 933 Ramsey Lake Rd., Sudbury, Ontario P3E 6B5

TO BE COMPLETED BY SUCCESSFUL GRANTEES AFTER PROJECT COMPLETION AND ACCOMPANIED BY WRITTEN REPORTS, MAPS, ETC.

Applicant ROGER DUFRESNE File Number OPAP-97-048

Proposed project area(s) (Twp. or claim map name, latitude and longitude) Completed?

1. FARR TOWNSHIP PLAN G-3635 Yes ☒ No ☐
2. SEE ANNEXES "A"; "A-1"; "A-2"; "A-3"; "A-4" Yes ☐ No ☐
LATITUDE: 47° 46' 59"; LONGITUDE: 80° 27' 47"

Changes to proposed project(s) (if any) N/A SEE ANNEXES "B"; "B-1"; "B-2";

List other co-owners of the property with OPAP grants that worked on project

DENIS CHARTRE OPAP-97-047

I. WORK PERFORMED BY APPLICANT (Summary of Section IV)

1. Project #1 area/name FARR TWP PROPERTY "ROY SILVER MINE"

			No. days worked by applicant (that's only you)
Traditional prospecting	No. of samples 52 ÷ 2 = 26		2
Geological surveys	~~Scale~~ HELP MAPPING		2
~~Geophysical surveys~~ PROPERTY visit	~~Type~~	~~Miles/km~~	1
Geochemical surveys	Type	No. of samples	
Drilling	Type	Ft./m	
Stripping/Trenching	Method EXCAVATOR, MANUAL		48
Other	Type POWER STRIPPING BRUSHING + MAG	TOTAL	53

Form filled out by ☒ Applicant ☐ Other (please specify)
Report prepared by ☒ Applicant ☒ Other (please specify) SERVICE EXPL.
Technical report Filed for Assessment Work Yes ☒ No ☐

I. WORK PERFORMED BY APPLICANT (Continued)

2. Project #2 area/name _____

		No. days worked by applicant
Traditional prospecting	No. of samples _____	_____
Geological surveys	Scale _____	_____
Geophysical surveys	Type _____ Miles/km _____	_____
Geochemical surveys	Type _____ No. of samples _____	_____
Drilling	Type _____ Ft./m _____	_____
Stripping/Trenching	Method _____ _____	
Other	Type _____	_____
	TOTAL	_____

TOTAL DAYS (ALL PROJECTS) A. _____
(Attach additional sheets for additional project areas as required)

II. EXPENDITURES (total of all projects) - Summary of I and II

1. Number of working days **by applicant** 53
(A) x $100/day ..... $ 5300.00

2. Number of report preparation days **by applicant** x $100/day ..... 3 ..... $ 300.00

3. Analyses/Assay costs ..... 808.92 ÷ 2 ..... $ 404.46

4. Equipment rentals
PUMP RENTAL _____
AND OPERATOR _____ $ 1080.00

5. Consumable Supplies ..... _____ $ _____

6. Contract services (state type)
# of workers SERVICE EXP $ 1605.00 802.50
# of days worked GEOLOGY MAPPING $ _____ $ _____
EXCAVATOR $ 3929.58 ÷ 2 $ 1964.79

7. Travel (state method: road, air, etc.)
9TR X 0.30 X 50 $ 1365.00
_____ $ _____ $ 1365.00
_____ $ _____

8. Food and Accommodation $20.00 PER DAY X 56 ..... $ 1120.00

9. Other expenses (specify, e.g. typing, printing, shipping of supplies)
OIL GAS PROPANE $ 735.99 735.99
SUPPLIES $ 1720.67 $ ~~1720.67~~
EQUIP. REPAIRS $ 1101.41 $ ~~1101.41~~

10. Helpers
# of helpers.....
# of days worked.....

TOTAL EXPENDITURES $ ~~14,529.64~~

$15 894.82

(ROGER) PAPER SUPPLIES AND COPY SERVICES

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
1997			
JAN 2	PHARMA PLUS	PAPER (ON SPECIAL)	5.74
7	CARL'S OFFICE	LEHER BINDING	26.39
7	GST #136179009	COLOUR COPY (MAPS)	17.25
9	CARL'S OFFICE	CARD STOCK	4.12
16	"	FASTENERS, PAPER, ETC.	16.98
20	CANADA POST	POSTAGE	.48
22	PAROISSE ASSOMPTION	COPY SERVICE	35.69
28	CARL'S OFFICE	TAPE	5.90
28	"	PAPER	6.21
28	"	PAPER	7.13
28	MET	STATIONARY	3.07
FEB 7	LOEB	PAPER (ON SPECIAL)	4.37
MARCH 4	CARL'S OFFICE	FOLDERS	13.24
20	"	PENS	6.19
29	COLES BOOK STORE	REFERENCE	37.40
13	MIGHTY DOLLAR	PAPER (ON SPECIAL)	3.45
14	LOEB	PEN	1.83
16	MIGHTY DOLLAR	PAPER (ON SPECIAL	5.28
APRIL 10	CARL'S OFFICE	STAPLES & PHOTO PAGES	15.43
23	"	PAPER	6.10
25	LOEB	PEN	1.82
MAY 01	WAL-MART	COMPUTER PAPER	27.24
02	CARLTON	THANK YOU CARDS	9.78
14	WAL-MART	COMPUTER PAPER	24.63
14	CARLTON	CARDS	11.33
29	"	CARDS	5.01
JUNE 1	CHAPTERS	REFERENCE	13.63
2	COLES	"	26.70
SEPT 30	CARL'S OFFICE	TAPE	2.29
Oct 31	"	BOOK	5.78

Mileage rate claimed _____ km at 30¢/km for use of own vehicle ..... _____

TOTAL 350.46

Attach additional sheets as required.

(ROGER) FIRST AID SUPPLIES

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
1997			
JAN. 18	K. L. PHARMACY	HAND CREAM	8.38
FEB 10	BDR. DRUGS	PAIN KILLER	2.00
14	K. L. PHARMACY	CREAM ETC	20.56
15	PHARMA PLUS	LUBRIDERM, VASELINE ETC.	15.08
MARCH 8	K.L. PHARMACY	CREAM	13.55
APRIL 9	BDR DRUGS	HAND CREAM	2.29
12	K.L. PHARMACY	BAND AIDS	5.80
JUNE 05	KL PHARMACY	PAIN KILLER	11.88
18	PHARMA PLUS	FOOT POWDER	9.77
AUG 1	KL. PHARMACY	CREAM	4.82

Mileage rate claimed _____ km at 30¢/km for use of own vehicle .....

TOTAL 94.13

Attach additional sheets as required.

(ROGER) WHITE PRINTS AND MAPS

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
1997	MINING RECORDER		
JAN 17	K. L. ONTARIO	MAP	1.15
27	"	"	4.60
FEB 07	"	"	1.15
20	"	"	6.90
20	"	"	6.90
17	COBALT OFFICE	"	10.48
18	"	PHOTO COPY	8.05
20	K.L. OFFICE	CL REP	5.40
21	"	CL REP	10.80
21	"	WHITE PRINT	3.45
21	"	"	4.60
24	"	COPY	1.02
MARCH 20	"	WHITE PRINT	1.15
20	"	COPIES	10.80
20	"	WHITE PRINT	1.15
21	"	COPIES	.80
24	"	FEE	2.30
24	"	WHITE PRINT	6.90
24	"	COPIES	10.80
25	"	MISC. PUB.	64.20
APRIL 4	"	COPY	10.35
4	"	WHITE PRINT	1.15
24	"	"	1.15
25	"	"	8.05
MAY 01	"	MAP	7.59
06	"	WHITE PRINT	1.15
30	"	"	6.90
JUNE 12	"	"	1.15
AUG. 1	"	"	2.30
SEPT 5	"	"	2.00
5	"	"	9.20
24	"	TWN REP	10.80
24	"	MISC. PUB.	32.96
26	HIGHWAY BOOK SHOP	REF. BOOKS	34.19

Mileage rate claimed _____ km at 30¢/km for use of own vehicle ..... _____

TOTAL 291.54

Attach additional sheets as required.

(ROGER) SUPPLIES P.1

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
1997			
JAN 12	CANADIAN TIRE	QH-T4 LAMPS	11.48
11	〃	KEYS	6.73
13	GUY'S SERVICE	MATCHES	2.62
FEB 20	K.L. HOME CARE	RED TAPE	5.73
20	〃	WOOD SCREWS	7.01
20	LOEB	BATTERY ETC.	14.03
20	〃	TOILET PAPER	5.70
20	〃	3-1 OIL	4.97
24	〃	PAPER TOWELS	4.49
MARCH 1	CANADIAN TIRE	STEEL WOOL / RECEPTICLE	24.69
1	〃	BATERY	6.89
4	RADIO SHACK	BATERY	5.74
24	DRAPERY CENTER	NOTION	1.73
29	PHARMA PLUS	BATERIES	5.74
APRIL 04	LEO'S SECOND HAND	CHISEL	7.19
04	BUSY BEE	WIRE BRUSH & RULER	12.62
18	DRAPERY CENTER	ZIPPER & FABRIC	3.40
MAY 15	CANADIAN TIRE	BATTERIES	16.98
23	GUY'S SERVICES	BATERY	5.85
24	〃	FUNNEL	11.74
29	CANADIAN TIRE	VINYL TAPE	1.02
31	PRICESS AUTO	REFERENCE BOOKS ETC.	47.42
31	CANADIAN TIRE	PADLOCKS	9.19
JUNE 03	PRO-GLASS AND LOCK	KEYS	6.73
04	CANADIAN TIRE	GLUE AND BULB	12.97
17	〃	BRUSH - ETC	10.33
25	LOU'S AUTO	HOSE CLAMP	4.00
26	PRO GLASS AND LOCK	KEYS	13.46
26	CANADIAN TIRE	TUB GLUE	11.49
27	〃	REDOX AND PUTTY	26.97
JULY 04	GOLDBELT	BLISTERPAK	2.61
05	CANADIAN TIRE	REDOX	19.28
07	〃	EMERY CLOTH AND HOSE	19.42
07	TRUCK STOP	CHAIN OIL	18.57
15	CANADIAN TIRE	FUSES	22.96
25	GRANT HOME CARE	NAILS	17.46
29	CANADIAN TIRE	BAHERY ETC	76.09
29	McGINNIS	HOSE CONNECTOR	11.10
AUG 02	CANADIAN TIRE	TOOLS	19.25

Mileage rate claimed _____ km at 30¢/km for use of own vehicle ..... _____

TOTAL 515.55

Attach additional sheets as required.

(ROGER) SUPPLIES P. 2

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
1997			
JULY 03	LOU'S AUTO	HOSE REPAIRS	28.75
AUG. 11	K. MART	PENCILS AND BULBS	6.69
11	WORK WORLD	WORK GLOVES	6.89
16	CANADIAN TIRE	HOLOGEN ORG. LAMP	14.94
22	PRINCESS AUTO	PULLER ETC	72.13
		HACK SAW BLADES	
SEPT 01	N. A. P. A.	PAINT	38.98
02	CANADIAN TIRE	PAINT & OIL	27.56
12	GUY SERVICES	BATTERY ETC	12.78
OCT 08	GUILLEVIN INT.	BATTERY ETC	28.41
08	CANADIAN TIRE	OIL & GEAR OIL	6.88
09	GUY'S SERVICES	SPARK PLUG BOX	9.15
09	N. A. P. A.	SPARK PLUGS	27.54
09	WALMART	LANTERNS ETC.	85.04
09	CANADIAN TIRE	HOSE CLAMPS	10.87
09	PRO GLASS LOCKS	KEYS	7.50
01	TRUCK STOP	CHAIN OIL & OIL	64.00
01	CANADIAN TIRE	VELCRO TABS	3.44
NOV 05	11	WASHERS & SCREWS	17.44

Mileage rate claimed _____ km at 30¢/km for use of own vehicle .....

TOTAL 468.99

Attach additional sheets as required.

(ROGER) PROPANE

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
1997	GOLD BELT SUPPLY	RENTAL CONTRACT	41.40
MARCH 6			
MAY 17	MATACHEWAN CAMP	100 LBS	44.85
JULY 20	"	"	45.00
AUG 27	"	"	44.85
OCT 9	"	"	54.50
30	LOU'S AUTO	LIGHT FIXTURE	41.35

Mileage rate claimed _____ km at 30¢/km for use of own vehicle .....

TOTAL 271.95

Attach additional sheets as required.

(ROGER) GAS & OIL (PUMP AND ATV)

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
1997	PETRO CANADA	GAS/OIL	26.00
JUNE 22	"	"	
JULY 02	"	"	85.88
04	"	"	17.44
10	GUY'S ESSO	"	54.33
20	PETRO CANADA	"	20.01
24	"	"	28.00
28	"	"	39.00
31	"	"	40.00
AUG 01	"	"	26.00
05	"	"	49.00
06	"	"	78.38

Mileage rate claimed _____ km at 30¢/km for use of own vehicle .....

TOTAL $ 464.04

Attach additional sheets as required.

(ROGER) EQUIPMENT REPAIRS

III. DETAILED LIST OF EXPENDITURES (Summarize in Section II)

Date	Recipient of Payment	Explanation	Amount
1997			
JAN 16	REDLINE AUTO	FRICTION WHEEL	33.01
20	LOU'S AUTO	PROPANE HOSE	22.95
20	ELMER'S SMALL ENGINES	SPROCKET & CHAIN	62.05
SEPT 3	"	21003-1276	991.35
		STATOR ASSEMBLY	
		CV BOOT 49006-1252	
		LABOUR	
OCT 01	"	OIL CHANGE	
		AND BRAKE	
		REPAIR TO	192.05
		BRAKE DRUM	
		ASSEMBLY	
		AND SHIFTER	
		ASSEMBLY	

Mileage rate claimed _____ km at 30¢/km for use of own vehicle .....

TOTAL $1,101.41

Attach additional sheets as required.

IV. DAILY REPORTS (Summarize work activity in Section I)

Day	Project Area	Date	Work Performed
1	CLAIMS 1214380-1214381	MAY 17/97	LOCATING AND MARKING AREAS
2	" "	18	LOCATING AND MARKING AREAS
3	" "	22	CUTTING TRAILS TO CREEK FOR PUMP
4	" "	23	" " " "
5	" "	24	" " " "
6	" "	JUNE 7	MANUAL & POWER STRIPPING
7	" "	8	" " "
8	" "	12	" " "
9	" "	13	" " "
10	" "	14	" " "
11	" "	19	CUTTING GRID LINES
12	" "	20	" " "
13	" "	21	" " " FOUND PIT TOOK SAMPLES
14	" "	JULY 9	SUPERVISING CONTRACTOR MANUAL STRIPPING
15	" "	10	" " " "
16	" "	11	" " " "
17	" "	12	MANUAL & POWER STRIPPING
18	" "	19	" " "
19	" "	20	" " "
20	" "	22	" " "
21	" "	23	" " "
22	" "	24	" " "
23	" "	25	" " "
24	" "	26	" " "
25	" "	AUG 9	MANUAL & POWER STRIPPING
26	" "	10	" " "
27	" "	11	" " "
28	" "	12	" " "
29	" "	13	" " "
30	" "	14	" " "
31	" "	15	" " "
32	" "	16	" " ALSO
33	" "	17	" MADE " FENCE " FOR SHAFT
34	" "	AUG 23	MANUAL & POWER STRIPPING
35	" "	24	" " "
36	" "	28	" " "
37	" "	29	" " "
38	" "	30	" " "
39	" "	31	TAKING SAMPLES
40	" "	SEPT 1	" "
41	" "	6	CUTTING GRID LINES

Attach additional sheets as required.

Paper

IV. DAILY REPORTS (Summarize work activity in Section I)

Day	Project Area	Date	Work Performed
42	CLAIMS 121380 - 121381	SEPT 7/97	CUTTING GRID LINES
43		12	" " "
44		13	" " "
45		OCT 2	" " "
46		3	" " "
47		OCT 4	HELP MAP WITH SERVICE EXPL.
48		5	" " " " "
49		10	DID MAG. SURVEY
50		11	" " "
51		25	" " "
52		26	" " "
53		NOV. 4	PROPERTY VISIT BY GERHART MEYER GARY GRABOW.
54		JAN 9	REPORT PREPARATION
55		10	" "
56		11	" "
57			
58			
59			
60			

Attach additional sheets as required.

V. SIGNIFICANT RESULTS (please complete)

Project Area	New Showings and/or Anomalies	Commodity	Best Analyses
FARR TWP PROPERTY (1997)	90 METRES OF MAIN VEIN	00.7 OZ 1.64% 3.22% .16%	AG. / T COBALT COPPER NICKEL

(SEE ANNEX E-2)

VI. CLAIMS STAKED DURING/AFTER PROSPECTING ACTIVITY (please complete)

Project Area	Claim Numbers	Number of Claim Units
N/A		

VII. OPTION AGREEMENTS RESULTING FROM OPAP PROJECT (please complete) Dollar Value of

Optionee	Property/Claims	Work Commitment
N/A		

The Ministry of Northern Development and Mines may verify all statements related to and made herein this application.

1. I am the person named in the Final Submission Form under the Ontario Prospectors Assistance Program.
2. I am ordinarily a resident of Canada.
3. I have complied with all the requirements of the said program.
4. I understand that it is an offence under the Ontario Mineral Exploration Act, R.S.O. 1990, to make a false or misleading statement and that all statements and all other information submitted in support of the said application are true and correct.
5. I was not employed by the Mines and Minerals Division of the Ministry while in receipt of the OPAP grant.
6. I am aware that any other Provincial or Federal Government financial assistance received for said application will be deducted from the amount of incurred "Total Eligible Expenses".

It is an Offence under subsection 8(1)(A) of the Ontario Mineral Exploration Act, R.S.O. 1990 to knowingly furnish false or misleading information.

Personal information on this form is obtained under the authority of the Ontario Mineral Exploration Act, R.S.O. 1990, sections 2, 3 and 4 and the Ontario Prospectors Assistance Program Regulation, sections 4, 5 and 6. The financial and technical information will be used for the purpose of determining the eligibility of the applicant to have a program designated for financial assistance and the amount of such assistance. Other information, such as statistical information about the individual projects will be used for the purpose of determining the overall effectiveness of the program. It may be disclosed for those purposes and I consent to its disclosure for such purposes. Questions about this collection should be directed to Senior Manager, Mines Group, Ministry of Northern Development and Mines, 5th Floor, 933 Ramsey Lake Road, Sudbury, Ontario P3E 6B5, Toll free 1-800-265-0834.

Signature of Applicant Roger Dufresne Date JAN 11, 1998

Name (print) ROGER DUFRESNE

Ministry of Natural Resources

Ontario

Ministry of Northern Development and Mines

DATE OF ISSUE

APR 24 1997

LARDER LAKE MINING DIVISION

INDEX TO LAND DISPOSITION

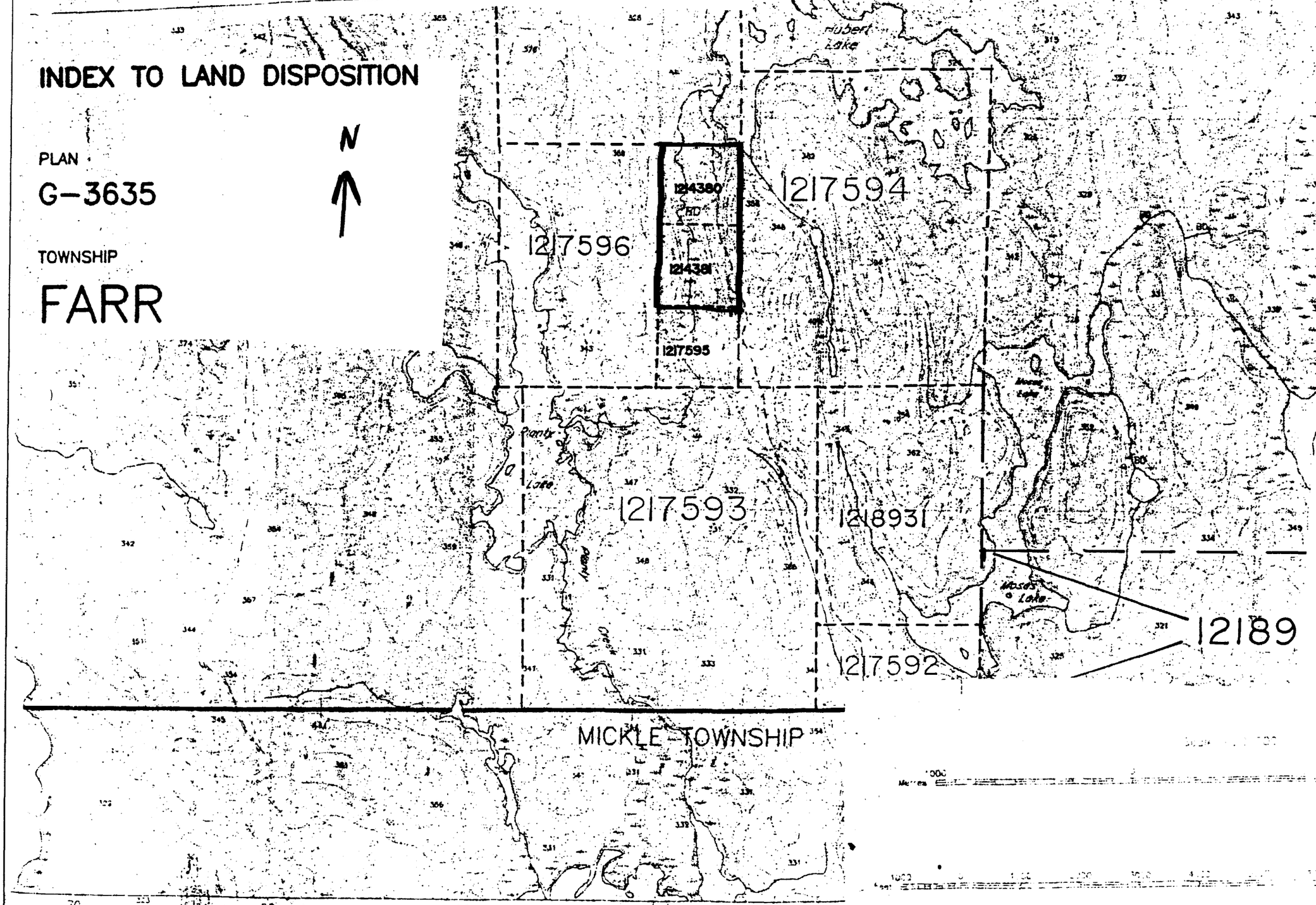
PLAN

G-3635

TOWNSHIP

FARR

N



M.N.R. ADMINISTRATIVE DIST

KIRKLAND LAKE

MINING DIVISION

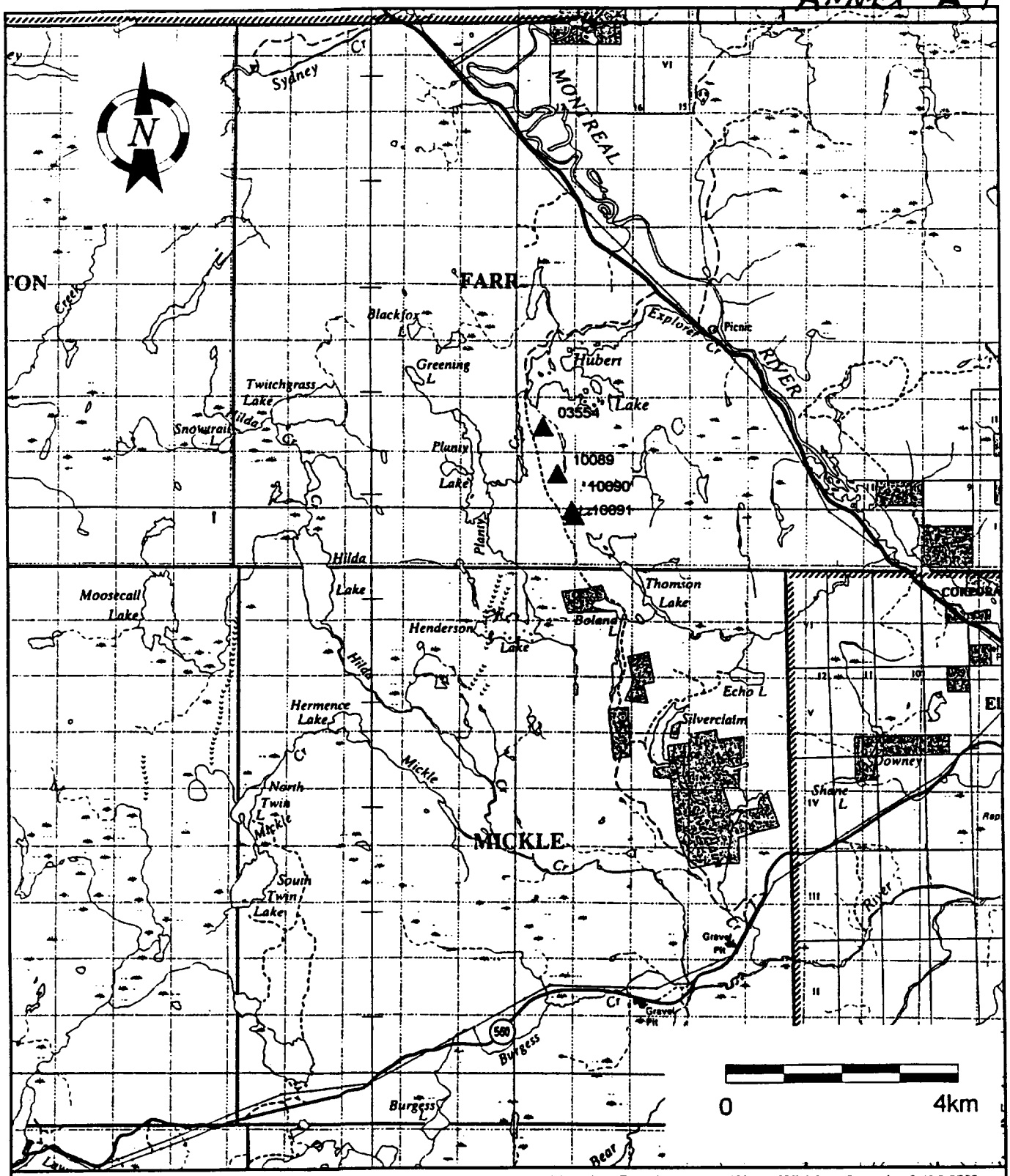
LARDER LAKE

LAND TITLES/REGISTRY DIVIS

TIMISKAMING

ANNEX A

ANNEX A-1



Patrick Chance & Associates
Consulting Geologists
P.O.Box 24090, 601 Dundas Street West, Whitby, Ontario, L1N 8X8
Phone: (905) 668-5442 **Fax:** (905) 668-5470

Ministry of Northern Development & Mines, Mining & Land Management Branch
Abandoned Mines Hazards Abatement Program; Cobalt District Site Inspections

FARR TOWNSHIP

Timiskaming District

LOCATIONS OF MINING-RELATED SITES

Filename - C-FARR.VSD
Last Edit Date - JUNE 8, 1994
Last Plot Date - JUNE 8, 1994

AMIS: 03554 **ROY** **MDI: T 0382**

Lot : 0	Con : 0	1/2 Lot :	1/4 Lot :	Part :	Other :
Datum : NAD 27	Site Easting : 540180mE	Inspection Date	Inspected by : L.D. Burden, B.Sc.		
Zone : 17	Site Northing : 5291680mN	10/5/93	W.G. Zwiers, B.Sc.		

Access: From Elk lake; N. on Hwy 65 for 13.6km; turn left on logging road; proceed for 5.2km; turn left, proceed past dirt piles for 2.4km; turn left, proceed for 200m turn LEFT, proceed for 1.5m.

General comments: B01 roof trusses collapsing; building partially burnt during MNR prescribed burn. Instability of sides would not allow depth sounding of S03.

B01 This observed feature is a headframe constructed of cinder block or brick.

Length (m) 13.50 Width (m) 6.50 Depth/Height (m) 9.50 Azimuth: Dip: Easting: 540180mE Northing: 5291680mN
Protection: Not present. Protection Condition:
Recommendation: Short Term: No remediation be undertaken at the present time. Long term: This feature should be removed from the site.

Rationale: No protection is present and the feature is partially hidden.

F01 This observed feature is a mill foundation constructed of concrete, on grade.

Length (m) 29.00 Width (m) 7.50 Depth/Height (m) Azimuth: Dip: Easting: 540190mE Northing: 5291700mN
Protection: Not present. Protection Condition:
Recommendation: Short Term: No remediation be undertaken at the present time. Long term: This feature should be removed from the site.

Rationale: No protection is present and the feature is partially hidden.

S01 This observed feature is a two-compartment shaft with vertical sides , in bedrock with a timbered collar.

Length (m) 3.00 Width (m) 2.00 Depth/Height (m) Azimuth: Dip: Easting: 540180mE Northing: 5291680mN
Protection: Temporary orange snow fence. Protection Condition: Poor to moderate
Recommendation: Short Term: No additional remediation be undertaken at the present time. Long term: This feature should be secured with a raised 35cm concrete slab (vented) to MNDM specifications.

Rationale: The current protection is inadequate.

S02 This observed feature is a raise to surface , in bedrock with a timbered collar.

Length (m) 2.00 Width (m) 1.00 Depth/Height (m) 22.00 Azimuth: Dip: Easting: 541150mE Northing: 52191710mN
Protection: Filled with run of mine (dump) waste Protection Condition: Poor to moderate
Recommendation: Short Term: This feature should be filled with run of mine (dump) waste. Long term: This feature should be filled with run of mine (dump) waste.

Rationale: The current protection is inadequate.

S03 This observed feature is a prospect shaft with vertical sides , in bedrock without a constructed collar.

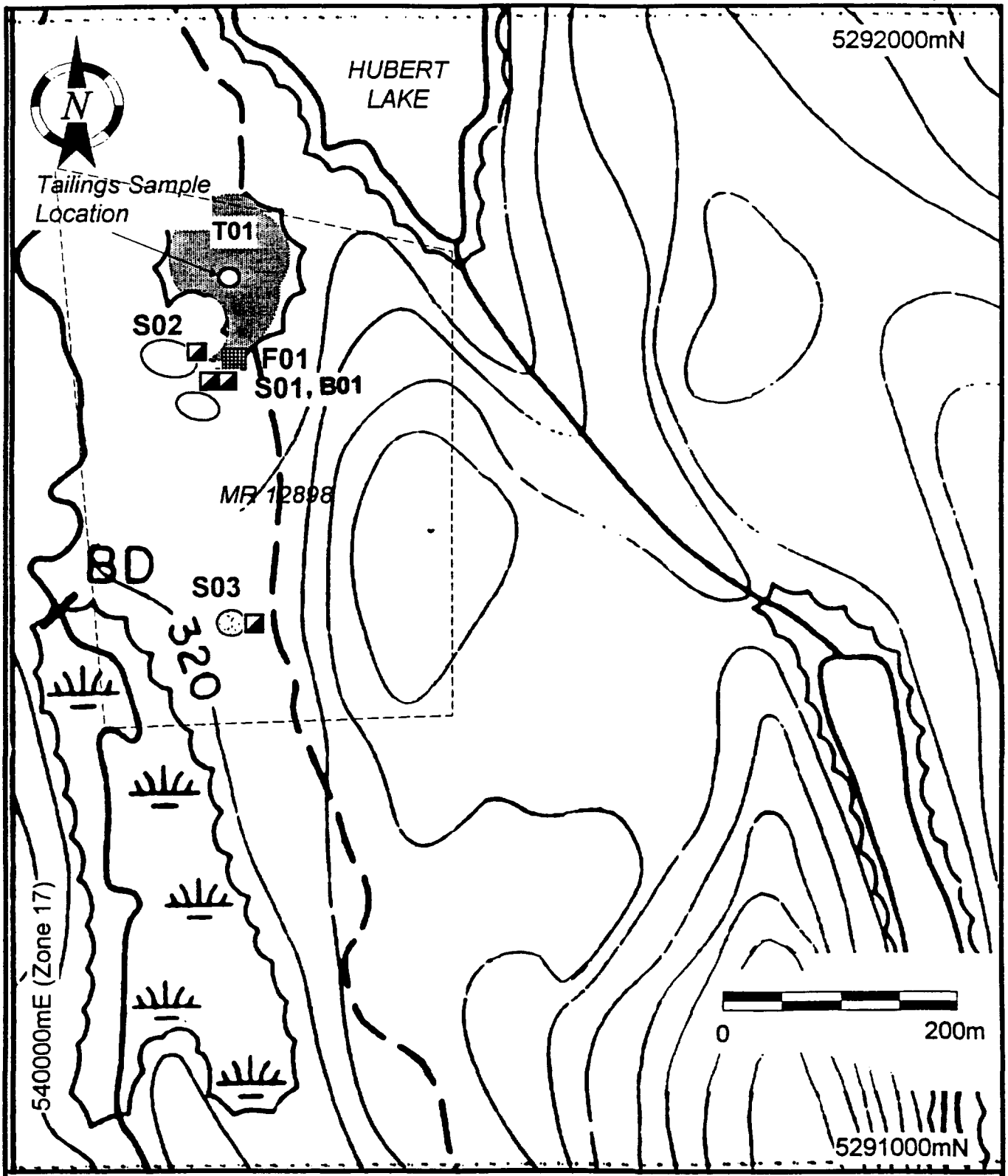
Length (m) 3.50 Width (m) 2.50 Depth/Height (m) 12.00 Azimuth: Dip: Easting: 540210mE Northing: 5291480mN
Protection: Not present. Protection Condition:
Recommendation: Short Term: This feature should be temporarily secured with orange snow fencing assuming permanent protection is budgeted for within the fiscal year. Long term: This feature should be filled with run of mine (dump) waste.

Rationale: No protection is present and the feature is partially hidden.

T01 This observed feature is a tailings pond which is now a free-draining tailings area.

Length (m) 120.00 Width (m) 60.00 Depth/Height (m) 3.00 Azimuth: Dip: Easting: 540190mE Northing: 5291780mN
Protection: Not present. Protection Condition:
Recommendation: Short Term: No remediation be undertaken at the present time. Long term: This feature requires detailed environmental testing and evaluation to determine the proper remediation.

Rationale: No protection is present and the feature is partially hidden.



Patrick Chance & Associates
Consulting Geologists
P.O.Box 24090, 601 Dundas Street West, Whitby, Ontario, L1N 8X8
Phone: (905) 668-5442 **Fax:** (905) 668-5470

Ministry of Northern Development & Mines, Mining & Land Management Branch
Abandoned Mines Hazards Abatement Program; Cobalt District Site Inspections

Site: Roy Silver
Farr Township
Timiskaming District
Lease (MRO)MR 12898
Commodity: Ag-Co
Inspected by: L.D. Burden B.Sc.
G. Zwiers, B.Sc.
AMIS Record: 03554
MDI Record: T0382
Date: 5 Oct 1993

Filename - cfa3554.vsd
Last Edit Date - March 27, 1994
Last Plot Date - March 27, 1994

ANNEX "A-2"

PRODUCT *PRODUIT*	PROVINCE OR TERRITORY *PROVINCE OU TERRITOIRE*	N.T.S. AREA *RÉGION DU S.N.R.C.*	RE. *RÉF.*
COBALT	Ontario	41 P/16	CO 1

NAME OF PROPERTY *NOM DE LA PROPRIÉTÉ*: HUBERT LAKE (TORMONT)

OBJECT LOCATED *OBJET LOCALISÉ*

UNCERTAINTY *FACTEUR D'INCERTITUDE*: (approx.) Lat. *Lat.* 47°47' Long. *Long.* 80°28'

Mining Division *Division minière*	Larder Lake	District *District*	Timiskaming
County *Comté*		Township or Parish *Canton ou paroisse*	Farr
Lot *Lot*		Concession or Range *Concession ou rang*	
Sec *Sect.*	Tp. *Ct.*	R. *R.*	

ANNEX "A-2"

OWNER OR OPERATOR/*PROPRIÉTAIRE OU EXPLOITANT*

Tormont Mines Limited,
Suite 405, 25 Adelaide St. W.,
Toronto, Ont.

DESCRIPTION OF DEPOSIT/*DESCRIPTION DU GISEMENT*

The property is underlain by diabase. East of the claims there is a granite contact, and to the west the diabase is overlain by cobalt sediments. The diabase is part of the main sill which cuts through the South Lorrain, Cobalt, Elk Lake and Gowganda areas. Several narrow calcite veins containing silver-cobalt-copper mineralization have been found on the property.

Associated minerals or products *Minéraux ou produits associés* - Silver, copper.

HISTORY OF EXPLORATION AND DEVELOPMENT
HISTORIQUE DE L'EXPLORATION ET DE LA MISE EN VALEUR

The property, until recently consisted of 4 claims, MR 12898-12900 and MR 14960, located on the west shore of Hubert Lake 7 miles west of the town of Elk Lake. Three shafts were sunk here about 1912.

On claim MR 12898, shaft No. 1 inclined at 80°, was sunk 76 feet on a calcite vein 7 to 8 inches wide. The vein, which was opened on surface for about 175 feet, strikes northeast and contained cobalt bloom, bornite and chalcopyrite. No. 2 shaft, located on claim 12899, was sunk vertically to a depth of 125 feet. A sample from a 4 inch calcite vein about 8 feet below the collar is reported to have assayed 3,562 oz/ton silver. Shaft No. 3, located on the same vein about 175 feet to the south of No. 2 shaft, is vertical and is about 100 feet deep.

Following early development, the property remained idle until leased by Roy Silver Mines Limited in 1950. In the spring of 1952, the company moved its mining plant from the Haultain shaft in Haultain township and erected it on the No. 1 shaft. During the year the shaft was deepened to 120 feet and a level established on the 66 foot horizon from which 87 feet of drifting and 72 feet of crosscutting were carried out. On surface 22 holes, totalling 2,741 feet, were diamond drilled.

In 1953 operations continued throughout the year. The No. 1 shaft was deepened to 290 feet and 2 new levels established at 135 and 205 feet. Eight holes, totalling 835 feet, were diamond drilled from surface and 10 holes, totalling 1,178 feet from underground. Some 2,209 tons of development ore was stockpiled.

During 1954 the main shaft was deepened to 390 feet and a new level established at 300 feet. Diamond drilling consisted of 2 holes from surface, totalling 105 feet. A total of 3,007 tons of cobalt ore was mined. An 80-ton flotation mill for the production of cobalt-copper concentrates was completed early in the year and operated from Feb. 16 to May 18 when all work on the property ceased. During this period 2,472 tons of ore was treated.

see Card 2 ....

F 500465 *

HISTORY OF PRODUCTION/*HISTORIQUE DE LA PRODUCTION*

In Apri 1954 a carload of cobalt-copper concentrate, said to average better than 7% cobalt and 6% copper, was shipped.

Temiskaming Testing Laboratories records that the leasees produced 1,084 ozs of silver in 1964; again in 1966 they report 804 ozs silver.

MAP REFERENCES/*RÉFÉRENCES CARTOGRAPHIQUES*

Map 64 A, Gowganda Mining Division and Vicinity, (Geol.), Sc. 1":1 mile.

Map 2046, Timmins-Kirkland Lake Sheet, (Geol. 1964), Sc. 1": 4 miles.

Map 41 P/16, Charleton Station, (Topo.), Sc. 1:50,000.

Map 288 G, Charleton Station, (Aeromag.), Sc. 1":1 mile.

REMARKS/*REMARQUES*

Comp./Rev. By *Comp./rév. par*							
Date *Date*	10-63	08-69					

REFERENCES/*BIBLIOGRAPHIE*

Annual Reports, Dept. of Mines, Ont.: Vol. 62, 1953, Pt. 2, p 115; Vol. 63, 1954, Pt. 2, p. 137; Vol. 64, 1955, Pt. 2, p. 132.

Mineral Policy Sector; Corporation File^ "Tormont Mines Limited".

Mineral Policy Circular #10, Ont. Dept. of Mines, 1968, p. 343.

MDIR; T 0382

PRODUCT *PRODUIT*	PROVINCE OR TERRITORY *PROVINCE OU TERRITOIRE*	N.T.S. AREA *RÉGION DU S.N.R.C.*	REF. *RÉF.*
COBALT	Ontario	41 P/16	CO 1

NAME OF PROPERTY *NOM DE LA PROPRIÉTÉ*: HUBERT LAKE (TORMONT)

HISTORY OF EXPLORATION AND DEVELOPMENT (continued)
HISTORIQUE DE L'EXPLORATION ET DE LA MISE EN VALEUR

Recorded development consists of the following:

	Drifting				Crosscutting				Raising			
~~Level~~	1952	1953	1954	Total	1952	1953	1954	Total	1952	1953	1954	Total
66'	87'		20'	107'	72'		20'	92'	-		94'	94'
135'		67'		67'		70'		70'		18'		18'
205'		329'	42'	371'		110'		110'				
300'							98'	98'		117'		117'

In March 1955 Roy Silver Mines was reorganized and renamed Tiara Mines Limited. In August 1961 another reorganization took place and the company was renamed Tormont Mines Limited. In the fall and winter of 1962-63 the company staked 26 claims surrounding the original 4 leased claims.

