

GM 51468

REPORT, OUTARDES PROPERTY

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MINISTRE DE
L'ÉNERGIE ET
DES RESSOURCES
NATURELLES
QUEBEC

A Report on
Falconbridge Limited's Outardes Property, Quebec

NTS 22K/3

PN 111



MER - S.I.S.E.M.

1992/10/21

GM 51468

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Summary

Falconbridge Limited's Outardes property is located within a mafic-ultramafic corridor which rims an anorthositic intrusion. The mafic rocks are of noritic composition and are tholeiitic in affinity; together with the ultramafics they appear to form a well-differentiated layered intrusion suite. The ultramafics, as expected, plot in the komatiitic field of the Jensen diagram.

The region has been subjected to two phases of folding, giving rise to a mushroom-shaped interference pattern which is arcuate to the north. The claim blocks lie on the northeast tip of the "cap". Some claims are in good standing until September 9, 1992, while others are in good standing until May 16, 1993.

Detailed mapping of the northern claim block has resulted in the discovery of over 40 mineralized showings, with sulphide contents ranging from 2% to 20%. The sulphides are disseminated and show primary texture resulting from magmatic differentiation. Best results to date are from a grab sample assaying at 0.36% Cu and 0.66% Ni, obtained from a host of olivine gabbro located on line 16+00E, station 3+50S.

Drilling is expected to commence within the next few months. Suggestions for drill hole locations are provided at the end of the report.

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Introduction

The Outardes property is located west of the Outardes Quatre Reservoir in the Grenville geological province. It is occupied by a series of mafic and ultramafic rocks which rim the western, northern, eastern and southeastern edge of an anorthositic intrusion. It was originally targeted for exploration because of the presence of regional-scale NE- and NW - trending structures which intersect in the area, and because of several anomalous lake sediment geochemical samples which were taken from the area (Choinière, 1987); in addition, the geological environment was felt to be a favorable one by our exploration criterias.

Reconnaissance geology was carried out in the 1990 season, resulting in the staking of 91 claims. A helicopter-borne geophysical survey was performed early in 1991. During the 1991 season grid-laying was done at 100-meter intervals on the northern block of claims and detailed mapping was carried out. In the fall of 1991 a ground geophysics survey was also undertaken.

Location and Access

The property, which comprises two blocks of claims, is located 120 kilometers northwest of Baie-Comeau, on the western border of the Outardes Quatre Reservoir (Figure 1). It is found within Townships 747 and 847 (NTS 22K/3). Access is by helicopter or floatplane, although many of the lakes in the area are too small to accomodate the latter. Lumber roads are scheduled to be built near the property in 1993.

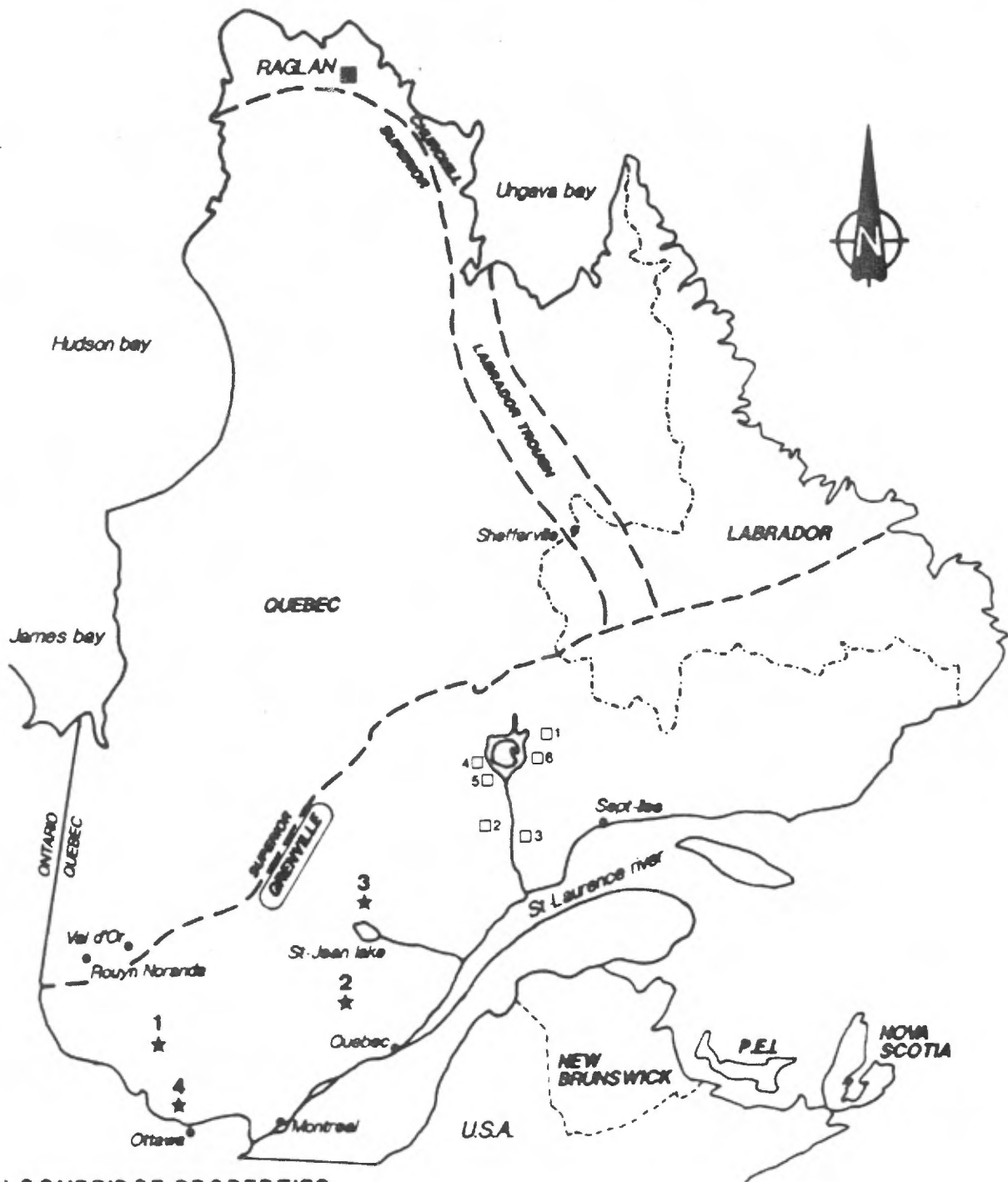
Claim Status

The 91 claims have been staked by Falconbridge and are 100% owned by Falconbridge. To date, no other claims have been staked by other companies in the immediate vicinity. Some claims are in good standing until September 9, 1992; others until May 16, 1993.

Topography and Vegetation

The area rises abruptly from the reservoir and is fairly mountainous. The soil is often less than two meters deep, and because of this, fallen trees are ubiquitous and traversing is often difficult.

Drainage is well developed. The locale is densely forested and occupied mainly by coniferous trees, with subordinate birch.