ANNEX A-

Client: 127749 - DUFRESNE ROGER J. Total Claims:

Township: ALMA

	Claim Number	Recording Date	Due Date	Claim Status	Percent /Option	Work Required	Work Applied	Total Reserve	Cla Ba
L	1096959	1989-JUL-31	2000-JUL-31	A	100.00	360	4,040	0	1,6

Township: CAIRO

	Claim Number	Recording Date	Due Date	Claim Status	Percent /Option	Work Required	Work Applied	Total Reserve	Cla Ba
L	1179885	1991-SEP-05	2002-SEP-05	A	100.00	400	3,600	0	
L	1179886	1991-OCT-17	2003-OCT-17	A	100.00	400	4,000	0	
L	1179887	1991-OCT-17	2001-OCT-17	A	100.00	130	3,470	0	
L	1179888	1991-OCT-17	2001-OCT-17	A	100.00	400	3,200	0	
L	1179889	1991-OCT-17	2001-OCT-17	A	100.00	400	3,200	0	
L	1179890	1991-OCT-17	2001-OCT-17	A	100.00	400	3,200	0	
L	1185634	1991-OCT-17	2001-OCT-17	A	100.00	400	3,200	0	
L	1185635	1992-JUN-09	2002-JUN-09	A	100.00	400	3,200	0	
L	1185636	1992-JUN-09	2001-JUN-09	A	100.00	400	2,800	0	

Township: FARR

	Claim Number	Recording Date	Due Date	Claim Status	Percent /Option	Work Required	Work Applied	Total Reserve	Cla Ba
L	1214380	1996-JUN-05	1998-JUN-05	A	100.00	400	0	0	
L	1214381	1996-JUN-05	1998-JUN-05	A	100.00	400	0	0	

Township: FLAVELLE

	Claim Number	Recording Date	Due Date	Claim Status	Percent /Option	Work Required	Work Applied	Total Reserve	Cla Ba
L	1046206	1988-OCT-31	1999-OCT-31	A	100.00	360	4,040	360	1,2
L	1046649	1989-JAN-09	2000-JAN-09	A	100.00	372	4,028	579	
L	1046650	1989-JAN-09	2001-JAN-09	A	100.00	360	4,440	484	
L	1046651	1989-JAN-09	2000-JAN-09	A	100.00	360	4,040	349	
L	1096955	1989-MAY-02	2000-MAY-02	A	100.00	360	4,040	354	1,2
L	1096958	1989-AUG-14	1999-AUG-14	A	100.00	360	3,640	365	1,6
L	1112013	1989-AUG-14	1999-AUG-14	A	100.00	360	3,640	315	1,6
L	1112016	1989-AUG-14	1999-AUG-14	A	100.00	360	3,640	412	1,6
L	1137323	1990-MAR-21	2000-MAR-21	A	100.00	360	3,640	0	
L	1137324	1990-MAR-21	2000-MAR-21	A	100.00	360	3,640	0	
L	1137325	1990-MAR-26	2000-MAR-26	A	100.00	360	3,640	4,949	
L	1137326	1990-MAR-21	2000-MAR-21	A	100.00	360	3,640	0	
	1137327	1990-MAR-26	2000-MAR-26	A	100.00	360	3,640	358	
L	1137328	1990-MAR-26	2000-MAR-26	A	100.00	360	3,640	239	
L	1145867	1990-MAR-26	2001-MAR-26	A	100.00	374	4,026	242	
L	1205842	1995-FEB-21	2000-FEB-21	A	100.00	400	1,200	201	

Ontario Northern Development and Mines

0 1000 2000 m
1:43483

97/03/19-15:32-afri4- Train Two
Sheet North 1 of 1, East 1 of 1
UTM zone 17 NAD 27

ERLIS DATABASES

Assessment Files

- Airborne Geophysics
- Ground Geophysics
- Geology
- Geochemistry
- Diamond Drilling

Physical

- Other

Selected Feature

Publications

- Bedrock Geology
- Energy
- Geochemistry
- Geophysics

Mineral Deposits

- Surficial Geology
- Miscellaneous

Selected Feature

Mineral Deposits

- Discretionary Occurence
- Occurence
- Prospect
- Developed Prospect Without Reserves
- Past Producing Mine Without Reserves
- Developed Prospect With Reserves
- Past Producing Mine With Reserves
- Producing Mine

Drill Holes

Diamond Drill Hole

- Wedged Diamond Drill Hole
- Overburden Drill Hole (Auger, Wacker)
- Percussion Drill Hole
- Reverse Circulation (Sonic)
- Underground Drilling
- Other

Rotation of Symbol Denotes Azimuth (e.g. 90)

Topographic

- Levee/Dyke
- Inland Water
- Rivers and Streams
- Major roads
- Minor roads
- Rail Line

Lithogeochemistry

Station Samples = 1

Station Samples > 1

SMY

FAR

MONTREAL

Twitchgrass Lake

Planty Lake

Hilda Lake

Hubert Lake

Moses Lake

MD141P16SW00003

16SW0002

16SW0003

MD141P09NW00034

0382	ROY	T	FARR	47|46`59"	80|27`47"

ANNEX "E"

DEPOSIT NAME: ROY UPDATE DATE:91/02/01 [Screen 1]

DISTRICT:	T	MDI #:	T 0382
NTS:	41P16SW	UTM ZONE:	17
LATITUDE:	47°46`59"	NORTHING:	5292129
LONGITUDE:	80°27`47"	EASTING:	540162
TOWNSHIP:	FARR		

	COMMODITY	STATUS	GRP
	QUALIFIER		
1.	AG	PRINC PAST PROD	M
2.	CO	MINOR PAST PROD	M
3.	CU	MINOR PAST PROD	MB

REFERENCES: OGS 1955, AR VOL 64 PT 2, P132-133
REFERENCES: NMI FILE, 41P/16 CO 1
REFERENCES: OGS 1968, MRC 10, P343
REFERENCES: AFCO c1955 ROY SILVER M FILE 1&2
REFERENCES: AFCO 1963 TORMONT;

DEPOSIT NAME: ROY UPDATE DATE: 91/02/01 [Screen 2]

DISTRICT:	T	MDI #:	T 0382
NTS:	41P16SW	UTM ZONE:	17
LATITUDE:	47°46`59"	NORTHING:	5292129
LONGITUDE:	80°27`47"	EASTING:	540162
TOWNSHIP:	FARR		

ENTITY CODED: S
DEPOSIT STATUS: PAST PROD
RES.GEOL.AREA: CO
MINING AREA:

HOW/POINT LOCATED: G / `L` OF `HUBERT L` JUST S OF 2ND `R` IN `FARR`
MAP REFERENCE: OGS 1962, P159 ELK LAKE - NEW LISKEA SCALE: <150000

ALTERNATE NAME:TIARA
ALTERNATE NAME:TORMONT
ALTERNATE NAME:HUBERT LAKE

DEPOSIT NAME: ROY UPDATE DATE 91/02/01 [Screen 3]

DISTRICT: T MDI #: T 0382
NTS: 41P16SW UTM ZONE: 17
LATITUDE: 47°46'59" NORTHING: 5292129
LONGITUDE: 80°27'47" EASTING: 540162
TOWNSHIP: FARR

MINERALS
1. SLVR
2. COAS
3. CLCP
4. BRNT

MILL CAPACITY: DEPTH OF WORKING: 119
MINING METHOD: RESERVES:

DEPOSIT NAME: ROY UPDATE DATE 91/02/01 [Screen 4]

DISTRICT: T MDI #: T 0382
NTS: 41P16SW UTM ZONE: 17
LATITUDE: 47°46'59" NORTHING: 5292129
LONGITUDE: 80°27'47" EASTING: 540162
TOWNSHIP: FARR

ROCK CLASS	ROCK GROUP CODE	ROCK NAME	ERA	SUPERGROUP	GROUP	FORMATION	RELATION TO DEPOSIT

ANNEX "B-11"

AS OF: 17/02/1997

LOCATION REPORT
MINERAL DEPOSIT INVENTORY
MINISTRY OF NORTHERN DEVELOPMENT AND MINES

Single Location MDI No

MDI NO: MDI41P16SW00003

MDI NO: MDI41P16SW00003 **DEPOSIT NAME:** HUBERT LAKE

ROY

LAT DEGREE	LAT MINUTES	LAT SECONDS	LNG DEGREE	LNG MINUTES	LNG SECONDS	UTM ZONE	UTM EAST	UTM NORTH	UTM DATUM
47	46	59.00	-80	27	47.00	17	540162.000	5292129.000	NAD27

ANNEX "B-11"

COMMODITIES
SILVER (P)
COBALT (S)
COPPER (S)

TOWNSHIP AREA NAME	CONCESSION	LOT	SECTION	LEGAL DESCRIPTION
FARR	NA	NA		

STATUS
PAST PRODUCING MINE WITHOUT RESERVES

OLD MDI NO	NMI NO	SMDR NO	AMIS NO
T 0382			

LOCATION POINT: G
CLAIM MAP NO:
RES GEOL DISTRICT: COBALT

LOCATION METHOD: CONVERSION FROM MDI

MAP POINT TAKEN: OGS 1962, P159 ELK LAKE - NEW LISKEARD SHEET
MAP SCALE: >125,000 <150,000
MAP ACCURACY:

ACCESS DESCRIPTION
N/A

CREATED BY: Unknown, 20/08/1982

REVISED BY: Unknown, 22/01/1996
ORGANIZATION AFFILIATION: Converted from the original MDI

****** END OF REPORT *****

BIBLIOGRAPHY REPORT
MINERAL DEPOSIT INVENTORY
MINISTRY OF NORTHERN DEVELOPMENT AND MINES

Single Publication No

MDI NO: MDI41P16SW00003

MDI NO: MDI41P16SW00003 DEPOSIT NAME: HUBERT LAKE

ROY

LAT DEGREE	LAT MINUTES	LAT SECONDS	LNG DEGREE	LNG MINUTES	LNG SECONDS	UTM ZONE	UTM EAST	UTM NORTH	UTM DATUM
47	46	59.00	-80	27	47.00	17	540162.000	5292129.000	NAD27

COMMODITIES

SILVER (P)
COBALT (S)
COPPER (S)

TOWNSHIP AREA NAME	CONCESSION	LOT	SECTION	LEGAL DESCRIPTION
FARR	NA	NA		

REFERENCE/PUBLICATION INFORMATION

REFERENCE NO: 1 PUBLICATION/REFERENCE NAME: PUBLICATION FORMAT: B REFERENCE DATE: 25/01/1996
AUTHOR OF PUBLICATION:
PUBLICATION DESCRIPTION/TITLE: AFCO 1963 TORMONT;
MAP SCALE:
SOURCE OF PUBLICATION:

REFERENCE NO: 2 PUBLICATION/REFERENCE NAME: PUBLICATION FORMAT: B REFERENCE DATE: 25/01/1996
AUTHOR OF PUBLICATION:
PUBLICATION DESCRIPTION/TITLE: AFCO c1955 ROY SILVER M FILE 1&2
MAP SCALE:
SOURCE OF PUBLICATION:

REFERENCE NO: 3 PUBLICATION/REFERENCE NAME: PUBLICATION FORMAT: B REFERENCE DATE: 25/01/1996
AUTHOR OF PUBLICATION:
PUBLICATION DESCRIPTION/TITLE: NMI FILE, 41P/16 CO 1
MAP SCALE:
SOURCE OF PUBLICATION:

REFERENCE NO: 4 PUBLICATION/REFERENCE NAME: PUBLICATION FORMAT: B REFERENCE DATE: 25/01/1996
AUTHOR OF PUBLICATION:
PUBLICATION DESCRIPTION/TITLE: OGS 1955, AR VOL 64 PT 2, P132-133
MAP SCALE:
SOURCE OF PUBLICATION:

BIBLIOGRAPHY REPORT
MINERAL DEPOSIT INVENTORY
MINISTRY OF NORTHERN DEVELOPMENT AND MINES

REFERENCE/PUBLICATION INFORMATION

REFERENCE NO: 5 **PUBLICATION/REFERENCE NAME:** **PUBLICATION FORMAT:** B **REFERENCE DATE:** 25/01/1996

AUTHOR OF PUBLICATION:

PUBLICATION DESCRIPTION/TITLE: OGS 1968, MRC 10, P343

MAP SCALE:

SOURCE OF PUBLICATION:

CREATED BY: Unknown, 20/08/1982

REVISED BY: Unknown, 22/01/1996

ORGANIZATION AFFILIATION: Converted from the original MDI

****** END OF REPORT *****

ANNEX-B-2

MINISTRY OF NATURAL RESOURCES
ONTARIO GEOLOGICAL SURVEY
GEOSCIENCE DATA CENTRE

MINERAL DEPOSIT
INVENTORY RECORD (MDIR)

DEPOSIT NAME ROY

DISTRICT	TIMISKAMING	MDIR #	T 0382	NTS EXT	TOWNSHIP EXT
NTS	41P/16SW	SMDR #		NTS EXT	TOWNSHIP EXT
TOWNSHIP	FARR	UTM ZONE	17	NTS EXT	TOWNSHIP EXT
LATITUDE	47° 46' 59"	NORTHING	5292101	NTS EXT	TOWNSHIP EXT
LONGITUDE	80° 27' 47"	EASTING	540227		

ENTITY CODED SIMPLE
POINT LOCATED "L" OF "HUBERT L" JUST S OF 2ND "R" IN "FARR"
HOW LOCATED GENERAL
MAP REFERENCE OGS 1962, P159 ELK LAKE - NEW LISKEARD SHEET
DEPOSIT STATUS PAST PRODUCER
MAP SCALE F
RECORD DATE AUG 20, 1982

	COMMODITY	QUALIFIER	STATUS
1	AG	MAJOR	PAST PRODUCER
2	CO	MINOR	PAST PRODUCER
3	CU	MINOR	PAST PRODUCER
4			
5			
6			
7			
8			
9			
10			
11			
12			

	REFERENCES
1	OGS 1955, AR VOL 64 PT 2, P132-133
2	OGS 1968, MRC 10, P343
3	NMI FILE, 41P/16 CO 1
4	
5	
6	
7	

	ALTERNATE NAMES
1	TIARA
2	
3	
4	
5	
6	
7	

LEGEND

ENTITY CODED

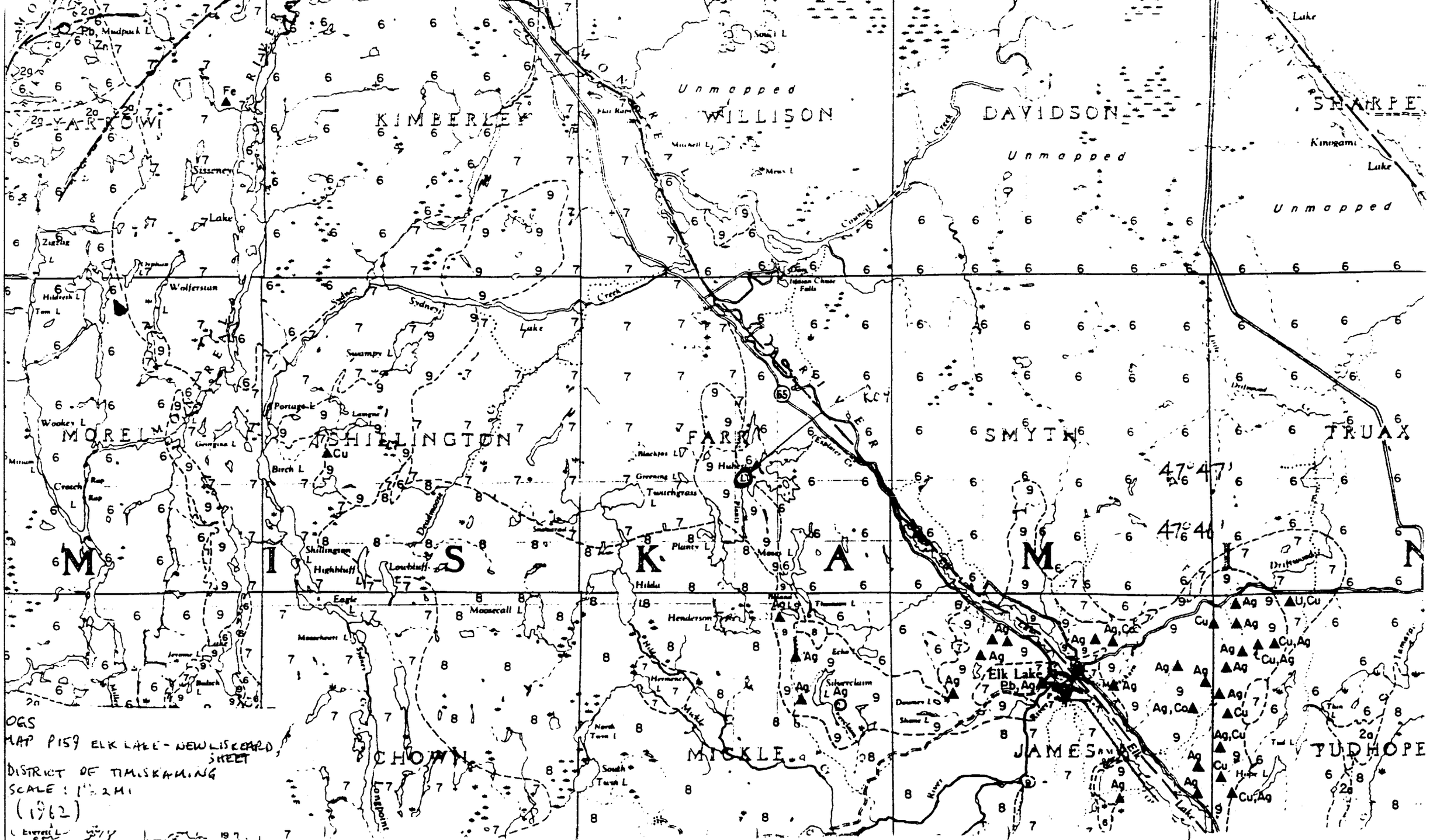
SIMPLE - A single body of mineralization.
COMPOUND - More than one body of mineralization.
PARTIAL - A single body of mineralization under two or more managements and thus split into two or more records.

HOW LOCATED

PRECISE - A clearly defined point at the deposit on published map showing latitudes and longitudes.
TRANSFER - Same as above but map lacks latitudes and longitudes; either geographic grid or point was transferred from or to another map respectively.
GENERAL - Point not at the deposit or location inferred from written or verbal descriptions.

MAP SCALE

CODE	RANGE (Map Scale)	IMPERIAL SCALE
A	≤12,000	1000 FT (12,000)
B	>12,000 ≤ 25,000	1/4 MI (15,840)
C	>25,000 ≤ 50,000	1/2 MI (31,680)
D	>50,000 ≤ 100,000	1 MI (63,360)
E	>100,000 ≤ 125,000	
F	>125,000 ≤ 150,000	2 MI (126,720)
G	>150,000 ≤ 200,000	
H	>200,000 ≤ 250,000	
I	>250,000 ≤ 300,000	4 MI (253,440)
J	>300,000 ≤ 500,000	
K	>500,000	


KIMBERLEY
WILLISON
DAVIDSON
SHARPE
YARROW
MORELAND
ASHBURNHAM
FARR
SMYTH
TRUAX
MISKAMI
CHOWN
MICKLE
JAMES
TUDHOPE
Unmapped
Elk Lake
47°47'
47°40'
OGS
MAP P159 ELK LAKE - NEW LISKEARD, SHEET
DISTRICT OF TIMISKAMING
SCALE: 1" = 2 MI
(1962)

ANNEX C

Cobalt demand to rise

Commentary

World demand for cobalt could increase to about 28,000 tonnes per year in 2000, up from 23,500 tonnes in 1995. This demand should remain stable, and could increase further if the price of cobalt remains relatively low.

Increased production of nickel-metal hydrides (NiMH) and lithium-ion (Li-ion) batteries in Japan has led to an increased demand for cobalt in that market. Manufacturers of superalloys remain the largest consumer of the metal, accounting for about 27% of the total. In 1995, the battery market accounted for only 3% of cobalt demand.

The production of Li-ion batteries in Japan, which started in 1993, increased 300% in 1994 and 167% in 1995. The production of NiMH batteries rose 184% in 1994 and 50% in 1995.

Li-ion batteries generate 3.6 volts — three times higher than other types, including NiMH batteries. Since Li-ion batteries also have a higher energy density and weigh less, they are more suitable for portable electronic devices such as mobile phones. NiMH batteries generate 1.2 volts — the same as nickel-cadmium (NiCd) batteries — but perform better. NiMH batteries, however, easily replace NiCd batteries, and have been creeping into the NiCd market.

Since the demand for portable electric devices is expected to increase 18-21% per year by 2000, the demand for NiMH and Li-ion batteries will also increase. Over the next 4-5 years, demand for Li-ion batteries could increase as much as 13-fold over current levels. Demand for NiMH will double over the same period, whereas demand for NiCd batteries will decrease as they are replaced with the next generation of batteries.

Japanese electronics firm Sony is the market leader in the production of Li-ion batteries and is planning an expansion before 2000, as is Matsushita, another Japanese electronics company. Should production of Li-ion batteries expand as planned, total capacity will exceed demand after 1997. As a result, competition would increase and prices would drop. Producers would then be forced to lower costs as margins narrow.

According to Yano Economic Research, a Japanese research company, prices for Li-ion batteries are expected to fall by 38% by 2000, mainly due to decreased costs for raw materials and improved productivity. Prices for NiMH and NiCd batteries are also expected to decrease, though Li-ion batteries will remain more expensive than their competitors.

Assuming that the lithium cobalt oxides used in Li-ion batteries will not be replaced with lithium nickel or manganese oxides (both of which have lower production costs but poorer performance), cobalt demand for batteries (including the NiMH type) will grow to 2,500 tonnes by the year 2000 from 700 tonnes in 1995. Should the market continue to grow at its current rate, demand could increase to 4,000 tonnes.

The demand for cobalt in other markets will also increase, or at least remain steady. Such markets include:

- ☐ superalloys in the aircraft industry, where cobalt demand could reach 7,000 tonnes by 2000;
- ☐ hardfacing and other alloys, including low-expansion material and high-speed steel, where the demand for cobalt will grow modestly to 1,800 tonnes by the year 2000, up from 1,650 tonnes in 1995;
- ☐ aluminum-nickel-cobalt and samarium cobalt magnets, where demand for the metal will increase modestly to 2,600 tonnes by 2000;
- ☐ the oil industry, where a possible expansion could raise the demand for cobalt in catalysts to 2,800 tonnes by 2000;
- ☐ colors, where the demand for cobalt will remain steady at 3,100 tonnes over the short term;
- ☐ sulphates, including anodizing, recording and electrolysis, where cobalt demand will remain steady at about 1,500 tonnes, the same figure as in 1995; and
- ☐ organic cobalt compounds, such as tire adhesives and soaps, where cobalt demand is expected to rise to 3,000 tonnes by 2000.

— The preceding is an excerpt of an article originally published in "Cobalt News," the publication of British-based Cobalt Development Institute.

Cobalt and Its Uses

There are only five known deposits of cobalt in the world either being worked or suitable for working at present — these at Cobalt, Ontario, the Belgium Congo, Rhodesia, Morocco and Missouri. While the United States is the greatest user of cobalt in the world, it produces only about 2% of its requirements from the Missouri deposits which are reputed to be a very low grade.

One of the most rapid increases in the uses of cobalt in recent years is in high-speed tool steels. In the United States alone there are upwards of 75 different types of cobalt high-speed tool steels where it has been amply demonstrated that the addition of cobalt to steel in quantities which may run as high as 15 - 35 per cent although lesser percentages are more common, raises the elastic limit of steel and its tensil strength increased up to 30%. Addition of cobalt also increases the hot hardness which permits cutting at higher speeds and machining of harder materials.

Since the war there is an enormous demand for new type high-speed tools, not alone in the United States but throughout the world in order to meet the mass demand for automobiles, new homes, household appliances, etc. Into this picture cobalt must inevitably step. Indeed in the whole metallic world, the demand for cobalt will be enormous.

SUPERIOR TO NICKEL: Pre-eminence of cobalt for plating purposes is also claimed by many authorities. It is claimed that:

(1) Cobalt may be plated from 4 to 15 times faster than nickel.

(2) Cobalt plating is harder than ordinary nickel plating.

(3) About one-fourth the weight of cobalt as compared with nickel is required to do the same protective work.

(4) Cobalt may be plated on brass, iron, steel, copper, tin, German silver, lead and Britannia metal.

Cobalt is in Great Demand as a Reagent

THAT IS: Something that produces reaction a substance employed to detect the presence of other properties in a compound. In this regard its uses are very numerous and large quantities of cobalt are required — and as an ingredient:

(1) Used extensively cemented with tungsten. This is the hardest artificial substance known, with the exception of sapphire, and approaches the diamond in hardness. Tungsten cobalt tools of good grade will easily cut chilled castings, manganese steel, porcelain, mycalex, ivory, quartz and other substances not readily cut with other tools.

(2) Used as a filament for electric lamps. The filament is made from a solution of cellulose, with zinc chloride, COBALT OXIDE and manganese sulphate. It is heated to incandescence for 24 hours and then coated with carbon.

(3) Gauges used for inspection of various war articles, as shells, etc., wea so that after about 300 tests, they are no longer reliable. When tippe with this alloy, only costing about five time as much, they will giv accurate results up to 35,000 - 50,000 tests.

(4) Electrical furnaces are now used extensively in the smelting of variou ores. Alloys of cobalt, chromium and aluminum are now employed i making resistance elements of the best grade. They are used to operat furances for long periods at temperatures reaching 1300°C.

(5) For producing lustrous coating on chinaware, porcelains and potteries Used as a pigment or colouring agent to produce a blue colour. In thi regard alone it is estimated that the consumption is in excess of ou whole production.

(6) For producing lustrous effects on glassware.

(7) In knitting machines, the steel needles wear, making imperfect articles The needles are now made of this metal and last 10 to 20 times as lon as the steel needles did.

(8) The balancing tips on weighing scales, wear and give inaccurate result —replaced by this metal, lasts years.

(9) In making oilcloth and linoleum varnish and lacquer coatings. (Adde to prevent the yellowing of the product.)

(10) As a bleaching agent and drier in making lacquer, paints and varnishes

(11) As a drier in making clear paints, enamels, lacquers and varnishes. W know of a Paint and Varnish Comany — one of the smaller — whic buys 3,500 lbs. a month of **Cobalt Sulphate.** Cobalt Sulphate contain between 34% - 36% Cobalt Metal for which they pay $2.35 per pound 35% of 3,500 lbs. a month equals 1,225 pounds. Per year equals 14,70 lbs. @ $2.35, equals $34,545.00.

(12) As an ingredient of compositions used to produce waxed fabrics withou changing the colours dyed thereon.

(13) In reclaiming rubber.

(14) In treating felt and furs.

(15) The starting point in making films.

(16) As an ingredient of motor fuels to improve their combustion.

(17) As an ingredient of sympathetic inks.

(18) As a reagent in aromatics and synthetic dye stuffs.

(19) **Other Uses:** An amalgam of cobalt is used in dentistry. Cobalt is use in thermocouples as it does not become brittle like nickel and gives high electromotive force.

(20) In salt form cobalt helps to make gasoline from coal — a process likel to increase vastly.

ANNEX "C-1"

(21) It is used in the manufacture of rotating fins of jet propelled and gas turbine engines.

(22) Cobalt has been used recently in connection with the development of atomic energy for peace-time purposes. Scientific research has proven cobalt retains its radioactivity longer than any other known substance other than radium itself. It is being used for therapeutic purposes in making radio-active chemicals, such as radio-active iodine, etc.

(23) Following are two interesting and important articles published in the press regarding the scientific use of Cobalt:

"DEVELOPING SYNTHETIC RADIUM TO AID CANCER TREATMENT — U.K."

London, Dec. 12 — (INS) — A leading British scientist disclosed today that atomic physicists have developed synthetic radium for supplementary use in the treatment of such diseases as cancer.

Prof. J. D. Cockroft, director of Britain's atomic energy research project, revealed COBALT can be endowed with radioactivity by submerging it in an atomic "pile" for a month. He said the resulting element is equal to that of the largest radium source now available to medicine."

"RADIOACTIVE TEST LIKELY FOR CANCER"

"Atlantic City, N.J. — June 10th — (AP) — Radioactive COBALT, gold and tantalum — fabricated into "needles" and other forms for insertion into cancerous tissue, and having up to 10 times the penetrating power of radium — may become available for experimental use in from six months to a year.

Dr. Stafford Warren of the school of medicine of the University of California, told a reporter today at the American Medical Association's centennial convention that such materials when ready for use would also be easier to handle and prepare than radium, and much cheaper."

FROM INFORMATION CONSIDERED RELIABLE IT IS FORECAST COBALT WILL SOON COMMAND MUCH HIGHER PRICES

FEATURED BY:

MAYFAIR MINES, LIMITED

Suite 403 — 156 Yonge Street
TORONTO, ONTARIO

Mine Location:
COBALT, ONTARIO

Northern Office:
HAILEYBURY, ONTARIO

COBALT AND ITS USES

IN RECENT YEARS — COBALT HAS BECOME A VERY IMPORTANT MINERAL IN THE ADVANCEMENT OF INDUSTRY, SCIENCE and MEDICINE.

ANNEX "C-2"

The Northern Miner

Vol. 83 No. 19 Since 1915 NORTH AMERICA'S MINING NEWSPAPER July 7, 1997 $1.75 +GST

Cobalt demand on rise as prices expected to fall

Battery sector becomes fastest-growing market

Higher prices for cobalt have led to increased production, and demand is expected to grow still further, according to a report released by a London-based firm of analysts.

Roskill Information Services notes that prices rose to a peak of US$30 per lb. in the early 1990s from US$10 per lb. in the late 1980s. The increase is attributable to higher demand and to a drop in supply from Zambia and Zaire.

Higher prices, however, have led to the development of new cobalt projects, which are expected to depress prices and bring about greater market stability. By the end of the decade, demand is projected to increase by 3% to 3.5% per year. Cobalt prices dropped steadily throughout 1996, reaching a low of about US$19 per lb., only to rise to US$25 per lb. as a result of supply fears stemming from political turmoil in the former Zaire. Prices are estimated to drop to about $US10 per lb. by 2000.

World demand for cobalt was strong in 1996 and is likely to remain so for the remainder of 1997. The growth has been led by the superalloys sector, the largest consumer of cobalt and a supplier of the aerospace industry. Commercial jet production in the late 1990s is expected to grow by an average of 7% per year.

The battery sector is expected to grow at a faster rate than any other cobalt market over the next five years. Consumption of cobalt in batteries was estimated at between 800 and 1,000 tonnes in 1996 but could reach 4,000 tonnes by 2000. The increased demand is being spurred by the wider use of personal electronics, including cellular phones and portable computers, which require lightweight and easily rechargeable batteries.

World production of refined cobalt rose to 30,000 tonnes in 1996 after falling to 19,000 tonnes in 1993. Production of refined cobalt rose in Canada, Finland and Norway. In Canada and Norway, production has risen by 70% since 1990.

10-821

Haultain & Nicol Tp

10821

ANNEX "D"

CYLINDROIDAL JOINTING IN DIABASE AT GOWGANDA, ONTARIO

By P. R. EAKINS[1]

ABSTRACT

Large nests of joints of cylindroidal form with rounded cigar-shaped terminations are unique, if minor, features of the geology of the Nipissing diabase sheet of the Gowganda area of Ontario. They appear to have formed around centres of cooling and contraction well separated from one another so that the more common hexagonal joint columns did not result through mutual interference.

INTRODUCTION

Large nests of cylindroidal joints are remarkable, minor features of the geology of the Gowganda area of Ontario, occurring in a thick sheet of Nipissing diabase and in later vertical diabase dykes. The cylindroidal joints form striking curved surfaces in many of the underground openings of the silver mines of the Gowganda camp.

Five- and six-sided columnar joint blocks are common structures in numerous bodies of diabase and basalt all over the world. Cylindroidal joint blocks occur more rarely, and the nested arrangement appears to be unique. The Gowganda cylindroidal joints received only passing mention in the reports on the Gowganda area by Burrows (1926) and Moore (1956).

Numerous observations of the cylindroidal joints were made by the writer in outcrop during the summer field season of 1959. The unique and striking character of the joints is, however, only properly revealed in underground openings. Unfortunately, due to limitations of time, only a few visits to the mines were possible, and the joint structures were not studied with all the care and attention to detail desirable. This report is a preliminary statement offered in the hope of stimulating detailed investigations of these unique structures at Gowganda, and their discovery and study elsewhere in the world.

ACKNOWLEDGEMENT

Special thanks are due to Brian Hester, mine geologist at the Siscoe Mine, for calling the writer's attention to the cylindroidal joints where they are best displayed underground at the Siscoe, and for his stimulating discussions of their origin.

Thanks are also due to G. Shartner, mine manager of Siscoe Metals of Ontario Limited; G. McLeod, mine manager, and M. Toti, chief engineer,

[1]Department of Geological Sciences, McGill University, Montreal, Quebec.

of the McIntyre Porcupine Mines, Limited (Castle Division), for their courtesies, kindness, and assistance during visits to the mines.

Mr. McLeod supplied the photograph shown in Plate I.

Thanks are also due to J. E. Gill, M. J. Rickard, and R. L. Eakins, of McGill University for critically reading the manuscript, and to Miss Anne Coeman for her efforts in preparing the paper for publication.

LOCATION OF THE GOWGANDA AREA

The Gowganda area is located approximately 50 miles northwest of the famed Cobalt silver district of east central Ontario. Two silver mines, the Siscoe and the Castle are presently operating in the area, which is serviced by the hamlet of Gowganda, once a bustling town of 5,000 souls during the silver booms of the first decades of this century. The mines and Gowganda are easily reached by road from the important centres of New Liskeard and Kirkland Lake.

GENERAL GEOLOGY

In overall features the geology and mineralization of the Gowganda area is very similar to that of the more famous and better known Cobalt district to the southeast (Moore, 1956; Thomson, 1957). The Gowganda and Cobalt areas are part of a larger province characterized by thick "sheets" of Nipissing diabase (tholeitic) and rich silver-cobalt ores.

In the central part of the Gowganda area, a sheet of medium-grained Nipissing diabase 800 feet to 1,000 feet thick intrudes early Precambrian volcanic rocks and intrusives, and later Precambrian Cobalt sedimentary rocks. The diabase sheet has the form of a rather regular saucer-shaped body, which is known locally as the Miller Lake Basin. The basin-shaped sheet is remarkably discordant to the structures of the enclosing early Precambrian rocks which generally have vertical to steeply dipping attitudes and east-west trends. The sheet shows few signs of having been warped or folded and was apparently intruded into its present shape. Similar basins and related domes in the Cobalt district are described and discussed by Thomson (1957).

Vertical diabase dykes are prominent in the Gowganda area. The dykes are of two main ages, although all are fresh-looking, particularly in hand specimen. The older dykes are pre-Cobalt and pre-Nipissing diabase, and are known as the Matachewan group. The Matachewan dykes form part of a north-trending swarm that extends well beyond the limits of the Gowganda area. As much as forty per cent of the Early Precambrian sections may be occupied by Matachewan diabase, which commonly forms ridges of well exposed outcrop. The dykes are all vertical to steeply-dipping.

The younger diabase intrusions resulted in vertical to steeply-dipping dykes that cut the Nipissing diabase sheet. They are thought to be Keweenawan in age. The later dykes are very much less numerous than

the Matachewan dykes, but they form two prominent sets, one striking northeasterly and the other northwesterly. In general the Matachewan and Keweenawan dykes are very similar in appearance and composition, and often are distinguished in the field only with difficulty.

Rich, narrow silver-bearing stringer zones and veins occur in the gently eastward-dipping part of the Nipissing diabase sheet at the western end of the Miller Lake Basin, and in the Nipissing diabase elsewhere in the Gowganda area. The silver ores consist of native silver in calcite and cobalt-iron-nickel arsenide stringers and veins; also native silver impregnations along joints and fractures in relatively unaltered diabase wallrock. The stringer zones and veins form a well-developed system of fractures in the diabase sheet with sets striking north-south, northeasterly, and slightly south of east. The sets all dip steeply. Vein widths are commonly only a few inches, but range up to several feet. The richness of the individual ore shoots more than compensates for their narrowness.

Numerous faults are present in the mines. Their relationship to the ore fractures is a matter of some debate (Moore, 1956).

The Gowganda ore zones have been exploited for more than fifty years. The two mines currently (1960) produce an aggregate daily rate of about 300 tons of ore containing in the range of 20 ozs to 40 ozs. Ag per ton. On the whole, the ground in which the mining operations is carried out is superbly competent, and all the stopes are of the simple open variety. The only serious predictable complication in stoping is the loosening of large curved slabs bounded by large radius joints by inadvertent or unavoidable undercutting.

NORMAL JOINTING

Normal, generally rectangular jointing is prominently developed in all the diabasic rocks of the Gowganda area. In the vertical diabase dykes, both Matachewan and Keweenawan, one set of joints parallels the dyke walls and a second vertical set normal to this, forming a rectangular system. A third, horizontal set normal to the walls usually occurs, but it is rarely as well exposed as the other two.

In the Nipissing sheet a rectangular system parallel and normal to the nearest major contact with the enclosing rocks reflects the local attitude of the sheet. In the underground workings jointing controls the rock breakage to a remarkable extent in many places. The joints are usually inclined ten to fifteen degrees from the horizontal and vertical, and the mine openings have a decided 'list' which is helpful to the stranger in orienting himself in the mines.

Rectangular jointing parallel to the joint system in the Nipissing diabase sheet is evident in many outcrops of the early Precambrian rocks in and around the Miller Lake Basin. Whether this jointing was formed prior to the intrusion of the Nipissing diabase and controlled the basin-like emplacement of the sheet, or resulted from stresses upon cooling in the nearby diabase after the sheet emplacement is not clear.

CYLINDROIDAL JOINTING

The cylindroidal joint nests occur in the Nipissing diabase sheet and in the northeasterly-trending Keweenawan dykes. In outcrop the cylindroidal jointing has only been observed in Nipissing diabase, and not in the Keweenawan dykes even though they are as well exposed on the surface. The joint nests have not been seen by the writer in any of the well-developed outcrops of Matachewan diabase in the area, but Brian Hester reports the occurrence of cylindroidal joint forms in one stope in Matachewan diabase at the Siscoe mine. As noted above, the cylindroidal jointing, while prominently exposed underground in the Keweenawan dykes, has not been observed in outcrop. The jointing may exist in outcrop, but to the best of the writer's knowledge no one has ever looked for it specifically. Because the Matachewan dykes lie outside the productive Nipissing diabase sheet they are rarely intersected by mine openings. The lack of cylindroidal jointing in the Matachewan diabase may therefore be only apparent and not real.

I. Cylindroidal Jointing in the Nipissing Sheet

On horizontal to subhorizontal outcrops of Nipissing diabase the cylindroidal joints appear as concentric, semi-circular to more rarely circular traces (Figure 1). The regularity of development of the jointing is often as perfect as can be expected in natural phenomena. The three-dimensional aspects of the cylindroidal joints and their well-developed nested form is superbly displayed in underground openings, and in particular in many of the open stopes of the mines. The curved joint planes impart a rolling grandeur to both hanging and footwalls where excavated rock has broken away along the joints.

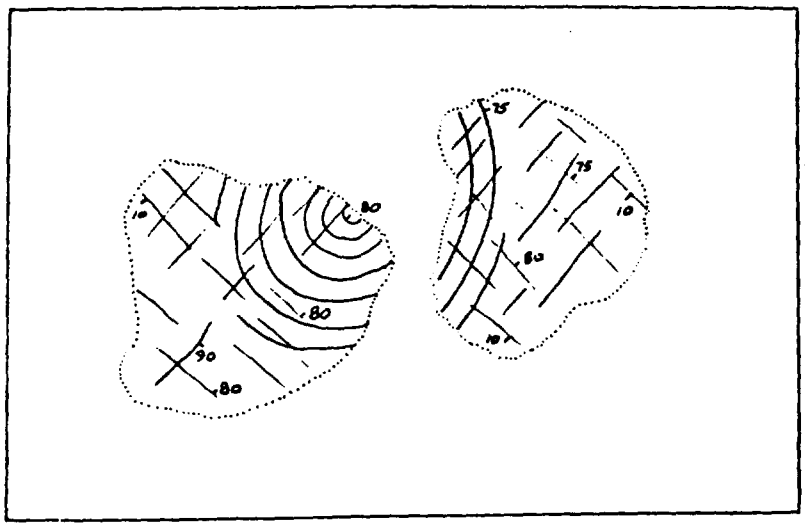


Figure 1: Sketch of outcrops of Nipissing diabase showing development of cylindroidal and rectangular jointing.

The cylindroidal joint nests consist of numerous cylindrical joints arranged one within the other with a common axis. The joint planes are spaced a few inches to 1 foot apart, and have radii of curvature of an inch or so up to more than 50 feet. Semi-cylindrical development is the most common form, but complete cylindrical development is not rare. One of the best examples of a fairly complete, large, nested pattern is exposed under and around the water tower at the Castle mill.

The most remarkable features of the cylindroidal joint nests are their axial terminations, which have been encountered in a few instances underground. The axial terminations appear in walls or backs as breached

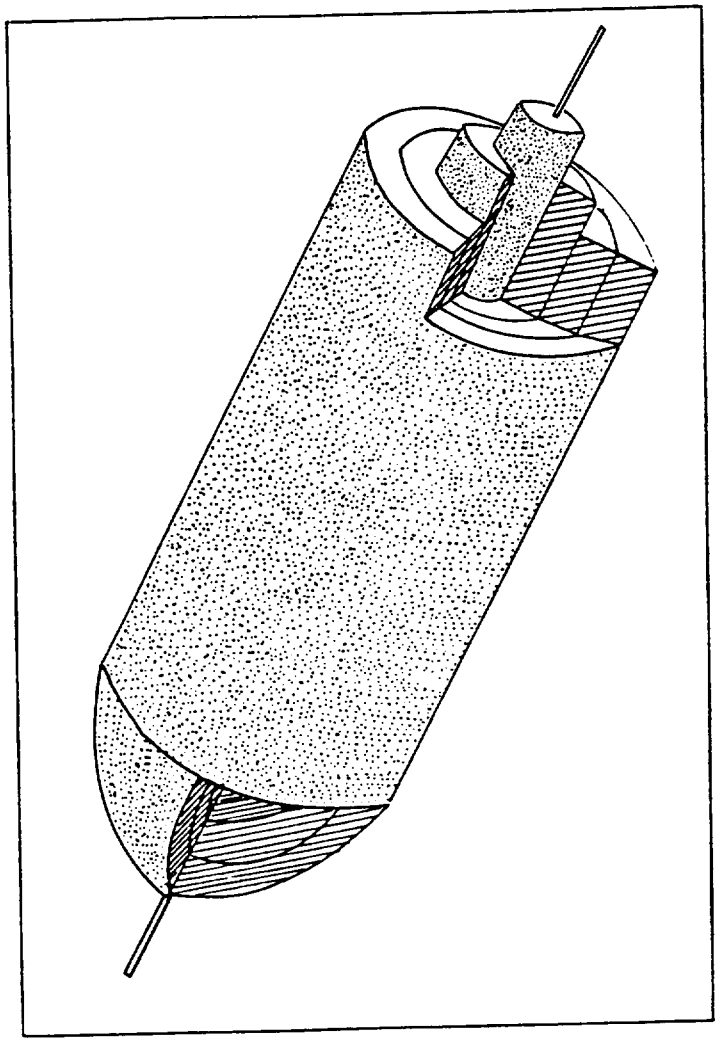


Figure 2: Idealized form of cylindroidal joint surfaces in Nipissing diabase.

large "onion-skin" structures formed by the cylindrical joints curving sharply towards their axes and wrapping around to form blunt cigar-shaped terminations to the nests (Figure 2). To date only lower terminations of joint nests have been exposed. Only a few joint nests approach the perfect form sketched in Figure 2.

From exposures in stopes it is evident that the joints may be as much as 75 feet long in their axial direction. This axial direction is apparently always normal or nearly so to the nearby main contact plane of the diabase sheet. In the area of the mines the upper diabase contact dips eastward at between 15 degrees and 25 degrees, with occasionally local steep "rolls" giving dips approaching the vertical. The axes of the joint nests therefore commonly plunge at 65 degrees to 75 degrees to the west. A few nests in the Nipissing sheet with horizontal axes have been reported in the Morrison mine in the southern section of the Miller Lake Basin (Moore, 1956).

The rock of the joint blocks is massive, medium-grained quartz diabase with occasional pegmatitic phases.

The rock in the joint nests is also broken by the regular rectangular jointing. Curved slabs of diabase are not uncommon, but mullion-like blocks have not, however, been produced by natural or artificial breakage of the joint nests.

The development and distribution of the cylindroidal jointing is widespread but irregular and apparently haphazard. No systematic survey of joint nests in the Nipissing diabase has as yet been made, but it seems from routine mapping that they are more common in the diabase sheet around the Miller Lake Basin than elsewhere in the area. In the vicinity of the mines where there are many fine exposures of diabase, the cylindroidal jointing affects about a quarter of the exposed rock, the remainder showing only the normal rectangular jointing. The joint nests apparently are somewhat more common underground. They occur from the surface down to the lowest levels below 1400 feet.

Several joint nests may occur side by side without mutual interference. However, many stope walls show a giant fluting imparted by the interference of parallel joint nests, both large and small.

The cylindrical joint surfaces are often coated with chloritic material, which is at times slickensided. Evidence of extensive movements beyond simple jostling is not present, and there is no brecciation or rotation of blocks.

The relationship between the joint nests and the silver-bearing veins and stringer zones has not been established. In the camp a general rule of thumb is that ore is likely to be encountered where the cylindroidal jointing is pronounced, but this role has not been substantiated or disproved by systematic study. The ore zones form a well-developed pattern of apparently cognate fractures. It is noteworthy that the narrow ore-bearing veins and stringer zones almost never cut across the cylindrical

joints, although they are occasionally seen to be deflected from their main path over short distances by the presence of nests. In detail some parts of the ore zones have a faintly sinuous pattern due to the influence of the nests. Occasionally ore stringers depart from their normal fractures to follow a curved joint plane, and thus swing around for a short distance before dying out. The joint nests do not appear to be related in any way to the many faults in the mines.

II. Cylindroidal Jointing in Keweenawan Dykes

Nests of cylindrical joints occur in the northeast-trending Keweenawan dykes where they are intersected underground in the Siscoe and Castle mines. They appear as remarkably loglike structures in the walls of cross cuts. Plate I shows parts of two such nests in end section. The Keweenawan dykes are composed of fine to medium-grained quartz diabase up to 100 feet thick (Moore, 1956). Although smaller in dimensions they appear to be in every sense identical to the larger nests in the Nipissing sheet. Their axes are oriented at right angles to the vertical dyke walls.

Moore states that the Keweenawan dykes are post-ore in age (1956, p. 10), and, if this is so, then the cylindroidal jointing is definitely of two distinct ages, as the Nipissing nests are distinctly pre-ore.

GENESIS OF THE CYLINDROIDAL JOINTING

Two origins for the stresses that resulted in the cylindroidal jointing in the Gowganda area may be considered:

(1) stresses caused by the tectonic forces which resulted in the ore fracture system and/or the faulting in the diabase sheet;

(2) stresses due to the contraction of the tabular diabase bodies during cooling.

A tectonic origin can be ruled out for the following reasons: 1) there is no evidence of strong deformation of the diabase bodies; and 2) there is no correlation between the cylindroidal joints and other features of definite tectonic origin, such as faults. The slickensides on some of the chloritized cylindrical joint faces can be explained by assuming a slight jostling of the joint blocks after their formation, presumably at the time of formation of the ore fracture system. Strong deformation in the diabase rocks is entirely lacking; the deformation that has taken place is not sufficient to account for the cylindroidal joints as mullion structures.

The formation of the cylindroidal joints due to stresses set up by the contraction of the diabase bodies upon cooling subsequent to consolidation has the appeal of simplicity and a parallel in the more common case of columnar jointing in basaltic sheets. Columnar joint blocks bounded by five, six, or more joint surfaces are common features in many tabular bodies of igneous rocks. The columnar are oriented with their

Plate I: End view of parts of two horizontal cylindroidal joint nests exposed at a turnoff in a cross-cut at the Castle mine, Gowganda, Ontario. (Note: the joint traces have been emphasized by crayon).

long dimensions parallel to the least dimension or the thickness of the tabular body, and frequently they extend from one side of the body to the other. Striking examples of such columnar jointing are to be found at the Giant's Causeway in Ireland and Staffa in Scotland. Horizontal "cordwood" jointing is typical of many vertical basalt dykes in California. In a homogeneous body relief takes place along tension joints tangential to the radially-oriented stresses and normal to the surface of cooling. Ideally a cylindrical joint surface forms but, due to mutual interference of stresses around uniformly distributed and closely packed axes, hexagonal joint blocks become the favoured form.

In the Gowganda diabase the stresses do not appear to have interfered with each other and ideal cylindrical forms have developed. The Gowganda joints are in medium-grained rocks that have cooled much more slowly than those finer grained igneous masses that show the typical hexagonal columnar jointing. This may account for the fewer axes of radial contraction and the consequent development of nested forms.

REFERENCES CITED

Burrows, A. G. (1926)—Gowganda Silver Area (Fourth Report, Revised); Ont. Dept. Mines, vol. 35, pt. 3, 1926, pp. 1-46.

Moore, E. S. (1956)—Geology of the Miller Lake portion of the Gowganda Silver Area; Ont. Dept. Mines, vol. 64, pt. 5, 1955, pp. 1-37.

Thomson, R. (1957)—Cobalt Camp: Structural Geology of Canadian Ore Deposits; Can. Inst. Mining Metal., pp. 377-388.

sts exposed at a
(Note: the joint

The Canadian Mining & Metallurgical Bulletin – Nov. 1967

Geology of the Silver Deposits near Miller Lake, Gowganda

B. W. Hester
At time of writing with — Texas Gulf Sulphur Co., Timmins, Ont.

Annual General Meeting, Quebec City, April, 1966

Transactions, Volume LXX, 1967, pp. 277-286

ABSTRACT

Native silver and cobalt arsenides occupy narrow vein fractures in and around gently dipping diabase intrusives in a structural environment very similar to that at Cobalt, Ontario. The diabase intrusion with which the principal mineralization is associated is of the form of a modified cone sheet rather than a warped sill as described in the literature previously. The vein fractures resulted from tectonic movements which have no relation to the cooling of the diabase. They form two sets of conjugate shear fractures, with related tensional openings. One set was active before intrusion of the diabase and was rejuvenated by the movements of the later, and post-intrusive, set. As a result of this rejuvenation, two additional tension directions developed. A generalized paragenesis of the vein-filling minerals, based on megascopic features, shows the silver to have been followed by a well defined sequence of calcite and quartz. Regional stresses were transmitted to the diabase sheet mainly through rigid dykes of an earlier diabase which are enclosed in incompetent, serpentinized, basic and ultrabasic rocks over the ore zones. After the evolution of the fracture pattern, stress exceeded the elastic limit and plastic deformation occurred along narrow zones around the already established fractures. Shear trajectories branched from the fractures. These are cycloidal in form and are typical of this type of deformation. Mineralization took place below the elastic limit as stress decreased. Thrust faulting is all post-ore and has no genetic significance.