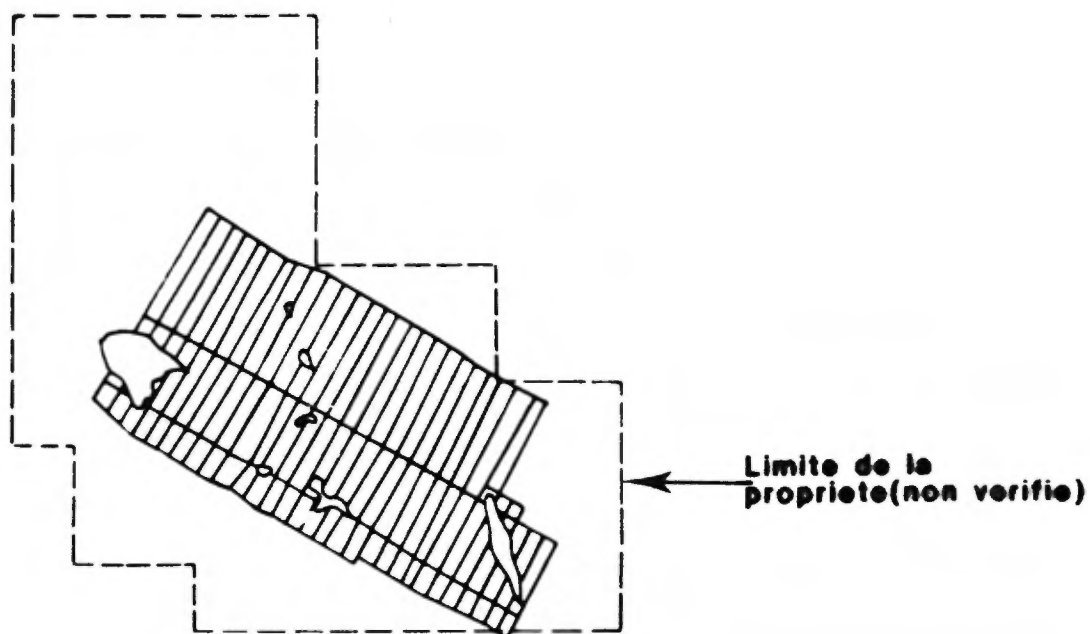


□ FALCONBRIDGE PROPERTIES

- 1- PETIT LAC MANIC
- 2- OUTARDES
- 3- MANICOUAGAN
- 4- LAC TETEPISCA
- 5- LAC DES PASSES