Introduction

MILLER LAKE lies 2 miles due east of the village of Gowganda in the district of Temiskaming, northern Ontario. Silver was first found in the general area of Gowganda in 1908, when spectacular showings of native silver in narrow veins were discovered near the south end of Gowganda lake, about 4 miles south of the village. These veins have consistently failed, however, to support the mining operations which have been attempted at intervals. Discoveries of less spectacular veins on the west side of Miller lake in the same year led to the development of a number of mines from which, to the end of 1962, over 50,000,000 ounces of silver had been taken.

The earliest production of silver in the Miller Lake area came from the property of the Millerett Silver Mining Company, where 611,822 ounces of silver were extracted from two small shoots of outcrop ore between 1910 and 1912. The M. J. O'Brien interests began production from their Miller Lake - O'Brien property in 1910. This developed into the most important mine in the camp and has been in continuous production ever since. The property was leased to individuals from 1939 to 1946, when it was bought by Siscoe Mines Limited for its wholly-owned subsidiary, Siscoe Metals of Ontario Limited.

The second mine of importance is that known formally as the Castle-Trethewey property, now operated as a division of McIntyre Porcupine Mines Limited. Production there started in 1921 and, with the exception of the period from 1931 to 1951, has been continuous. Silver mineralization is known at a number of localities south of Miller lake, but not in sufficient quantities to support continuous, economic operations. Extensive underground work was conducted at the Tonopah, Morrison and Coleroy properties (*Figure 1*).

In many ways, the geological features of the mineralization of the Miller Lake - Gowganda area bear a strong resemblance to the better known Cobalt area, which is about 55 miles to the southeast.

The grade of ore mined has, in recent years, been maintained at between 20 and 40 ounces of silver per ton at the two operating mines. Between 2 and 2½ million ounces of silver were produced annually from the camp up to 1962. Current production is about 1.4 million ounces annually.

General Geology and Structure

All rocks in the area are of Precambrian age. They fit readily into the well established classification of the rocks in this part of the Canadian Shield.

Keewatin

The oldest rocks in the area form a series of intensely folded and metamorphosed volcanic rocks of the Keewatin type. Basic tuffs and flows, well chloritized by metamorphism, are prominent in this series, which also includes minor bodies of porphyritic, acidic rock. An extensive area of basic-ultrabasic rock lies around the west side of Miller lake in the vicinity of the principal mines. The relationship of these rocks to the surrounding volcanic rocks is not clear. There is field evidence of some basification of tuffs, and elsewhere there is evidence of intrusion. Where determinable, the strike of the tuffs is easterly, and the dips steep. P. Eakins (1959) has suggested a possible correlation between the thick series of tuffs exposed on the south side of Miller Lake with a similar series to the north, around the Castle No. 3 shaft. If this is true, then a fold axis strikes through the middle of the lake, and this may control the position of the basic-ultrabasic mass.

Zigzag folding is well developed in the basic-intermediate tuffs in several places. The axial planes of this minor folding strike due north.

The concept of a fold axis through the Miller Lake area was proposed by Moore (1955), who also pointed out the large granitic masses both north and south of the area, which, he surmised, must also lie under the Keewatin rocks at a shallow depth.

Matachewan

A great number of diabase dykes of the Matachewan swarm strike northerly through the Keewatin-type rocks. These diabases are readily distinguished in the field from the several generations of later diabase by the irregularly distributed feldspar phenocrysts, some up to 3 inches in length, which are to be seen in most exposures. Dykes up to 400 feet wide occur. A stretching of the crust in the order of 10 per cent must have taken place in the exposed area of Keewatin-type rocks to allow the intrusion of so much dyke material.

Huronian

Overlying the Keewatin-type rocks and the Matachewan-age diabase dykes is a series of conglomerates and quartzites of Huronian age. The conglomerates are coarse, poorly sorted, and sometimes contain subangular boulders. Individual beds of conglomerate are very irregular in composition. Moore (1955) considers these conglomerates to be, in part at least, c glacial origin. They are the lowest member of th series, but the frequency with which quartzites ar found interbedded with them is indicative of som fluvial action. A glacial association is suggested by th frequent beds of finely interbedded, cherty and are naceous material with a varved appearance.

Throughout the series, dips are less than 10 de grees. At the Millerett property, a buried cliff wa exposed underground on the pre-Huronian surfac The cliff is covered with flat-lying Huronian sedi ments which have slumped locally at high angles nea the cliff face (Burrows, 1926).

Nipissing

Diabase intrusives of the Nipissing type, and o supposed early Keewatin age, are prominent in th Gowganda area. More than 95 per cent of the silve mined in the area has come from the veins in thi rock. This diabase is thought by Burrows (1926 and Campbell (1930), and by many other writers to be in the form of a warped sill, many parts o which have been removed by erosion, but which ori ginally was continuous with the sill of similar dia base at Cobalt. Other writers (e.g., Moore, 1955 considered the diabase at Gowganda to be a separat body from that at Cobalt. A close examination of th field evidence, and contouring of sub-surface con tacts, reveals that the form of the intrusive is les simple than this interpretation allows.

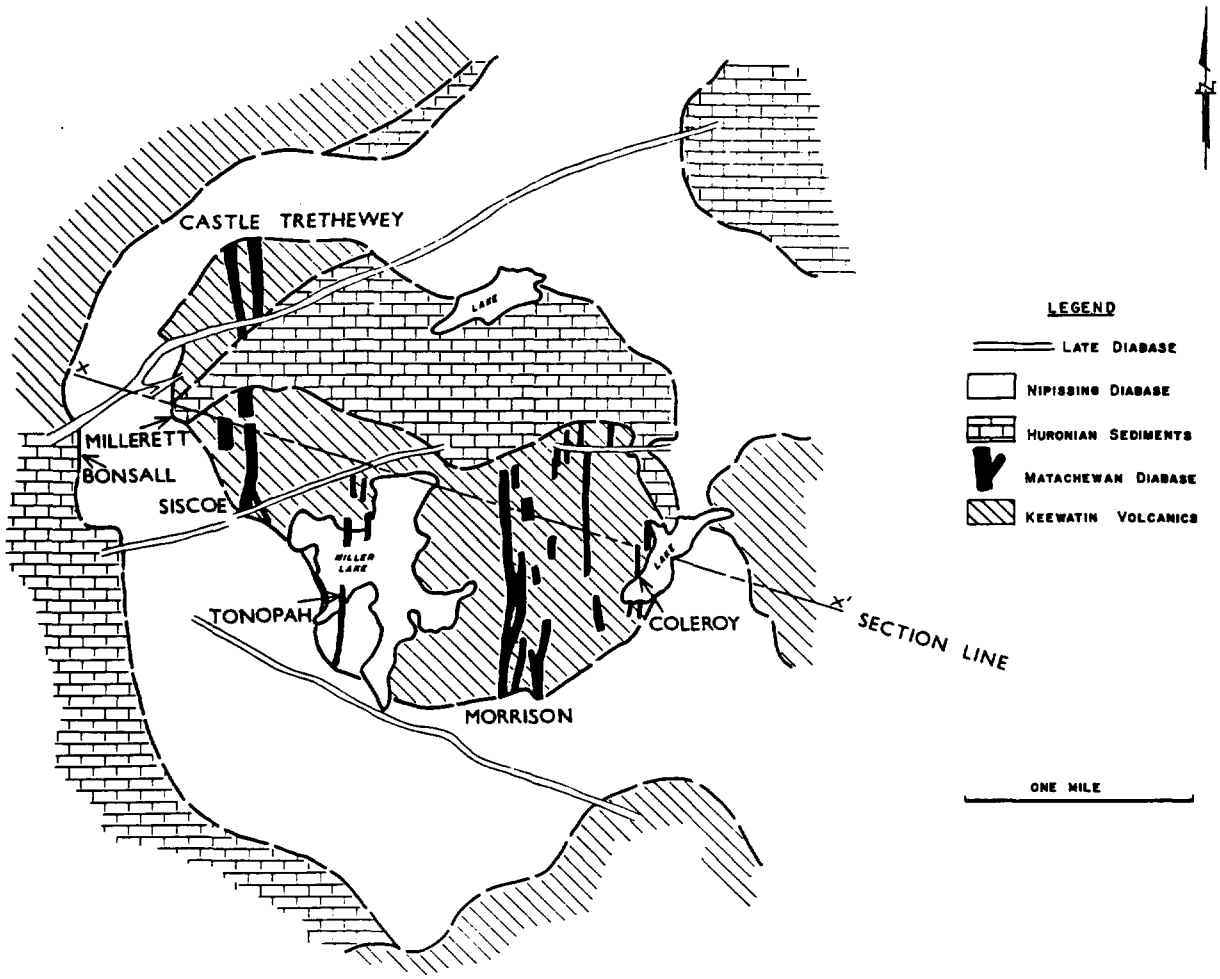


Figure 1.—General Geology of the Miller Lake Area (modified after Moore, Burrows and Eakins).

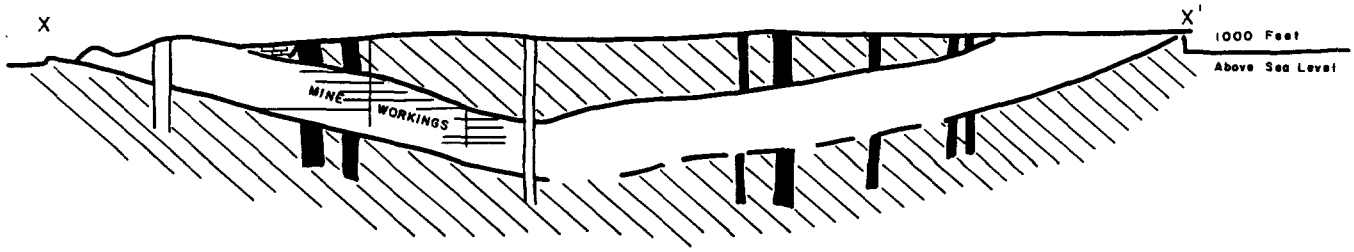


Figure 2.—Cross Section on line X-X' of Figure 1.

Underground exploration has now shown that the lower contact of the intrusive is generally parallel to the upper one and that steep contacts are confined to the northern edge. The true thickness of the intrusive is abut 800 feet. At outcrop, the upper contact dips inward at about 25 degrees. Dips lessen at depth, and the lowest point on the upper contact is about 1,550 feet below surface in the center of the basin-shaped mass (see section in *Figure 2*).

At both upper and lower contacts, a glassy, chilled edge, about 2 inches thick, has developed.

It is difficult to accept the interpretation of the diabase intrusive as a sill when its contacts with the Huronian sediments are steeper than the bedding, and there is no sign of warping in the sediments. The conclusion that some of the dips in the intrusive contact were initial is unavoidable. The characteristic, annular outcrop of the saucer-shaped intrusives with which the silver is associated is also a feature of the Cobalt area, as described by Thomson (1957). In that camp, a similar lack of correspondence between the dips of the intrusives and sediments has been noted. The form and general field relations of these intrusives are very suggestive of cone sheet structures of the type described by Carey (1957).

Carey explains that in a basin of newly deposited sediments between 5,000 and 15,000 feet thick, such as the basin which the Huronian rocks in the Miller Lake - Gowganda area may be supposed to have occupied, the specific gravities of the rocks involved would vary from about 2.0 at surface to 2.4 at 15,000 feet due to the effects of compaction. A diabase magma, rising through the crystalline basement rocks, would have a specific gravity of at least 2.7. Upon entering the sedimentary series, less work would be done by this magma if it were to intrude laterally and raise the block of sediments than if it were to find its way to surface. There would also be a tendency for the hydraulic head of magma to punch a conical-shaped, inward-dipping fracture in the sediments as the magma approached the surface. The resulting structure is a compromise between these two tendencies, and a flat cone sheet is formed with a rough, trumpet shape. Depending on the position of the top of the sediments relative to sea-level, the cone sheet would form either above the basement contact or below it. This mechanism explains adequately the form of the intrusive around Miller lake. Elsewhere in the area, the form of the intrusives is not the same. Contacts are often steep; aeromagnetic anomalies indicate vertical bodies of diabase, and there are linking structures between large bodies of diabase. These are interpreted as irregular intrusives, of generally dyke-like form, with a northerly trend.

The form of these dykes and irregular masses of diabase may have been controlled to some extent by older faults. Burrows (1926) and Moore (1955) found good evidence for a fault striking northward under Gowganda lake, around which a large mass of diabase is situated. The similarly oriented diabase body lying to the east of Miller lake might well be controlled by a parallel feature. Extensive northerly faulting occupies a belt, 50 miles wide, west of Gowganda. This has been termed the Onaping lineament by Wilson (1949). He suggests that the dominant movement on these faults is horizontal and left-handed. He also suggests that the area of the lineament, that is the area comprising the Huronian sediments in the Gowganda-Cobalt area, has been down-faulted into a graben structure.

Post-Nipissing Rocks

Several diabase dykes, from 100 to 400 feet wide, cut all the rocks in the area. Two directions of strike are prominent — northeast and southeast. Diabase dykes with a northeast strike occur for at least 350 miles northeastward from Gowganda to Chibougamau, as noted by Norman (1948). The westward extent is not known. The set of dykes with the southeast strike is not so well developed.

Faulting

In addition to the north-striking faults of regional dimensions already mentioned, three directions of faulting are important within the Nipissing diabase near Miller lake. Movement on them must, in part at least, post-date this intrusive. Faults of all three directions have a demonstrable major thrust component with a minor strike slip. The set of faults with the greatest amount of movement strikes northerly and dips east at about 40 degrees. Where the faults cut the diabase, the fault filling varies from a few inches to several feet of crushed material with only minor gouge. In the narrower sections, a filling of tremolite-quartz-epidote-axinite is common. Slickensiding is well developed. Total off-setting by post-diabase movement is in the order of 50 to 60 feet where it has been measured. Faults of this direction occur throughout the cone sheet from west to east. They have affected underground development in all underground operations by off-setting the veins. The gross effect of all these faults has been to raise the eastern side of the cone sheet several hundred feet above the western side by thrusting.

The other two sets of faults generally show less displacement than the set just described. Movements in the order of 10 to 15 feet have commonly been measured. One of these sets dips northward at 15 degrees, and the other dips northeastward at the same angle. Both are frequently encountered by underground workings in the diabase, where they have the same physical characteristics as the faults of the northerly set.

The diabase wallrock of these faults is typically sausseritized for several feet on either side of the plane. This alteration is indistinguishable in hand specimen from alteration along some ore veins.

The Ore Deposits

Native silver and cobalt-iron arsenide minerals occur in quartz-calcite veins up to several inches wide which dip at from 60 degrees to vertical.

Mineralogy and Paragenesis

The very unusual assemblage of minerals in the mines of the Cobalt and Gowganda - Miller Lake areas has received considerable attention. Excellent descriptions of the Miller Lake minerals have been given by Todd (1926) and Bastin (1949). Bastin recognized the following minerals, in order of decreasing abundance:

Native Silver	Arsenopyrite
Lollingite	Cobaltite
Skutterudite	Galena
Safflorite	Niccolite
Rammelsburgite	Breithauptite
Tetrahedrite	Chalcopyrite
Smaltite	Sphalerite
Chloanthite	

Bastin also reported that ruby silver, pyrite, bismuth, stephanite and argentite were known. Todd reported a silver mercury amalgam, bornite, hematite, dyscraite, erythrite and temiskamite.

Pink, pearly grey and white calcite are found in the veins. The only other gangue mineral is quartz, which is milky and commonly forms ribbon structures.

Much of the native silver occurs in a dendritic habit, surrounded by the iron-cobalt arsenides. Pink calcite is a common associate in the better mineralized sections. Silver is common in leaf form, both within the calcite veins and in knife-edge joints in the wallrock close to the veins. Silver in any form is rare in the quartz-bearing sections of the veins, but, where found, is usually of the leaf variety. Leaf silver is rarely found in the fault planes within the diabase.

Little has been published on the paragenesis of the gangue minerals. Visible evidence of movement along the veins is good. Todd (1926) noted considerable brecciation in thin and polished sections. The walls of veins show well developed slickensides in a nearly horizontal direction. Fragments of earlier deposited minerals are cemented by later minerals.

The observed effect of faults on veins and a comparison of the minerals found in the two forms of openings allow conclusions to be drawn on their relative time of emplacement and the character of the mineralizing solutions which flowed through them. The vein minerals were clearly deposited in a reducing environment. They contain no evidence of oxidation, nor do they contain any boron mineral equivalent to the axinite of the faults. The faults rarely contain calcite, although this is the most common mineral in the veins. Where silver mineralization occurs in a fault, it is always close to the intersection of the fault with a well mineralized vein and generally between the off-set portions. Spectacular wire silver has been noted in this environment. Frequently, the silver in the faults has been oxidized, either partially or completely, to a sulphide mineral. This latter phenomenon has been noted as deep as 850 feet from surface at the Siscoe Metals property. Oxidation o vein material 400 feet from surface has been de scribed by Mason (1959) in the Cobalt area and i is also known in the Keeley-Frontier workings i South Lorrain township. This phenomenon is genera ly thought to be due to a lowered water table, pos sibly during the Pleistocene glaciation. It is difficul to understand why it should have been so highly se lective a process, on the one hand producing oxidatio effects at 850 feet below surface and on the othe hand leaving fresh silver and sulphides unaltered a surface.

From megascopic relations in hand specimens an underground exposures, the following paragenesis o the commoner vein and fault minerals is proposed

1.... Crystallization of native silver into dendriti habit, followed by iron-cobalt arsenides.

2.... Deposition of pink, red and pearly grey cal cites, some of which contain disseminated arsenide and others fine chlorite.

3.... Brecciation of ore minerals and flowage of cal cites.

4.... Deposition of white calcite with very smal amounts of silver and base-metal sulphides.

5.... Movement along vein walls, without much brec ciation.

6.... Deposition of milky quartz on one wall of th vein from a succession of mineralizing fluids, eacl followed by slight movement and retention in th quartz of a selvage of diabase. Minor base-metal sul phides were deposited with the quartz.

7.... Large-scale movement along certain veins on ly. Intense brecciation of earlier minerals and wall rock and cementation with milky calcite to form bar ren veins up to 6 feet wide.

8.... Intrusion of post-ore diabase dykes. In a fev rare cases, narrow dykelets followed veins and mo bilized some of the silver; this was deposited in joint in the later diabase. Silver in veins cut by dykes wa also mobilized and driven into the vein away fron the dyke.

9.... Faulting, and epidote-axinite-quartz-tremolit mineralization of the faults.

Structure of the Veins and Wallrock

The shearing mentioned above is well developec on the walls of nearly all the veins, whether ore bearing or not. Vein walls commonly show excellen slickensiding in a nearly horizontal direction. The veins display many of the features commonly found in deposits which owe their origin to the filling o fractures. These features include consistent vein di rections and dips, changes in the width of vein fil lings due to the formation of openings by relative movements of the vein walls, shingle structures, en richment of ore at vein intersections and brecciated vein material. Dips are generally between 70 degrees and vertical; gentler-dipping veins are known. The width of mineralization rarely exceeds 6 inches. The value of this vein filling often exceeds 5,000 ounces per ton in higher grade sections. In 1917, a vein of this type of material with a width in excess of 30 inches was encountered in the then Miller Lake O'Brien mine.

The wallrock of the veins characteristically displays a very unusual joint structure. This is in the form of

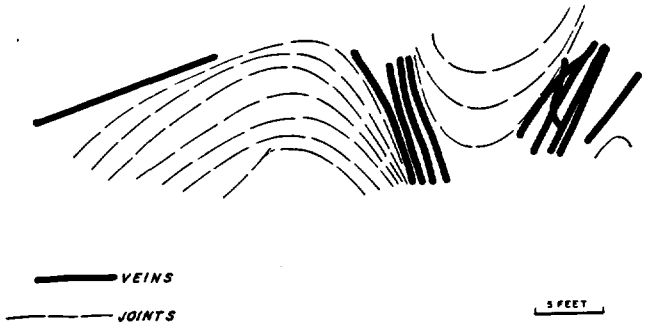


Figure 3.—Plan of Crosscut through Several Veins showing the Development of Joints.

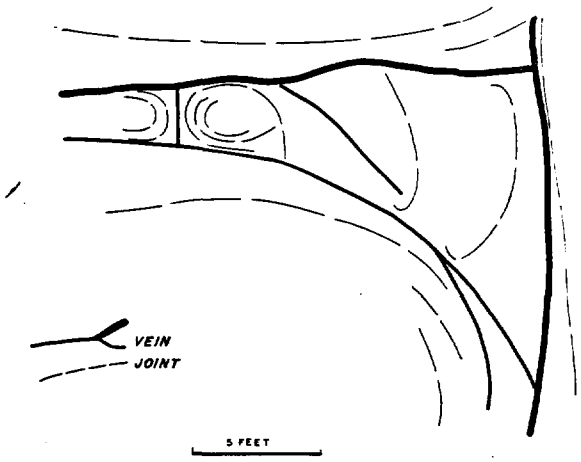


Figure 4.—Plan of Drift showing Joints Developed Around a Vein Intersection.

columnar-like joints which have a cross section in the form of a smooth curve to which the veins are tangential. The origin of these joints has been ascribed by previous observers [see Eakins (1961) and Moore (1955)] to the cooling of diabase. The structure has been interpreted as a mass of partly developed columns, each with a cross section of an incomplete circle. The absence of columns with completely circular sections was thought to be due to mutual interference in the development of adjacent columns. The occurrence of these columns with the ore-bearing veins led these observers to conclude that there is an association between the two structures, and, because the columns were interpreted as cooling structures, then the veins must have been formed during cooling as well. Eakins (1961) noted that the veins appear to belong to cognate systems. Features of these cognate systems are described below, and it is concluded that the fractures are the result of tectonic movements in which cooling of the diabase has played no obvious part. The origin of the joint forms must therefore be sought in the light of this interpretation.

No intensive study of the distribution of the columnar joints has been made, but they are visibly confined, in a general way, to the diabase near ore zones. The long axes of the columns are parallel, so that the mass effect, when seen in an open stope, is one of a fluted surface. The radius of curvature of any column is consistent, but can be between 1 and 20 feet. The assumed interference of one column on the development of another is so common that the supposedly fully developed columns with a completely circular cross section are never seen (*Figure 5*). Even in the most complex pattern of branching and crossing veins, no column is cut by a vein. The two are invariably tangential and the principal axes of symmetry of vein pattern and joints are coincident (see *Figures 3* and *4*). From this it will be apparent that the columns plunge parallel to the vein intersections.

The outer surface of each column is well grooved, with nearly horizontal slickensiding similar to that along the vein walls. Within the column, concentric joints, roughly 6 inches apart, parallel the outer joint. Each joint face is similarly well slickensided, and, like the outer one, contains a thin smear of chlorite and white clay. Near a vein, these joints might be filled with grey or white calcite. A second set of joints cuts the columns radially, and therefore cuts the peripheral joints orthogonally. These are not mineralized and have very smooth faces. Close to a vein, the peripheral joints of the columns tend to become closer, and they eventually join at the junction with the vein (see *Figures 3* and *5*).

Eakins (1961) points out that the long axes of the columns lie roughly perpendicular to the upper contact of the diabase intrusive. He uses this observation in support of the interpretation that the columns represent an unusual form of columnar jointing which

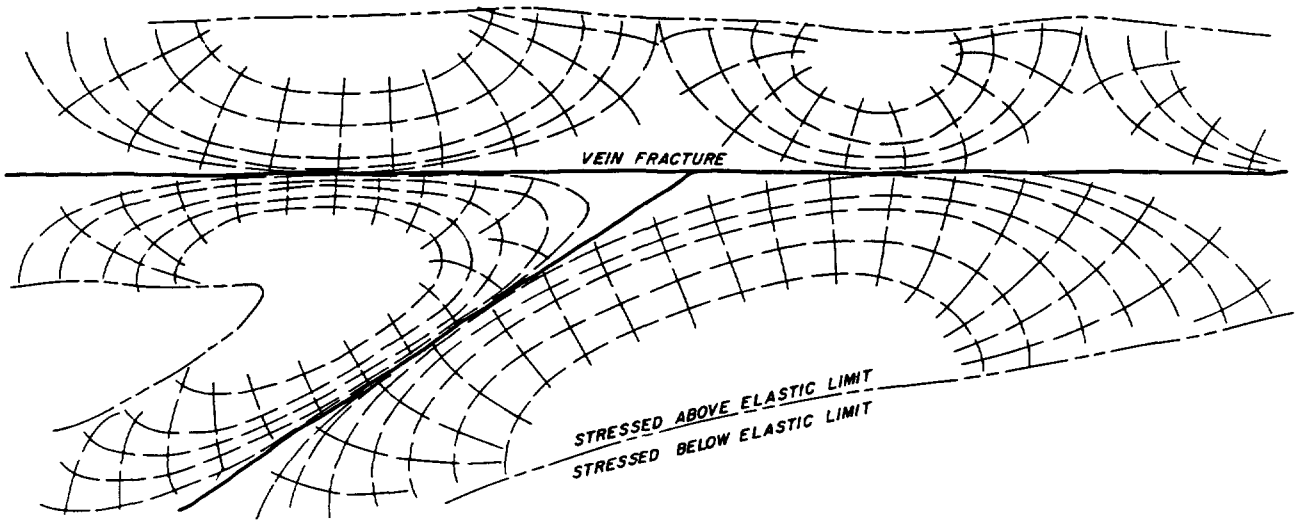


Figure 5.—Relationship of Joints and Veins in Idealized Form.

formed as the result of the cooling of the diabase. The relation is apparent only, as it holds true in a general way on the western side of the diabase cone sheet. Elsewhere, the relation is not true [see Moore (1955), page 35]. Were the joints due to cooling, their initial attitude would have been vertical. There is no evidence that the diabase has been folded, and so the reason for the observed inclination of the columns from the vertical is difficult to explain if the columns originated through cooling. In the unusual circumstance of two veins joining beneath a well formed column, the joint "nest" [to use the term coined by Eakins (1961)] terminates vertically in a roughly hemispherical segment. Here again, no completely hemispherical section has been noted and any extrapolation of this structure to such a form is based on conjecture.

If the joints represented cooling phenomena, polygonal forms would be expected to occur somewhere in the cone sheet, either near the veins or elsewhere. This is not the case. In any event, columnar joints would not likely form by cooling under the conditions in which a cone sheet of the great thickness of this one was emplaced. A steep thermal gradient is an indispensable condition for a cooling joint to form. J. C. Jaeger (1957) estimates that a diabase intrusive of the form and dimensions of the Miller Lake cone sheet would take about 300 years to solidify and a further 100,000 years to cool down even to 300°C. In a well reasoned argument, he concludes "...open contraction joints may be expected to occur in thin and shallow buried sills and to become steadily less obvious as the thickness and depth of burial increase..." From these conclusions, and those reached on the depth at which the cone sheet was intruded, it is reasonable to expect few cooling cracks of any magnitude. Jaeger's study led him to conclude that, in more deeply buried intrusives, all stresses due to cooling would be accommodated by creep.

The interpretation of the slickensiding on the peripheral joints as a feature of late "jostling" (Eakins, 1961) provides no explanation for the wedging of joints against the veins. Neither does it explain the absence of slickensiding on the radial joints, which, presumably, were "jostled" as much as the other joints.

The form of the joints is suggestive of mullion and boudinage structures, but these occur only where rocks of different competence are involved.

Previous observers have all tacitly assumed that the curved form of the joints represents an arc of a circle. Many of the joint surfaces approach this form, but the deviations from the exactly circular form are hard to explain. Such deviations are common at vein intersections where surfaces could be better described as hyperbolic. In *Figure 4*, an unusual structure is shown which has developed between two veins and has the form of a spiral. Even joints of apparently circular section are more elliptical when closely examined. These non-circular structures might be dismissed as mere local irregularities were it not that they occur within such a thick, physically homogenous rock.

The suggestion is offered here that the phenomenon of curved jointing is due to plasticity resulting from the immediate wallrock of the veins being stressed beyond its elastic limit.

Surface mapping of the pre-Nipissing rocks reveals two aspects in which the area appears to differ from other areas of silver mineralization in the Temiskaming district: (1) the presence of wide dykes of Matachewan diabase, and (2) the extensive areas of serpentinized rocks over those parts of the Nipissing diabase in which the joint nests are best developed and which are coincident with the ore-bearing sections. No comparable development of joint nests has been reported from other areas of identical, or very similar, mineralization, even though the associated body of Nipissing diabase is of similar magnitude and form.

Evidence is presented later for the supposition that northerly compressive forces were responsible for much of the deformation and fracturing in the Nipissing diabase with which the ore veins are associated. Stresses resulting from this compression would, in the area of the mineralization, be confined within the Matachewan diabase dykes because of their superior rigidity compared with the very incompetent serpentinized rocks enclosing them. The latter would, presumably, yield plastically at a very low level of stress. Although the regional stresses were still quite moderate, the build-up of stress in those dykes in the serpentinized mass would reach the point of elastic release along shear planes well before rupture occurred elsewhere in similar dykes which were in a different host rock. With the increase in compression, stresses in the dykes would increase to the point where, ultimately, the elastic limit would be exceeded and further deformation would be in the plastic domain. These conditions would be transmitted to the diabase cone sheet contained in these rocks.

While plastic conditions prevailed, all planes in the diabase, quite irrespective of their origin as either tensional or shear fractures, would accommodate movement. In this way, primary differences between fractures of different origins would be lost and all would accommodate movement by plastic flow. The zones within which plastic conditions prevailed probably extended about 10 to 20 feet on each side of the vein fractures, but wider zones, where several parallel vein fractures lie close together, may have been present. Beyond these zones, the diabase country rock remained rigid and deformed elastically. Within the zones of plasticity, the principle planes of release were along the previously established fracture directions. Two other planes of shear developed which are characteristic of many forms of plastic deformation in that they form two sets of orthogonal cycloids. These shear planes, or shear trajectories, as they are usually known, are the curved joints and orthogonal, radial joints which form the joint nests (see *Figure 5*).

The development of orthogonal shear trajectories of cycloidal form is a typical phenomenon of plastic deformation. The structures at Gowganda seem to be just a special case involving these features. The cycloidal form accounts readily for the lack of completely closed nests. The point at which two curved joint surfaces meet is actually the cusp which develops at the end of each cycloid. Where two veins intersect, a modified form of joint is found. This is a complex of two cycloids, one on each vein, which merge at the intersection of the veins. The very unusual spiriform joint in *Figure 4* has developed in a block of diabase between two closely spaced vein fractures. The joint is in the form of an epicycloid which has developed along the single axis of symmetry within the block. The joints in the wallrock are typically developed around a plane of symmetry parallel to the vein fracture.

Size and Distribution of Ore Shoots

A typical ore shoot is equidimensional, with a vein width of 1 to 2 inches. The silver is contained both in the vein and in joints in the wallrock. Planar dimensions of the order of 100 to 200 feet are usual, but smaller shoots are a source of important tonnages. Several shoots with dimensions in excess of 400 feet have been found; their extraction generally coincided with the periods of greatest production.

Early in the development of the camp, it was thought that ore shoots were confined to the upper 200 feet of the diabase body. Development down the dip of the diabase host rock, however, has shown that ore may be expected anywhere within its upper half and, rarely, may even extend for a short distance in the lower half. Although small shoots have been found in every other rock type of pre-Nipissing age, very little ore has been taken from veins in them. At one time, a small body of ore was mined from near the lower contact of the diabase intrusive at the Bonsall property (see *Figure 1*). Little exploration has been conducted since then for further orebodies in such situations, but it seems reasonable to assume that this was not a unique occurrence.

Generally, there is only one ore shoot within each vein. The most common ore control is a vein intersection. Frequently, ore shoots are present on both the intersecting veins, but not always at the same elevation. A striking example of this is seen in the Siscoe Metals mine where, on the 93S vein, ore extends beyond the upper contact of the diabase for 25 feet into the overlying Keewatin ultrabasic rocks and the top of the mineralization in the 13W vein, which it joins at ...ht angles, is 200 feet lower. Both veins contain ore shoots having strike and dip lengths in excess of 400 feet and of similar excellent grade. The relative positions of the bottoms of these shoots is not yet known.

Vein intersections are generally T- or Y-shaped. The principal calcite- or ore-filled fractures intersect with no change in strike, but the many calcite-filled stringers in the walls swing from one vein direction to another along openings in the curved joint nest (see *Figure 4*). Curved veins of this type are generally barren, even when they are as wide as 6 inches.

Development work has followed the ore shoots from surface for more than ¾ mile down the dip of the diabase body to a depth of about 1,500 feet from surface without any visible change in mineralization, or in the size and frequency of ore occurrences.

Attempts to reconstruct strain ellipses for every combination of fault and vein intersection have met with no success. From this evidence, and from their different mineral content, it is concluded that the veins and faults owe their origins to forces widely separated in both time and direction.

The Development of the Fracture Pattern

Early in the exploration at the mines, it was noticed that where a system of ore-bearing veins came close to the upper contact of the diabase, the contact departed from its usual smooth form and displayed anticline- and syncline-like structures. At one time these were thought to be due to post-diabase folding; but now that such folding is known not to exist, the structures have been interpreted as original warps

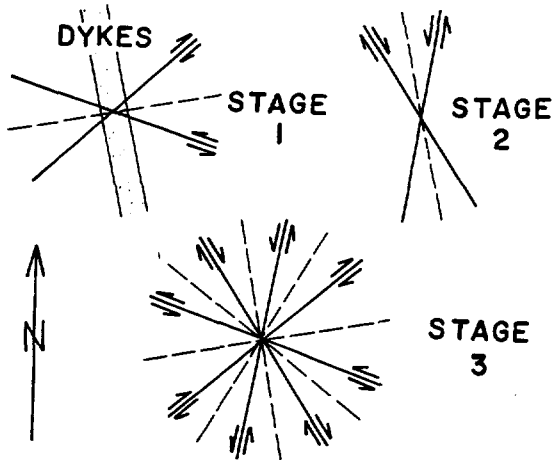


Figure 6.—Proposed Stages in the Development of the Fracture Pattern.

in the otherwise smooth form of the contact. These structures are known locally as "rolls" and, on a strictly empirical basis, there is a good correlation between them and the ore veins.

A study of vein attitudes in underground exposures, and a compilation of all the known veins in the Miller Lake area, has led to the identification of eight directions of fracture and to an explanation for the association of ore with the "rolls" in the diabase contact. For convenience, the veins will be referred to by their strike directions measured clockwise from true north (see *Figure 6*).

A well developed zone of veins with 010-150-170 directions strikes roughly southerly through the Capitol section of the Castle-Trethewey property and eastern part of the Siscoe property into the Tonopah workings (see *Figure 1*). An unusual feature of this zone is the lack of any apparent irregularity at the diabase-Keewatin contact. Several thick dykes of Matachewan diabase overlie part of the eastern wall of the zone. They appear to be discontinuous as the result of separation by shearing roughly parallel to their strike. Some of the veins beneath these dykes present a highly brecciated appearance, and it is concluded that they have been the loci of intense movement. A composite plan of a well mineralized part of this vein zone is shown in *Figure 7*. Characteristic changes from one strike direction to another are apparent in many of the veins, thus imparting a vague sygmoidal form to the plan of the zone.

These three vein directions are interpreted as forming a conjugate system which has resulted from a horizontal compression in the 170 direction. Thus, the 170 vein direction represents a plane of tensional release and the 010 and 150 vein directions represent planes of shearing. The 080 vein direction may be related to this compression, as it coincides with the theoretical direction of release fractures of the tensional type. Some veins of this direction appear to be related to this zone of veins (see *Figure 7*). The vein zone is traceable right across the diameter of the outcrop of the diabase cone sheet. Other occurrences of veins with these directions are minor, but some do contain ore sections.

Detailed mapping of the "rolls" in the upper contact of the diabase invariably indicates the presence of well developed shears with a 050 strike. These are generally filled with calcite where they cut the diabase, but degenerate to thin zones of gouge or schist

with occasional "boudins" of calcite in the incompetent Keewatin rocks. The contact maintains its usual smooth form right up to the shear, then dips sharply to follow the rupture for a vertical distance of about 50 feet, and then reverts to its gentle-dipping, smooth form as it leaves the shear plane. Fragments of chilled diabase from the contact are commonly found in the shear where it coincides with the contact. In a less common form of "roll," a shear striking at 110 is associated with the 050 shears. In general appearance, these shears are indistinguishable from each other. As they are followed into the diabase, they often lose their identity and completely disappear. Thus, a shear bordering a "roll" which may be thought, from apparent displacement of the contact, to have a horizontal movement in the order of several tens of feet may not be visible as more than a knife-edge crack only a few feet into the diabase. Parallel shears are sometimes well developed in the diabase. These two shear directions are interpreted as representing a pair of conjugate shears of pre-Nipissing age.

One of the orebodies which was mined from the Millerett section of the Siscoe Metals property occurred completely in Huronian conglomerates and, in this respect, is unique in the camp. The buried cliff of Keewatin ultrabasic rocks which has been disclosed by the underground workings there displays shearing along its face which strikes at about 050; i.e., parallel to the supposed pre-Nipissing shearing. No vestige of this shearing is to be seen in the overlying conglomerate. The cliff is interpreted here as a pre-Huronian erosion feature along a shear with strike 050 which is clearly also of pre-Huronian age. The evidence presented above on age relations at the diabase contacts dates the 050 and 110 shearing as pre-Nipissing. Evidence from the buried cliff indicates that at least one of these 050 shears is pre-

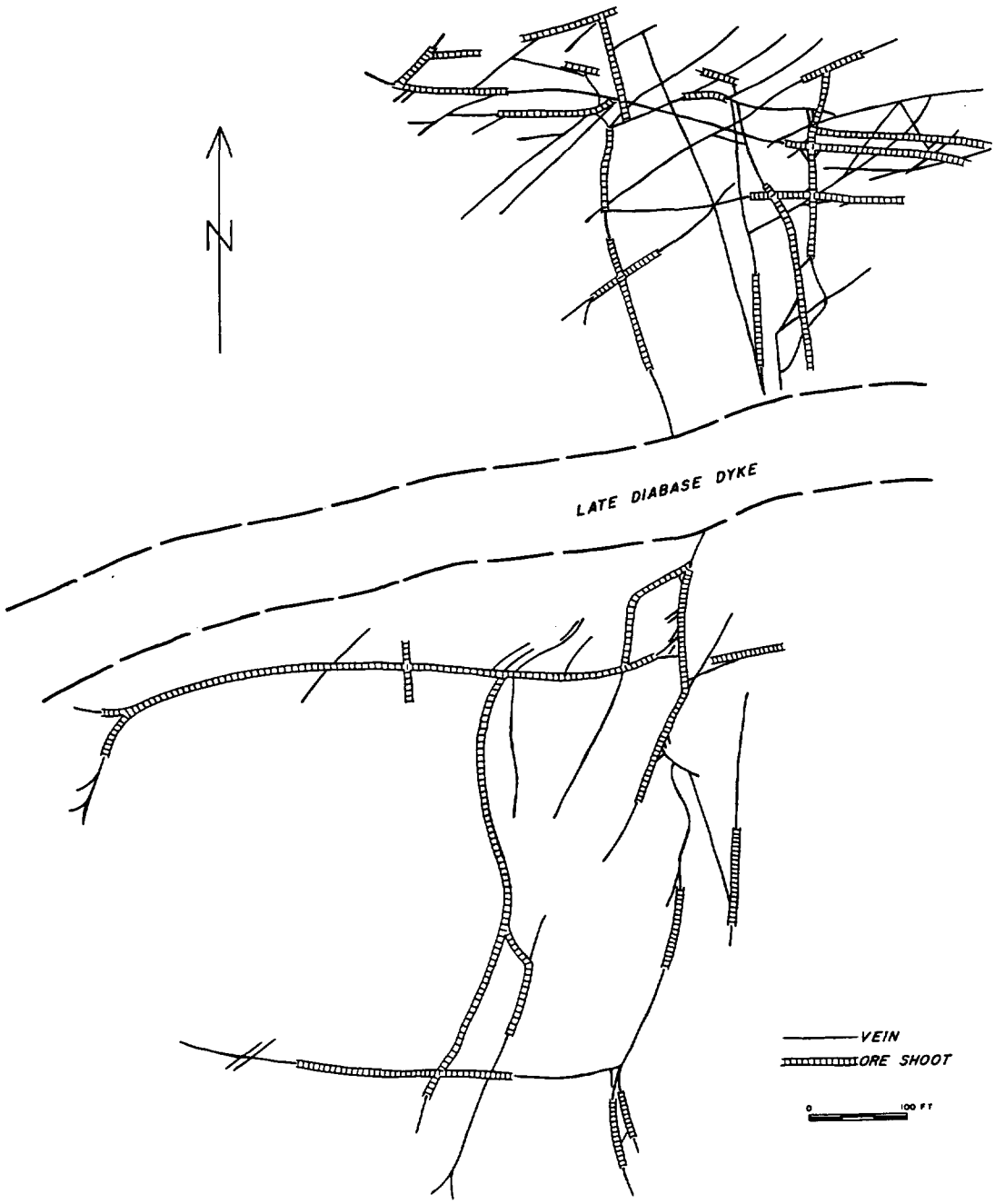


Figure 7.—Composite Plan of Part of the Vein System on the property of Siscoe Metals of Ontario Ltd., showing Stoped Sections in Relation to the Vein Pattern.

Huronian. No pre-Matachewan shearing in either the 050 or 110 direction is known, so these conjugate directions were probably initiated between Matachewan and Huronian time; rejuvenation has occurred at intervals since then. The direction of principal stress which produced the 050 and 110 shear planes would, theoretically, lie on the bisector of the acute angle between the shears, that is, at 080. Veins of this strike are well developed within the diabase, but have not been recorded in Keewatin rocks. These are clearly of tensional origin and resulted from dilation which took place at right angles to the direction of greatest stress. The direction of these tensional veins is exactly at right angles to the 170 veins of similar origin, which are associated with the veins of the 010 - 150 set described above.

The suggested sequence of events leading to the development of the fracture pattern as now seen is as follows:

1.... Compression in the 080 direction in pre-Huronian time led to the development of shears striking at 050 and 110, and, possibly, to tensional openings striking at 080.

2.... A wide-angle, conical fracture was developed, and it was intruded by the Nipissing diabase. The form of the fracture was modified where it cut the earlier, near-vertical, shears.

3.... Compression from the 170 direction, parallel to the Matachewan dykes, led to the development of conjugate shear fractures striking at 010 and 150 and a tensional fracture striking at 170. This compression rejuvenated some of the older fractures of the 050 - 110 set, and emphasized the 080 direction. All these were thus reproduced within the Nipissing diabase intrusive.

4.... As a combined result of the initial compression and the rejuvenation, four active shear planes were developed within the Nipissing diabase; viz., 010, 050, 110 and 150. Relative movement along these shears forced the segments between the 010 and 050, and 110 and 150 planes to move outward (see *Figure 6*). As these segments moved outward, tensional release occurred to compensate for the dilation within the segments. Two tensional directions developed, one associated with each segment; they strike at 050 and 125.

All these directions have been noted in the vein patterns and all contain ore with a greater or lesser frequency. Most of the veins which developed to accommodate compression from the 170 direction lie close to, or beneath, Matachewan diabase dykes. These dykes are far more competent than the ultrabasic-basic suite of Keewatin rocks which they cut. From this association, it is concluded that stress in the 170 direction was transmitted to the Nipissing diabase intrusive through these dykes. Initial deformation took place by fracture in the elastic domain. Rapid build-up of stress, however, permitted local accommodation by fracture in the plastic domain, and during this deformation any original distinctions between fractures of shear origin and tension origin were lost (see *Figure 5*). In the plastic domain, all fracture planes became loci of adjustment and shear trajectories developed in their walls within the limits of plasticity. Mineralization occurred close to the end of plastic deformation. Minor mineralization, with or without rejuvenation of minerals, took place well into the period of deformation in the elastic domain which concluded the deformation as stress declined.

Conclusions

(1) ... The Nipissing diabase intrusive in which the native silver - cobalt arsenide mineralization occurs is in the form of a modified cone sheet and not a sill, as previously proposed. Other diabase bodies in the area are dyke-like complexes, the form of which has been modified by earlier faults.

(2) .... The mineralization occurs in veins, and, from their orientation and properties, a tectonic interpretation, based on well established and generally accepted principles, can be made. A history of fracturing, as the result of compression from different directions, accounts for all the observed features and vein relations. The interpretation of the veins as resulting from the filling of cooling cracks within the diabase intrusive is not tenable and should be discarded. The veins do not have the features of cooling cracks and none should be expected in an intrusive of the type in which the veins are found.

(3) .... The paragenesis of the vein minerals is simple and indicates that the ore minerals were deposited first. Ordered deposition of successive minerals by fracture filling was interrupted by minor movements along the veins.