- 6- LAC DECHENE

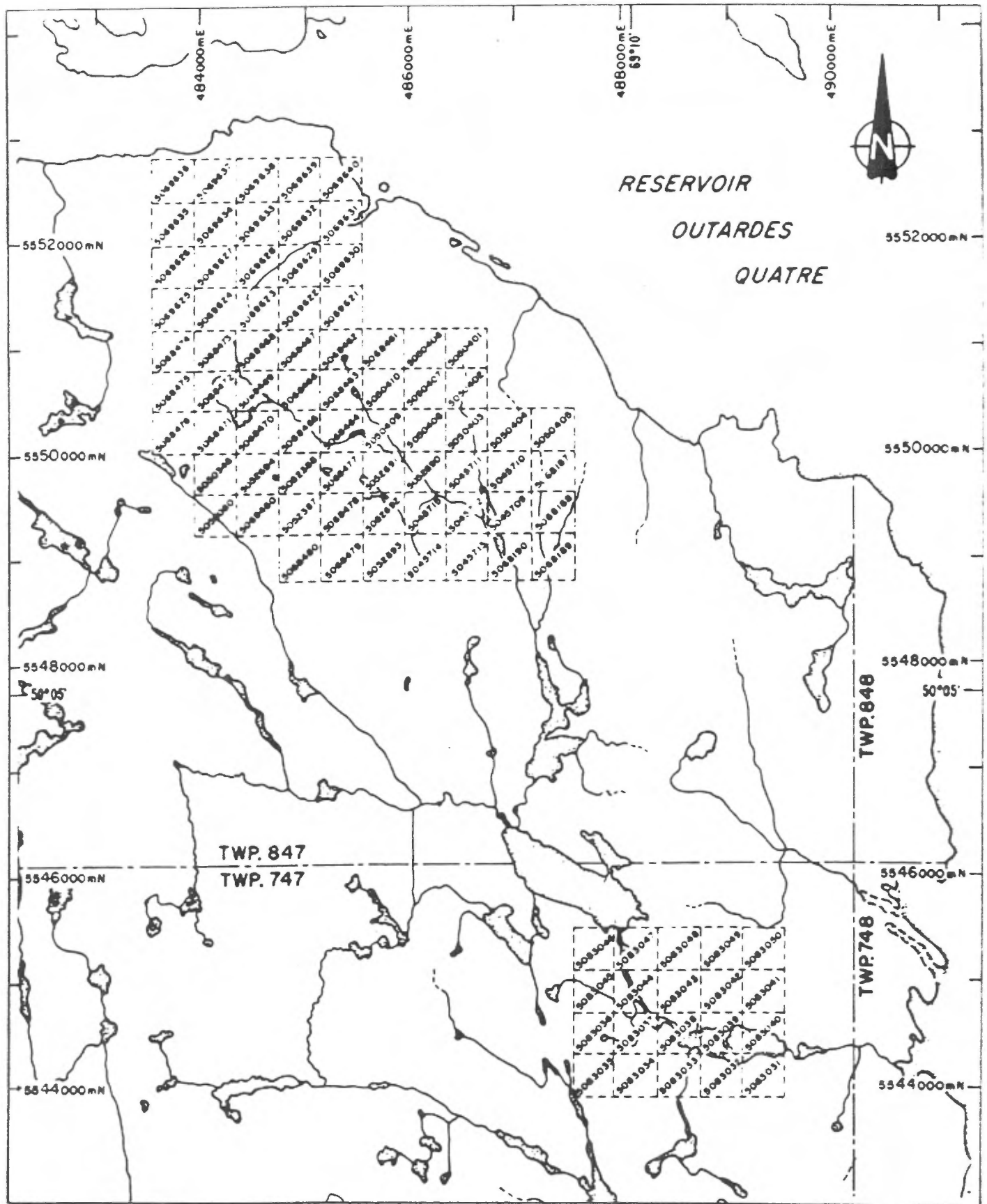
- ★ 1- RENZY LAKE DEPOSIT
- 2- EDOUARD LAKE DEPOSIT
- 3- McNICKEL SHOWING
- 4- CALLUMET MINE