(4) .... Unusual curved joints are tangential to the veins and, for reasons of symmetry, the two are thought to be related genetically. As a cooling origin for the vein fractures must be discarded, so must this origin for the joints. Stress during the final period of deformation was transmitted to the Nipissing diabase intrusive through rigid dykes contained in highly incompetent rocks. Fractures developed initially by release in the elastic domain. Rapid build-up of stress beyond the elastic limit of the diabase led to plastic deformation within narrow zones containing the veins. In addition to movement on the vein fractures, shear trajectories developed in the form of cycloids tangential to the veins. Mineralization took place as stress declined to below the elastic limit.

Acknowledgments

Permission of both McIntyre Porcupine Mines Ltd. and Siscoe Metals of Ontario Ltd. to publish these observations is acknowledged with thanks.

Ideas presented in this paper were developed as the result of stimulating discussions in the field with many geologists, too numerous to name individually, to each of whom the writer's appreciation is extended.

Dr. N. S. Beaton was kind enough to read the manuscript of this paper. His encouragement and helpful criticism in the field are gratefully acknowledged.

References

Bastin, Edson S., (1949), "Deposition and Resolution of Native Silver of Gowganda, Ontario," *Economic Geology*, Vol. 44, No. 5.

Burrows, A. G., (1926), "Gowganda Silver Area," (4th Report revised), *Ontario Dept. of Mines*, Vol. XXXV, Part 3.

Campbell, Angus D., (1930), "Gowganda Silver Area," *Transactions*, C.I.M., Vol. XXXIII, pp. 272-291.

Carey, S. Warren, (1957), "Relation of Basic Intrusions to Thickness of Sediments," Dolerite — A Symposium, *University of Tasmania* Publication, pp. 165-169.

Eakins, P. R., (1959), Private Report to Siscoe Metals of Ontario Ltd. and McIntyre Porcupine Mines Ltd.

Eakins, P. R., (1961), "Cylindroidal Jointing in Diabase at Gowganda, Ontario," *Proceedings*, G.A.C., Vol. 13, pp. 85-93.

Mason, J., (1959), "Geology of Christopher Mine," *Canadian Mining Journal*, Vol. 80, No. 11, pp. 71-77.
Moore, E. S., (1955), "Geology of the Miller Lake Portion of the Gowganda Silver Area," *Ontario Dept. of Mines*, 64th Annual Report, Vol. LXIV, Part 5.
Norman, G. W. H., (1948), "Major Faults, Abitibi Region," in *Structural Geology of Canadian Ore Deposits*, C.I.M., p. 836.
Jaeger, J. C., (1957), "The Solidification and Cooling of Intrusive Sheets," Dolerite — A Symposium, *University of Tasmania* Publication, pp. 77-87.
Thompson, R., (1957), "Cobalt Camp," *Structural Geology of Canadian Ore Deposits*, C.I.M., pp. 377-388.
Todd, E. W., (1926), "Gowganda Vein Minerals," *Ontario Dept. of Mines*, Vol. XXXV, Part 3.
Wilson, J. Tuzo, (1949), "Some Major Structures of the Canadian Shield," *Transactions*, C.I.M., Vol. LII, pp. 231-242.

ANNEX "E-1"

Swastika Laboratories

A Division of TSL/Assayers Inc.

Assaying - Consulting - Representation

Established 1928

Assay Certificate

7W-3533-RA1

Company: **R. DUFRESNE**
Project: OPAP-97
Attn: R. Dufresne

Date: SEP-22-97

We hereby certify the following Assay of 52 Rock samples submitted SEP-04-97 by .

Sample Number	Au g/tonne	Au Check g/tonne	Ag oz/ton	Co %	Cu %	Ni %	Pb %	Zn %
51	-	-	0.01	0.001	0.68	0.009	0.003	0.010
52	-	-	0.01	0.004	0.57	0.006	-	-
53	-	-	0.03	0.001	1.55	0.004	-	-
54	-	-	0.01	0.004	0.038	0.006	-	-
55	-	-	0.01	0.144	0.005	0.013	-	-
56	-	-	0.03	0.36	0.145	0.021	-	-
57	-	-	0.06	0.38	0.006	0.031	-	-
58	-	-	0.02	0.141	0.003	0.015	-	-
59	-	-	0.19	0.72	0.23	0.072	-	-
60	0.01	-	1.03	3.92	4.58	0.43	0.014	0.002
61	0.01	-	0.73	3.48	2.90	0.32	0.013	0.004
62	-	-	0.08	0.162	0.026	0.018	-	-
63	-	-	0.09	0.014	0.100	0.009	-	-
64	-	-	0.51	0.204	14.02	0.011	-	-
65	-	-	0.08	0.69	0.26	0.071	-	-
66	0.05	-	1.99	7.40	12.44	0.54	0.015	0.003
67	-	-	0.31	0.61	0.182	0.057	-	-
68	-	-	1.42	1.83	2.84	0.23	0.009	0.004
69	0.05	-	4.12	2.56	13.74	0.22	0.006	0.007
70	-	-	0.07	0.040	2.49	0.004	-	-
71	-	-	0.07	0.107	0.22	0.013	-	-
72	0.06	-	2.80	6.08	5.54	0.55	-	-
73	0.02	-	1.98	3.23	3.90	0.33	0.005	0.006
74	0.03	-	1.27	3.13	2.90	0.27	-	-
75	-	-	0.06	0.30	0.55	0.033	-	-
76	0.03	0.02	0.50	3.73	6.72	0.42	0.008	0.003
77	-	-	0.11	0.29	0.38	0.035	-	-
78	-	-	0.71	1.35	3.39	0.161	-	-
79	-	-	0.13	0.188	0.022	0.021	-	-
80	-	-	0.07	0.42	0.047	0.024	-	-

One assay ton portion used.

Certified by G. Libby

1 Cameron Ave., P.O. Box 10, Swastika, Ontario P0K 1T0
Telephone (705)642-3244 Fax (705)642-3300

Swastika Laboratories

A Division of TSL/Assayers Inc.

Established 1928

Assaying - Consulting - Representation

Assay Certificate

7W-3533-RA1

Company: **R. DUFRESNE**
Project: OPAP-97
Attn: R. Dufresne

Date: SEP-22-97

We hereby certify the following Assay of 52 Rock samples submitted SEP-04-97 by .

Sample Number	Au g/tonne	Au Check g/tonne	Ag oz/ton	Co %	Cu %	Ni %	Pb %	Zn %
81	-	-	0.02	0.25	0.034	0.020	-	-
82	-	-	0.08	0.180	0.142	0.018	-	-
83	0.04	0.04	4.70	0.157	3.83	0.014	0.001	0.024
84	-	-	0.06	0.183	0.145	0.021	-	-
85	-	-	0.09	0.011	0.46	0.003	-	-
86	-	-	0.01	0.005	0.023	0.007	0.001	0.022
87	-	-	0.03	0.003	0.040	0.007	-	-
88	-	-	0.11	0.132	0.53	0.028	0.012	0.012
89	-	-	0.05	0.60	0.055	0.130	-	-
90	-	-	0.06	0.46	0.022	0.087	-	-
91	0.08	-	0.12	0.010	0.94	0.005	-	-
92	0.04	0.05	0.01	0.020	0.084	0.005	-	-
93	0.21	-	0.17	0.164	0.89	0.012	-	-
94	0.21	-	0.10	0.022	1.60	0.006	-	-
95	0.75	0.84	0.48	0.050	4.23	0.008	-	-
96	0.20	-	0.64	0.011	4.56	0.003	-	-
97	0.12	-	0.13	0.020	1.41	0.007	0.017	0.013
98	0.13	-	0.10	0.013	1.16	0.008	0.066	0.041
99	0.09	-	0.26	0.031	5.59	0.007	0.007	0.009
100	0.06	-	0.47	0.040	5.30	0.006	-	-
112	0.39	-	0.82	0.024	8.46	0.004	-	-
113	0.04	-	0.01	0.007	0.149	0.007	-	-

One assay ton portion used.

Certified by G. Gelop

1 Cameron Ave., P.O. Box 10, Swastika, Ontario P0K 1T0
Telephone (705)642-3244 Fax (705)642-3300

ANNEX "E-2"

PROSPECTING PROGRAM

CHARTRE-DUFRESNE OPAP PROJECT

FARR TOWNSHIP

December 1997

TABLE OF CONTENTS

MAPS

I - INTRODUCTION:

This report, written at the request of D. Chartré and R. Dufresne, describes the PROSPECTING program carried out on the CHARTRE-DUFRESNE property located in Farr township, province of Ontario.

The stripping, trenching and sampling program was undertaken during the months of August, September and October 1997. The program also included line cutting and a magnetometer survey.

The PROSPECTING program was initiated to re-evaluate the SILVER, COBALT and COPPER occurrences located on the former « Roy Silver Mines Ltd. » property, and also, to search for additional veins which could occur within the local diabase sill.

II - PROPERTY:

The CHARTRE-DUFRESNE property referred to in this report consists of 2 sixteen hectare claims located in the south-central area of FARR twp. The claims are numbered 1214380 and 1214381.

III - LOCATION & ACCESSIBILITY:

The claim group located in FARR township lies at an approximate distance of 10 Km northwest of the town of Elk Lake. From Elk Lake, the property is readily accesible by driving northwestwards along highway 65 for a

distance of 13.6 Km then, southwestwards along logging roads for an additional distance of 7.6 Km; the logging road traverses the claims in a north-south direction.

IV - PROSPECTING PROGRAM (1997):

A) Stripping, trenching & sampling:

A total of 15 distinct areas have been subjected to stripping and sampling along an area measuring approximately 900 m long by 300 m wide. A few old pits and trenches have also been dewatered.

Trenching and stripping was done with a mechanical shovel; the exposed bedrock was then cleaned by a fire hose. Exposed veins were then sampled and assayed.

The most important veining system has been observed within area 2-A - the former Roy mine site. The main vein has been observed for a length of 90 m, its width varies from a few cm to 30 cm. The vein is occasionally off-set by a few cm by faulting.

The vein material consists mainly of calcite, occasionally stained pink (cobalt bloom). The vein contains disseminated cobalt arsenides and chalcopyrite. The 55 samples taken along the vein averaged the following: 0.7 oz Ag/T, 1.64% Co., 3.22% Cu and 0.16% Ni.

The trenched and stripped (areas) containing calcite veins within the

the established grid lie between line 100 S and line 600 s from 80 W to 100 W - they include (areas) 2-A, 3, 4, 5 and 6.

The other stripped areas contain occasional narrow quartz-hematite veins, most of which trend north-south. A few veins containing disseminated chalcopyrite have also been observed, the most important of which occurs in (area) 12 where an old pit exposes a 20 cm wide vein with appreciable disseminated chalcopyrite.

The (areas) of trenching and sampling have been drawn on a map at the scale of 1:1 000.

B) Magnetometer Survey:

In addition to the trenching and sampling, a magnetometer survey was carried out along an established grid whose 800 m long base line trends north south - cross lines, spaced at every 100 m intervals extend on both sides of the base line to cover the claims. Thus, a total of 5.1 line Km have been cut and surveyed.

The magnetometer survey was carried out using an Exploranium G - 816 proton magnetometer; readings were taken at every 12.5m intervals.

The data were plotted on a map at the scale of 1:5 000; the report includes a coloured map, black and white maps with posted readings

and contoured intervals.

The magnetometer survey has defined 2 anomalous zones in the vicinity of the base line, these trend more or less north-south. The anomalous zones appear to be caused by local increases of disseminated magnetite within the main diabase sill.

V - CONCLUSIONS & RECOMMENDATIONS:

The PROSPECTING program carried out on the CHARTRE-DUFRESNE property located in Farr township included trenching, stripping and sampling along a length of 800 m. The program included that area located on the former ROY property mine site. The extensive trenching did not, however, expose any new COBALT-SILVER vein systems.

The MAGNETOMETER survey appears to indicate the presence of a fault zone which could explain the fact that calcite veins have not been observed south of line 600 S.

The north-south trending stream located in the western area of the property could indicate the presence of a stronger fracture system. which should be investigated for the presence of COBALT-SILVER veins.

Respectfully submitted:

E. Chartré, B.A., B. Sc.: _____ December 5,1997

Swastika Laboratories

A Division of TSL/Assayers Inc.

Assaying - Consulting - Representation

Established 1928

Assay Certificate

7W-3533-RA1

Date: SEP-22-97

Company: **R. DUFRESNE**
Project: OPAP-97
Attn: R. Dufresne

We hereby certify the following Assay of 52 Rock samples submitted SEP-04-97 by .

Sample Number	Au g/tonne	Au Check g/tonne	Ag oz/ton	Co %	Cu %	Ni %	Pb %	Zn
51	-	-	0.01	0.001	0.68	0.009	0.003	0.010
52	-	-	0.01	0.004	0.57	0.006	-	
53	-	-	0.03	0.001	1.55	0.004	-	
54	-	-	0.01	0.004	0.038	0.006	-	
55	-	-	0.01	0.144	0.005	0.013	-	
56	-	-	0.03	0.36	0.145	0.021	-	
57	-	-	0.06	0.38	0.006	0.031	-	
58	-	-	0.02	0.141	0.003	0.015	-	
59	-	-	0.19	0.72	0.23	0.072	-	
60	0.01	-	1.03	3.92	4.58	0.43	0.014	0.00
61	0.01	-	0.73	3.48	2.90	0.32	0.013	0.004
62	-	-	0.08	0.162	0.026	0.018	-	
63	-	-	0.09	0.014	0.100	0.009	-	
64	-	-	0.51	0.204	14.02	0.011	-	
65	-	-	0.08	0.69	0.26	0.071	-	
66	0.05	-	1.99	7.40	12.44	0.54	0.015	0.00
67	-	-	0.31	0.61	0.182	0.057	-	
68	-	-	1.42	1.83	2.84	0.23	0.009	0.00
69	0.05	-	4.12	2.56	13.74	0.22	0.006	0.00
70	-	-	0.07	0.040	2.49	0.004	-	
71	-	-	0.07	0.107	0.22	0.013	-	
72	0.06	-	2.80	6.08	5.54	0.55	-	
73	0.02	-	1.98	3.23	3.90	0.33	0.005	0.006
74	0.03	-	1.27	3.13	2.90	0.27	-	
75	-	-	0.06	0.30	0.55	0.033	-	
76	0.03	0.02	0.50	3.73	6.72	0.42	0.008	0.003
77	-	-	0.11	0.29	0.38	0.035	-	
78	-	-	0.71	1.35	3.39	0.161	-	
79	-	-	0.13	0.188	0.022	0.021	-	
80	-	-	0.07	0.42	0.047	0.024	-	

One assay ton portion used.

Certified by G. Libby

1 Cameron Ave., P.O. Box 10, Swastika, Ontario P0K 1T0
Telephone (705)642-3244 Fax (705)642-3300

Swastika Laboratories

A Division of TSL/Assayers Inc.

Established 1928

Assaying - Consulting - Representation

Assay Certificate

7W-3533-RA1

Company: **R. DUFRESNE**
Project: OPAP-97
Attn: R. Dufresne

Date: SEP-22-97

We hereby certify the following Assay of 52 Rock samples submitted SEP-04-97 by .

Sample Number	Au g/tonne	Au Check g/tonne	Ag oz/ton	Co %	Cu %	Ni %	Pb %	Zn %
81	-	-	0.02	0.25	0.034	0.020	-	-
82	-	-	0.08	0.180	0.142	0.018	-	-
83	0.04	0.04	4.70	0.157	3.83	0.014	0.001	0.024
84	-	-	0.06	0.183	0.145	0.021	-	-
85	-	-	0.09	0.011	0.46	0.003	-	-
86	-	-	0.01	0.005	0.023	0.007	0.001	0.022
87	-	-	0.03	0.003	0.040	0.007	-	-
88	-	-	0.11	0.132	0.53	0.028	0.012	0.012
89	-	-	0.05	0.60	0.055	0.130	-	-
90	-	-	0.06	0.46	0.022	0.087	-	-
91	0.08	-	0.12	0.010	0.94	0.005	-	-
92	0.04	0.05	0.01	0.020	0.084	0.005	-	-
93	0.21	-	0.17	0.164	0.89	0.012	-	-
94	0.21	-	0.10	0.022	1.60	0.006	-	-
95	0.75	0.84	0.48	0.050	4.23	0.008	-	-
96	0.20	-	0.64	0.011	4.56	0.003	-	-
97	0.12	-	0.13	0.020	1.41	0.007	0.017	0.013
98	0.13	-	0.10	0.013	1.16	0.008	0.066	0.041
99	0.09	-	0.26	0.031	5.59	0.007	0.007	0.009
100	0.06	-	0.47	0.040	5.30	0.006	-	-
112	0.39	-	0.82	0.024	8.46	0.004	-	-
113	0.04	-	0.01	0.007	0.149	0.007	-	-

One assay ton portion used.

Certified by G. Gilbert

1 Cameron Ave., P.O. Box 10, Swastika, Ontario P0K 1T0
Telephone (705)642-3244 Fax (705)642-3300

TRENCHING ALONG DIABASE SILL
NORTH OF ROAD

MECHANICAL SHOVEL AT WORK

CHARTRE-DUFRESNE PROPERTY

OPAP PROJECT

Dec. 1997

SERVICES EXPLORATION ENRG.

EXPOSING MAIN VEIN

ROY SHAFT AREA

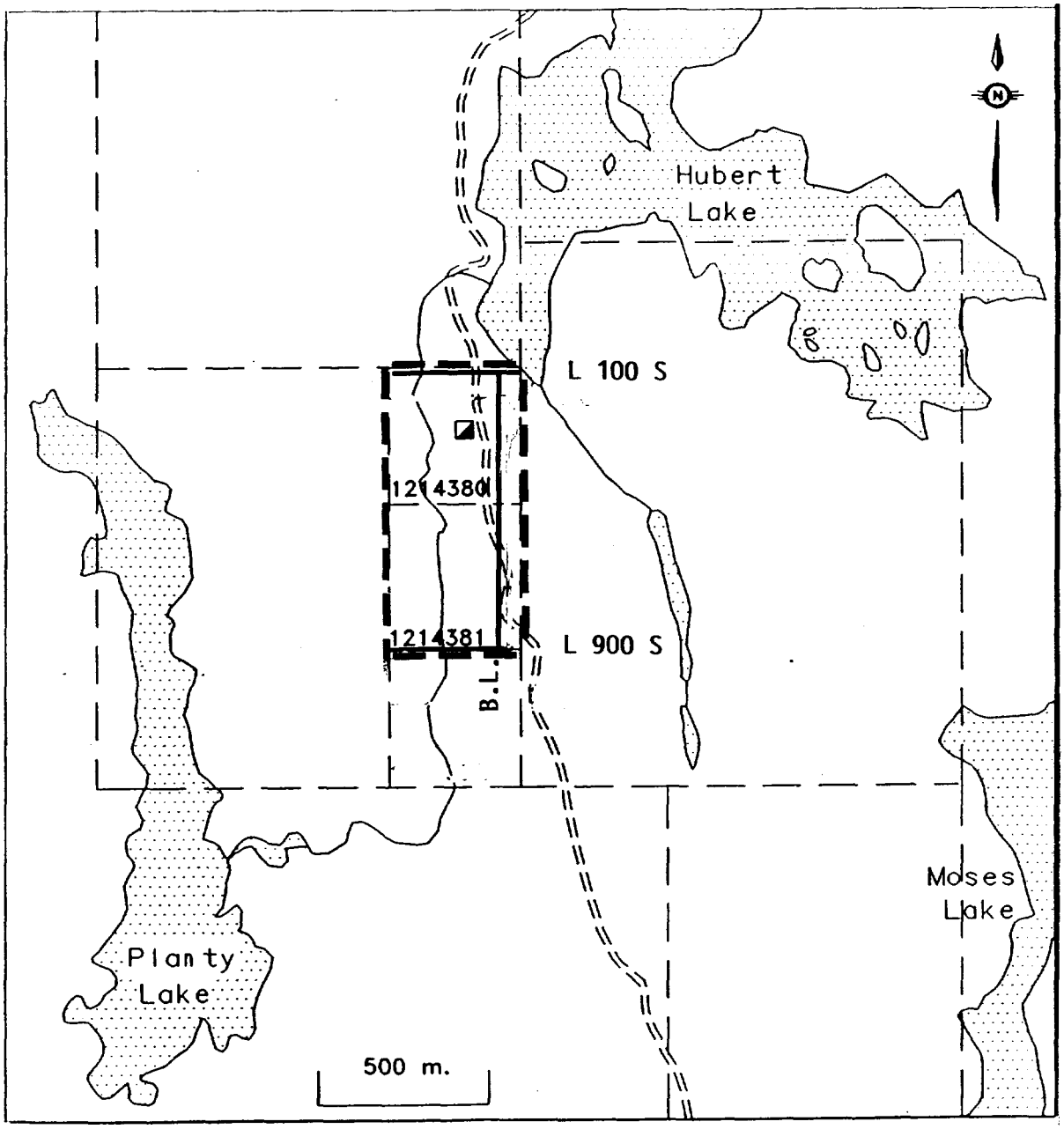
MAIN VEIN NEAR SHAFT

CHARTRE-DUFRESNE PROPERTY

OPAP PROJECT

Dec. 1997

SERVICES EXPLORATION ENRG.

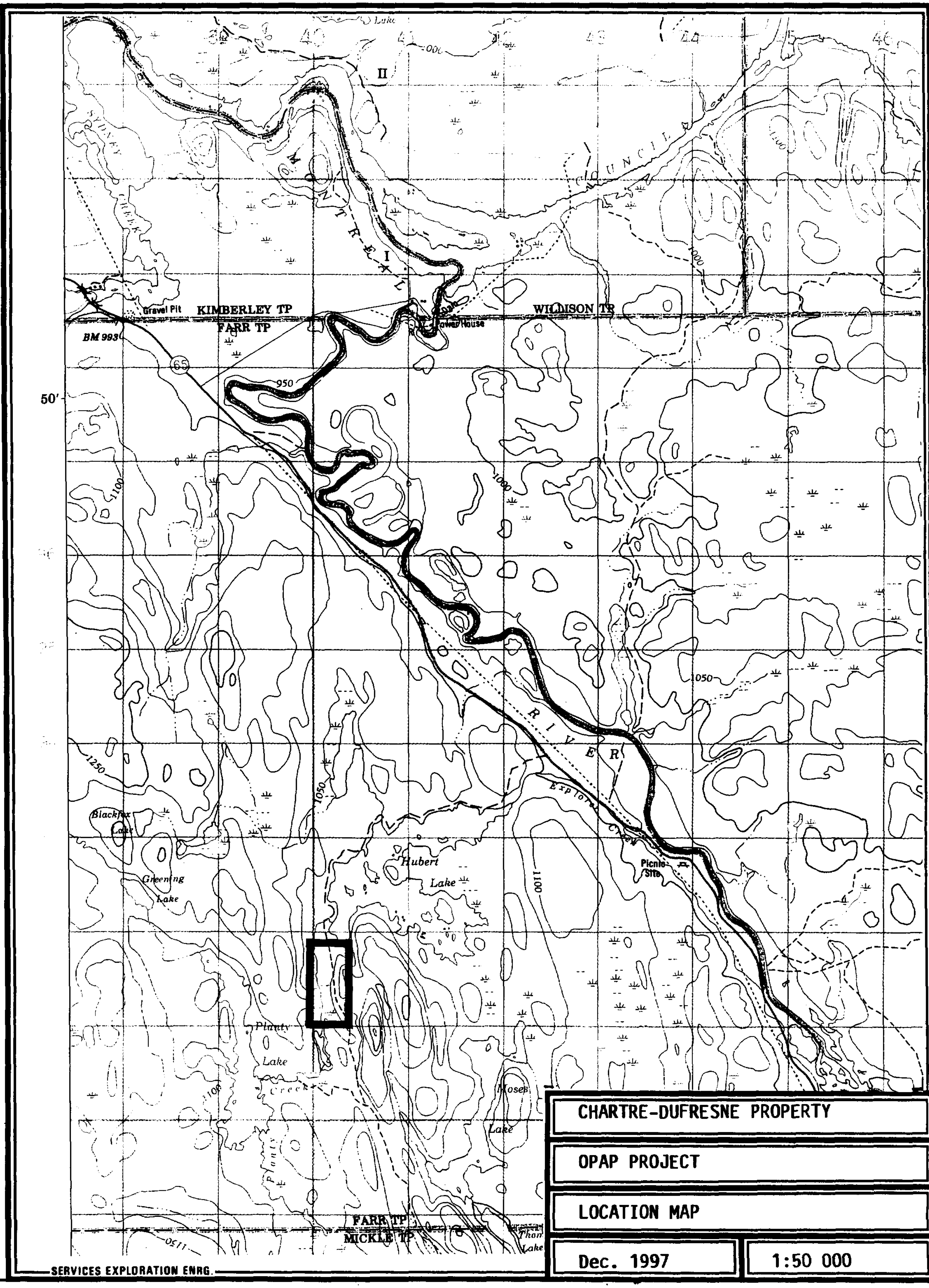


CHARTRE-DUFRESNE PROPERTY

FARR TWP. CLAIM MAP

Dec. 1997 | 1:20 000

SERVICES EXPLORATION ENRG.

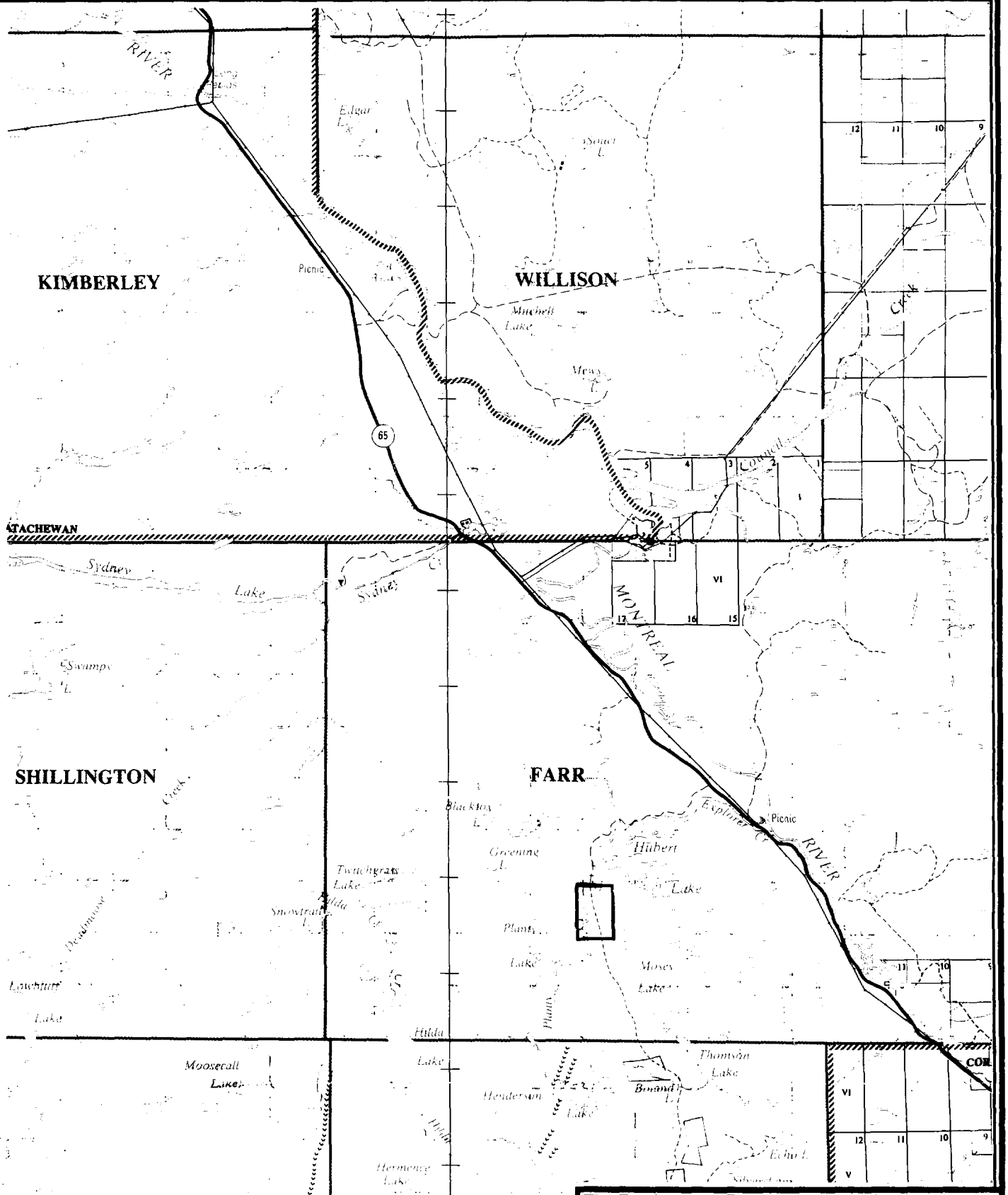


CHARTRE-DUFRESNE PROPERTY

OPAP PROJECT

LOCATION MAP

Dec. 1997	1:50 000



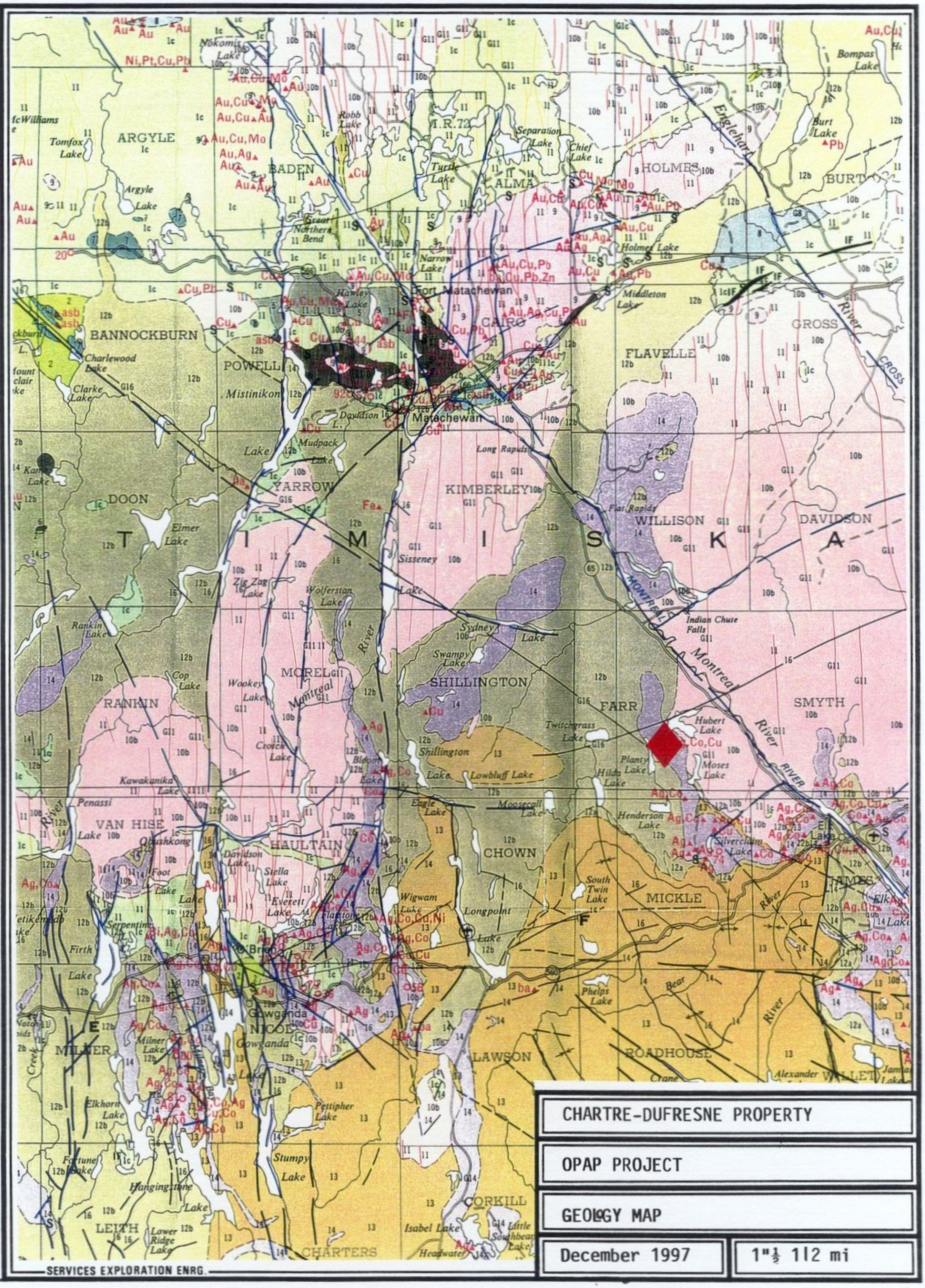
CHARTRE-DUFRESNE PROPERTY

OPAP PROJECT

LOCATION MAP

Dec. 1997 | 1:100 000

SERVICES EXPLORATION ENRG.



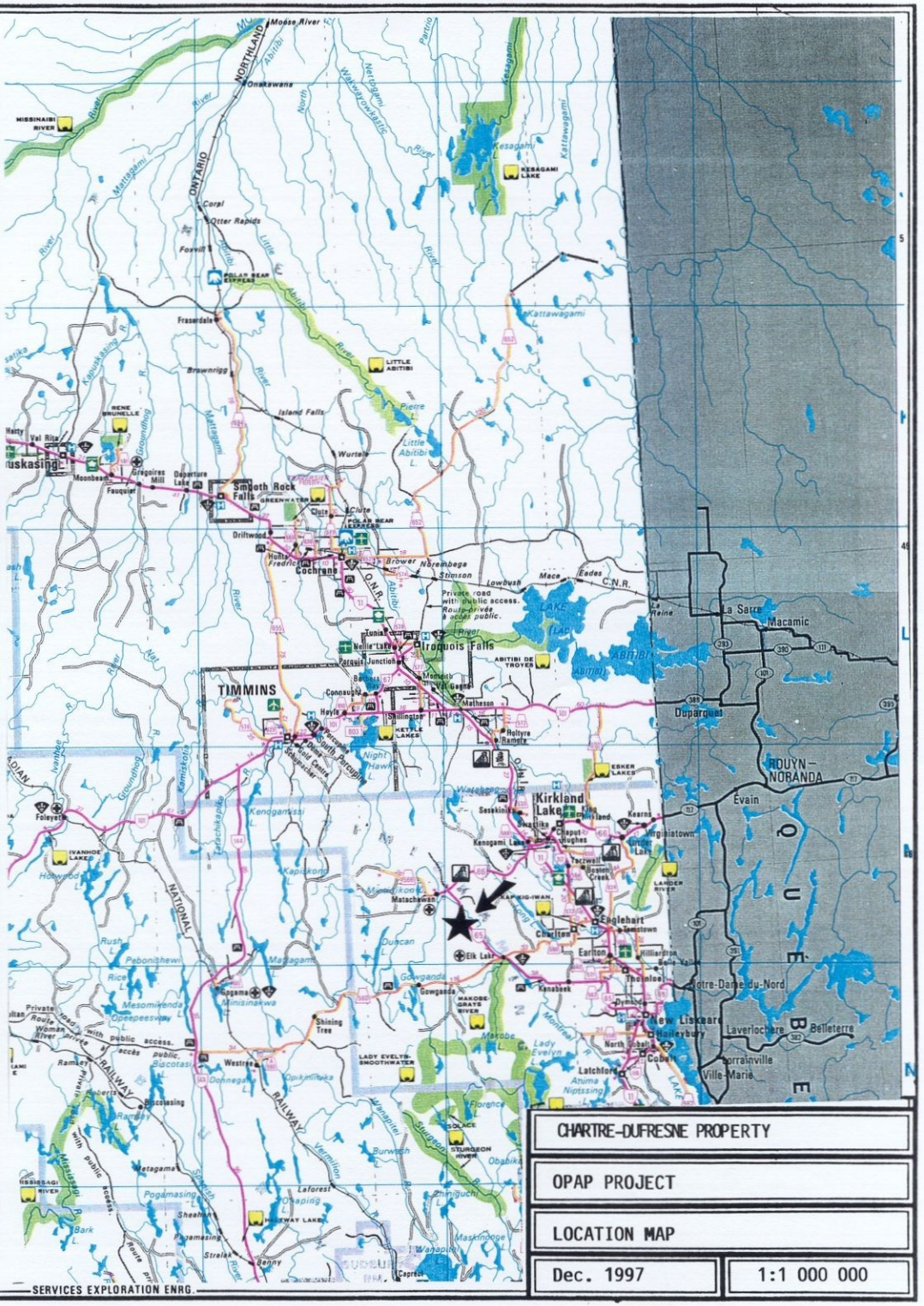
CHARTRE-DUFRESNE PROPERTY

OPAP PROJECT

GEOLGY MAP

December 1997

1"½ 1|2 mi



CHARTRE-DUFRESNE PROPERTY

OPAP PROJECT

LOCATION MAP

Dec. 1997

1:1 000 000

ANNEX #1

NAME OF PROPERTY BOLAND-THOMSON

LOCATION

Lat. 47°45' Long. 80°27'

Mining Division Larder Lake District Timiskaming

County Township ~~or Parish~~ Farr and Mickle

Lot Concession or Range

Sec. Tp. R.

OWNER OR OPERATOR AND ADDRESS

Vermont Mines Limited,
Suite 505, 80 Richmond St. W.,
Toronto.

DESCRIPTION OF DEPOSIT

Ore or substance

Character of Deposit--Nipissing diabase underlies most of the property. Granite, part of the Round Lake batholith, outcrops in the eastern part of the property. A trench 3 to 4 feet in depth has been blasted along a ½ to 2 inch calcite vein for 60 feet. A rich pocket of silver is located in the vein about 15 feet from the northern end of the trench. Some native silver and argentite occur as well in the diabase adjacent to the vein. West and north of the shaft, reconnaissance has shown a great many calcite veins to be present.

Associated Minerals of value - Cobalt.

HISTORY OF EXPLORATION AND DEVELOPMENT

In 1909 the Boland-Thomson Silver Mining Company, Limited was incorporated to develop this prospect. A shaft, with some lateral development on the bottom level, was sunk to a depth of 70 feet, and several pits and trenches dug.

In 1946, the Fahrenheit Mining Company Limited acquired part of the present property, dewatered the shaft, and sampled the bottom level. The workings were then allowed to flood. In 1954 the property was optioned to W.S. Kennedy and 12 diamond drill holes put down (1,000 feet). Dr. R. Thomson, Resident Geologist for the Ontario Department of Mines, examined the property, and took some samples. The sampling and drill results show that silver is present in significant amounts.

In 1960 Vermont Mines Limited acquired 10 claims and optioned 2 additional claims covering the prospect.

Shipping point | Distance from mine

Material shipped | Carrier

Destination

MAP REFERENCES

Map 41 P/NE, Elk Lake, Ontario, (Topo.), Sc. 1":2 miles.

Map 283G, Elk Lake, (Aeromagnetic), Sc. 1":1 mile.

Map P-240, Mickle Township, (Geol., 1964), Sc. 1":¼ mile.

Map 2046, Timmins-Kirkland Lake, (Geol. Compil., 1964), Sc. 1": 4 miles.

REMARKS

Mineral Resources Division; Corporation Files "V nt Mines Limited"; "Brant Mines Limited".

Annual Report, Dept. of Mines, Ont.; Vol. 56, Part 2, p. 106, 1947.

AUG 1969

ONTARIO BUREAU OF MINES, 1918

Vol. XXVII., Part III.

Section I

COBALT

ITS

OCCURRENCE, METALLURGY, USES AND ALLOYS

By

Charles W. Drury

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:

Printed and Published by A. T. WILGRESS, Printer to the King's Most Excellent Majesty

1919

Ontario, Canada[2]

Situation and Discovery

The ore bodies at Cobalt, which carry silver, cobalt, nickel, and arsenic, e discovered in 1903 during the building of the Timiskaming and Northern ario railway. The first of these deposits to be worked lies within half a mile Cobalt station, which is about 330 miles north of Toronto. One of the oldest wn ore bodies in North America, the argentiferous galena on the east side of e Timiskaming, is distant only eight miles from Cobalt station. This galena osit, known as the Wright mine, was apparently discovered by voyageurs over years ago.

It may be added that the building of the Canadian Pacific railway exposed Sudbury nickel deposits 90 miles southwest of Cobalt. It can thus be l that each of the two railways in this part of Ontario, brought to light an portant mineral field.

The Sudbury deposits have received a great deal of attention from geologists his and other continents. One group, among whom may be mentioned Barlow,[3] eman,[4] and Vogt, regard them as due to magmatic segregation from an original eous magma, without further concentration. Another group, among whom Dickson,[5] Beck,[6] and Knight,[7] contend that these deposits are the result iqueous igneous action, and that the sulphides were deposited after the accom-ying rocks were formed.

Before proceeding to a consideration of the cobalt veins, a table showing the relations of the rocks at Cobalt is given below.

[1] Bowler, Chinese Treatment of Cobalt Ores. Chemical News, Vol. LVIII, 1888, p. 100.

[2] Miller, Willet G., The Cobalt-Nickel Arsenides and Silver Deposits of Timiskaming, tario. Reports of Bureau of Mines, Ontario: Vol. XIV, Pt. II, first edition, 1905; second tion, 1906; third edition, 1908; fourth edition, Vol. XIX, Pt. II, 1913. The larger part the description of the deposits at Cobalt is taken from Dr. Miller's reports.

[3] Barlow, Nickel and Copper Deposits of the Sudbury Mining District. Geol. Survey Can., 1901, Pt. H.

[4] Coleman, The Sudbury Nickel Region, Ontario Bureau of Mines, Vol. XIV, 1905, Pt. III; e Nickel Industry, with Special Reference to the Sudbury Region, Ontario, Department of nes, Ottawa, 1913.

[5] Dickson, The Ore Deposits of Sudbury, Ontario. Am. Inst. Min. Eng. Trans., Vol. XXIV, 1904, pp. 3-67.

[6] Beck, The Nature of Ore Deposits, p. 41.

[7] Knight, Origin of Sudbury Nickel-Copper Deposits. Eng. and Min. Jour., Vol. CI, 16, p. 811; also Report Royal Ontario Nickel Commission, 1917.

PALEOZOIC
Silurian
Niagara

(*Great unconformity*)

EOZOIC OR PRE-CAMBRIAN
Later Dikes

Nipissing Diabase
(*Intrusive contact.*)

Cobalt Series
(*Unconformity*)

Lorrain Granite
(*Intrusive contact.*)

Lamprophyre Dikes
(*Intrusive contact.*)

Timiskaming Series
(*Unconformity*)

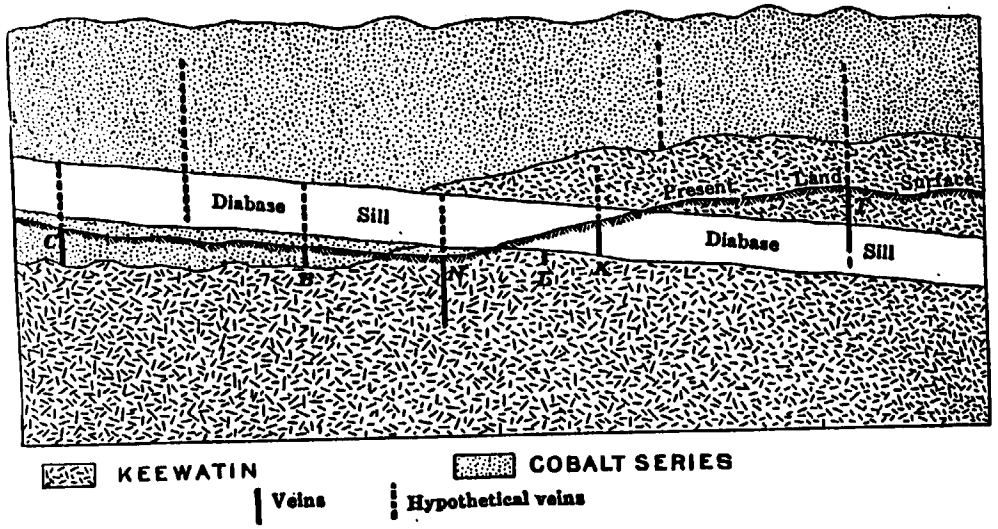
Keewatin Complex

Character and Origin of Cobalt Veins

The deposits at Cobalt occupy narrow, practically vertical fissures, and joint-planes in the metamorphosed Cobalt series. A few productive veins of similar form have been found in the intrusive Nipissing diabase. Others occur in the Keewatin, which is the oldest series of the area, and which consists of basic volcanic rocks. The most productive veins in the Keewatin have been No. 26 on the Nipissing and the vein system on the Timiskaming-Beaver. The former vein lies close to the western edge of the diabase sill. Before erosion of the sill took place, vein No. 26 lay beneath the sill or in its foot-wall. The Timiskaming-Beaver veins, on the other hand, lie in the upper or hanging wall of the sill. There are veins which run from the conglomerate and other fragmental rocks of the Cobalt series into the underlying Keewatin; and there are veins, e.g. the Nova Scotia and Timiskaming veins, which run downward from the Keewatin into the underlying, intrusive Nipissing diabase. A vein on the Cobalt Central passes from the surface downward through the Nipissing diabase into the Cobalt series, which here forms the foot-wall of the diabase sill. Moreover, "blind" veins, or veins that do not outcrop at the surface, have been worked on several properties. One of the most interesting of these occurs beneath Peterson lake. This vein is in the Keewatin, which is here overlain by the Nipissing diabase sill. The vein runs up to the bottom of the sill, but not into it. The figure on page 24 shows the relationship of the rocks and the type veins described.

[1] Miller, W. G., The Cobalt-Nickel Arsenides and Silver Deposits of Timiskaming, Ontario, fourth edition, Ont. Bur. Min., Vol. XIX, 1913, Pt. II, p. 48.

The veins of ... st of the producing mines lay below the diabase sill before it was eroded, e.g., those on the Coniagas, Nipissing, Hudson Bay, Trethewey, Buffalo, Mining Corporation, Crown Reserve, Drummond, Lawson at Kerr lake, LaRose and McKinley-Darragh at Cobalt lake. The King Edward, Silver Cliff, and some of the O'Brien veins lie within the sill. In the outlying camps good examples of veins occurring in the sill are the Wettlaufer of South Lorrain, and Miller-Lake O'Brien of Gowganda.



Generalized vertical section through the productive part of the Cobalt area.

The section shows the relations of the Nipissing diabase sill to the Keewatin and the Cobalt series, and to the veins. The eroded surface is restored in the section. The sill is less regular than the illustration shows it to be.

B and C represent a large number of veins that are in the fragmental rocks, Cobalt series, in the lower or foot-wall of the eroded sill. N represents a type of vein, such as No. 26 on the Nipissing, in the Keewatin below the eroded sill, and L a type such as one under Peterson lake, in the Keewatin foot-wall, but not extending upward into the sill; K, a vein in the sill itself, such as No. 3 on the Kerr Lake property; T, a vein such as that on the Timiskaming or Beaver properties, in the Keewatin hanging wall and extending downward into the sill.

At Diabase mountain the top of the hill is diabase, while the rocks below the diabase are composed of slates and conglomerates lying on Keewatin greenstones, so that certain veins, as on the Penn-Canadian and Bailey, started in the sill and continued downward into the underlying rocks.

At the Timiskaming shaft the upper contact between the Keewatin and the diabase is approximately 575 feet from the surface. Along this contact, both above and below, the Timiskaming and Beaver mines have recovered their richest ores. In order to ascertain the thickness of this diabase sill it was diamond-drilled, and the lower contact between the diabase and the Keewatin formations was found at an approximate depth of 1,670 feet from the surface, showing the sill to have a thickness of about 1,100 feet. After diamond drilling was finished, a shaft was sunk through the sill. Exploration work from this shaft, conducted along the ... f the sill and in the rocks immediately below, has failed to disclose

The following paragraphs, regarding the origin of th ...es at Cobalt, ar... copies from W. G. Miller's report.[1]

The material in the veins at Cobalt has, in all likelihood, been deposited from highl... heated and impure waters which circulated through the cracks and fissures of the crust an... probably were associated with—followed—the Nipissing diabase eruption.

The waters are said to be associated or connected with the diabase eruption in th... sense that they probably represented the end product of the eruption. In many volcani... regions, hot springs are present long after the rocks have solidified. In the Cobalt are... the fissures and joints now occupied by the ores were probably produced by the gradu... shrinkage in cooling of the diabase, the ores being deposited by the waters which represente... the last stage of vulcanicity.

It is rather difficult to predicate the original source of the metals—silver, cobal... nickel, arsenic, and others—now found in these veins. They may have come up from ... considerable depth with the waters, or they may have been leached out of what are now th... folded and disturbed greenstones and other rocks of the Keewatin. Analyses of variou... rocks of the area have not given a clue to the origin of the ores. However, the widespread... occurrence of cobalt veins in the diabase, or in close association with it, shown by discoveri... throughout a region three thousand square miles or more in extent, appears to be pretty co... clusive proof that the diabase and the ores came from one and the same magma.

As the ore bodies in the vicinity of Cobalt station, and elsewhere in Ontario, may ... said to be unique among those known in North America, we have no chance of institutin... comparisons on this continent. Some European veins, however, such as those of Annaber... Joachimsthal and other localities[2] show a similar association of minerals.

These European ores are considered by most authors to be genetically connected wi... intrusions of granite. At Joachimsthal the veins are said to be cut across by basic dik... and there is evidence to the effect that at the time of the eruption of the dikes the ve... formation had not yet been completed. Since especially nickel and cobalt minerals a... characteristically connected with basic rocks, the question arises as to whether the Europe... ores mentioned may not be more closely connected in origin with basic rocks than they a... considered to be. There may be deeper seated intrusions of these rocks slightly older th... the dikes.

Ores and Minerals

The most important ore in the veins at Cobalt is native silver, associat... with which is usually some dyscrasite, argentite, pyrargyrite and other compoun... of silver, smaltite, niccolite, and related minerals. Many of the minerals occ... mixed in the ores and for this reason some of them have not been clearly identifi... Another feature of the minerals, which renders their identification difficult, is t... fact that most of them occur in the massive form. Crystals when present are sm... being frequently almost microscopic in size. The following minerals have be... identified and can be conveniently classed under the headings:

I. Native Elements.—Native silver, native bismuth, graphite.

II. Arsenides.—Niccolite, NiAs; chloanthite, $NiAs_2$; smaltite, $CoAs_2$; a... löllingite, $FeAs_2$.[3]

III. Arsenates.—Erythrite, or cobalt bloom $Co_3As_2O_8.8H_2O$; annaberg... or nickel bloom $Ni_3As_2O_8.8H_2O$; scorodite, $FeAsO_4.2H_2O$.

IV. Sulphides.—Argentite, Ag_2S; millerite, NiS; argyropyrite?; strom... erite? $(Ag,Cu)_2S$; bornite, Cu_5FeS_4; chalcopyrite, $CuFeS_2$; sph... erite, ZnS; galena, PbS; pyrite, FeS_2.

V. Sulpharsenides.—Mispickel, FeAsS; cobaltite, CoAsS.

VI. Sulpharsenites.—Proustite, Ag_3AsS_3; xanthoconite? Ag_3AsS_3.

[1] Miller, W. G., Ont. Bur. Min., Vol. XIX, 1913, Pt. II, p. 8.

[2] See description, page 6.

[3] Ellsworth, A Study of Certain Minerals from Cobalt, Ontario. Ont. Bur. Min., ...

VII. Antimonides.—Dyscrasite, Ag_6Sb; breithauptite, NiSb.

VIII. Sulphantimonites.—Pyrargyrite, Ag_3SbS_3; stephanite, Ag_5SbS_4; polybasite? Ag_9SbS_6; tetrahedrite, $Cu_8Sb_2S_7$; freibergite? (silver bearing tetrahedrite).

IX. Sulphobismuthites.—Matildite, $AgBiS_2$, emplectite, $CuBiS_2$.

X. Mercury.—Amalgam (?).

XI. Phosphate.—Apatite.

XII. Oxides.—Asbolite; heubachite?; heterogenite?; arsenolite, As_2O_3; roselite? $(Ca,Co,Mg)_3As_2O_8.2H_2O$.

XIII. Veinstones.—Calcite, dolomite, aragonite, quartz, barite, fluorite.[1]

The above table contains a few minerals that have been found in only one or two veins and cannot be considered characteristic. Millerite, for instance, is of rare occurrence, and emplectite has been found only in the Floyd mine, near Sharp lake, in the western part of the Cobalt area. Bornite, chalcopyrite, zinc blende, galena, and pyrite are not characteristic of most of the ore, these minerals occurring more frequently in the wall rock or in non-silver bearing ore of the Keewatin. Apatite in recognizable crystals has been found in the ore of only one mine. Mercury appears to occur in the ore of all the mines that contain high values in silver, but whether it occurs only as amalgam or in other forms has not been determined.

A question-mark has been placed after the names of several minerals in the table which have been reported to occur in the veins, but whose identification has not been made complete by chemical analyses or crystallographic measurements. Gold in small quantity has been found in a number of veins, especially in those in which cobaltite or mispickel are characteristic minerals.

Certain shipments from the Timiskaming mine contained copper in economic quantities.[2]

While we have both native silver and arsenides in abundance, the compounds of arsenic and silver occur only in small quantities. Antimony, which is not abundant, is found in some compounds where we would expect to find arsenic, since the latter is so much more common.

One would also expect to find more compounds of bismuth, since this metal occurs in the free state in considerable quantities in some of the deposits. It might also be expected that native arsenic would occur, but so far it has not been found.

Nearly all the chemical groups of minerals found in the celebrated Joachimsthal deposits of Bohemia are present in the Timiskaming ores. The most important exception is uraninite or pitchblende, which came into prominence a few years ago as the chief source of the element radium.

Order of Deposition of Minerals

The following table shows, in descending order from the youngest to the oldest, the general succession in order of deposition of the principal minerals of the Cobalt area proper. There appear to be, however, minor exceptions to this order.

[1] Barite and fluorite have not been found in the veins at Cobalt proper, but they occur with silver-cobalt ores in one or two veins near Elk lake, and in Langmuir township in the southeast part of the Porcupine area. Small veins of barite have also been found in the Nipissing-diabase in Leonard and Lawson townships, in the Gowganda silver area.

III. Decomposition products, e.g. erythrite or cobalt bloom, annabergite or nickel bloom, and asbolite.

II. Rich silver ores and calcite.

I. Smaltite, niccolite, and dolomite or pink spar.

After the minerals of group I were deposited the veins were subjected to slight movement. In the cracks thus formed the minerals of group II were deposited. A few veins that escaped the disturbance do not contain silver in economic quantity.

This order of deposition appears to be the same as that of the minerals in the Annaberg deposits of Germany and those of Joachimsthal, Austria.[1]

Messrs. Campbell and Knight[2] subjected specimens of the cobalt-silver ores of Cobalt to examination, using methods employed in metallography. While the results confirm, in a general way, Miller's observations on hand specimens, and of blocks of ore, they have worked out the order of deposition of the minerals in greater detail. They state that, although all of the structures met with in the examination cannot be satisfactorily explained, they point to the following order of deposition for the principal constituents. First came the smaltite, closely followed by the niccolite; other minerals in small amount came down at this time. Then after a period of slight movement in which the first minerals were more or less fractured, calcite was deposited as a ground-mass. Later came argentite, which was followed by native silver and native bismuth. Lastly came the surface decomposition products, erythrite and annabergite.

Arranged in order, the succession is, then, as follows:

Smaltite, niccolite, period of movement and fracturing, calcite, argentite, native silver, native bismuth, period of decomposition, and finally erythrite and annabergite.

At Annaberg, bismuth ore is thought to have been deposited with the cobalt-nickel minerals and not with the rich silver ore. Moreover, at the time Messrs. Campbell and Knight made their examination of the ores from Cobalt it was not known that two carbonates occur in the gangue, viz., calcite (white) and dolomite (pink). The latter has been found to belong to an older generation than the former.

Any statement as to the form in which the native silver came in solution in the veins must be merely hypothetical. Silver carbonate, Ag_2CO_3, like calcium carbonate, $CaCO_3$, is soluble in excess of carbon dioxide, CO_2. Hence when the calcite, $CaCO_3$, of the cobalt-silver veins was being carried in solution, it does not seem improbable that silver carbonate may have been in solution at or about the same time.

Palmer and Bastin[3] discuss metallic minerals as precipitants of silver and gold, and their experiments show that certain sulphides and arsenides of copper a

[1] Beck, The Nature of Ore Deposits, Weed's translation, pp. 285-289.

[2] Campbell and Knight, Microscopic Examination of the Cobalt-Nickel Arsenides and Silver Deposits of Timiskaming. Economic Geology, Vol. I, 1906, pp. 767-776. The Paragenesis of the Cobalt-Nickel Arsenides and Silver Deposits of Timiskaming. Eng. and Min. Jour., Vol. LXXXI, 1906, p. 1089.

[3] Palmer and Bastin, Metallic Minerals as Precipitants of Silver and Gold. Econ. Geol., Vol. VIII,

Silver Production, Cobalt Mines, 1904 to 1917[1]

Year	No. of producing mines	Shipments and Silver Contents								
		Ore		Av. per ton	Concentrates		Av. per ton	Bullion	Total	
		tons	ounces	ounces	tons	ounces	ounces	ounces	ounces	value
										$
1904	4	158	206,875	1,309	.....	.....	.....	.....	206,875	111,887
1905	16	2,144	2,451,356	1,143	.....	.....	.....	.....	2,451,356	1,360,503
1906	17	5,335	5,401,766	1,013	.....	.....	.....	.....	5,401,766	3,667,551
1907	28	14,788	10,023,311	677	.....	.....	.....	.....	10,023,311	6,155,391
1908	30	24,487	18,022,480	736	1,137	1,415,395	1,244	.....	19,437,875	9,133,378
1909	31	27,729	22,436,355	809	2,948	3,461,470	1,174	.....	25,897,825	12,461,576
1910	41	27,437	22,581,714	821	6,845	7,082,834	1,030	980,633	30,645,181	15,478,047
1911	34	17,278	20,318,626	1,176	9,375	8,056,189	858	3,132,976	31 507,791	15,953,847
1912	30	10,719	15,395,504	1,436	11,214	9,768,228	871	5,080,127	30,243,859	17,408,935
1913	35	9,861	13,668,079	1,386	11,016	8,489,321	770	7,524,575	29,681,975	16,553,981
1914	32	4,302	6,504,753	1,511	12,152	8,915,958	733	9,742,130	25,162,841	12,765,461
1915	24	2,865	6,758,286	2,359	11,996	10,001,548	834	7,986,700	24,746,534	12,135,816
1916	28	2,177	4,672,500	2,146	8,561	7,598,011	887	7,644,579	19,915,090	12,643,175
1917	28	2,288	3,271,353	1,429	13,720	6,445,243	469	8,053,318	19,401,893	16,121,013
To'l.	....	151,568	151,712,958	1,001	88,964	71,234,197	801	50,145,038	274,724,172	151,950,561

As the camp has developed, the average grade of ore shipped has gradually lowered in value. The introduction of concentration plants in 1908 has tended to keep the shipments up to a high standard, but there is a growing tendency to treat the ore at the mines and recover the silver as bullion for shipment. The average concentration ratio of the different mills during 1914 was 47-1. Further information on the treatment of the ores at Cobalt will be found under the heading "Development of the Metallurgy of the Silver-Cobalt Ores of Ontario."

In the purchasing of the cobalt ores payment is made for the silver and in some cases for the cobalt, the amount paid for the silver varying with the grade of the ore. The different schedules that have been adopted are given in the descriptions of the Coniagas Reduction Co. and the Deloro Mining and Reduction Co. under the "Metallurgy of Cobalt."

In 1905 the price offered for cobalt in ores containing about 6 per cent. cobalt, fell from 65 to 35 cents a pound and at the same time the allowance which had been made previously for the nickel and arsenic, viz., 12 and 0.5 cents a pound respectively was cancelled.

Between 1905 and 1909, ten cents per pound was allowed for the cobalt in the ores if they contained more than 6 per cent., except where the nickel was greater than the cobalt.

Between 1909 and 1914 very little was realized for the cobalt except in the case of high grade ores.

Since 1914, some of the companies have been paying for cobalt, but in some cases not for silver in the same ore. The amount paid for cobalt varies with the

[1] Ont. Bur. Min., Vol. XXVII, 1918, p. 16.

between 6 and 8 per cent., ten cents a pound in ores between 8 and 10 per cent., and fifteen cents a pound in ores over 10 per cent. cobalt.

Most of the cobalt ores that are purchased for the recovery of the cobalt are treated by Canadian smelters. However, a quantity of ore is imported by smelters in the United States, the chief importer being the American Smelting and Refining Company. The Pennsylvania Smelting Co., Carnegie, Pa.; the Balbach Smelting and Refining Co., Newark, N.J.; and the United States Metals Refining Co., Chrome, N.J., also import small quantities of cobalt ores.

Shipments of cobalt-nickel residues from the Nipissing high-grade mill containing 9 per cent. cobalt and 4.5 per cent. nickel have been made by the Nipissing Mining Co. to H. Wiggin and Co., Birmingham, England.

A few shipments containing 4,500 ounces of silver per ton were made previous to 1913 to the Government smelter, Saxony, Germany.

United States smelters imported during 1915, 7,310 tons of ore from the Cobalt district containing 3,580,843 fine ounces of silver, as against 7,206 tons containing 3,966,301 fine ounces in 1914.

In 1916 shipments of ore and concentrates from Cobalt to refineries in the United States comprised 364 tons of ore carrying 408,014 ounces, and 3,700.35 tons of concentrates carrying 1,629,841 ounces—a total of 2,037,855 ounces of silver. In 1917 to refineries in the United States there were consignments from Cobalt amounting to 6,307 tons, from which 2,914,267 fine ounces of silver were recovered. These shipments were on the whole of considerably lower grade than those to the home refineries, averaging only 462 ounces of silver to the ton, as against 810 ounces. Much the larger quantity treated by U. S. plants was at the works of the American Smelting & Refining Company, Denver, Col., and Perth Amboy, N.J. Of the total quantity of silver contained in the product of the Cobalt mines in 1917, namely 19,401,893 ounces, 14,504,681 ounces were refined at the mines in Cobalt or in Ontario works, being about 75 per cent. of the whole.

Additional References

Occurrence and Utilization of Cobalt Ores, Bulletin Imperial Institute, London, Vol. XIV, 1916, pp. 417-437.

Wilson, M. E., Origin of Cobalt Series. Journal of Geology, Vol. XXI, 1913, pp. 121-141.

Power, F. Danvers, The Mineral Resources of New Caledonia, Institution Mining and Metallurgy, Trans., Vol. VIII, 1899-1900, pp. 426-472. This article contains an extensive bibliography.

CHAPTER II

THE METALLURGY OF COBALT

Very little is known about the details of the metallurgy of cobalt in comparison with our knowledge of the other metals, except by those directly connected with the industry. It is not a new subject, since the treatment of cobalt ores was practised for several hundred years in Europe, where the output of the world's supply of cobalt was controlled until the discovery of the Canadian cobalt deposits in 1903. New South Wales, Norway, New Caledonia, Germany, Chile, and Hungary were the chief producers of cobalt ores, while the largest refineries were located in Germany and England. Since 1902 there has been very little cobalt ore mined outside of Canada, except in the United States during 1903 and 1908, when there was a production of 60 and 100 tons respectively of cobalt oxide from the ores of Missouri. Until 1913, the world's annual production of cobalt oxide amounted to approximately 250 tons, but within recent years the production has increased until in 1916 it amounted to 400 tons. Within the last few years the quantity of cobalt metal produced has increased from practically nothing in 1913, to 165 tons in 1916, and 158 tons in 1917.

The price of cobalt oxide (70 per cent. cobalt) fluctuated little previous to 1907, the oxide selling at prices varying from $1.60 to $2.00 a pound. In 1907 the price rose to $2.50, but in 1908 it dropped to $1.40. Since 1908 the price has gradually declined, the average for 1915 being 90 cents a pound. Owing to the increased present demand the price has risen to $1.50 (1917). The value of metallic cobalt is given (1917) as $2.00 to $2.25 a pound.

In reviewing the metallurgy of cobalt, two noticeable changes are evident first, previous to the discovery of the large cobalt deposits in Canada, practically all compounds of cobalt were produced in Europe; and second, in the European refineries ores were treated for the cobalt content alone, while from the ores of Canada, metallic silver, cobalt, nickel, and arsenic oxide are recovered. The associated metals are often a source of revenue for the smelters.

Since most of the cobalt compounds produced in Europe were used in the ceramic industries, and as the requirements of these industries at the time were not such as to demand a high-grade cobalt oxide, it is reasonable to conclude that the processes used in Europe did not produce a high-grade cobalt oxide. However the demand of the ceramic industries at the present time is for a high-grade oxide and this is supplied by the Canadian smelters at practically one-half the price that the low and medium cobalt compounds or smalts were sold at in Europe ten years ago.

The elements arsenic, sulphur, copper, iron, and nickel, which are usually associated with cobalt ores, are common to the ores of Europe and Canada, while those from New Caledonia, though free from sulphur and arsenic, contain a large percentage of manganese. However, arsenic and sulphur cannot be altogether considered as impurities in cobalt ores, since the presence of either element enables the ores to be reduced in blast-furnaces to produce a speiss or matte.

nickel, e.g. chalcocite and niccolite, precipitate metallic silver very efficiently from dilute aqueous solutions of silver sulphate. However, the more common sulphides, such as pyrite, galena, and sphalerite were relatively inactive as precipitants of silver from aqueous sulphate solutions.

Argentite, proustite, and native silver in hair-like form, appear to be of secondary origin. These minerals are found in vugs in the lower workings of the mines where the ore has become leaner, or below the productive zone in the veins.

The silver-bearing solutions working downward beneath the sill, in the fractured rocks, lost their silver content by precipitation on coming in contact with the cobalt-nickel minerals before a great depth was reached. Hence it is not surprising to find that rich silver ore does not extend to as great a depth beneath the sill as do the cobalt-nickel ores. Practically all the samples of native silver, excepting those that show a crystalline form or occur in veinlets, contain mercury.

Cobalt minerals are also found in areas lying at some distance from the town of Cobalt. The most important deposits occur in South Lorrain, Casey township, and Gowganda. The Lake Superior silver deposits also contain small amounts of cobalt.

Other minor occurrences of nickel-cobalt ores in Canada are given in the "Annual Report of the Geological Survey of Canada," vol. XIV, 1901, pt. II, to 1917.

The following table shows the production of the Cobalt district from 1904 to 1917.

Total Production of Cobalt Mines 1904-1917[1]

Year	Nickel		Cobalt		Arsenic		Silver		Total value
	tons	value	tons	value	tons	value	ounces	value	
		$		$		$		$	$
1904..	14	3,467	16	19,960	72	903	206,875	111,887	136,217
1905..	75	10,000	118	100,000	549	2,693	2,451,356	1,360,503	1,473,196
1906..	160	.....	321	80,704	1,440	15,858	5,401,766	3,617,551	3,764,113
1907..	370	1,174	739	104,426	2,958	40,104	10,023,311	6,155,391	6,301,095
1908..	612	.....	1,224	111,118	3,672	40,373	19,437,875	9,133,378	9,284,869
1909..	766	.....	1,533	94,965	4,294	61,039	25,897,825	12,461,576	12,617,580
1910..	504	.....	1,098	54,699	4,897	70,709	30,645,181	15,478,047	15,603,455
1911..	392	.....	852	170,890	3,806	74,609	31,507,791	15,953,847	16,199,346
1912..	429	14,220	934	314,381	4,166	80,546	30,243,859	17,408,935	17,818,082
1913..	377	13,326	821	420,386	3,663	64,146	29,681,975	16,553,981	17,051,839
1914..	(a) 90	28,978	(a) 351	590,406	2,030	116,624	25,162,841	12,765,461	13,501,469
1915..	(b) 35	28,353	(b) 206	383,261	2,490	148,379	24,746,534	12,135,816	12,695,809
1916..	(b) 79	59,380	(b) 400	805,014	2,160	200,103	19,915,090	12,643,175	13,707,672
1917..	(b)155	125,071	(b) 337	1,138,190	2,592	608,483	19,401,893	16,121,013	18,028,597
Total.	4,058	283,969	8,950	4,388,400	38,789	1,524,569	274,724,172	151,950,561	158,176,339

[1] Ont. Bur. Min., Vol. XXVII, 1918, p. 16.

(a) Metallic contents of nickel and cobalt oxides respectively.

(b) Metals and metallic contents of all nickel and cobalt compounds.

ANNEX
"H-3

Report on MR.12898 & 12900 - Farr Township

Montreal River Mining Division

by Robert Thomson

June 6, 1950

2.18274

On June 6, 1950: Writer made a rapid examination of above claims; in connection with Mr. C.H. Bain and J.P. Melisek.

These claims lie in the Elk Lake, part of the Temiskaming-silver-cobalt Mining area. In this part are numerous native silver occurrences in veins in the Nipissing diabase; about 1908 to 1911 a considerable amount of work was done on these without developing any profitable mines. Notwithstanding this unfortunate history, more exploration seem to be well justified.

Bain and Melisek have been trying to interest exploration companies in their group of claims which includes the above two. At present a deal is pending: if this should go through, they would have no further interest in mining and shipping high grade.

The most important work on MR.12897 (the old Currie claim) is near the south line where a shaft had been put down a long time ago by former operators. The shaft is said to be 125 feet deep without any significant amount of lateral work. The size of dump accords with such a depth being attained. At the south east corner of the shaft on a face extending from the rock surface to some four feet below, a very good silver showing is exposed with a width up to about seven inches; this showing had been undercut by a stub drift some 5 or 6 feet long, but not presently accessible. Bain and Melisek report an assay of some 3,600 oz. silver per ton

obtained in a sample taken from the showing; it seems quite possible to obtain such an assay return.

No reliable information is available as to what was found in the shaft, although pieces of silver may be seen in the dump.

Bain and Melisek said that their intention was to leave intact the high grade silver presently exposed, but to follow the vein southerly from the shaft by surface trenching. They hoped to find similar high grade ore along it which they would extract from the surface. In view of the erratic nature of silver deposition in this vicinity, there is no certainty that they would uncover similar high grade.

A considerable amount of trenching had been done on this claim some 30 years ago, but no evidence was seen of much recent work. About 100 yards north of the shaft is a small pit with calcite veins said to contain silver.

Claim MR.12900 adjoins and lies south of MR.12900 ~~near its north line~~ and about 170 feet from the shaft mentioned above is another known as the Sterling shaft and believed to be about 100 feet deep. South of this small veins are exposed in trenches for about 100 yards. Silver is said to occur along these veins and very probably does in small amounts. Work on some of these trenches had been made recently.

(2N-3W)

MICA F

BAIN - MICKLE TWP 2N

November 15, 1949:

In conversation with T. Keefer spoke of showing he had visited recently in Farr Township. This showing had been brought to my attention by Mr. Sharpe, Mining Recorder, Silver Lake. The holders of the claims are in the Shell Garage, Silver Lake. Information below is as given by T. Keefer.

The four claims are:

MR.12898, formerly DG-36
MR.12899, formerly DG-39
MR.12900, formerly DG-40
MR.14960, formerly RSC-48

Access may be had by canoe across Hubert Lake. The showings are in Nipissing diabase. The extent of the diabase is shown on Ont. Dept. of Mines, Map 1934(a), second edition, 1942, apparently reduced from W.H. Collins' map. It seems likely (but not proved)

Collins, W.H. "The Geology of Gowganda Mining Division", Geol. Survey Canada, Mem. No. 33, 1913, Maps 64(a) and (1). Scale one inch = 1 mile.

---

that the diabase body dips westward under the Cobalt sediments. This is inferred from W.H. Collins' statement(Op. cit. p. 60) that in Mickle Twp, on what seems to be the south-easterly intrusion of the diabase body, at Silver Lake, it is overlain by quartzite and dips south westward. Keefer states he has been told that a pit on the diabase in Farr Twp. passed through the diabase into underlying granite. The position of this pit is unknown and the authenticity of the information uncertain.

T.K. states that a northerly-southerly ridge, bounded on either side by drift depressions, runs through the four claims. The showings are on this ridge. The topography is said to suggest the presence of faults on either side of the ridge.

Apparently the claims were prospected fairly well many years ago.

The showings causing the present interest are said to occur

on MR.12900. Apparently quite a number of veins or veinlets occur and to strike largely in either of two directions north-southerly, and east-westerly.. A shaft was put down, a long time ago, on a north-southerly vein, and another, close by, on an east-westerly one. It is said that the recent discovery is at the side of one of these shafts. Silver and cobalt occur and the width is about 8 inches.

ANNEX "H-41"

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

Hon. WELLAND S. GEMMELL, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

SIXTIETH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. LX, PART II, 1951

Mines of Ontario in 1950

Compiled by

M. READE

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO
Printed and Published by Baptist Johnston, Printer to the Queen's Most Excellent Majesty
1952

Morse, vice-president; G. E. Buchanan, secretary-treasurer; J. T. Symons, assistant secretary-treasurer; H. T. Hooper, director. The head office is at 100 Adelaide Street West, Toronto. The mine address is Cobalt.

The company acquired a group of 6 claims located in lot 4, concession IV, in the township of Coleman, district of Timiskaming. The property of the company includes the former Penn-Canadian and Foster mines surrounding Glen lake.

Work was commenced in October, 1950. The Foster No. 1 shaft was dewatered to the 230-foot horizon for sampling and examination. The former Penn-Canadian No. 2 shaft located on the north end of Glen lake was reconditioned and a new headframe and hoist-room were built. A single-drum air hoist was installed, and dewatering operations commenced. No. 2 shaft is reported to be about 120 feet deep with approximately 800 feet of lateral workings established at the 110-foot horizon.

J. H. Price is mine manager employing eight men.

Roy Silver Mines, Limited

Roy Silver Mines, Limited, was incorporated in July, 1949, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,400,003 have been issued. The officers and directors are: J. W. Tovell, president; H. G. Miller, vice-president; R. Patriquin, secretary; R. Miller, S. Rudolph, and M. Marcus, directors. The head office is at 66 King Street West, Toronto. The mine address is Box 30, Cobalt.

The two properties formerly known as Wigwam Silver Mines, Limited, and Haultain Mining Company, Limited, both in Haultain township, Gowganda area, district of Timiskaming, have been acquired by Roy Silver Mines, Limited. The company also holds claims in South Lorrain, Coleman, and Farr townships, district of Timiskaming, and Strathy township, district of Nipissing.

The two-compartment, vertical Haultain shaft was pumped out in October and was found to be 350 feet deep, with stations established at the 150- and 250-foot horizons. On the 150-foot level, 642 feet of lateral work had been completed.

Surface-trenching amounted to 102 feet in length, and 3 feet in depth. Diamond-drilling consisted of eight surface holes, totalling 1,410 feet.

Camp buildings for accommodation of a crew of 15 men were erected. A new headframe was built over the shaft collar, and a frame building for housing a hoist and compressor was completed.

An average force of four men was employed. H. G. Miller is mine manager.

ANNEX
"H-5"

PROVINCE OF ONTARIO
DEPARTMENT OF MINES

HON. PHILIP T. KELLY, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

SIXTY-FIRST ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. LXI, PART 2, 1952

Mining Operations in 1951

Compiled by
M. READE

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO
Printed and Published by Baptist Johnston, Printer to the Queen's Most Excellent Majesty
1953

Underground work carried out at the Penn-Cobalt No. 5 shaft was as follows:

Level	Drifting	Crosscutting	Raising
	feet	feet	feet
70-foot		105	
140-foot	242	241	100
210-foot	120	11	171
Total	362	357	271

Quantity of silver-cobalt ore hoisted from the No. 5 shaft during the year amounted to 2,211 tons. In addition the company removed 607 tons of ore from their Kerr Lake property and 981 tons of ore from a stock pile at the Kerr Lake property. About 3,200 tons of ore from these operations were concentrated at the Colonial mill of Silanco Mining and Refining Company, Limited.

An average of 18 men was employed during the year. J. H. Price is manager.

Roy Silver Mines, Limited

Roy Silver Mines, Limited, was incorporated in July, 1949, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 2,500,003 have been issued. The officers and directors are: M. Marcus, president and director; H. G. Miller, vice-president and director; M. E. Bishop, treasurer and director; C. A. Colville, assistant-treasurer; J. W. Tovell, secretary and director; R. Patriquin, assistant secretary; R. Miller, director. The head office of the company is at 66 King Street West, Toronto, and the mine address is Box 30, Cobalt.

Development during 1951 was confined to the Wigwam claims at the south end of the property. In earlier years an adit had been driven into the side of a hill and several hundred feet of drifting done. A winze was also sunk from the adit level and two levels established.

The winze was pumped out this year to a depth of 210 feet exposing the two levels at the 100-foot and 200-foot elevation from the adit. No further work was done in the winze.

On July 21, drifting was started to extend the drift behind or east of the winze on the adit level and three finger-drifts were fanned out to explore the possibilities of the downward extension of a vein showing on surface. A total of 143 feet of drifting was completed before operations were suspended in November.

G. Pollard is superintendent in charge of operations, and an average of six men was employed during the year.

ANNEX
"H-6"

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. PHILIP T. KELLY, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

SIXTY-SECOND ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. LXII, PART 2, 1953

Mining Operations in 1952

Compiled by

D. J. FIELD

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO

Printed and Published by Baptist Johnston, Printer to the Queen's Most Excellent Majesty

1954

near the southeast shore of Glenn Lake, and mining was carried on from this level, the ore being removed through the adit entrance provided.

Development work during 1952 amounted to: drifting, 515 feet; crosscutting, 155 feet; raising, 118 feet. Diamond-drilling consisted of 8 holes, totalling 830 feet, from surface, and 29 holes, totalling 2,827 feet, from underground.

About 1,297 tons of ore were sent to the Colonial mill at the Silanco Mining and Refining Company, Limited, for treatment.

Mining operations were supended in September.

A crusher-house, boiler-house, machine shop, and warehouse were built, and a mill building, designed for the treating of 100 tons per day, had been partially completed when construction work was discontinued in October.

Kerr Lake Mine

The Kerr Lake property consists of three, 40-acre claims, plus a small fraction lying south of Kerr Lake.

The vertical two-compartment No. 13 shaft was deepened from 90 to 155 feet in 1952, and a new level was established at 140 feet. A new 30-foot headframe and hoist-house were built, and the single-drum air-hoist from the Foster No. 5 shaft was installed.

A long drive to the north was made on the 140-foot level, to connect with the 140-foot-level workings of the old Kerr Lake No. 7 shaft. Five raises were driven along this drift, and some stoping was done.

Other work was done on the Kerr Lake main east vein from the bed of Kerr Lake, which has been kept drained. About 510 tons of ore were broken on the 175-foot level of these workings, and hoisted to the stockpile.

The connection made between the 200-foot level of the Crown Reserve mine and the 225-foot level of the Kerr Lake has been mentioned above.

The development work during 1952 on the Kerr Lake property amounted to: drifting, 685 feet; crosscutting, 56 feet; raising, 512 feet. Diamond-drilling consisted of 12 holes, totalling 1,065 feet, from underground.

About 1,265 tons of ore were hoisted.

J. H. Price is manager of the company's operations. An average of 35 men was employed at the three operations, 7 at the Crown Reserve, 18 at the Foster, and 10 at the Kerr Lake.

Roy Silver Mines, Limited

Roy Silver Mines, Limited, was incorporated in July, 1949, with an authorized capitalization of 5,000,000 shares of $1 par value. In October, 1952, the capitalization was increased to 4,500,000 shares, of which 3,000,000 have been issued. The officers and directors are: Maurice Marcus, president; S. M. Goldberg, vice-president; R. J. McQueen, secretary; I. A. Wechsler, treasurer; L. S. Tsepn and Z. M. Rosenthal, directors. The head office is at 357 Bay Street, Toronto. The mine address is Elk Lake.

The company holds claims in Hauitain, South Lorrain, and Coleman [illegible] townships, district of Timiskaming, and Farr and Strathy townships, district of Nipissing. Work at the Hauitain and Wigwam properties, in Hauitain township, was suspended in November, 1951. In the spring of 1952, operations were begun at the company's cobalt-copper property in Farr township, on the west shore of Hubert Lake, 7 miles west of the town of Elk Lake. A 2½-mile [illegible] road has been built from the Matachewan highway to the property.

The headframe and other buildings, and the hoist and [illegible]

moved from the Haultain shaft to the new operation and installed at the No. 1 shaft.

The vertical two-compartment No. 1 shaft is 120 feet deep. It was dewatered, straightened, and retimbered to the 66-foot level, where 87 feet of drifting and 72 feet of crosscutting were done. Twenty diamond-drill holes, totalling 2,741 feet, were drilled from surface.

About 120 tons of ore were hoisted.

J. G. Pollard is manager. An average of 10 men was employed.

ANNEX "H-7"

The purpose of the road is to truck ore from the shaft to the Silver Miller (LaRose) Mill and to facilitate further exploration of the Roy Silver Mines ground. It is hoped that such shipments can be started within the next two months.

A 40 foot headframe has been erected and the old two compartment shaft (some 60 feet deep) is being straightened. Operations are being pushed to get into production as soon as possible presumably to take advantage of the present price of cobalt.

In my opinion the profitable future operation of this mine are not assured: it seems to be marginal. However the only way this can be determined is by further working and in my opinion the Company's effort justifies the assistance on the road.

At the present time the camps and mine are being serviced in two ways:-

1. By a trail (old road) to Hubert Lake from Highway 65; then by small boat on Hubert Lake; by a trail (old road) to the shaft (some 900' S. of

the Lake) and camps (some 3500' S. of the Lake).

2. By an old road (shown on accompanying sketch) branching northerly from the Elk Lake - Gowganda road at some 4 miles West of Elk Lake, going past quite a number of silver prospects on which much exploration has been done in time past and then into Farr Township to the Roy Silver camps and shaft. At present this road can be used by trucks but is in poor shape. Although this road passes through a silver bearing territory it is not suitable for trucking ore from the Roy Silver Mines, particularly in winter. Both the length and the presence of hills make it unsuitable for ore transportation.

The Roy Silver group is underlain by diabase; the silver-cobalt veins are very largely confined to it and associated with aplite dikes. The thickness of the diabase at the Roy Silver workings is not known nor has the altitude been precisely determined.

Veins and silver-cobalt occurrence are fairly numerous.

This property is an old one being worked about 1910, with very small production. At the south end of the claims a shaft (some 100 feet deep) was put down on a silver occurrence. In a rapid examination in June, 1950, the writer saw high grade silver ore left by the early operators at this shaft. Another shaft (some 60' deep) with 20 feet of drifting at the depth was put down on what is now MR-12899. This is the one on which Roy Silver are presently concentrating their efforts. Although silver occurs, cobalt is presently more the important metal as shown by the dump.

Roy Silver Mines acquired the property in 1950. At first, directed towards exploration of the silver occurrence at the south shaft, included dewatering and diamond drilling. It was not successful in finding ore. No work is being carried on in this vicinity at present.

The cobalt (with some silver) occurrences in the vicinity of the North shaft are the ones on which work is being restricted at.

Mr. Pollard, manager for Roy

Silver states that a bulk sample of some hundred pounds of ore from the old dump gave an assay return of some 6% cobalt. The writer, during a visit in 1950, obtained an assay return of 15.28% cobalt from the cobalt arsenides, selected to be as pure as possible.

The old trenches in the vein were cleaned out and sampled. An extensive series of shallow diamond drill holes were put down to test the vein. In the vicinity of the shaft some intersections of interest were obtained but farther south the results were negligible. The irregular and sporadic occurrence of the cobalt ore renders interpretation of diamond drill results difficult and uncertain.

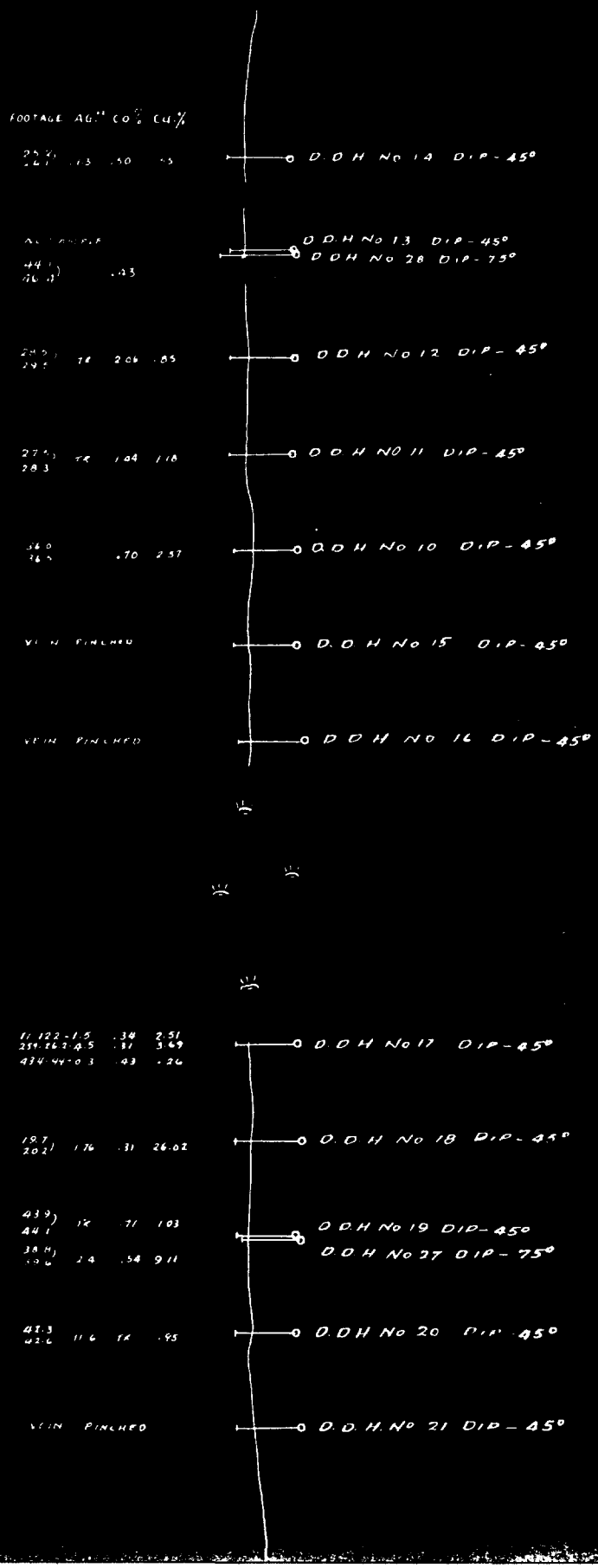
The shaft was dewatered and found to require straightening. Mr. Pollard states that cobalt occurs from the surface to the depth of 33 feet; from there to the bottom at 66 feet there is no cobalt. Near the end of the drift extending some 20 feet northerly from the shaft bottom, Mr.

Pollard states that cobalt mineralization in interesting amount came in again.

Roy Silver interpreted the results of the above exploration as sufficiently encouraging to warrant moving the 40 foot headframe from their operation in Haultain Township and erecting it over the old shaft. Their immediate plan is not to put enough ore in sight to have a mill on the property, but to ship what ore is accessible to the LaRose Mill at Cobalt and at the same time explore further.

The margin of profit on shipping this ore would not, at best, in my opinion, be large, but they have no doubt figured it closely.

I was of the opinion that further exploration at depth and laterally for branching and parallel veins should be pushed.



ROY SILVER MINES LTD.

SHOWING

ANNEX 11H-8

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. PHILIP T. KELLY, *Minister of Mines* — H. C. RICKABY, *Deputy Minister*

SIXTY-THIRD ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. LXIII, PART 2, 1954

Mining Operations in 1953

Compiled by
D. J. FIELD

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO
Printed and Published by Baptist Johnston, Printer to the Queen's Most Excellent Majesty
1955

No. 2 shaft workings. The work in 1953 was done from the Main shaft. The following table shows the development work done during the year:

Level	Drifts	Crosscuts	Raises
	feet	feet	feet
2nd (No. 14 shaft area)...	482	120	104
2nd (Main shaft area)....	201	75	15
4th (Main shaft area)....	1,190	419	190

Some preliminary development work was done on the 5th and 6th levels, which are accessible from the 4th level of the Main shaft workings by way of an inclined manway through an old stope.

Diamond-drilling in 1953 consisted of 16 holes, totalling 3,763 feet, from surface, and 49 holes, totalling 5,144 feet, from underground.

Most of the ore mined was stored underground; 1,031 tons were hoisted and stockpiled on surface. No ore was milled or shipped in 1953.

The vertical, two-compartment No. 81 shaft on the Nipissing property is 581 feet deep, with levels at 150, 425, and 520 feet. It was dewatered in 1953 to the 425-foot level and reconditioned. A new headframe was built. A 36- by 45-inch double-drum Canadian Ingersoll-Rand electric hoist was bought but was not installed. A geological examination was made, and some sampling was done on the 425-foot level. Work from the shaft was suspended for the winter months.

Hydro-electric power is used for hoisting, lighting, and pumping, and hydraulic air for drilling.

B. L. Jackson is mine manager. An average of 30 men was employed, of whom 20 were underground and 10 on the surface.

Roy Silver Mines, Limited

Roy Silver Mines, Limited, was incorporated in July, 1949, with an authorized capitalization of 3,000,000 shares of $1 par value. The capitalization was increased to 4,500,000 shares in 1952 and to 5,500,000 shares in 1953. The number of shares issued at December 31, 1953, was 4,270,575. The officers and directors are: Maurice Marcus, president; S. M. Goldberg, vice-president and treasurer; I. A. Wechsler, assistant secretary; L. S. Joseph and Louis Cohen, directors. The head office is at 357 Bay Street, Toronto. The mine address is Elk Lake.

The company holds claims in Coleman, South Lorrain, Haultain, and Farr townships, district of Timiskaming, and Strathy township, district of Nipissing.

Operations continued throughout 1953 on the cobalt-silver property in Farr township, on the west shore of Hubert Lake, 7 miles west of the town of Elk Lake. The vertical, two-compartment No. 1 shaft, on claim M.R. 12898, was sunk a further 170 feet to a total depth of 200 feet, and two new levels were established at 135 and 205 feet. The following table shows the development work done on the two levels:

Level	Drifts	Crosscuts	Raises
	feet	feet	feet
135-foot........	[illegible]	[illegible]	[illegible]
205-foot........	320	[illegible]	[illegible]

Diamond-drilling consisted of 8 holes, totalling 835 feet, from surface, and [illegible] holes, totalling 1,178 feet, from underground.

There were 2,209 tons of ore hoisted and stockpiled.

Power for air hoisting, drilling, and pumping was supplied by diesel-driven compressors, and for lighting by a diesel-driven generator.

A power-house, crusher-house, and ore bin were built during 1953. A 30- by 100-foot, cement-block, mill building and a frame boiler-house were under construction at the end of the year.

An average of 21 men was employed, of whom 5 were underground and 16 on the surface. J. G. Pollard is manager.

ANNEX
11-4-9 11

PROVINCE OF ONTARIO

DEPARTMENT OF MINES

HON. PHILIP T. KELLY, *Minister of Mines* H. C. RICKABY, *Deputy Minister*

SIXTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO DEPARTMENT OF MINES

BEING

VOL. LXIV, PART 2, 1955

Mining Operations in 1954

Compiled by
D. J. FIELD

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO
Printed and Published by Baptist Johnston, Printer to the Queen's Most Excellent Majesty
1956

Most of the work in 1954 was done through the main shaft. No. 81 shaft was dewatered. The following table shows the development work done during the year:

	Drifts	Crosscuts	Raises
	feet	feet	feet
MAIN SHAFT AREA:			
3rd level			45
4th level	572	139	144
5th level	70		
NO. 2 SHAFT AREA:			
2nd level	81		178
NO. 6 SHAFT AREA:			
1st level	46		205
NO. 14 SHAFT AREA:			
2nd level			132

Diamond-drilling in 1954 consisted of 32 claims, totalling 2,895 feet, from underground.

A total of 11,793 tons of ore was mined.

A 100-ton mill was built and equipped. It operated from September 1 to the end of the year and treated 11,840 tons of ore.

An average of 45 men was employed, 19 underground and 26 on the surface. Basil Jackson was manager.

Ramardo Mines, Limited

Ramardo Mines, Limited, was incorporated in January, 1946, with an authorized capitalization of 3,000,000 shares of $1 par value, of which 1,525,000 have been issued. The officers and directors are: R. V. Arntfield, president; H. W. Crossin, vice-president; A. D. Clelland, secretary; D. R. Arntfield, treasurer; T. J. Boodell and G. C. Crawford, directors. The head office is at 67 Yonge Street, Toronto.

The company owns the property formerly known as the Trout Lake mine, in South Lorrain township, district of Timiskaming.

Operations were carried on from June to October 14, 1954. The No. 2 shaft and No. 1 winze, both sunk by former operators, were dewatered. The shaft is 350 feet deep, and the winze runs from the 350-foot level to a depth of 850 feet from surface. The 850-foot level was sampled, and three diamond-drill holes, totalling 1,800 feet, were drilled.

A timber headframe and a small office were built.

W. Hammerston was in charge.

Roy Silver Mines, Limited

Roy Silver Mines, Limited, was incorporated in July, 1949, with an authorized capitalization of 3,000,000 shares of $1 par value. The capitalization was increased to 4,500,000 shares in 1952, and to 5,500,000 shares in 1953. The number of shares issued at December 31, 1954, was 5,355,575. The officers and directors are: Maurice Marcus, president; S. M. Goldberg, vice-president and treasurer; George Scott, secretary; I. A. Wechsler, L. S. Joseph, and Louis Cohen, directors. The head office is at 357 Bay Street, Toronto. The mine address is Elk Lake.

The company holds claims in Coleman, South Lorrain, Haultain, and Farr townships, district of Timiskaming, and Strathy township, district of Nipissing.

Operations were continued at the property in Farr township, 7 miles west of the town of Elk Lake, from January 1 to May 18, 1954. The vertical, two-compartment No. 1 shaft was sunk a further 100 feet to a total depth of 390 feet, and a new level was established at 300 feet. The following table shows the development work done in 1954, and the total when operations were suspended:

Level	Drifts		Crosscuts		Raises	
	1954	Total	1954	Total	1954	Total
	feet	feet	feet	feet	feet	feet
66-foot	20	107	20	92	94	94
135-foot		67		79		18
205-foot	42	371		110		117
300-foot			98	98		

Diamond-drilling in 1954 consisted of 2 holes, totalling 105 feet, from surface.

A total of 3,007 tons of cobalt ore was mined.

The building and equipment of an 80-ton flotation mill was completed. The mill operated from February 16 to May 18 and treated 2,472 tons of ore. The concentrates were sent to Cobalt Chemicals, Limited, for further treatment.

Following the suspension of operations on May 18 the shaft was kept dewatered.

An average of 17 men was employed, 12 on surface and 5 underground. J. G. Pollard was manager while the mine was in operation. Ray Menasse, the mill superintendent, has been in charge since that time.

ANNEX "H-10"

Box 21,
Cobalt, Ontario,
3rd June, 1954.

Mr. Maurice Marcus,
625 Liberty Avenue,
Pittsburgh, PA, U.S.A.

Dear Mr. Marcus:

Claude O'Shaughnessy of T.T.L. informed me yesterday that it would be a week or more before he could sample our concentrates and supply us with a certificate of weight and grade.

Mr. Dick Gegg, purchaser of ores for Cobalt Chemicals, advised me a few days ago that their smelter schedule re copper payments would be similar to Deloro's. - So considering the low copper content of the ore at Roy Silver it would be wise to make no allowance for copper when calculating ore values--consequently, the underground material is or is not ore on the strength of the cobalt content alone.

The following figures give grade, tonnages and concentrates produced for the periods of milling from 16th February to 18th May, 1954. Please note in the right hand column that I have calculated the grade for each period based on the concentrates produced plus the average tails for that period.

Period	Tons Milled	Average Head Sample	Average Tailings Sample	Tons Concentrate Produced	Average Grade Concentrate	Average Grade ore based on Conc.&Tail's
1-15 May	478.08	0.28	0.04	10	11.04	0.27
15-30 Apr	390.70	0.24	.08	12.23	9.44	0.375
1-15 Apr	347.62	.20	.05	7.7	7.39	0.211
1-31 Mar	646.46	.34	.04	12.8	7.50	0.188
16-28 Feb	391.35	0.14	.03	4.5	4.0	0.076
17-18 May	81.3			1.35		
	2335.51			48.58		

Assuming that the 16-28 February was a trial run and since no assays are available for the 17-18 May, let us average out the remainder.

1st March - 15th May Period

Total tons milled 1,862.86
Average grade from head sample 0.27% cobalt
Average grade from concentrates produced plus aferage tailings sample
= 0.203 plus .047 = 0.25% cobalt

Diamond Drilling I have prepared a section showing all information available on Roy Silver:- the drilling results are insufficient on which to base ore reserves. There are only 3 holes to the north of the shaft and only one of these (No. 13) is of ore grade. Both others, No. 14 & 28, are below ore grade. To the south of the shaft, I would consider only No. 12 of possible ore grade; No. 11 is marginal. The remaining holes, Nos. 10, 15, 16, in shaft area are below ore grade.

In my opinion the average grade calculated by these two methods checks within reasonable limits - in other words, the milling of 1862.86 tons of ore indicate a grade of 0.25 - 0.27% cobalt at a recovery of 81.2%. Value of this material at $1.60 per lb. and 81% recovery = $1.60 \times 0.26 \times \frac{20 \times 81}{100}$ = $6.74
Even if we allow for 150% dilution (i.e. if the stopes were mined 1½ times wider than required) then the grade would only be 16.25 - which could not be mined at a profit under present conditions at Roy Silver.

The results of this milling, I hold to be very significant. Even conceding the fact that the mining operation was poorly carried out, it is well to remember that it would have to be improved by approximately 200% before the venture became commercial.

I spoke with Milt Halstead last night after his return from the property. I shall send a carbon copy of this letter to him so that he will be aware of what I say re our confirmation. I believe I am correct when I say that he agrees with me to this extent that below the 100 level the vein is not ore. Milt believes, however, that above the 100' level the vein is ore. Let us consider the information available as to grade above this 100' horizon.
Surface Samples: these figures here are same as supplied in my letter dated 14th May, 1954.
Average width 10.5"
" Co value 1.78%
No allowance for copper.
At a 24" mining width and 81% recovery (I do not agree with 24" mining width but use it here to calculate possible grade at such a width).

$$\text{Dollar value of } \frac{1.78 \times 10.5}{24} \times 160 \times \frac{20 \times 81}{100} = 20.22$$

NB
(13)
(12)
(11)

Diamond Drilling I have prepared a section showing all information available on Roy Silver:- the drilling results are insufficient on which to base ore reserves. There are only 3 holes to the north of the shaft and only one of these (No. 13) is of ore grade. Both others, Nos. 14 & 28, are below ore grade. To the south of the shaft, I would consider only No. 12 of possible ore grade; No. 11 is marginal. The The remaining holes, Nos. 10, 15, 16, in shaft area are below ore grade.

Underground Sampling Sampling conducted by G. Pollard is in my opinion unreliable and hence unsuitable for determining ore grade.

Summing up, I would say that data on which to calculate grade and tonnage are limited but by utilising this limited information of milling, diamond drilling and surface sample, I cannot see the existence of any material worth mining.

I believe Milt agreed with me that underground sampling should be the decisive factor.

Sincerely,

L. J. Cunningham, B.Sc.,
Mining Engineer.

cc Mr. Goldberg, Pittsburgh, PA
Mr. Milt Halstead, Sault Ste. Marie, Ont.

REPORT ON

TIARA MINES LIMITED

FARR TWP. PROPERTY

L. J. Cunningham

E. E. Campbell

31 December 1955

CONTENTS

EXAMINATION

At the request of Mr. L. Pancer, President of Tiara Mines Limited, an examination of the Farr Twp. property of Tiara Mines Limited was made jointly by Mr. L. J. Cunningham and Mr. E. E. Campbell in October 1955. Mr. E. McGarry was employed under the direction of Mr. Cunningham and Mr. Campbell to sample the underground openings.

Messers Cunningham and Campbell spent two full days together on the property making this examination. Mr. Cunningham has spent the equivalent of three days on draughting and calculations; Mr. Campbell has spent the equivalent of three days on calculations and on the preparation of this report. Mr. McGarry spent 12 days cutting samples underground and recording the results.

Mr. Cunningham, B.Sc., of Cobalt, Ontario, is a consulting mining engineer with a background of cobalt and silver operations gained while employed with Cobalt Consolidated Mining Corporation Ltd; he was consulting for Roy Silver Mines Ltd., the predecessor of Tiara, during the time in which they were actively operating the property. Mr. Campbell, B.Sc., M.Sc., M.A., of Haileybury, Ontario, is a mining and geological engineer, and is the manager of Cobalt Consolidated Mining Corporation Ltd. Mr. McGarry is an engineer employed by Cobalt Consolidated.

GENERAL

Tiara Mines Ltd. owns a property consisting of 6 mining claims, MR 14960, 12898, 12899, 12900, 18304, 20254. The first 4 of these are held under mining leases from the Crown; the last 2 are unpatented claims. The property is located in Farr Twp., about 10 miles by road Northwest of Elk Lake, Ontario. It has been operated for the recovery of cobalt and copper.

The six claims are underlain by Nipissing diabase which has a North-South trend. The surface exposure of the diabase measures approximately 1,200 feet in an East-West direction; to the East the diabase is in contact with older granite; to the West it is in contact with older Huronian (Cobalt) sediments. In this area all known cobalt and silver deposits occur in Nipissing diabase.

A two compartment shaft is located midway between the contacts of the diabase in M. C. 12898. The shaft is 310 feet deep and serves openings on the 66, 135, 205, and 305 foot levels. With minor exceptions, all the openings on these levels are located on one vein which strikes N 15° E and dips 72° East. This vein is best exposed upon the 205 foot level; portions of the vein have been stoped out from the 205 foot level to surface.

The mine is equipped with an air hoist and a 500 cu. ft. deisel-compressor unit; all mining equipment is complete and in good condition.

A well constructed mill with a probable top capacity of 75 tons per day is located near the shaft. The mill is designed to employ gravity and flotation methods to produce a bulk concentrate; no provision has been incorporated into the flow sheet to separate the cobalt from the copper values contained in the mill feed.

The mine was in production from 16 February to 18 May 1954; during this period 2,335 tons of mill feed were treated.

An office building, sleeping accomodation, and mess facilities are adequate and have been well maintained. Two men live at the property to maintain the plant and equipment; the mine is kept free of water.

ORE RESERVES

Description of deposit:

Nearly all underground development has been performed on one strong vein structure in Nipissing diabase. The vein strikes N 15° E and dips 72° E. Where it could be examined the vein contains from 2 inches to 18 inches of pink aplitic material. Metallic mineralization consisting of cobalt arsenides, cobalt sulpharsenides and copper pyrites is erratically disseminated throughout the aplitic material and in places occurs in massive veins up to 4 inches in width on one or on both sides of the aplite. The cobalt mineralization can be readily detected where it has been exposed to the air by means of its oxidation product, cobalt bloom. Prolific cobalt bloom commonly leads to an over-estimation of the cobalt content of the vein. The aplite may be observed to be in sharp contact against the diabase; in other places it shows the mineral textures of the adjacent diabase and appears to be a reddish discoloration and alteration of diabase. No cobalt or copper mineralization is visible in unaltered diabase surrounding the aplitic material. The rock adjacent to the vein is, as is common in other deposits in diabase, well jointed along planes parallel to the vein. It is evident that this jointing has been responsible for over-breaking and uncontrollable dilution in many openings where the vein has been mined out.

One shoot of material containing heavier mineralization than usual is evident from a visual examination of the underground workings. The linear dimensions of the shoot were determined originally from surface sampling, and they were confirmed by underground development. The shoot measures 167 feet in length on the 205 ft. level. Stoping operations above the 205 ft. level were conducted throughout the whole length of this shoot; those on the 66 and 135 ft. levels were located within a limited portion of the shoot.

There is an apparent change in the character of the vein on the 305 ft. level. Here it is a strong calcite vein mineralized with cobalt arsendies and chalcopyrite, and as such holds forth the possibility of higher associated silver values than the aplite veins in the higher horizons. Study of the jointing in the diabase exposed in the underground openings indicates that the diabase sill dips West at about 20 degrees, and that the lower contact should be within a few hundred feet of the 305 ft. level. High grade silver deposits in lower contact portions of the sill are not common in the area but are known to exist. The promising appearance of the vein on the 305 ft. level and the indicated proximity of the lower contact suggest that this structure should be tested at deeper horizons.

Approximately 500 feet West of the shaft, Plante Creek occupies a marked topographic depression which roughly parallels the strike of the vein in the mine workings. It is possible that this depression reflects the presence of a vein structure of importance; the mine workings are an excellent site from which this possibility might be tested by diamond drilling.

All data bearing upon the grade of the material in the main vein have been compiled and studied. The information is presented under the following headings:

Original surface sampling
Surface diamond drilling
Underground sampling prior to shut down
Calculation of grade from mill records
Channel sampling, October 1955

In all cases involving deliberate rock samples, the figures have been recalculated to show the grade across 3.0 feet, the minimum stoping width that could probably be maintained in this deposit. Erratic high values have not been cut.

ORE RESERVES - Cont'd

Original surface sampling:

The surface exposure of the vein was sampled by Mr. M. C. Halstead at some date before April 1951. The results are presented on map I of this report. They show that the average of 24 samples evenly spaced over a length of 140 feet of the vein immediately North of the shaft was 0.52% cobalt and 0.67% copper over 3.0 feet.

Surface diamond drilling:

The results of a 15 hole diamond drill programme to test the continuity of mineralization under deep overburden are shown on map I. All assay values have been re-calculated to show the grade over 3.0 feet. The average cobalt content of 4 holes intersecting the vein within the limits of the shoot and above the 135 ft. level is 0.51% over 3.0 ft.

Underground sampling prior to shut down:

The average of 17 channel samples taken by Mr. L. J. Cunningham in June 1954 on exposures of the vein on the 66 foot level, combined and recalculated over a 3.0 ft. width, is 0.27% cobalt. The location and values obtained at successive sample stations are shown on map I.

Calculation of grade from mill records:

The mill operated from 16 February until 18 May 1954. Mill figures for the period 16 - 28 February may be disregarded as they apply to the tune up period. Figures for 16 - 18 May are not available. In the mill operation a sample of crushed mill feed was taken each hour; mill tailings and concentrates were evidently sampled in an acceptable way. Figures on the mill performance are summarized below:

Period	Tons Milled	Average Head Sample	Average Tailing Sample	Calculated Heads ■
1-31 Mar.	646	0.34% Co.	0.04% Co.	0.188% Co.
1-15 Apr.	348	0.20% Co.	0.05% Co.	0.211% Co.
15-30 Apr.	391	0.24% Co.	0.08% Co.	0.375% Co.
1-15 May	478	0.28% Co.	0.04% Co.	0.270% Co.
76 days	1,863	0.278% Co.	0.050% Co.	0.252% Co.

Average tons per day 25

Average head sample 0.278% cobalt
Calculated heads ■ 0.252% cobalt

Extraction, indicated from head sample 82%
indicated from calculated heads 80%

■ Calculated heads = $\frac{\text{content of concentrates + content of tailing}}{\text{tonnage}} \times 100$

The two figures for the grade of mill feed derived from two methods of sampling check well within usual limits. It must be noted that since the smelter schedule under which it was intended to sell the mill production contained no provision for payment for copper, no figures for copper content were kept. Since however, the average grade of all concentrates as determined by Temiskaming Testing Laboratories was 7.61% cobalt and 5.10% copper, an estimate of the copper content of the mill feed may be made by assuming that the mill extraction of copper is the same as that of cobalt and by applying this copper : cobalt ratio to the cobalt value of the head sample. This computation gives a copper content of the head sample of 0.186% copper.

Channel sampling, October 1955:

During the recent examination it became evident that all previous sampling data pertained only to the upper levels of the deposit; a competent and experienced sampler was therefore employed to thoroughly sample the 205 foot level, the most extensive level in the mine. In view of the localization of the metallic content of the deposit in and adjacent to the aplite portion of the vein, each channel was so cut as to produce 2 samples; the first across the aplite and the second across equal widths of wall rock on both sides of the aplite. The combined width of both samples was always 36 inches. The two samples were assayed separately and the value of the 3 foot channel was computed by weighting the values on the basis of the widths of sample from which each was obtained. The samples were assayed in the laboratories of Cobalt Chemicals' smelter at Gillies Limit. The results are plotted on map I. The average of 15 combined and recalculated samples taken from within the limits of the shoot is 0.24% cobalt and 0.32% copper. Values which are slightly higher than the average for the whole mine were obtained in the Northern portion of the 205 foot level.

Cut-off grade:

It is necessary, to interpret the figures for grade, to arrive at an estimate of the cost of mining and milling one ton of mill feed from this mine. It can be seen that the average daily capacity of the mill was only 25 tons. This is so low a figure that it should be ignored. Examination of the mill equipment allows an estimate that its ultimate capacity might reach 75 tons per day. Experience with local operations allows a safe prediction that, at this rate, operating costs at the property would be roughly $17 per ton. If a contract could be obtained paying $1.60 per pound of cobalt contained in the concentrates, the premium price under existing schedules, and assuming a mill extraction of 85% which should be obtainable with this mill, the minimum grade that would be required to cover costs would be:

$$17.00 \div (1.60 \times .85) = 12.5 \text{ lbs. of cobalt per ton}$$
$$\text{or } 0.63\% \text{ Co.}$$

Assuming that processes of differential concentration of the cobalt and copper content of the mill feed could be achieved, and there are good technical reasons for the assumption, the copper content indicated by the various methods of assessing grade is so low that it would do little more than offset the added cost and diminished extraction that such a treatment would entail.

SUMMARY

The results of all data relating to the metal content of the highest grade shoot known to exist on the Farr Twp. property belonging to Tiara Mines Ltd., are tabulated below:

Type of sampling	Cobalt Content	Copper Content
Surface channel samples	0.52%	0.67%
Surface diamond drill holes	0.51%	-
66' level channel samples	0.27%	-
205' level channel samples	0.24%	0.32%
Daily mill head samples, average	0.278%	-
Calculated mill head samples, average	0.252%	0.186%

The underground sampling checks well with the milling results. The surface channel and diamond drilling results are about double those obtained underground but are nevertheless below the cut-off grade of 0.63% cobalt.

CONCLUSIONS

The underground workings expose a vein structure containing cobalt and copper mineralization.

Under current metal prices, no ore is known to exist on the property.

Two geological possibilities of ore occurrences exist within areas immediately adjacent to the mine workings; these merit testing by a modest exploration programme.

RECOMMENDATIONS

We recommend that an underground diamond drilling programme of approximately 3000 feet be applied to the search for an ore deposit within the areas adjacent to the underground workings.

If, at the conclusion of this diamond drilling programme, there is no marked improvement in the chances of finding an ore body, we recommend that the mine be allowed to fill with water, and that the plant and equipment be sold.

L. J. Cunningham

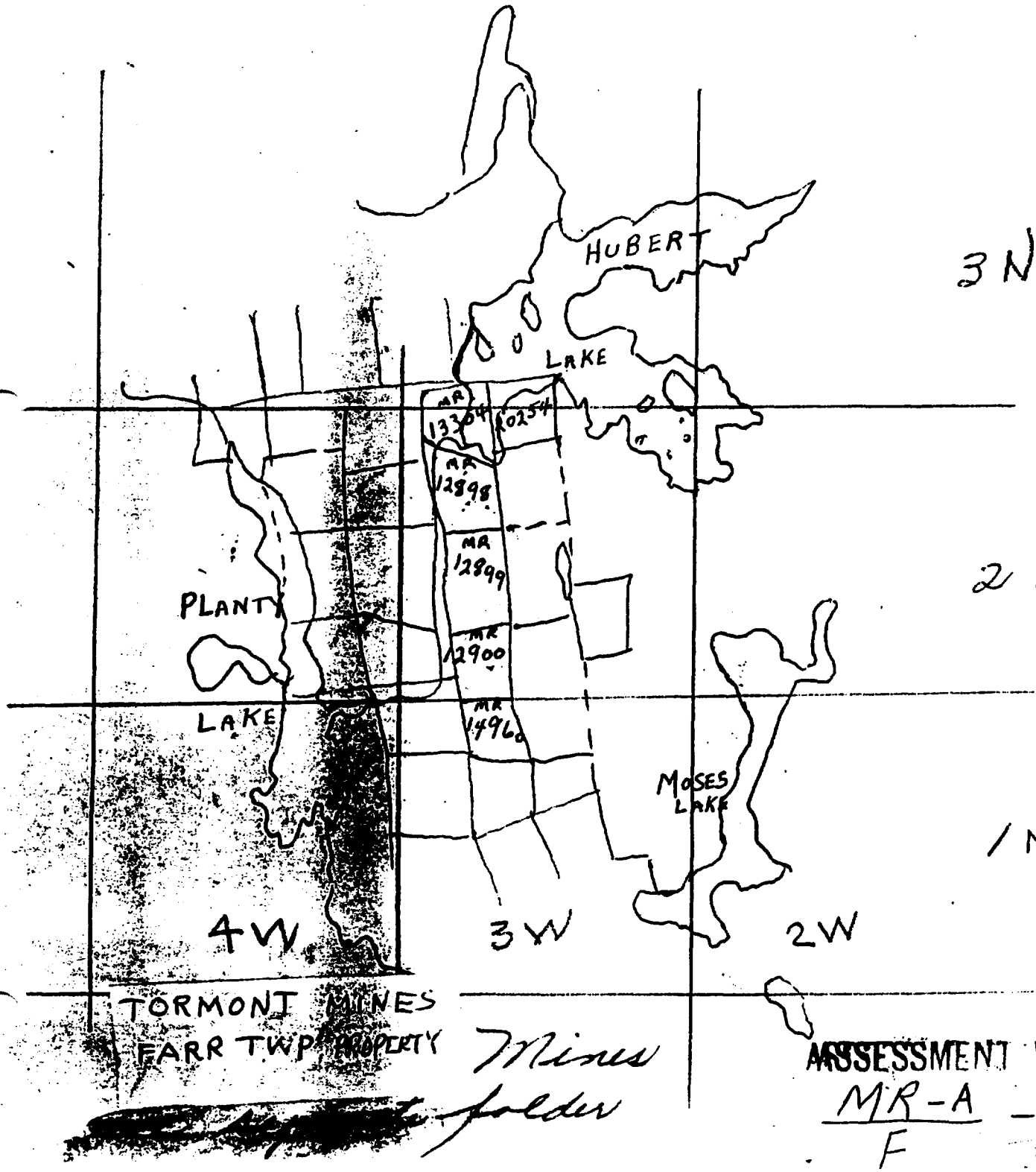
L. J. Cunningham

31 December 1955

E. E. Campbell

E. E. Campbell

MS 2N 3W

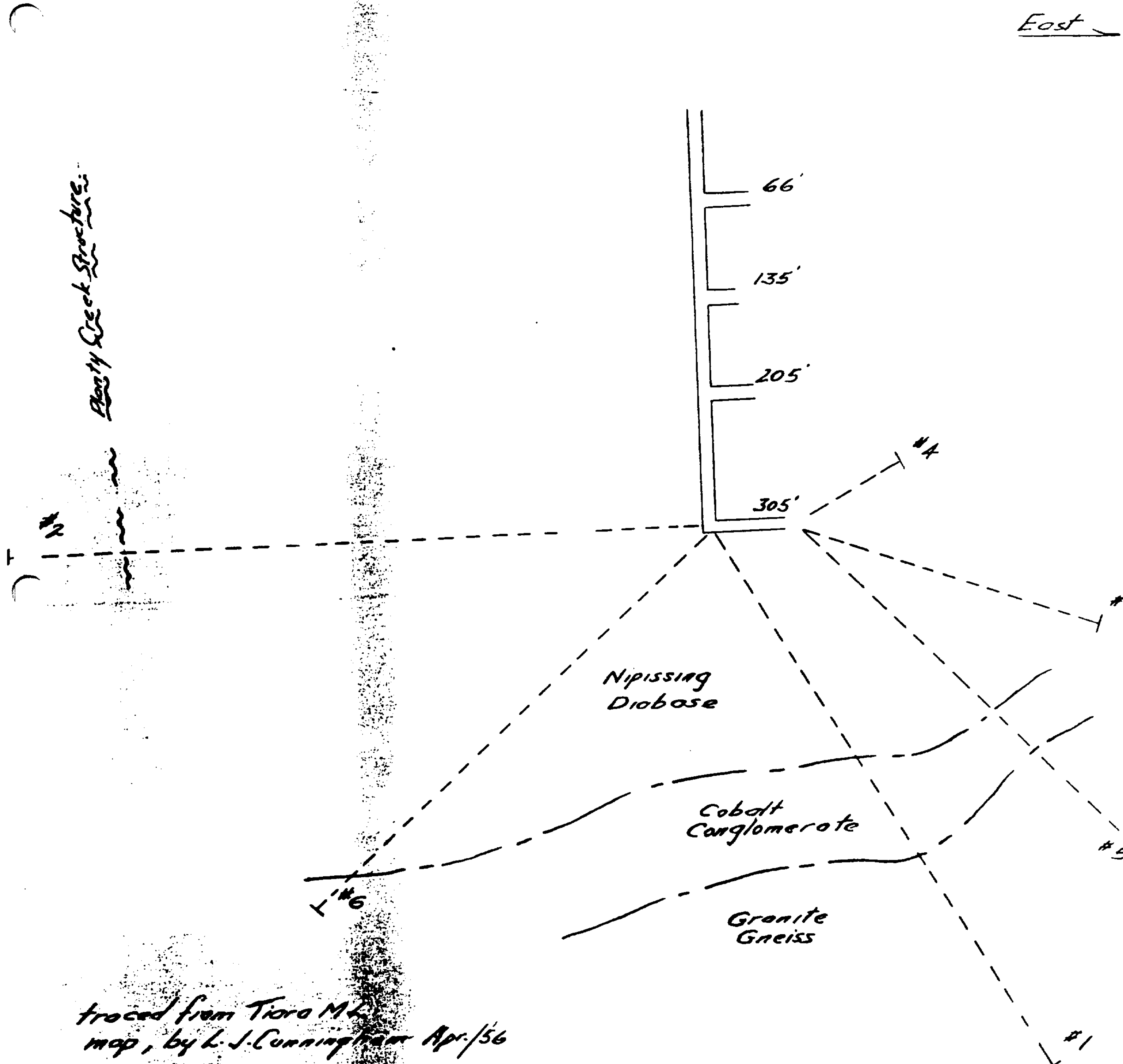


TORMONT MINES
FARR TWP PROPERTY

Mines folder

ASSESSMENT WORK
MR-A - 2N
F 3W

ANNEX "H 12"



traced from Tiora M.
map, by L.J. Cunningham Apr./56
Scale: 1"=100'
ROY SILVER - FARR TWP., ONT

[signature] B.A., M.
for TORMONT MINES LTD.

ASSESSMENT WORK
ONT. DEPT. MINES
MAR 3 1964
RESIDENT GEOLOGIST
COBALT, ONTARIO

SHEET NUMBER 1

SECTION FROM ..... TO .....

DIAMOND DRILL RECORD

LOCATION: LAT. 305' Level Station
DEP. 5' east of shaft

ELEVATION OF COLLAR Track Elevation

DATUM

DIRECTION AT START: BEARING Magnetic East
DIP -60°

STARTED } April 1956
COMPLETED }

ULTIMATE DEPTH } Purpose To
PROPOSED DEPTH } locate lower diabase contact and test Main Vein.

DEPTH FEET	FORMATION	SAMPLE No.	WIDTH OF SAMPLE	GOLD $	SLUDGE GOLD $	
0 - 4	Casing					
4 - 190	Nipissing Diabase - coarse, dark green spotty					
	17 - 23 - marked breakage parallel to 30°/core					
	18 - 19 - Two ½ discontinuous chalcopyrite and pyrrhotite veins 25°/core					
	27-9, 94-6, 99-100, 118-120 -- strong breakage					
	121 - ¼ quartz vein 80°/core					
	124 - two ⅛ ¼" quartz veins 38°/core					
	164.5 Breakage water reported fine grained chilled edge at contact					
190 - 267	Cobalt conglomerate					
	coarse granite boulders to 7" in gritty matrix					
267 - 452	fine grained uniform diabase (possible dike)					

NORTHERN MINER PRESS LIMITED, TORONTO-STOCK FORM No 501 REV. 9/44

DRILLED BY Barron Diamond Drilling

SIGNED

PROPERTY [redacted]

PAGE 1

LOCATION 305' Level 50' from shaft south wall

COLLAR: LAT 3' above datum

DEP

ELEV.

BEARING Magnetic West

DIP 0°

DEPTH OF HOLE

STARTED 2 Apr. 1486

COMPLETED April

FROM	TO	DESCRIPTION	SAMPLE NO.	CORE FT.	
0		**Nipissing Diabase**			
	0 - 115	Coarse with black spots dark green			
	115	finer grained probably quartz diabase			
	407-411	fine grained reddish purple apletic dike 10°/core sharp contact specularite and chalcopyrite in minor amounts at contacts			
	418-424	apletic dike as above			
		Economic Geology			
	3' - 35'	occassional narrow ¼"-½" slickensides low angle 20°/core no vein material			
	67'	1/8" chalcopyrite in ½" dark chloritic band 55°/core			
	128'	½" carbonate vein 70°/core			
	130, 130.1, 130.9, 171½	¼" to ½" carbonate veins 45°/core			
	132	1½" quartz vein 60°/core			
	184	2½" carbonate vein 30°/core (1) 6" with chalcopyrite & pyrite mineralisation 6" over ½" 3" red aplatic alteration			
	198	2" quartz 80°/core minor chalcopyrite and aplite			
	204	½" carbonate vein			
	224	1/8" " "			
	231	¼" " "			
	231.3	1" " " ½" chalcopyrite & pyrite 45°/core			
	257.5	½" " " 80°/core			
	262	1" " " 60°/core minor chalcopyrite			
	269	1" quartz vein 80°/core			
	283.7	2" quartz carbonate vein ¼" red aplite			
	288	Two ½" carbonate veins 80°/core			
	305.3	¼" carbonate vein 30°/core			
	316-317	Three 1/8" carbonate veins			
	325, 327, 327.5	½" - 1" quartz carbonate veins			
	328, 329	3" quartz vein plus smaller ones 70°/core			

Ag - Cu

4.4 0.40

TPC NEW LISKEARD, ONTARIO

DRILLED BY

SIGNED

L. J. CUNNINGHAM

PROPERTY [redacted]

LOCATION

COLLAR: LAT.

DEP.

ELEV.

BEARING

DIP

DEPTH OF HOLE

STARTED

COMPLETED

FROM	TO	DESCRIPTION	SAMPLE NO.	CORE FT.
	329, 331.5	½" quarts carbonate		
	333.7	1" carbonate vein minor chalco 70°/core		
	335, 339.8	½" quarts carbonate veins		
	340-350	approx. 15 veins to 1" occasional vugs occassional specularite mineralisation.		
	352.5	1½ quarts carbonate vein minor chalcopyrite and hemotite		
	350-360	approximately 15 veins as above		
	375	½" carbonate vein		
	385	1" " "		
	~~398 398~~			
	397	½" " "		
	425 - 450	minor breakage with carbonate veins to ¼" usually 60 - 70°/core little hematite		
	450 - 475	similar to 425 - 450 but less vein material		
		461 - ½" carbonate vein some magnetite (?) and pyrite		
		480 - 1" carbonate vein 45°/core little chalcopyrite		
	500	End of hole		

TPC NEW LISKEARD, ONTARIO

DRILLED BY Barron Diamond Drilling.

SIGNED

L. J. CUNNINGHAM

D. D. HOLE NO. [illegible]

PROPERTY Tiara Mines Limited

PAGE 1

FROM	TO	DESCRIPTION	SAMPLE NO.	CORE FT.	
		at face of crosscut at 305' station 25' east of shaft			
				}	APRIL 1956
		Magnetic East		}	MAY
		-20°			
0		Nipissing Diabase			
	0 - 92	Dark Black spots			
	0 - 30	Slickensides chloritic generally 0 - 30°/core			
	47 - 85	slight breakage no carbonate veins 60° and parallel to core			
	92 - 105	becomes fine grained spotting disappears			
	105	becoming coarse grained			
	126 - 134	Broken chloritic fractures 30° - 40°/core			
	177 - 179	reddish Diabase			
		Bad and continually caving at 179 cemented twice			
		226 - End of Hole			

TPC NEW LISKEARD, ONTARIO

DRILLED B Farron Diamond Drilling.

SIGNED L. J. CUNNINGHAM

D. D. HOLE O. 2

PROPERTY Tiara Mines Limited

FROM	TO	DESCRIPTION	SAMPLE NO.	CORE FT.
		At face of Crosscut of 305' level 95' east of shaft May 1956		
		Bearing Magnetic East Dip plus 30°		
0	79	DIABASE coarse grained dark green		
		70 1" aplite few specks chalcopyrite 71 ½" chalcopyrite 73 ½" quartz scattered pyrite		
		79' End of Hole		

TPC NEW LISKEARD, ONTARIO

DRILLED B Bacon Diamond Drilling.

SIGNED L. J. CUNNINGHAM

PROPERTY Tiara Mines Limited

FROM	TO	DESCRIPTION	SAMPLE NO.	CORE FT.
		At face of crescent on 305' level 95' east of shaft May 1956		
	Bearing	Magnetic East		
	Dip	-45°		
0	197	DIABASE		
197	234	Cobalt conglomerate		
234		3" white barren quartz few specks pyrite		
234	348	Granite and granite gneiss red to grey		

TPC NEW LISKEARD, ONTARIO

DRILLED BY Barron Diamond Drilling.

SIGNED L. J. CUNNINGHAM

PROPERTY [illegible]

PAGE 1

LOCATION

COLLAR: LAT. 325' level
50' from station in north wall
DEP.
ELEV.

DEPTH OF HOLE

STARTED May 26

COMPLETED June 26

BEARING Magnetic North

DIP -60°

FROM	TO	DESCRIPTION	SAMPLE NO.	CORE FT.
0	136	DIABASE coarse dark green spotty hypersene 17' ½" sand coloured granitic dike 70°/core minor chalcopyrite mineralization along contacts 84' ½" specularite and specks of chalcopyrite 20°/core		
136	320	DIABASE dense fine grained dark grey 146 ½" specularite and specks chalcopyrite 180 1" white quartz 70°/core specks pyrite 210-213 irregular carbonate fractures 30° 15°/core 214 ½" pyrite and chalcopyrite 60°/core 262-5 breakage slickensides		
320	347	DIABASE coarse grained 338 - 1" cream coloured cherty vein		
347	355	DIABASE fine grained		
355	380	fine grained altered spotty greywacke grading into grit at 36°		
380	387	conglomerate and grit reddish in colour		

END OF HOLE

.PC NEW LISKEARD, ONTARIO

DRILLED BY [illegible]

SIGNED

L. J. CUNNINGHAM

ONTARIO

DEPARTMENT OF MINES

Statistical Review of the Mineral Industry and Mining Operations for 1963

By

G. S. RIDDELL

Annual Report for the Year 1963

Volume 73

TORONTO

Printed and Published by Frank P. Gee, Printer to the Queen's Most Excellent Majesty

Of the total ore hoisted, 39 percent of the tonnage or 42 percent of the ounces came from stopes above the 900-foot level and the balance from No. 11 winze workings.

Milling

		1963	1962
Ore treated	tons	64,600	58,665
Calculated heads	oz. per ton	21.58	24.22
Mill residues	oz. per ton	0.61	0.71
Recovery	percent	97.18	96.63
Total recovery—mill	oz.	1,355,866	1,407,987
Hand-picked mine ore	oz.	48,161	61,583
Over-all silver production	oz.	1,404,027	1,469,570

The mill operated efficiently throughout the year. A minor change in reagents used in the flotation circuit resulted in an improved over-all recovery. Including hand-picked mine ore, over-all recovery in high-grade form accounted for 85.2 percent of total production, distributed as follows:

	1963	1962
	percent	percent
1. Hand-picked high-grade	3.4	4.2
2. High-grade concentrates	81.8	84.2
3. Flotation concentrates	14.8	11.6
Total	100.0	100.0

The average number of employees was 101: 67 underground, and 34 on surface. E. A. Pearson was mine manager.

Solomino Gold Mines Limited

Solomino Gold Mines Limited was incorporated in March 1962 with an authorized capitalization of 5,000,000 shares of $1 par value of which 400,000 shares have been issued. The directors and officers were: R. Zarysky, president and director; W. Pankiewich, vice-president and director; P. Kohut and T. Romaniuk, directors; B. Romaniuk, secretary; H. Schemionek, treasurer. The head office is at Suite 223, 12 Richmond Street East, Toronto. The mine address is Elk Lake.

The property, formerly the Beacon Silver property, comprises nine claims in James township, District of Timiskaming, about seven miles south of Elk Lake.

The two compartment shaft in claim MR.28869, about 370 feet deep, was pumped to the 200-foot level, and a sampling and diamond-drilling program was carried out. About 25 feet of surface trenching, averaging 12 feet in depth, was completed. Seven diamond-drillholes, totalling 469 feet, were completed from surface, and one hole 362 feet deep from underground. A storage shed 12 x 12 ft. was constructed.

Operations were terminated in September.

G. G. Caron was in charge, and eight men were employed during the period of operation.

Tormont Mines Limited

Tormont Mines Limited was incorporated in July 1949 with an authorized capitalization of 5,000,000 shares of $1 par value of which 3,300,000 shares have been issued. The directors and officers were: Andrew Robertson, president and

director: Wilfred Garnett, vice-president and director; G. D. Pattison, secretary-treasurer and director; R. D. Bell, L. N. Dalton, L. C. Creery, and S. J. O. McClay, directors. The head office is at Suite 405, 25 Adelaide Street West, Toronto 1. The mine address is Elk Lake.

The property comprises 65 claims: 34 in Haultain township, which included the Wigwam property, and 31 in Farr township, which included the Little Otisse and Roy Silver properties, near Lost Lake, District of Timiskaming.

Operations proceeded from 8 January to 7 September 1963.

SHAFTS, TORMONT MINES LIMITED

	Claim	Inclination	Number of Compartments	Total Depth below Surface
				feet
Wigwam adit	MR.13255	Horizontal	-	180
Haultain	MR.12913	Vertical	-	375
Little Otisse	MR.12900	Vertical	-	105
Roy	MR.12898	Vertical	-	250±

The following table shows the development footage completed in 1963, and the total development footage when work terminated on 7 September 1963:

	Drifts		Crosscuts		Raises	
	1963	Total	1963	Total	1963	Total
	feet	feet	feet	feet	feet	feet
Wigwam adit	111	1,691	—	470	[illegible]	307
100-foot level	—	150	—	—	—	—
HAULTAIN						
125-foot level	—	20	—	—	—	—
150-foot level	—	380	—	270	—	—
250-foot level	no record		—	—	—	—
350-foot level	no record		—	—	—	—

About 500 feet of surface trenching, averaging 2 feet in depth, and eight diamond-drillholes, totalling 643 feet from underground, were completed.

The average number of employees was 41: 3 underground, and 1 on surface. R. A. Granger was resident engineer.

ANNEX
"H-141"

REPORT ON A GEOLOGICAL SURVEY OF THE TORMONT MINES PROPERTY IN FARR TOWNSHIP, ELK LAKE SILVER AREA, ONTARIO

FOR
THE DIRECTORS

January 8th, 1964.
Haileybury, Ontario

E.L. MacVeigh B.A., M...

. . . . . .

CONTENTS

Maps & Diagrams:

a. Geological Plan of Tormont Property
Scale 200' to 1"

b. Generalized East-West Geological Section
Scale 400' to 1"

c. Neighboring Property Locations
Scale ½ mile to 1"

d. "Little Otisse" Shaft Workings
Scale 20' to 1"

e. "Roy Silver" Surface Veins and Plant
Scale 20' to 1"

f. "Roy Silver" Shaft Workings -Longitudinal Stope Sections & Level Plan
Scale 20' to 1"

g. "Tiara Mines" Section Showing Underground Diamond Drilling. Scale 100' to 1".

SUMMARY

Tormont Mines Limited hold a group of 25 mining claims in the Elk Lake Silver Area. The claims are located in Farr Township near Hubert Lake approximately 7 miles northwest of the town of Elk Lake.

During the Summer and Fall of 1963 the writer conducted a geological mapping of the Tormont property with a program of prospecting, surface work, and a dewatering of the 100' deep Little Otisse shaft location. No significant silver occurrences were found though numerous low silver values were found associated with cobalt mineralization in calcite veins in the diabase sill.

The geological mapping shows the presence of the Nipissing diabase sill in the central part of the property where it strikes north-south and dips flatly west about -10^{0} to -15^{0}. The outcrop area of diabase is upwards of $\frac{1}{4}$ of a mile wide and is shown to be overlain by Cobalt sediments to the west and underlain by Cobalt sediments and Algoman granite to the east. A deep erosional valley traverses the Tormont property from north to south, a distance of a mile and a half, in the diabase area. This feature is traceable at least three miles further south. Along its length from north to south are located silver and cobalt occurrences. In Farr Township these are the shaft locations of "Roy Silver" and "Little Otisse" on the Tormont property. In Mickle Township silver occurrences in the proximity of the depression are; the Boland Lake silver location on the Norvalie

property, the Alsof shaft (formerly Mapes-Johnson), and the Candore (formerly Majortrans). The lineal depression possibly marks a fault location near which silver deposits have been localized.

On the Tormont property the Nipissing diabase is divided into a coarse and medium grained phase. The coarse phase is a thickness of 200' or more on the hanging wall of the diabase. The only known silver high grade obtained from the Tormont ground was that of the Little Otisse shaft on present claim MR. 12900 close to the contact of the coarse and medium diabase. It is not known whether there is an intrusive contact between the two phases or a gradational change. The contact location might have structural importance for silver occurrence.

In spite of the lack of success in finding silver during the recent work program it is recommended that the property be retained by Tormont Mines. In the writer's opinion it is quite possible that further work on the diabase in Miville and Farr Townships could give successful direction to the search for silver deposits.

PROPERTY & ACCESS:

The property of Tormont Mines Limited in Farr Township, Ontario, is a silver and cobalt prospect composed of 25 claims, approximately 1,000 acres. The claims are recorded in the Montreal River Mining Division as follows:

Claims held under Lease: MR.12898-99
MR.12900
MR.14960

Unpatented claims: MR.35349-49-50-51-52-53
MR.35452-53-55-56
MR.35862-63-65-66-67-68
MR.36300-01-02-03
MR.37240

The leased claims were acquired by Tormont Mines when they took over the property holdings of Tiara Mines Limited. The unpatented claims were staked for the Tormont Company in 1962 and 1963.

Access to the ground is by way of Elk Lake, Ontario. From Elk Lake the route is via the Matachewan Highway, No. 65, to Mileage 7 and thence 3 miles west along the north side of Hubert Lake to the site of the "Roy Silver" shaft and former mill site. This location is at the north end of the Tormont property, and a car may be driven this far. Further access may be gained by following a bush road south through the Tormont claims. This road leads 8 miles south to the Gowganda Highway, No. 560, where it joins in Mickle Township about mileage 4 west of Elk Lake.

HISTORY:

The leased claims held by Tormont Mines Limited in Farr Township are developed by two vertical shafts and a short adit working. The 100' vertical shaft is the central part of the property on leased claim MR. 12900, and probably the adit working on the claim to the south, MR. 14960, are developments by Sterling Mines Limited. This company was incorporated in 1909 and the mining work was probably done shortly

afterwards. The Sterling shaft on MR. 12900 is referred to locally as the Little Otisse shaft.

Some small scale interim work was possibly carried on between the early days and 1950 when Roy Silver Mines Limited commenced operations for cobalt at a north shaft location on leased claim MR. 12898. This shaft was carried to a depth of 305' by Roy Silver and approximately 750' of lateral mining work done on levels established at 66' -135' -295' and 305'. The mining was done at the time of a high cobalt metal price and some steping supplied cobalt ore to a mill constructed on the property. A small shipment of concentrates was made to the smelter at Cobalt, Ontario. A sample by the writer of a bag of concentrates left at the property assayed 3.70 ozs. per ton of silver, 6.50% cobalt and 5.39% copper. Apparently silver values in the ore were very low and stope section assays of the Roy Silver operation show a very marginal operation at the best of prices for cobalt.

In 1955 Roy Silver Mines Limited was renamed Tiara Mines Limited and under the latter company some diamond drilling was carried out from the 305' level of the shaft on Claim MR. 12898 in 1956.

In 1961 Tiara Mines Limited was renamed Tormont Mines Limited. In 1963 Tormont Mines undertook a program of staking, field exploration and geological mapping to investigate the silver chances in Farr Township.

GEOLOGY

The country or basement rock of Parr Township is composed of granite in the eastern half and Cobalt sediments in the western half. Along the general north-south boundary of these two rock formations is an exposure of the Nipissing diabase sill which can be traced continuously from Elk Lake through James and Mickle Townships and north into Parr Township. This diabase exposure is part of an undulating sheet forming basins and domes and important as a source of native silver between Cobalt and Gowganda, Ontario. In Parr Township the diabase sill and the Cobalt sediments composed of conglomerate, arkose and greywacke, are observed to dip west at -10° to -15°. Five to ten miles west of the diabase exposure in Parr Township, outcrops of the sill are found in Chown, Shillington and Boulbain Townships. At the east side of the latter township the diabase sill dips at about 25° being the eastern flank of the productive Miller Lake Basin of Gowganda. A large basin area can be assumed to exist in the diabase underlying parts of Chown, Shillington, Mickle and Parr. It is not known whether the diabase east of Parr Township intrudes the granite or has been eroded from this area. While the Tormont geological plan and section show the latter, it is reported that the diabase sill dips east at the Candore property in Mickle Township 3 miles to the south of Tormont. This could mean a roll in the diabase along a north-south axis and its continuation east as a subsurface feature.

The diabase sill occurrence on the Tormont property is shown on the accompanying map on a scale of 200' to 1".

Tormont

The flat dipping sill is overlain to the west by sediments, chiefly quartzite and arkose which are Upper Cobalt formation or possibly Lorrain. To the east the diabase is underlain by Cobalt sediments and Algoman granite as indicated by deep diamond drill holes which penetrated the bottom of the diabase sill from the Roy Silver shaft workings. Surface outcrops of the Cobalt conglomerate to the east of the diabase show pebbles ranging in size up to 2" but not the large boulder basal horizon of the Cobalt formation.

The diabase sill shows a projected thickness of over 1000' which might have been affected by faulting. On the hanging wall or west side of the diabase outcrop area is a 200' thickness of a very coarse diabase phase which was not observed in contact with the medium to fine grained phase in the middle and lower parts of the sill. A possible fault location marks the boundary of the two phases and the possibility of an intrusive contact should not be precluded.

On the Tormont property there probably exists a fault or zone of faults marked by the deep north-south depression which is followed closely by the bush road. Near this possible fault location old shaft dumps show some coarse brecciation and shearing. The south part of the Tormont property indicates that the diabase may be in fault contact with the sediments to the west. It is not known whether the fault is low angle or steep but displacement is indicated and this seems to be the only map location where it could exist.

MINERAL DEPOSITS

On the Tormont property in Farr Township native silver occurrence was found in the original work at the Stoplow shaft in claim MR. 12903. This shaft was dewatered by Tormont during the 1963 work program. The shaft is a vertical two compartment opening sunk to a depth of 100' on a 4" calcite vein striking N 60° E and dipping 80° to the southeast. The shaft vein at surface has been deeply rock blasted at the collar but visible silver may be found in the diabase wall rock and a sample of 5" of this material taken by the writer assayed over 100 ounces of silver per ton. Between surface and the 45' level approximately 100 tons of rock have been open stoped from the shaft at both ends and this section is now tight lagged and rock filled and could not be examined. Presumably sufficient silver was found to carry out this mining. At a depth of 45' a level was established and 50' of drifting carried out northeast from the shaft on a branching vein system. The strong shaft vein was left in the southeast wall 25' back from the face. The veins on the 45' level contain some massive hematite with pyrite and a little chalcopyrite but no cobalt mineralization. On the 100' level 35' of drifting was carried northeast from the shaft on a narrow calcite vein which appears to be the shaft vein with a flatter dip of 65° to the southeast. Small cross-veins striking northwest-southeast on this level show massive hematite. A short 20' cross-cut was driven northwest from the 100' level station intersecting three small ½" calcite veins showing chalcopyrite. In all eighteen samples were taken of the veins underground all showing values of less than one ounce of silver per ton.

One hundred and fifty feet south of the Little Otisse shaft a second shaft has been sunk to a shallow depth on a north-south sheared and brecciated zone in the diabase. Considerable cobalt mineralization occurs in the dump with one massive piece showing 4" of smaltite. Grab samples from this dump showed the best assay to be 2 ounces of silver per ton. This zone may be followed 600' south as exposed in old trenching.

Considerable surface work during the summer and Fall of 1963 was done near the Little Otisse shaft in the northeast part of claim MR.12930. This location is attractive because of the record of silver occurrence, the abundance of cross-fracturing and the development of concentric jointing in the diabase. Although the trenching exposed considerable calcite vein material with cobalt mineralization, no significant silver finds were made.

A second location where considerable surface work was done by Tormont in 1963 is on claim MR. 37240 where an area of highly fractured and jointed medium grained diabase occurs in the coarse diabase area. Numerous calcite veins are present, a few with cobalt mineralization, but only very low silver values were found.

CONCLUSION & RECOMMENDATIONS

The field work on the Tormont silver property in Farr Township in 1963 did not reveal significant silver occurrence in surface work or in the dewatering of the old Sterling shaft.

The underground development at the Sterling shaft (or Little Otisse shaft) showed values of less than one ounce per ton in narrow calcite veins though high grade silver was undoubtedly found near surface in the old work. The Torment geological mapping indicates that structurally the underground drifting might better have been directed southwest from the shaft towards junctions with the known north-south shear and crossed fault zones. All lateral development was carried out to the northeast and north.

A regional possibility for silver ore occurrences on Torment and the neighbouring companies in Miekle Township to the south, is the possibility that the indicated north-south fault zone and parallel shear zones will make ore where junctions are formed with cross-fracturing. Similar favourable structures might be provided by the contact horizon between the coarse and fine grained phases of the diabase.

Considering the demand for silver a good deal of ore search will no doubt be done in the Elk Lake Area. A successful development on the Nipissing diabase sill in Miekle or Dove Townships may give good direction to future exploration on Torment ground. It is recommended that at least a nucleus of claims be retained by Torment covering the indicated location of the fault zone from the north to the south end of the Torment property, a distance of 9,200'.

The known native silver deposits of the Elk Lake Area are similar to those of Cobalt in that they occur almost entirely within a host rock of Nipissing diabase sill. Also, most discoveries are near the top of the sill though the attitude

and thickness of the remnant portions of the sill in the Elk Lake Area are imperfectly known

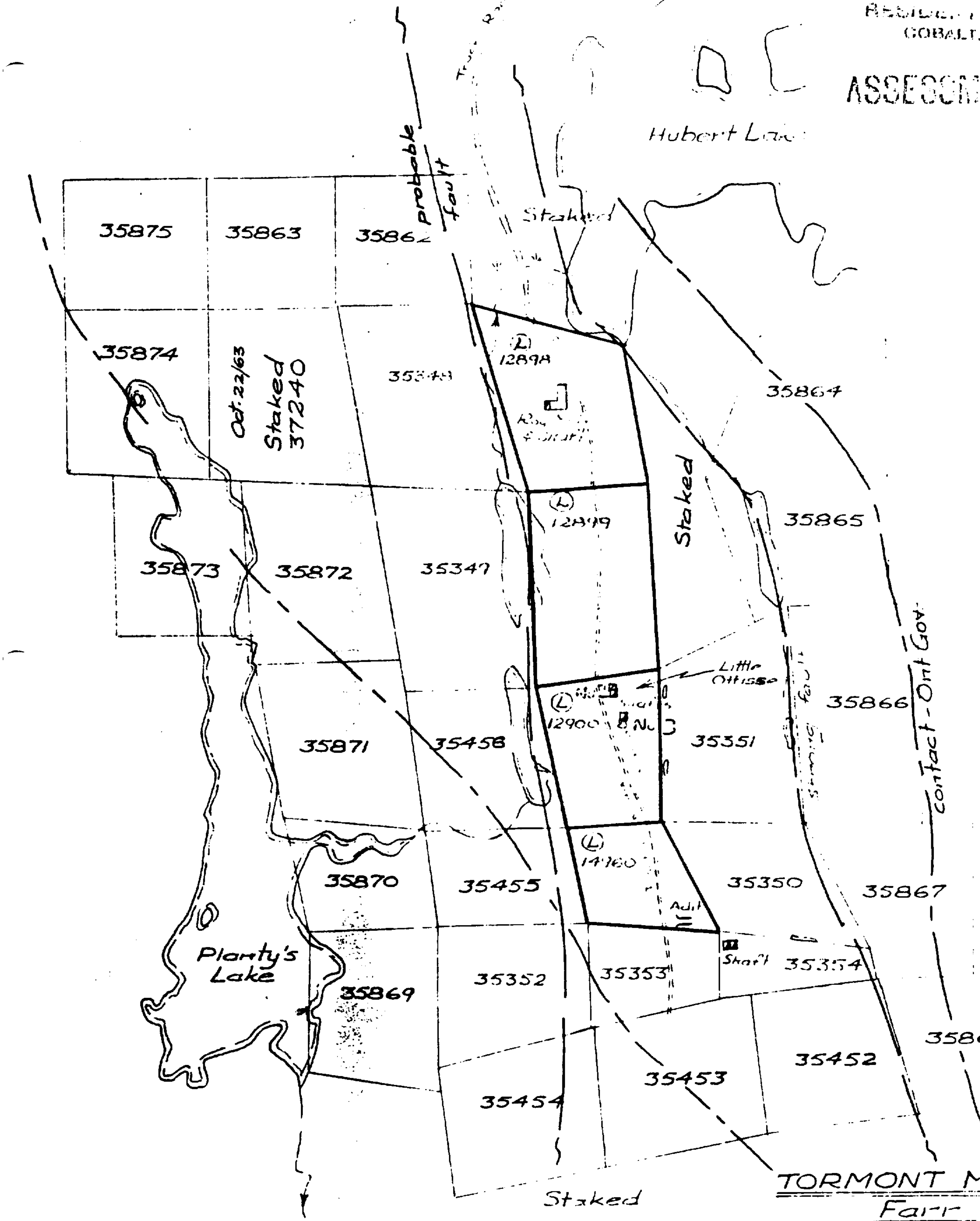
The two dominant patterns of the silver bearing calcite filled fracture systems in the Nipissing diabase basin areas are tangential and normal to the basin rims. These are assumed to be subsidence cracks. Usually where silver is found faults are present and appear to have exerted a complicated control of the silver distribution by channeling and damming solutions and creating further fracturing. In the Gowganda Camp low angle faults seem to have particularly influenced silver distribution. The resulting combination of the above is usually a repetition of favourable structure down the dip of the diabase.

Silver exploration in the Nipissing diabase sill is handicapped by the low incidence of discoveries which might be expected at surface of an ore system which is usually plunging to depth. Though much investigation has been carried out there are few practical guides to ore search and yet the probability exists that undiscovered silver ore deposits occur and with persistence will be proven up by mining.

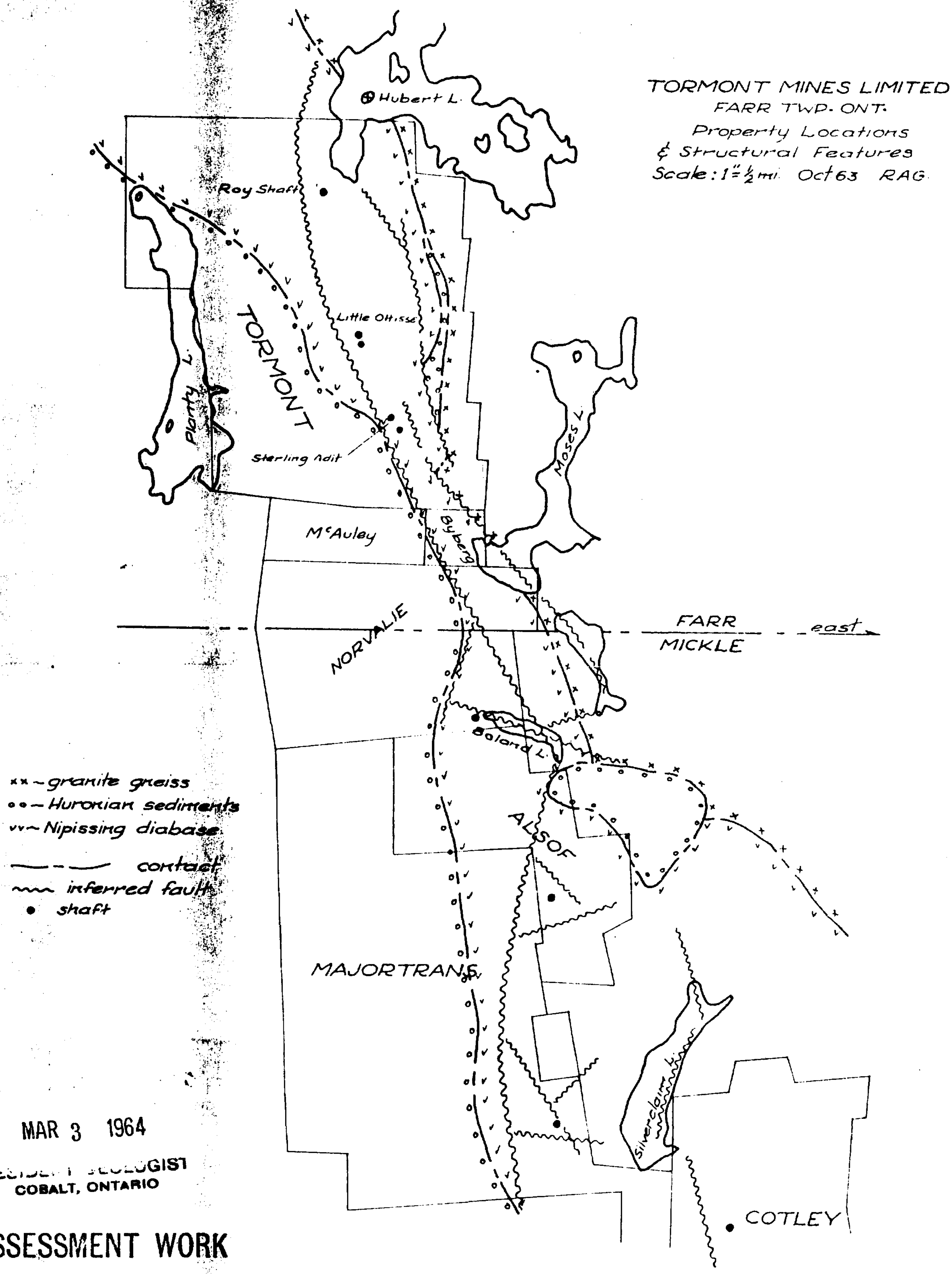
Respectfully submitted by

E.L. MacVeigh B.A., M.C.

January 8th, 1964,
Haileybury, Ontario.



TORMONT MINES LTD
Farr Twp
Scale 1" 200ft RRG
BA, MS



ANNEX
"H-15"

ONTARIO
DEPARTMENT OF MINES

Mineral Resources Circular No. 10

Silver Cobalt Calcite Vein Deposits of Ontario

By
A. O. SERGIADES

1968

Table 20.

ELK LAKE AREA (1)

LIST OF PROPERTIES

*	(Historical Name)	(Present Owner)
	AULD TWP. (see Fig.13)	
	CANE TWP. (see Fig.13)	
	DANE TWP. (see Fig.13)	
	FARR TWP.	
O 1	Roy Silver Mines Ltd.	Tiara Mines Ltd.
	JAMES TWP.	
▲ 6	Beacon Consolidated Mines Ltd.	M. Romaniuk.
▲ 3	Beaver Auxiliary Mining Co. Ltd.	J.J. Gray.
▲14	Big Six Silver-Cobalt Mines Ltd.	J.J. Gray.
▲ 8	Cole Property-Patricia Mines Ltd.	
▲ 5	Devlin Mining Co. Ltd.	W.L. Powell
▲17	Elk Lake Cobalt Mines of Ontario.	Ethel Copper Mines Ltd.
▲16	Elk Lake Discovery Mines Ltd.	
● 1	Ethel Copper Mines Ltd.	Ethel Copper Mines Ltd.
▲13	German Development Co. Ltd.	
▲12	Giles, D., prospect.	
▲10	Langham Cobalt Mines Ltd.	
▲21	Marvel Silver Mines Ltd.	G.S. Welsh.
▲ 9	McKenzie Mining & Explor. Co.	M. Mallinson.
▲22	Montreal River International Mines Ltd.	Montreal River International Mines Ltd.
▲18	Moose Horn Mines Ltd.	Laurin-Welsh.
▲15	Mother Lode Mining Co. Ltd.	G.S. Welsh prospect.
O 2	Mother Lode Mining Co. Ltd.	
▲ 7		Norton-McMahon prospect.
▲20	Prudential Mines Ltd.	
▲19	Regal Mining Co. Ltd.	
▲ 4	Regent Mines Ltd.	G.S. Welsh.
▲11	Tee Arr Mining Co. Ltd.	Bermead Mining Corporation Ltd.
	KLOCK TWP. (see Fig.13)	
	MICKLE TWP.	
▲ 5	Fahrenheit Mining Co. Ltd.	Vermont Mines Ltd.
O 1	Mapes-Johnston Mining Co. Ltd.	K.S. Oliver.
▲ 6	Mickle Silver Mines Ltd.	McAuley-Rotondo Claims.
▲ 3	North American Silver Mining Co. Ltd.	
O 2	Otisse Mining Co.	B.L. Morrison.
O 4	Shane-Darragh (cl. No. WD 904).	Cotley Mines Ltd.
	SMYTH TWP.	
▲ 1	Cobalt Union Mines Ltd.	Silver-Men Mines Ltd.
	SPEIGHT TWP. (see Fig.13)	
	TUDHOPE TWP.	
▲ 3	Jackpot Silver mines.	
▲ 2	Paramount Syndicate.	
▲ 1	Silver Alliance Mines Ltd.	
▲ 4	United States Silver Mines Ltd.	
	VAN NOSTRAND TWP. (see Fig.13)	
	WHITSON TWP. (see Fig.13)	
	WILLET TWP.	
▲ 4	Accra Explor., Ltd. (Barnet).	T.F. Barnet.
▲ 5	Floyd property (A. Mosher).	E.W.J. Floyd.
O 1	Lucky Godfrey Silver Mines.	
▲ 3	Tichbourne prospect.	
▲ 2	Willet Silver Mines Ltd.	

* Number refers to that on deposit description card; non sequence follows as a consequence of data processing.

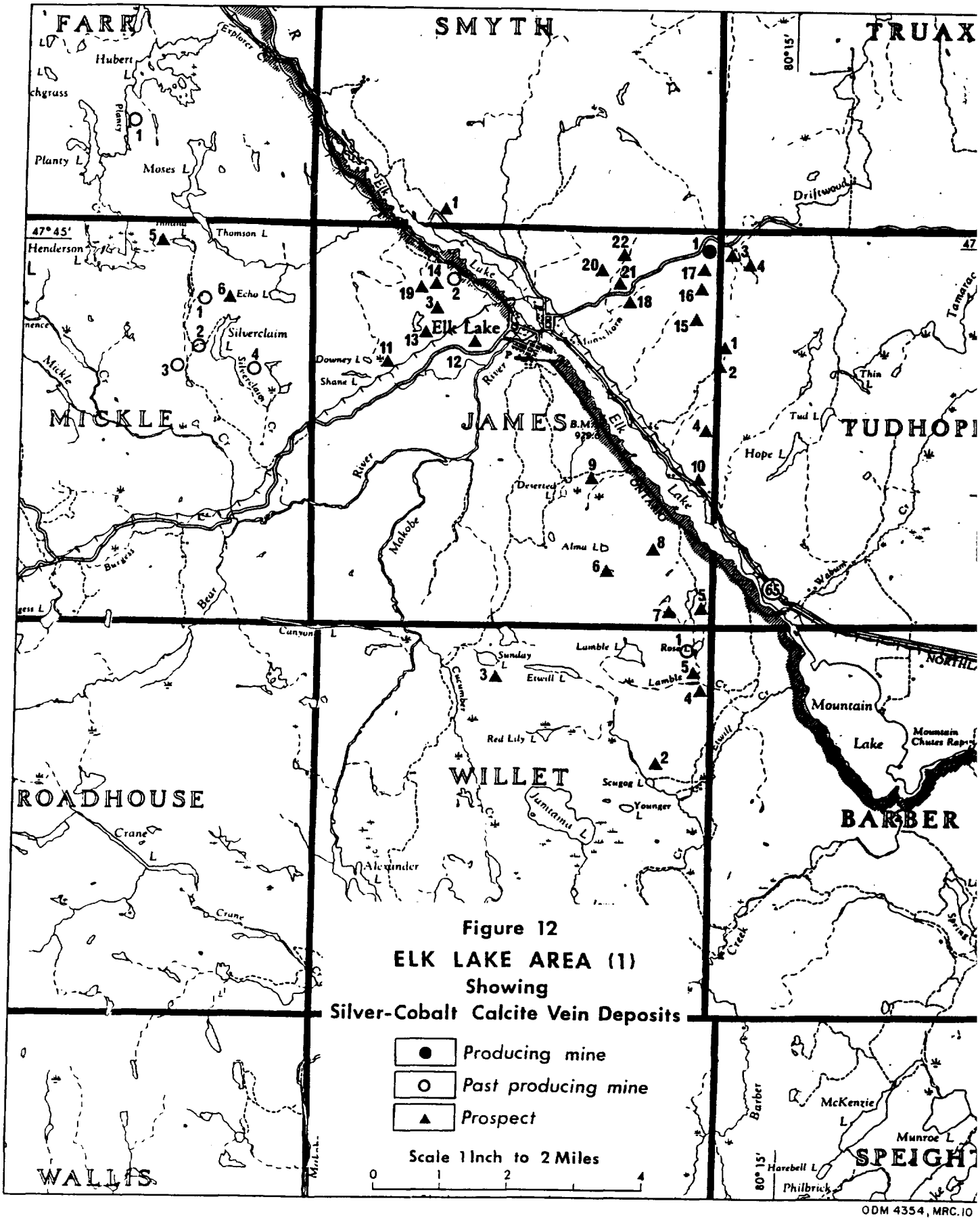


Figure 12

ELK LAKE AREA (1)
Showing
Silver-Cobalt Calcite Vein Deposits

● Producing mine
○ Past producing mine
▲ Prospect

Scale 1 Inch to 2 Miles

0 1 2 4

ODM 4354, MRC.10

Table 20a

ELK LAKE AREA (1)

PRODUCTION TABLE

*	(Historical Name)	Production Silver (Troy oz)	Production Cobalt (lbs)
	AULD TWP.		
	(see fig.13)		
	CANE TWP.		
	(see fig.13)		
	DANE TWP.		
	(see fig.13)		
	FARR TWP.		
O 10	Roy Silver Mines Ltd.	1,888	3,007 tons Co Ore
	JAMES TWP.		
▲ 6	Beacon Consolidated Mines Ltd.		
▲ 3	Beaver Auxiliary Mining Co. Ltd.		
▲ 14	Big Six Silver-Cobalt Mines Ltd.		
▲ 8	Cole Property-Patricia Mines Ltd.		
▲ 5	Devlin Mining Co. Ltd.	132	
▲ 17	Elk Lake Cobalt Mines of Ontario Ltd.		
▲ 15	Elk Lake Discovery Mines Ltd.		
● 1	Ethel Copper Mines Ltd.	6,061	
▲ 13	German Development Co. Ltd.		
▲ 12	Giles, D., prospect.		
▲ 10	Langham Cobalt Mines Ltd.		
▲ 21	Marvel Silver Mines Ltd.		
▲ 9	McKenzie Mining & Explor. Co.		
▲ 22	Montreal River International Mines Ltd.		
▲ 18	Moose Horn Mines Ltd.		
▲ 15	Mother Lode Mining Co. Ltd.		
O 2	Mother Lode Mining Co. Ltd.	1,581	
▲ 7	Norton-McMahon prospect.		
▲ 20	Prudential Mines Ltd.		
▲ 19	Regal Mining Co. Ltd.		
▲ 4	Regent Mines Ltd.	117	
▲ 11	Tee Arr Mining Co. Ltd.		
	KLOCK TWP.		
	(see fig.13)		
	MICKLE TWP.		
▲ 5	Fahrenheit Mining Co. Ltd.		
O 1	Mapes-Johnson Mining Co. Ltd.	1,000	870
▲ 6	Mickle Silver Mines Ltd		
▲ 3	North American Silver Mining Co. Ltd.		
O 2	Otisse Mining Co.	2,380	026
O 4	Shane-Darragh (cl. No. WD.904)	64,471	2,367
	SMYTH TWP.		
▲ 1	Cobalt Union Mines Ltd.		
	SPEIGHT TWP.		
	(see fig.13)		
	TUDHOPE TWP.		
▲ 3	Jackpot Silver mine.		
▲ 2	Paramount Syndicate	242	
▲ 1	Silver Alliance Mines Ltd.	510	
▲ 4	United States Silver Mines Ltd.		
	VAN NOSTRAND TWP.		
	(see fig.13)		
	WHITSON TWP.		
	(see fig.13)		
	WILLET TWP.		
▲ 4	Accra Explor., Ltd. (Barnet).		
▲ 5	Floyd property (A. Mosher).		
O 1	Lucky Godfrey Silver Mines.	9,835	592
▲ 3	Tichbourne prospect.		
▲ 2	Willet Silver Mines Ltd.		

* Number refers to that on deposit description card; non sequence follows as a consequence of data processing.

COMMODITY	NAME OF OCCURRENCE:	LAT. 04778300	REF. NO.
Silver Cobalt	CIRCA 1968: TIARA MINES LTD. HISTORICAL NAME: ROY SILVER MINES LTD. (Lease)	LONG. 08046700	O.D.M-Ag-0716001

	CODE No.	MINING DIV.	LOT, CONCESSION, CLAIMS OR LEASE ACREAGE
CO. or DIST. TIMISKAMING	59	MONTREAL RIVER	Includes claims: MR 12898-12900 and MR 14960.
TP. or SQUARE FARR	007160		
LOCATION: SW side of Hubert Lake, 7 miles northwest of ELK LAKE.		NTS 041P16W	UTM

HISTORY OF OWNERSHIP:
1912:

1950: Leased to Roy Silver Mines Ltd.*

1955: Leased to Tiara Mines Ltd.*

1961: Leased to TormoreMines Ltd.*

1964: Leased to D. Culhame.

1966: Leased to H. Townson.
1968: Tiara Mines Ltd.
* Reorganization of company with change of name.

EXPLORATION AND DEVELOPMENT
1912: No.1 inclined shaft in claim MR 12898 was sunk 75'.
No.2 shaft in claim MR 12899 was sunk 125'.
No.3 shaft (17'S of No.2 shaft) was sunk 100'.
1950-54: No.1 shaft was deepened to 390' with levels at 66', 135', 205' and 300'.
Underground work includes:-
Level 66': drifts 107' crosscuts 92', raises 94'.
" 135': " 67' " " 70' " 18'.
" 205': " 37' " " 110' " Nil
" 300 " Nil " " 98' " 117'

PRODUCTION ORE RESERVES (DATE AND AUTHORITY)
1953: 2,209 tons of development ore were stockpiled.
1954: 3007 tons of cobalt ore were mined.
1964: 1084 ozs. of silver (T.T.L.)
1966: 804 ozs. of silver (T.T.L.)

OCCURRENCE | RAW PROSPECT | DEVELOPED PROSPECT | PRODUCER | PAST PRODUCER X

MAJOR ORE MINERALS Silver. Co-arsenides.

MINOR ORE MINERALS Chalcopyrite, bornite.

ORE FABRIC Vein.
MAJOR GANGUE MINERALS Calcite.
COUNTRY ROCK OR FORMATION Nipissing Diabase.

AGE: GEOLOGICAL Aphebian | ABSOLUTE 2150 m.y.

REFERENCE
1955: O.D.M. Annual Rept. Vol.64, pt.2, p.132.

DIMENSIONS AND GRADE, QUALITY, ECONOMIC FEATURES
April 1954: A carload of Cobalt-copper concentrate was said to average better than 7% cobalt and 6% copper.
No.1 shaft vein is exposed at surface for 175'NE, dips 80° for 75' depth and is from 7" to 8" wide.
No.2 shaft vein at 8' below collar of shaft is 4" wide and assayed 3,562 oz./ton silver.

MAP REFERENCE USED FOR LOCATION
O.D.M. Map 2046, Timmins-Kirkland Lake Sheet, 1964.

FILE STATUS:	DATE	SIGNATURE
SKELETAL		
INCOMPLETE		
COMPLETED	1968	A.O.S.
REVISED		

COMMODITY	NAME OF OCCURRENCE:	LAT. 47° 47'	REF.NO.
Silver Cobalt	CIRCA 1968: TIARA MINES LTD. HISTORICAL NAME: ROY SILVER MINES LTD. (Lease)	LONG. 80° 28'	O.D.M.-Ag- 0716001

GEOLOGY
Nipissing diabase in the form of a sheet or sill, probably about 500' thick dips W off Algoman granite to underlie gently W dipping Gowganda conglomerate and quartzite on east side of property.
The Montreal River Fault strikes nearly NW two miles northeast of the property.
In the diabase several narrow calcite veins occur that show silver-cobalt-copper mineralization.

EXPLORATION AND DEVELOPMENT (Cont)
Diamond drilling includes:-
8 holes, totalling 835' were drilled from surface.
10 holes, totalling 1,178' were drilled underground.
Some production was obtained.
1964-66: Small scale mining took place.

ALTERATION | METAMORPHISM | MINERAL PARAGENESIS

	AGE OF FORMATION, ROCK OR MINERAL	AGE OF DEFORMATION:	AGE OF ORE MINERAL
GEOLOGICAL AGE	Aphebian		Post-Huronian
ABSOLUTE AGE	2150 m.y.		N.G.T. 2150 m.y.
ROCK TYPE AND/OR MINERAL	Diabase		
METHOD	K/Ar Rb/Sr Pb/Pb C14	K/Ar Rb/Sr Pb/Pb C14	K/Ar Rb/Sr Pb/Pb C14
	X	NAME OF TECTONIC EVENT	X

COMPANY REPORTS | METALLURGY REFERENCE

ECONOMICS REFERENCE | MILLING REFERENCE

GEOCHEMICAL DATA REFERENCE | MINING REFERENCE

GEOPHYSICAL DATA REFERENCE | MORPHOLOGY REFERENCE OF ORE ZONE OR MINERALIZED ZONE
PLAN SECTION LONGITUDINAL PROJECTION

MAP REFERENCE
O.D.M. Map 2046, Timmins-Kirkland Lake Sheet; 1964.
O.D.M. Map P.159, Elk Lake-New Liskeard Sheet, 1962.

ODM FILES

Ministry of Natural Resources
Ontario

Farr twp

ANNEX "A-16" #4

A separate form is required for each type of work to be recorded

THE MINING ACT REPORT OF WORK

To the Recorder of ......Larder Lake...... Mining Division

I, ...Thomas Bell......
Name of Recorded Holder

......Elk Lake, Ont...... K18186
Post Office Address — Prospector's Licence

do hereby report the performance of ......40...... days of Blasting trenching
type of work

not before reported to be applied on the following contiguous claims

Claim No.	Days	Claim No.	Days	Claim No.	Days
446166	40				

Geological Branch ODM
ASSESSMENT FILES
RESEARCH OFFICE
JAN 29 1976
RECEIVED

All the work was performed on Mining Claim (s) 446166
(In the case of geological and/or geophysical survey (s) where more than 18 claims are involved attach a schedule)

READ CAREFULLY: THE FOLLOWING INFORMATION IS REQUIRED BY THE MINING RECORDER.

For Manual Work, Stripping or Opening up of Mines, Sinking Shafts or Other Actual Mining Operations — Names and addresses of the men who performed the work and the dates and hours of their employment.
For Diamond and other Core Drilling - Footage, No. and angle of holes and diameter of core. Name and address of owner or operator of drill. Dates when drilling was done. Signed core log and sketch in duplicate.
For Compressed Air or Other Power Driven or Mechanical Equipment
Type of drill or equipment. Names and addresses of men engaged in operating equipment and the dates and hours of their employment.
For Power Stripping - Type of equipment. Name and address of owner or operator. Amount expended. Dates on which work was done. Proof of actual cost must be submitted within 30 days of recording.
With each of the above types of work sketches are required to show the location and extent of the work in relation to the nearest claim post. In the case of diamond or other core drilling the sketch must be submitted in duplicate.
For Geophysical, Geological, Geochemical Surveys and Expenditure Credits - the name of author of report. Covering dates of survey (linecutting & office). Type of instrument used. Total amount of expenditure. Technical reports, maps, expenditure breakdown, receipts must be filed in duplicate with the Minister within 60 days of recording.
For Land Survey - the name and address of Ontario Land surveyor.

The Required Information is as Follows: (Attach a list if this space is insufficient)

Thomas Bell Elk Lake [illegible]
[illegible]
[illegible]
[illegible]

Date ......Elk Lake [illegible]...... Thomas [illegible] Bell
Signature of Recorded Holder or Agent

The Mining Act
Certificate Verifying Report of Work

I, ...[illegible]......
......[illegible]......
(Post Office Address)

hereby certify:

1. That I have a personal and intimate knowledge of the facts set forth in the report of work annexed hereto, having performed the work or witnessed same during and/or after its completion.

2. That the annexed report is true.

Dated......19...... ......
Signature

(file L446166)

RECORDED JAN 5 1976

THE PENALTY FOR MAKING A FALSE STATEMENT IN THIS REPORT AND/OR CERTIFICATE IS $500. OR SIX MONTHS IMPRISONMENT OR BOTH

#237

ONTARIO

THE MINING ACT REPORT OF WORK

A separate form is required for each type of work to be recorded.

To the Recorder of LARDER LAKE Mining Division

I, THOMAS L. BELL (name of Recorded Holder) K18186 (Miner's Licence)

BOX 142 ELK LAKE ONT (Post Office Address)

do hereby report the performance of 42 days of blasting mucking sampling (type of work)

before reported to be applied on the following contiguous claims

Claim No.	Days	Claim No.	Days	Claim No.	Days
KH6166	42				

Geological Branch ODM
ASSESSMENT FILED
RESEARCH OFFICE
NOV 17 1977
RECEIVED

All the work was performed on Mining Claim (s) KH 6166
(In the case of geological and/or geophysical survey (s) where more than 18 claims are involved attach a schedule)

READ CAREFULLY: THE FOLLOWING INFORMATION IS REQUIRED BY THE MINING RECORDER.

For Manual Work, Stripping or Opening up of Mines, Sinking Shafts or Other Actual Mining Operations – Names and addresses of the men who performed the work and the dates and hours of their employment.
For Diamond and other Core Drilling - Footage, No. and angle of holes and diameter of core. Name and address of owner or operator of drill. Dates when drilling was done. Signed core log and sketch in duplicate.
For Compressed Air or Other Power Driven or Mechanical Equipment
Type of drill or equipment. Names and addresses of men engaged in operating equipment and the dates and hours of their employment.
For Power Stripping - Type of equipment. Name and address of owner or operator. Amount expended. Dates on which it was done. Proof of actual cost must be submitted within 30 days of recording.
With each of the above types of work sketches are required to show the location and extent of the work in relation to the nearest claim post. In the case of diamond or other core drilling the sketch must be submitted in duplicate.
For Geophysical, Geological, Geochemical Surveys and Expenditure Credits - the name of author of report. Covering dates of survey (linecutting & office). Type of instrument used. Total amount of expenditure. Technical reports, maps, expenditure breakdown, receipts must be filed in duplicate with the Minister within 60 days of recording.
For Land Survey - the name and address of Ontario Land surveyor.

The Required Information is as Follows: (Attach a list if this space is insufficient)

B. Casting, mucking, sampling. Self and Client Mulyneaux address at Elk Lake Ont.

June 3/77 2 men – 6 hrs – 2 days
" 4/77 2 men – 6 hrs 2 days
" 7/77 2 men – 6 hrs 2 days
" 8/77 2 men – 6 hrs 2 days
" 10/77 " – 6 hrs 2 days
" 13/77 " – 6 hrs 2 days
" 15/77 " – 6 hrs 2 days
" 16/77 " – 6 hrs 2 days
June 20/77 – 2 days
" 21/77 – 2 days
" 23/77 – 2 days
" 24/77 – 2 days
July 5/77 – 2 days
" 6/77 – 2 days
" 7/77 – 2 days
" 9/77 – 2 days
July 12/77 – 2 days
" 13/77 – 2 days
" 15/77 – 2 days
" 18/77 – 2 days
" 19/77 – 2 days

Date Oct 28/77

Thomas L. Bell
Signature of Recorded Holder or Agent

THE PENALTY FOR MAKING A FALSE STATEMENT IN THIS REPORT AND/OR CERTIFICATE IS $500. OR SIX MONTHS IMPRISONMENT OR BOTH

The Mining Act
Certificate Verifying Report of Work

THOMAS L. BELL
BOX 142 ELK LAKE ONT
(Post Office Address)

LARDER LAKE MINING DIVISION
RECEIVED
NOV 1 1977
AM 7 8 9 10 11 12 1 2 3 4 5 6 PM

hereby certify:

1. That I have a personal and intimate knowledge of the facts set forth in the report of work annexed hereto, having performed the work or witnessed same during and/or after its completion.

2. That the annexed report is true.

Dated Oct 28 1977

Thomas L. Bell
Signature

(file L446166)

Ministry of Natural Resources
Ontario

Fran strip

#233

A separate form is required for each type of work to be recorded.

THE MINING ACT REPORT OF WORK

To the Recorder of LARDER LAKE Mining Division

I, THOMAS L. BELL (name of Recorded Holder) K 18186 (Prospector's Licence)

BOX 142 ELK LAKE ONT (Post Office Address)

do hereby report the performance of 36 days of DRILLING WITH GAS PLUGGER (type of work)

not before reported to be applied on the following contiguous claims

Claim No.	Days	Claim No.	Days	Claim No.	Days
446166	36				

All the work was performed on Mining Claim (s) 446166

(In the case of geological and/or geophysical survey (s) where more than 18 claims are involved attach a schedule)

READ CAREFULLY: THE FOLLOWING INFORMATION IS REQUIRED BY THE MINING RECORDER.

For Manual Work, Stripping or Opening up of Mines, Sinking Shafts or Other Actual Mining Operations — Names and addresses of the men who performed the work and the dates and hours of their employment.

For Diamond and other Core Drilling - Footage, No. and angle of holes and diameter of core. Name and address of owner or operator of drill. Dates when drilling was done. Signed core log and sketch in duplicate.

For Compressed Air or Other Power Driven or Mechanical Equipment

Type of drill or equipment. Names and addresses of men engaged in operating equipment and the dates and hours of their employment.

For Power Stripping - Type of equipment. Name and address of owner or operator. Amount expended. Dates on which work was done. Proof of actual cost must be submitted within 30 days of recording.

With each of the above types of work sketches are required to show the location and extent of the work in relation to the nearest claim post. In the case of diamond or other core drilling the sketch must be submitted in duplicate.

For Geophysical, Geological, Geochemical Surveys and Expenditure Credits - the name of author of report. Covering dates of survey (linecutting & office). Type of instrument used. Total amount of expenditure. Technical reports, maps, expenditure breakdown, receipts must be filed in duplicate with the Minister within 60 days of recording.

For Land Survey - the name and address of Ontario Land surveyor.

The Required Information is as Follows: (Attach a list if this space is insufficient)

Drilling with gasoline plugger on copper, silver vein, self and Clint Molyneau, address Elk Lake Ont.

2 men 6 hrs - June 1st/77 = 4 days
" " - " 2nd/77 - 4 days
" " - " 6 /77 = 4 days
" " - " 9 /77 = 4 days
" " - " 11 /77 = 4 days
" " - " 22/77 = 4 days

July 4 - 2 men 6 hrs = 4 days
July 11 - " "
July 14 - " "

Geological Branch ODM
ASSESSMENT FILES
RESEARCH OFFICE
NOV 17 1977
RECEIVED

Date Oct 28/77

Thomas L. Bell
Signature of Recorded Holder or Agent

The Mining Act
Certificate Verifying Report of Work

I, THOMAS L. BELL

BOX 142 ELK LAKE ONT
(Post Office Address)

hereby certify:

1. That I have a personal and intimate knowledge of the facts set forth in the report of work annexed hereto, having performed the work or witnessed same during and/or after its completion.

2. That the annexed report is true.

Dated Oct 28 1977

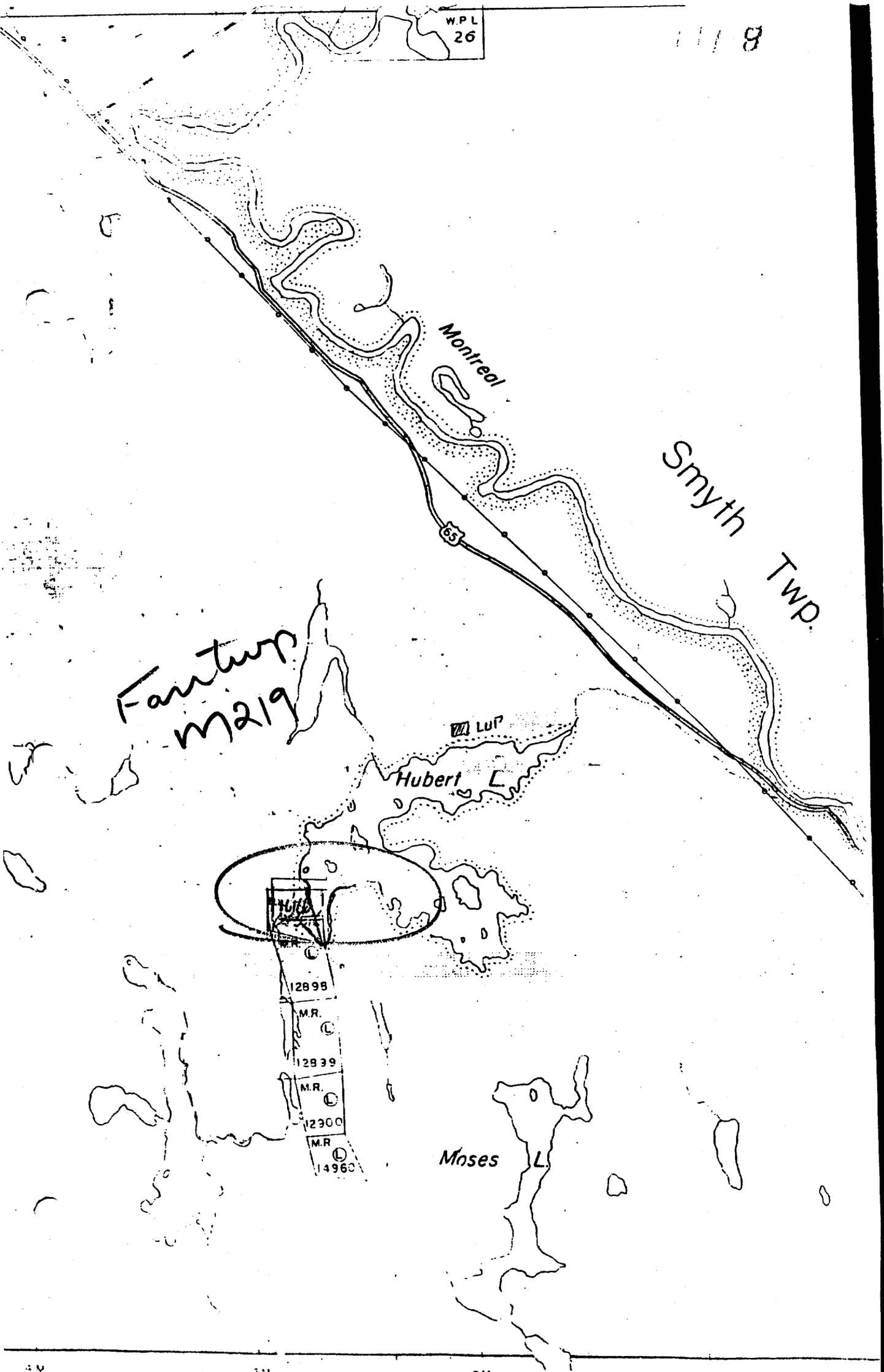
Thomas L. Bell
Signature

LARDER LAKE
RECEIVED
NOV 1 1977
AM 7 8 9 10 11 12 1 2 3 4 5 6 PM

THE PENALTY FOR MAKING A FALSE STATEMENT IN THIS REPORT AND/OR CERTIFICATE IS $500. OR SIX MONTHS IMPRISONMENT OR BOTH

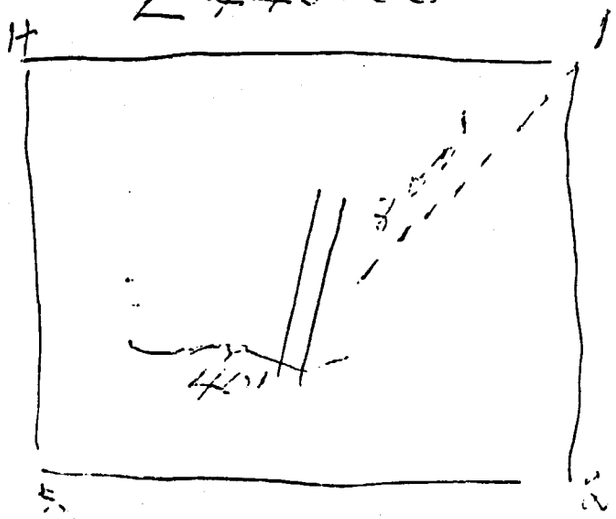
(file L446166)

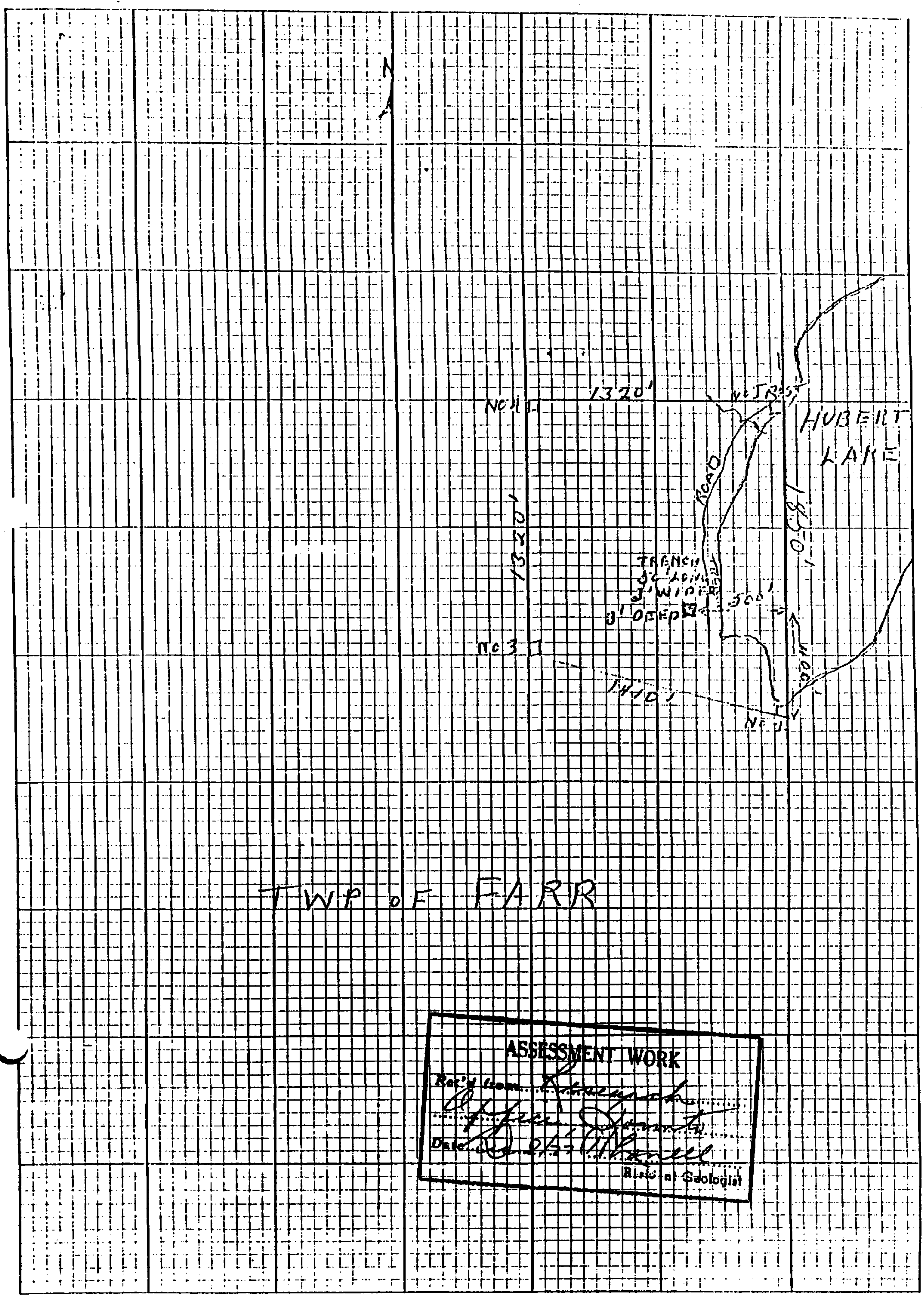
1-041


W.P.L
26
Montreal
65
Smyth Twp.
Fauntwp
M219
LUP
Hubert L.
M.R.
12898
M.R.
12839
M.R.
12900
M.R
14960
Moses L.
2M
1M

Mickle Twp.

FAR TO
L446166





N
NO 4
1320'
NO 1 POST
HUBERT
LAKE
ROAD
1320'
1820'
TRENCH
30' LONG
3' WIDE
3' DEEP
500'
NO 3
1410'
400'
NO 2
TWP OF FARR
ASSESSMENT WORK
Rec'd from
Date
Resident Geologist

ANNEX "I-11"

ALEX MACINTYRE & ASSOCIATES LIMITED

MINING CONTRACTORS

FAX 705-567-4925 P.O. BOX 517 PHONE 705-567-3266
KIRKLAND LAKE, ONTARIO
P2N 3J5

INVOICE

Roger Dufresne
14 Wright Hargreaves Avenue
KIRKLAND LAKE , Ontario

Invoice No. : 97 - 07 - 09
Date : July 11/97
Your P.O. No.: Verbal

Excavator Work Stripping Your Claims, Farr Township :

Date	Float	892 Excavator	Operator Travel
July 09/97	5.0	11.5	1.0
July 10/97		11.5	1.0
July 11/97	5.0	6.5	1.0
	10.0	29.5	3.0

Float	10.0 hrs	@	$ 75.00/hr	$ 750.00
892 Excavator	29.5 hrs	@	$ 95.00/hr	2,802.50
Operator Travel	3.0 hrs	@	$ 40.00/hr	120.00
				3,672.50

PAID
ALEX MacINTYRE & ASSOC. LTD.
P.O. BOX 517
KIRKLAND LAKE, ONT. P2N 3J5
Rec'd Cheques $3929.58
Aug 6/97

7% G.S.T. (R 100 128 164) **$ 257.08**

TOTAL INVOICE **$ 3,929.58**

(Deposit Received $ 1,000.00)

ANNEX "I-2"

Swastika Laboratories
P.O. Box 10
Swastika, Ontario
P0K 1T0

INVOICE

NO: 00041786

DATE: 09/22/97

PAGE: 1

SOLD TO:
R. DUFRESNE
14 WRIGHT-HARGREAVES AVE

KIRKLAND LAKE, ON P2N 1B2

SHIP TO:
Same

GST Number: R132862640

Proj #/P.O. # OPAP 1997

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	G	P	UNIT PRICE	AMOUNT
	21		Au			8.00	168.00
	52		Ag			2.50	130.00
	52		Co			1.50	78.00
	52		Cu			1.50	78.00
	52		Ni			1.50	78.00
	14		Pb			1.50	21.00
	14		Zn			1.50	21.00
	52		Sample Prep			3.50	182.00
			Cert #7W-3533-RA1				
			GST @ 7%				52.92

SWASTIKA LABORATORIES
PAID
OCT 14/97
WITH THANKS
PER

COMMENTS:
Net 30 Days

TOTAL 808.92

SERVICES EXPLORATION SERVICES Enrg. Reg'd.

765, BOUL. QUÉBEC
C.P. 428
ROUYN-NORANDA, P.Q.
J9X 5C4

TÉLÉPHONE: (819) 797-0853
1-800-567-6053

FAX: (819) 797-1848
1-800-661-1848

ANNEX I-3

Levés géophysiques	Geophysical Surveys
Levés géologiques	Geological Surveys
Jalonnement de claims	Claim staking
Dessin et reproduction	Drafting and Reproduction
Coupage de lignes	Line Cutting
Programmes d'exploration	Exploration Programmes
Ventes d'articles d'exploration minière	Sales of mining exploration articles

En compte avec:
In account with:

Dennis Chartré - Roger Dufresne

Box 53

Swastika, Ont.

P0K 1T0

FACTURE / INVOICE 8821

DATE	NUMÉRO DU CLIENT / CUSTOMER NO.
December 5,1997	
Nº COMMANDE / PURCHASE ORDER NO.	

Projet: 1997 OPAP PROJECT - FARR TWP.
Project: _____

DESCRIPTION	PRIX UNITAIRE / UNIT PRICE	TOTAL
Geological mapping - drafting & report		$ 1 500.00
GST		$ 105.00
	TOTAL	$ 1 605.00

T.P.S./G.S.T.: R105801906
T.V.P./P.S.T.: Q-10-0169-9225 TV 0001

THANK YOU

LF-2132

10-B-97

Code: _____

TERME: NET 30 JOURS
TERMS: NET 30 DAYS

COPIE DU CLIENT

ANNEX "I-4"

DUFRESNE
EQUIPMENT RENTALS

OUR NUMBER 48919
DATE DEC 20 1997
CUSTOMER'S ORDER
SALESMAN
TERMS
F. O. B.

SOLD TO R. DUFRESNE
14 WRIGHT HARGREAVES
SHIP TO KIRKLAND LAKE, ONTARIO
ADDRESS P2N 1B2 VIA

INVOICE

RENTAL OF WAJAX MARK III HIGH PRESSURE WATER PUMP 1500' OF 1½" HOSE; AND OPERATOR (PAUL DUFRESNE OR ASSISTANT)			
12 DAYS ON FARR TWP. (ROY SILVER MINE PROPERTY) AT AID	90 00		1080 00

BLUELINE D 31

DUFRESNE
EQUIPMENT RENTALS

OUR NUMBER 48920
DATE DEC 20 1997
CUSTOMER'S ORDER
SALESMAN
TERMS
F. O. B.

DENIS CHARTRE
SOLD TO BOX 53, SWASTIKA AVE.
SWASTIKA, ONTARIO
SHIP TO P0K 1T0
ADDRESS VIA

INVOICE

RENTAL OF WAJAX MARK III HIGH PRESSURE WATER PUMP 1500' OF 1½" HOSE; AND OPERATOR (PAUL DUFRESNE OR ASSISTANT)			
12 DAYS ON FARR TWP (ROY SILVER MINE PROPERTY) AT AID	90 00		1080 00

BLUELINE D 31

ANNEX "J-1"

Ministry of Northern Development and Mines

Ontario

MAP 2543

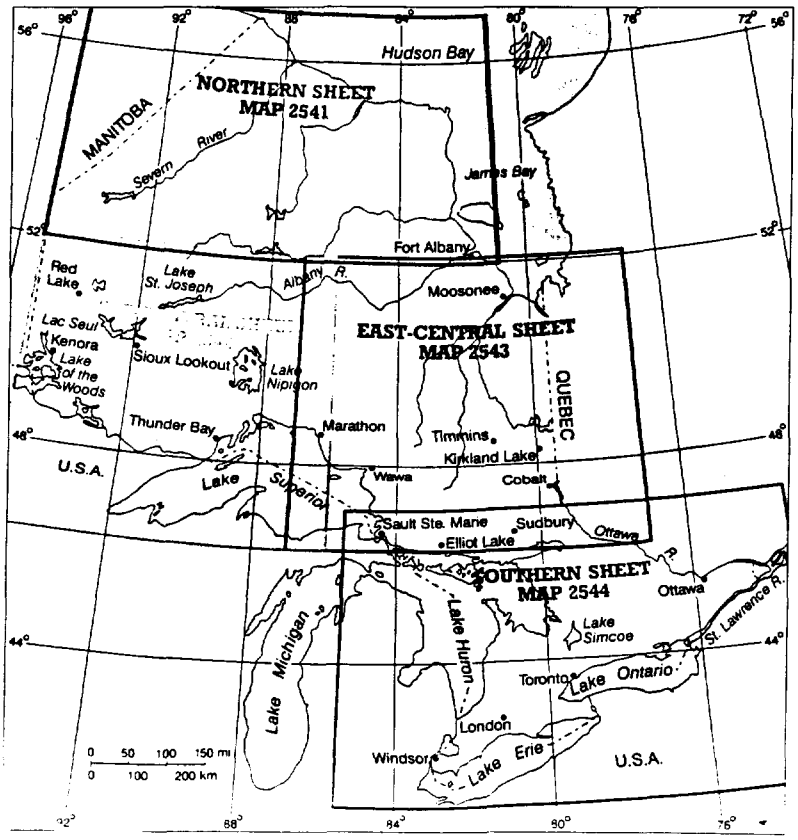
BEDROCK GEOLOGY OF ONTARIO

EAST-CENTRAL SHEET

Scale 1:1 000 000

Kilometres 20 0 20 40 60 80 100 Kilometres

Miles 10 0 10 20 30 40 50 Miles



KIRKLAND
AUBIN
WILHELM
CRAWFORD
DUFF
ST. JOHN
PYNE
Potter
AURORA
Porquis
MOBERLY
FORTUNE
Lake Abitibi
265m
La Reine
Dupuy
SARGEANT
CNR
Black Creek
CARR
SERMAN
STOCK
MURPHY
Mattagami Heights
GODFREY
FREY
KEEFER
PRICE
ADAMS
TOLSTOI
McEVAY
TERRY
NORDICA
DUNMORE
SEWELL
HILLARY
REYNOLDS
McKEOWN
DOYLE
MUSGROVE
SHERA
CROTHERS
McBRIDE
HASSARD
ENGLISH
REGAN
NORTHRUP
ROBLIN
GOUIN
MIDLOTHIAN
HALLIDAY
TIMISKAMING
DAVIDSON
SHARPE
SAVARD
Glenvale
CHAMBERLAIN
BLAIN
MARQUIS
PACAUD
OTTO
GROSS
WILLISON
Tatachikapika
MIDDLEBORO
EMERALD
Mattagami
WIGLE
Stackpool
HAZEN
CARTER
STETHAM
SMYTH
TRUAX
ROBILLARD
Elk Lake
Tomstown
Earlton
ARMSTRONG
HILLIARD
Belle Vallée
INGRAM
PENSE
Judge
HARLEY
DYMOND
Uno Park
HARRIS
New Liskeard
Haileybury
COLEMAN
Cobalt
Latchford
LORRAIN
Lorrain Valley
ALEN
SOMME
NOBLE
NATAL
ST LOUIS
BRUNSWICK
Minisinakwa
Nabakwasi
CHAMPAGNE
WEISS
LONDONDERRY
GARVEY
GARIBALDI
SHEARD
WESTBROOK
Westree
HENNESSY
MOFFAT
AMYOT
DUFFERIN
Biscotasi
Donnegana
INVERNESS
EDINBURGH
CHALET
PAUDASH
BREBEUF
BREWETT
BEULAH
HODGETTS
CAVANA
BAYNES
MARQUETTE
SHIRLEY
Felix
BREADNER
BATTERSBY
McNAMARA
COTTON
HOWEY
MARCONI
Metagama
LaROCHE
ATHLONE
MULDREW
FAIRBAIRN
DUNBAR
SWEENY
BERESFORD
Laforest
GRIGG
ALTON
Fluorite
MORSE
ANTRIM
EMO
DEL VILLANO
DENNIE
Spanish River
Nitro
BERT
ULSTER
MUNSTER
LEINSTER
TYRONE
KITCHENER
HUTTON
OSHELL
OUELLETTE
CRAIG
MONCRIEFF
HESS
MARTY
FOY
BOWELL
Wanapitei Lake
ROWAT
SOLSKI
TOFFLEMIRE
HART
CARTIER
Capreol
Bear Island
Lake Temagami
AFTON
SCHOLES
PHYLLIS
CLEMENT
TORRINGTON
Marten River
McCALLUM
HOBBS
PARDO
McWILLIAMS
Cedar Lake
McLAREN
THISTLE
BASTEDO
FELL
LYMAN
River Valley
GIBBONS
CHERRIMAN
Tomiko
COLE
Nipissing
BEST
CHAMBERS
CYNTHIA
BRIGGS
HEBERT
ELDRIDGE
Redwater
HARTLE
MILNE
OLIVE
ANGUS
GOODERHAM
LA SALLE
KENNY
OSBORNE
LADMAN
HAMMELL
STEWART
NOTMAN
Timiskaming
Notre-Dame
Laverlochère
Lorrainville
Ville-Marie

MIDDLE AND LOWER SILURIAN

53 **Sandstone, shale, dolostone, siltstone**
- 53a Guelph Fm.
- 53b Lockport Fm.
- 53c Amabel Fm.
- 53d Clinton Gp.; Cataract Gp.
- 53e Thornloe Fm.; Earlton Fm.
- 53f Wabi Gp.
- 53g Attawapiskat Fm.
- 53h Ekwan River Fm.
- 53i Severn River Fm.

ORDOVICIAN

UPPER ORDOVICIAN

Shale, limestone, dolostone, siltstone
- 52a Queenston Fm.
- 52b Georgian Bay Fm.; Blue Mountain Fm.; Billings Fm.; Collingwood Mb.; Eastview Mb.
- 52c Liskeard Gp.
- 52d Red Head Rapids Fm.
- 52e Churchill River Gp.
- 52f Bad Cache Rapids Gp.

MIDDLE ORDOVICIAN

51 **Limestone, dolostone, shale, arkose, sandstone**
- 51a Ottawa Gp.; Simcoe Gp.; Shadow Lake Fm.
- 51b Chazy Gp., Rockcliffe Fm.

LOWER ORDOVICIAN

50 **Dolostone, sandstone:** Beekmantown Gp.

CAMBRIAN

49 **Conglomerate, sandstone, shale, dolostone:** Potsdam Gp.; Nepean Fm., Covey Hill Fm.

PRECAMBRIAN[d]

GRENVILLE PROVINCE[e]

PROTEROZOIC

NEO– TO MESOPROTEROZOIC (0.57 to 1.6 Ga)

48 **Tectonite unit:** tectonites, straight gneisses, porphyroclastic gneisses, unsubdivided gneisses in major deformation zones, mylonites, protomylonites

CENTRAL METASEDIMENTARY BELT

47 **Late felsic plutonic rocks**[f]**:** granodiorite, granite, syenite, pegmatite, alkalic granite, migmatitic gneisses

46 **Mafic to ultramafic plutonic rocks**[f]**:** *diorite, gabbro, peridotite, pyroxenite, anorthosite, derived metamorphic rocks*

45 **Alkalic plutonic rocks:** nepheline syenite, alkalic syenite, fenite; associated mafic, ultramafic and carbonatitic rocks

44 **Early felsic plutonic rocks**[f]**:** granodiorite, tonalite, monzogranite, syenogranite; derived gneisses and migmatites

GRENVILLE SUPERGROUP AND FLINTON GROUP[g]

43 ***Carbonate metasedimentary rocks:*** marble, calc-silicate rocks, skarn, tectonic breccias

42 ***Clastic metasedimentary rocks***[f]**:** *conglomerate, wacke, quartz arenite, arkose, limestone, siltstone, chert, minor iron formation, minor metavolcanic rocks*

41 ***Mafic to felsic metavolcanic rocks:*** *flows, tuffs, breccias, minor iron formation, minor metasedimentary rocks; includes reworked pyroclastic units, amphibolite*

MESOPROTEROZOIC (0.9 to 1.6 Ga)

Sudbury Igneous Complex (1850 Ma): norite, gabbro, granophyre

Whitewater Gp.[f]**:** fragmental rocks, mudstone, wacke

Carbonatite–alkalic intrusive suite (ca. 1.9 Ga): carbonatite, nepheline syenite, alkalic syenite, ijolite, fenite; associated mafic and ultramafic rocks

23 **Mafic intrusive rocks**[f]
- 23a *Molson swarm (1884 Ma)* diabase dikes; and *Sutton Inlier:* diabase sills
- 23b *Wabigoon swarm:* diabase dikes
- 23c *North Channel swarm:* diabase dikes

22 **Sedimentary rocks**
- 22a *Animikie Gp.*[m]*:* wacke, shale, iron formation, limestone, minor volcanic rocks
- 22b *Sutton Inlier:* dolostone, chert breccias, argillite, wacke, conglomerate, iron formation

21 **Mafic and related intrusive rocks**[f]
- 21a *Preissac swarm:* diabase dikes
- 21b *Marathon swarm:* diabase dikes
- 21c *Kenora–Fort Frances swarm:* diabase dikes
- 21d *Nipissing sills (2219 Ma):* diabase sills, dikes and related granophyre
- 21e Mafic dikes and plutons of uncertain age

20 **Felsic intrusive rocks (Murray Granite 2388 Ma, Creighton Granite 2333 Ma):** granite

HURONIAN SUPERGROUP (2.2 Ga to 2450 Ma)

Cobalt Gp.[n]**:** conglomerate, wacke, arkose, quartz arenite, argillite

Quirke Lake Gp.; Hough Lake Gp.; Elliot Lake Gp.
- 18a Conglomerate, wacke, arkose, quartz arenite, argillite, limestone, dolostone
- 18b Volcanic rocks of the Elliot Lake Gp.

INTRUSIVE ROCKS

17 **Mafic and ultramafic intrusive rocks**
- 17a *Matachewan and Hearst swarms (2454 Ma)*[f]*:* diabase dikes
- 17b Gabbro, anorthosite

SUPERIOR PROVINCE

ARCHEAN

NEOARCHEAN (2.5 to 2.9 Ga)

INTRUSIVE ROCKS

16 **Diorite–nepheline syenite suite**[goq]**:** pyroxenite, diorite, monzonite, syenite, nepheline syenite (saturated to undersaturated suite)

NEO– TO MESOARCHEAN (2.5 to 3.4 Ga)[egop]

INTRUSIVE ROCKS

15 **Massive granodiorite to granite:** massive to foliated granodiorite to granite
- 15a Potassium feldspar megacrystic units

Diorite–monzonite–granodiorite suite: *diorite, tonalite, monzonite, granodiorite,* syenite and hypabyssal equivalents (saturated to oversaturated suite)

13 **Muscovite-bearing granitic rocks:** muscovite-biotite and cordierite-biotite granite, granodiorite-tonalite

12 **Foliated tonalite suite:** tonalite to *granodiorite—foliated to massive*

11 **Gneissic tonalite suite:** tonalite to granodiorite—foliated to gneissic—with minor supracrustal inclusions

Mafic and ultramafic rocks[q]**:** gabbro, anorthosite, ultramafic rocks

Ontario Ministry of Northern Development and Mines

Declaration of Assessment Work Performed on Mining Land

Mining Act, Subsection 65(2) and 66(3), R.S.O. 1990

Transaction Number (office use)
W9880.00148
Assessment Files Research Imaging

41P16SW2001 2.18274 FARR 900

y of subsections 65(2) and 66(3) of the Mining Act. Under section 8 of the to review the assessment work and correspond with the mining land holder. ıg Recorder, Ministry of Northern Development and Mines, 6th Floor,

2.18274

CHARTRE - DUFRESNE
1997 FARR TWP PROP.

Instructions: - For work performed on Crown Lands before **recording** a claim, use form 0240.
- Please type or print in ink.

1. Recorded holder(s) (Attach a list if necessary)

Name / Add / Nan / Add	Mr. Roger Dufresne 14 Wright-Hargreaves Ave. Kirkland Lake, Ontario P2N 1B2	Client Number 137749 Telephone Number (705) 567-3725 Fax Number
		Client Number
		Telephone Number
		Fax Number

2. Type of work performed: Check (✓) and report on only ONE of the following groups for this declaration.

☒ Geotechnical: prospecting, surveys, assays and work under section 18 (regs) ☐ Physical: drilling, stripping, trenching and associated assays ☐ Rehabilitation

Work Type: PROSPECTING PROGRAM ASSAYS MAGNETOMETER SURVEY		Office Use
		Commodity
		Total $ Value of Work Claimed 28,926
Dates Work Performed: From 17 Day 05 Month 1997 Year	11 Day 01 Month 1998 Year	NTS Reference
Global Positioning System Data (if available)	Township/Area: FARR TWP	Mining Division: Larder Lake
	M or G-Plan Number: G-3635	Resident Geologist District: Kirkland Lake

Please remember to: - obtain a work permit from the Ministry of Natural Resources as required;
- provide proper notice to surface rights holders before starting work;
- complete and attach a Statement of Costs, form 0212;
- provide a map showing contiguous mining lands that are linked for assigning work;
- include two copies of your technical report.

3. Person or companies who prepared the technical report (Attach a list if necessary)

Name: SERVICE EXPLORATION	Telephone Number: (819) 797-0853
Address: 765 BOUL. QUÉBEC	Fax Number: 1-800-661-1848
Name: C.P. 428	Telephone Number
Address: ROYN-NORANDA P.Q.	Fax Number
Name: J9X 5C4	Telephone Number
Address	Fax Number

RECEIVED
MAR - 3 1998
GEOSCIENCE ASSESSMENT OFFICE

RECEIVED
LARDER LAKE
MINING DIVISION
MAR 2 1998
8:15 AM

4. Certification by Recorded Holder or Agent

I, ROGER DUFRESNE (Print Name), do hereby certify that I have personal knowledge of the facts set forth in this Declaration of Assessment Work having caused the work to be performed or witnessed the same during or after its completion and, to the best of my knowledge, the annexed report is true.

Signature of Recorded Holder or Agent: Roger Dufresne		Date: MARCH 2, 1998
Agent's Addr: Mr. Roger Dufresne 14 Wright-Hargreaves Ave. Kirkland Lake, Ontario P2N 1B2	Telephone Number (705) 567-3725	Fax Number

0241 (02/96) Deemed MAR 31/98

5. Work to be recorded and distributed. Work can only be assigned to claims that are contiguous (adjoining) to the mining land where work was performed, at the time work was performed. A map showing the contiguous link must accompany this form.

W9880.00148

Mining Claim Number. Or if work was done on other eligible mining land, show in this column the location number indicated on the claim map.		Number of Claim Units. For other mining land, list hectares.	Value of work performed on this claim or other mining land.	Value of work applied to this claim. 2.1827 4	Value of work assigned to other mining claims.	Bank. Value of work to be distributed at a future date.
eg	TB 7827	16 ha	$26, 825	N/A	$24,000	$2,825
eg	1234567	12	0	$24,000	0	0
eg	1234568	2	$ 8, 892	$ 4,000	0	$4,892
1	1214380	16	14,463.	1200.	0	13,263.
2	1214381	16	14,463.	1200.	0	13,263.
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
		Column Totals	28,926.00	2400.	0	26,526.

I, Roger Dufresne (Print Full Name), _____, do hereby certify that the above work credits are eligible under subsection 7 (1) of the Assessment Work Regulation 6/96 for assignment to contiguous claims or for application to the claim where the work was done.

Signature of Recorded Holder or Agent Authorized in Writing: Roger Dufresne — Date: MARCH 2, 19

6. Instructions for cutting back credits that are not approved.

Some of the credits claimed in this declaration may be cut back. Please check (✓) in the boxes below to show how you wish to prioritize the deletion of credits:

- ☐ 1. Credits are to be cut back from the Bank first, followed by option 2 or 3 or 4 as indicated.
- ☐ 2. Credits are to be cut back starting with the claims listed last, working backwards; or
- ☒ 3. Credits are to be cut back equally over all claims listed in this declaration; or
- ☐ 4. Credits are to be cut back as prioritized on the attached appendix or as follows (describe):

RECEIVED
MAR - 3 1998
GEOSCIENCE ASSESSMENT OFFICE

Note: If you have not indicated how your credits are to be deleted, credits will be cut back from the Bank first, followed by option number 2 if necessary.

For Office Use Only

Received Stamp: RECEIVED LARDER LAKE MINING DIVISION MAR 2 1998 9:15 AM

Deemed Approved Date	Date Notification Sent
Date Approved	Total Value of Credit Approved
Approved for Recording by Mining Recorder (Signature)	

0241 (02/96)

Ontario Ministry of Northern Development and Mines

Statement of Costs for Assessment Credit

Transaction Number (office use)
W9880.00148
P. 3

Personal information collected on this form is obtained under the authority of subsection 6(1) of the Assessment Work Regulation 6/96. Under section 8 of the Mining Act, the information is a public record. This information will be used to review the assessment work and correspond with the mining land holder. Questions about this collection should be directed to the Chief Mining Recorder, Ministry of Northern Development and Mines, 6th Floor, 933 Ramsey Lake Road, Sudbury, Ontario, P3E 6B5.

2.18274

Work Type	Units of Work Depending on the type of work, list the number of hours/days worked, metres of drilling, kilometres of grid line, number of samples, etc.	Cost Per Unit of work	Total Cost
MANUAL LABOUR (DENIS)	P. 11	61 X 100	6,100.00
MANUAL LABOUR (ROGER)	P. 18	56 X 100	5600.00
ASSAYS		(ANNEX I-2)	808.92
SERVICE EXPLORATION (GEOLOGICAL REPORT)		(ANNEX I-3)	1605.00
EXCAVATOR AND OPERATOR		(ANNEX I-1)	3929.58
PUMP RENTAL AND OPERATOR		(ANNEX I-4)	2160.00
Associated Costs (e.g. supplies, mobilization and demobilization).			
PROPANE AND FUELS	720.47 + 735.99		1456.46
SUPPLIES	366.77 + 1720.67		2087.44
EQUIPMENT REPAIR (P.26)		1101.41	
Transportation Costs			
DENIS	P. 11		1474.20
ROGER	P. 18		1365.00
Food and Lodging Costs			
DENIS	P. 11		1220.00
ROGER	P. 18		1120.00
		Total Value of Assessment Work	28,926.60

RECEIVED
LARDER LAKE
MINING DIVISION
MAR 2 1998
9:15 am

RECEIVED
MAR - 3 1998
GEOSCIENCE ASSESSMENT OFFICE

Calculations of Filing Discounts:

1. Work filed within two years of performance is claimed at 100% of the above Total Value of Assessment Work.
2. If work is filed after two years and up to five years after performance, it can only be claimed at 50% of the Total Value of Assessment Work. If this situation applies to your claims, use the calculation below:

TOTAL VALUE OF ASSESSMENT WORK × 0.50 = Total $ value of worked claimed.

Note:
- Work older than 5 years is not eligible for credit.
- A recorded holder may be required to verify expenditures claimed in this statement of costs within 45 days of a request for verification and/or correction/clarification. If verification and/or correction/clarification is not made, the Minister may reject all or part of the assessment work submitted.

Certification VERIFYING COSTS:

I, Roger Dufresne (please print full name), do hereby certify, that the amounts shown are as accurate as may reasonably be determined and the costs were incurred while conducting assessment work on the lands indicated on the accompanying Declaration of Work form as RECORDED HOLDER (recorded holder, agent, or state company position with signing authority) I am authorized to make this certification.

Signature	Date
Roger Dufresne	MARCH 2, 1998

0212 (02/96)

Ministry of
Northern Development
and Mines

Ministère du
Développement du Nord
et des Mines

Ontario

Geoscience Assessment Office
933 Ramsey Lake Road
6th Floor
Sudbury, Ontario
P3E 6B5

Telephone: (888) 415-9846
Fax: (705) 670-5881

Visit our website at:
www.gov.on.ca/MNDM/MINES/LANDS/mlsmnpge.htm

May 20, 1998

ROGER J. DUFRESNE
14 WRIGHT HARGREAVES AVENUE
Kirkland Lake, Ontario
P2N-1B2

Dear Sir or Madam:

Submission Number: 2.18274

Subject: Transaction Number(s):		**Status**
	W9880.00148	Approval

We have reviewed your Assessment Work submission with the above noted Transaction Number(s). The attached summary page(s) indicate the results of the review. WE RECOMMEND YOU READ THIS SUMMARY FOR THE DETAILS PERTAINING TO YOUR ASSESSMENT WORK.

If the status for a transaction is a 45 Day Notice, the summary will outline the reasons for the notice, and any steps you can take to remedy deficiencies. The 90-day deemed approval provision, subsection 6(7) of the Assessment Work Regulation, will no longer be in effect for assessment work which has received a 45 Day Notice. Allowable changes to your credit distribution can be made by contacting the Geoscience Assessment Office within this 45 Day period, otherwise assessment credit will be cut back and distributed as outlined in Section #6 of the Declaration of Assessment work form.

Please note any revisions must be submitted in DUPLICATE to the Geoscience Assessment Office, by the response date on the summary.

If you have any questions regarding this correspondence, please contact Lucille Jerome by e-mail at jeromel2@epo.gov.on.ca or by telephone at (705) 670-5858.

Yours sincerely,

ORIGINAL SIGNED BY
Blair Kite
Supervisor, Geoscience Assessment Office
Mining Lands Section

Correspondence ID: 12288

Copy for: Assessment Library

Work Report Assessment Results

Submission Number: 2.18274

Date Correspondence Sent: May 20, 1998 **Assessor:** Lucille Jerome

Transaction Number	First Claim Number	Township(s) / Area(s)	Status	Approval Date
W9880.00148	1214380	FARR	Approval	May 20, 1998

Section:
14 Geophysical MAG
10 Physical PSTRIP

Correspondence to:
Resident Geologist
Kirkland Lake, ON

Assessment Files Library
Sudbury, ON

Recorded Holder(s) and/or Agent(s):
ROGER J. DUFRESNE
Kirkland Lake, Ontario

Correspondence ID: 12288

Ministry of Natural Resources
Ontario

Ministry of Northern Development and Mines

INDEX TO LAND DISPOSITION

PLAN
G-3635

TOWNSHIP
FARR

M.N.R. ADMINISTRAT
KIRKLAND

MINING DIVISION
LARDER LA

LAND TITLES/REGIST
TIMISKAMIN

Scale 1:20 000
Metres 1000 0 1000
Feet 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000
Contour Interval 10 Metres

KIMBERLEY TOWNSHIP
WILLISON TOWNSHIP
SHILLINGTON TOWNSHIP
SMYTH TOWNSHIP (See Map G - 3715)
MICKLE TOWNSHIP
LOT 1 CON 1
LOT 18 CON 6
LOT 15 CON 6
1225482
1225481
1217598
1217597
1217594
1217596
1217595
1217593
1218931
1218932
1217592
2.18274 PSTRIP MAG

AREAS WITHDRAWN FROM DISP
MRO – Mining Rights Only
SRO – Surface Rights Only
M+S – Mining and Surface Ri

Description | Order No. | Date

SYMBOLS

- Boundary
  - Administrative District
  - Township, Meridian, Baseline
  - Road allowance: surveyed / shoreline
  - Lot/Concession: surveyed / unsurveyed
  - Parcel: surveyed / unsurveyed
  - Right-of-way: road / railway / utility
  - Reservation
- Cliff, Pit, Pile
- Contour
  - Interpolated
  - Approximate
  - Depression
- Control point (horizontal)
- Flooded land
- Mine shaft
- Pipeline (above ground)
- Railway: single track / double track / abandoned
- River/Stream/Creek: intermittent
- Road/highway, county, township: access / trail, bush
- Shoreline (original)
- Transmission line
- Wooded area

- (G) M.T.C. PIT FILE 193407
- (32) M.T.C. PIT NO.210
- (33) GRAVEL FILE 127307
- (34) PROPOSED SITE NORTHERN TELEPHONE

400' Surface rights along the of all lakes and rivers

DISPOSITION OF CROWN LANDS

- Patent
  - Surface & Mining Rights
  - Surface Rights Only
  - Mining Rights Only
- Lease
  - Surface & Mining Rights
  - Surface Rights Only
  - Mining Rights Only
- Licence of Occupation
- Order-in-Council: OC
- Cancelled
- Reservation
- Sand & Gravel
- Land Use permit

DATE OF ISSUE
MAY 2 1 1998
PROVINCIAL RECORDING OFFICE - SUDBURY

THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDS MINISTRY OF NORTHERN DEVELOPMENT AND MINES FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.

ARCHIVED SEPT. 18, 1996

CIRCULATED AUGUST 16/96

N

1+00 E

BL 0+00

1+00 W

2+00 W

3+00 W

4+00 W

L 1+00 S

L 2+00 S

L 3+00 S

L 4+00 S

L 5+00 S

L 6+00 S

L 7+00 S

L 8+00 S

L 9+00 S

1214380

1214381

AREA # 1

54 qtz v. + Cpy

53

qtz v. + Cpy 51

52 qtz v. + Cpy

AREA # 2

55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 SHAFT 72 73 74 75 76 77 78 79 Veins with cobalt bloom quartz, calcite, aplite

Muck pile

Vent raise

70

71

AREA # 2-B

a few narrow qtz v. + hematite

AREA # 12

Pit 1

6" qtz v.+ hematite + Cpy

94 95 96

qtz v.+ hematite

qtz v.+ hematite

97

98 qtz v.+ hematite

99

6" qtz v.+ hematite + Cpy

qtz v.+ hematite 100 narrow qtz v.

qtz v.+ hematite

AREA # 13

112

2" qtz v. + hematite + Cpy + Py

qtz v. + hematite + Py

Road

AREA # 3

81 82 83 84 85 2"-3" qtz v. + Cpy + cobalt bloom

86 fault 87 hematite v.

AREA # 4

AREA # 5

88 2" calcite vein

altered zone

calcite vein 89 90 2" calcite-cobalt vein

AREA # 6

AREA # 7

91 narrow rusty zone

AREA # 8

92 hematite vein

93 narrow hematite v.

AREA # 9

113 hematite vein

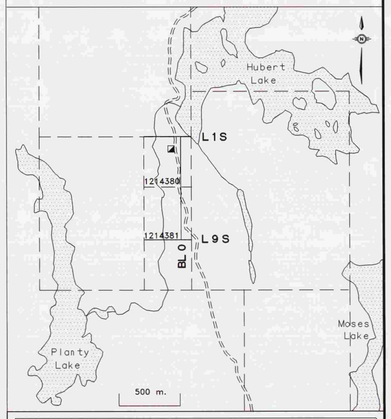
AREA # 14

AREA # 10

AREA # 15

LEGEND

- Trenching area
- Soil
- Exploration pit
- Vein
- 91 • Sample (location & no)
- Claim post



CHARTRE – DUFRESNE PROPERTY
(Former Roy Silver Mines Ltd)

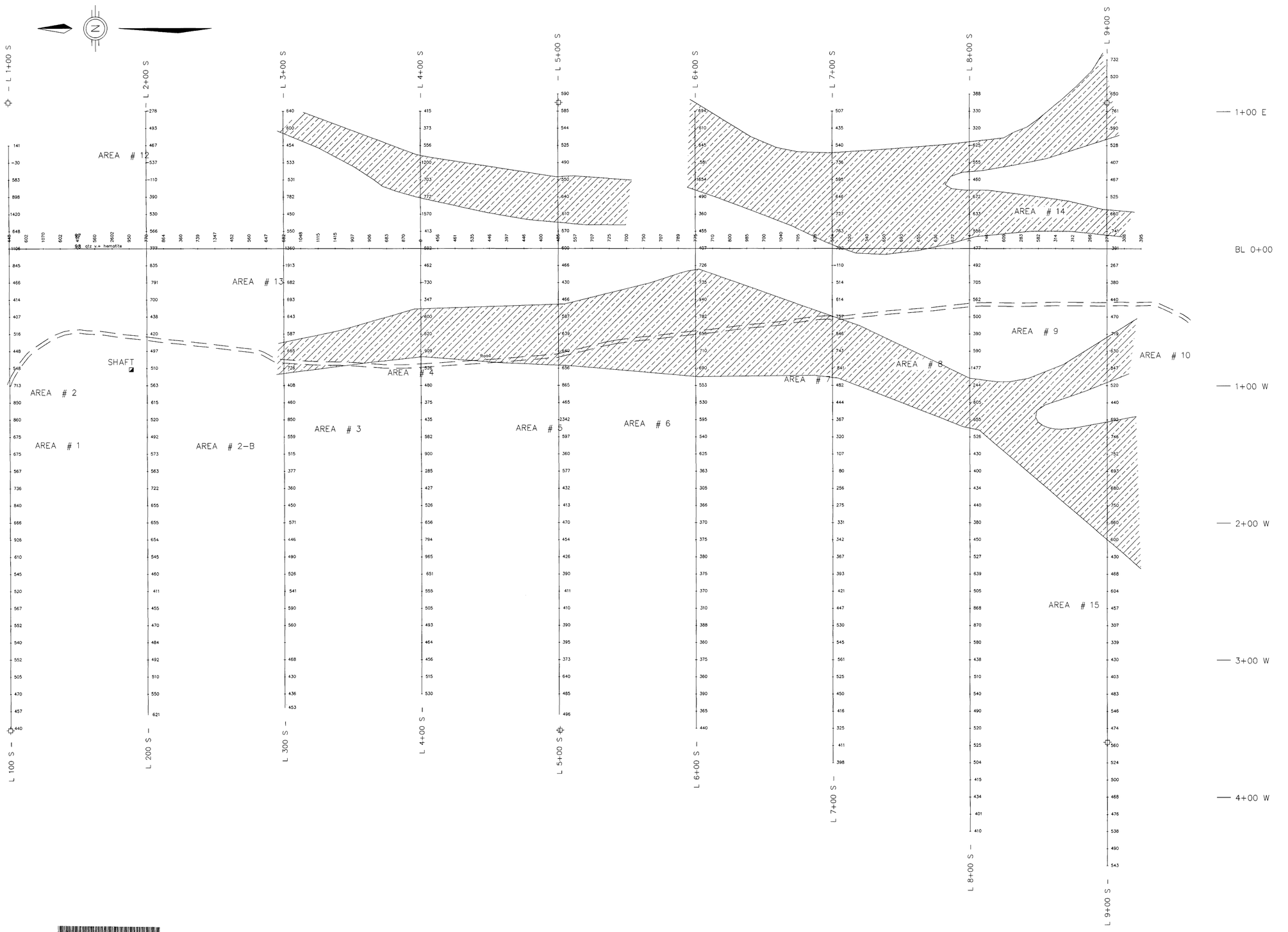
OPAP PROJECT

TRENCHING & MAPPING PROGRAM

2.18274

Township Farr	
Scale 1 : 1000	Date Dec. 97
0 10 20 30 m.	plan #: SER0015.DWG

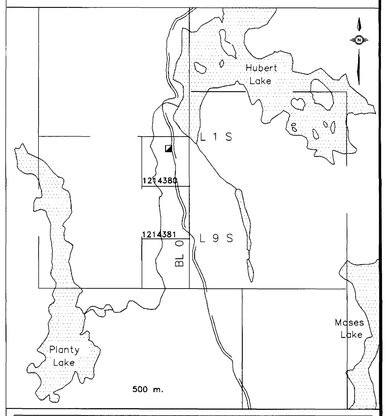
41P16NW2001 2.18274 FARR 210



MAGNETOMETER SURVEY
INTERPRETATION MAP

LEGEND

MAGNETIC ANOMALY



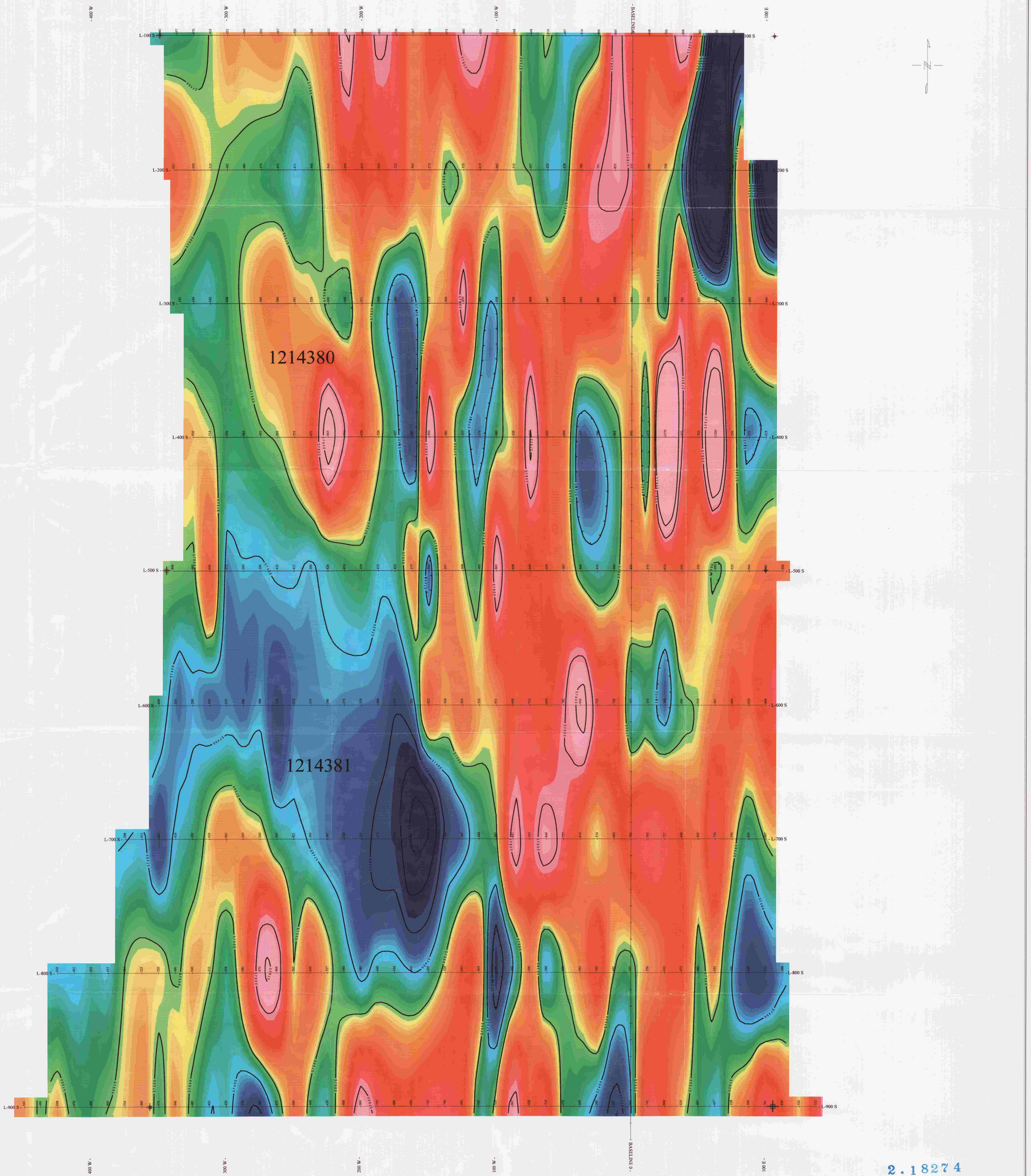
CHARTRE - DUFRESNE PROPERTY
(Former Roy Silver Mines Ltd)

OPAP PROJECT

TRENCHING & MAPPING PROGRAM

2.18274

Township Farr	
Scale 1 : 1000	Date Dec. 97
0 10 20 30 m.	plan #: SER0015.DWG



Scale 1:1000

20 0.0 20 40 60

(meters)

41P16SW2001 2.18274 FARR 230

2.18274

BASE FOR POSTING: 57 000

CHARTRE - DUFRESNE PROPERTY
(Former Roy Silver Mines LTd.)

MAGNETOMETER SURVEY

OPAP PROJECT **FARR TWP.**

DRAWN BY: N. SINCLAIR SCALE: 1 : 1000