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Carte exécutée :	date:		
Dessiné : R.Dube	date: 05/91	GRENVILLE PROJECT PROPERTIES LOCATION	
Supervisé : R.Laplante	date:		
Approuvé :	date:		
Echelle 1: 10 000 000		N.T.S. :	Zone U.T.M.: 19 U
0 100 200 300 400 Km (mètres)		No. Carte:	No. Micro :
		No. Project 111	

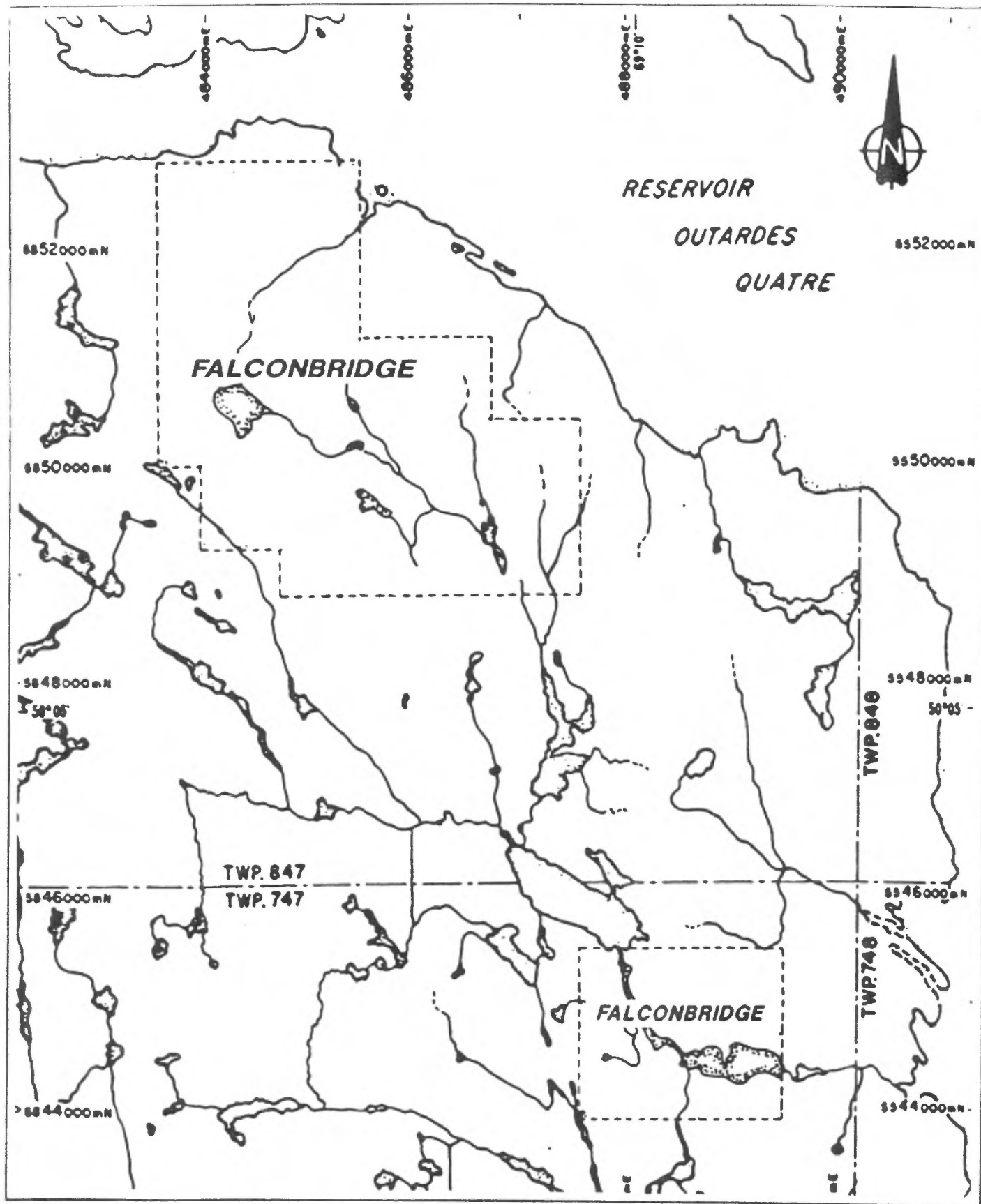


Travaux exécutés: G.Houle	date: 07/91	FALCONBRIDGE LTÉE. - EXPLORATION ROUYN-NORANDA	
Carte exécutée :	date:		
Dessiné : L.Dube	date: 21/11/91	OUTARDES COUPE DE LIGNE	
Supervisé : R.Lemery	date: 21/11/91		
Approuvé :	date:		
Echelle 1: 50 000	 (mètres)	N.T.S. : 22 K/3	Zone U.T.M. : 19 U
		No. Carte:	No. Micro :
			

No.
Projet
111



Travaux exécutés:		date:		FALCONBRIDGE LTEE. - EXPLORATION ROUYN-NORANDA		OUTARDES CARTE DE CLAIM		No. Projet 111 	
Carte exécutée :		date:							
Dessiné : GEODES Inc		date: 04/91							
Supervisé : R.Laplante		date: 04/91							
Approuvé :		date:							
Echelle		0 0.5 1.0 1.5 2.0 Km		N.T.S. : 22 k / 3		Zone U.T.M. : 19 U			
1: 50 000				No. Carte:		No. Micro :			



Travaux exécutés:		date:		FALCONBRIDGE LTEE. - EXPLORATION ROUYN-NORANDA		OUTARDES DETENTEURS	No. Projet 111
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Dessiné : GEODES inc		date: 04/91					
Supervisé : R.Lemery		date: 21/11/91					
Approuvé :		date:					
Echelle		N.T.S. : 22 K/3		Zone U.T.M. : 19 U			
1: 50 000  (mètres)		No. Carte:		No. Micro :			

DF

53 O U T A

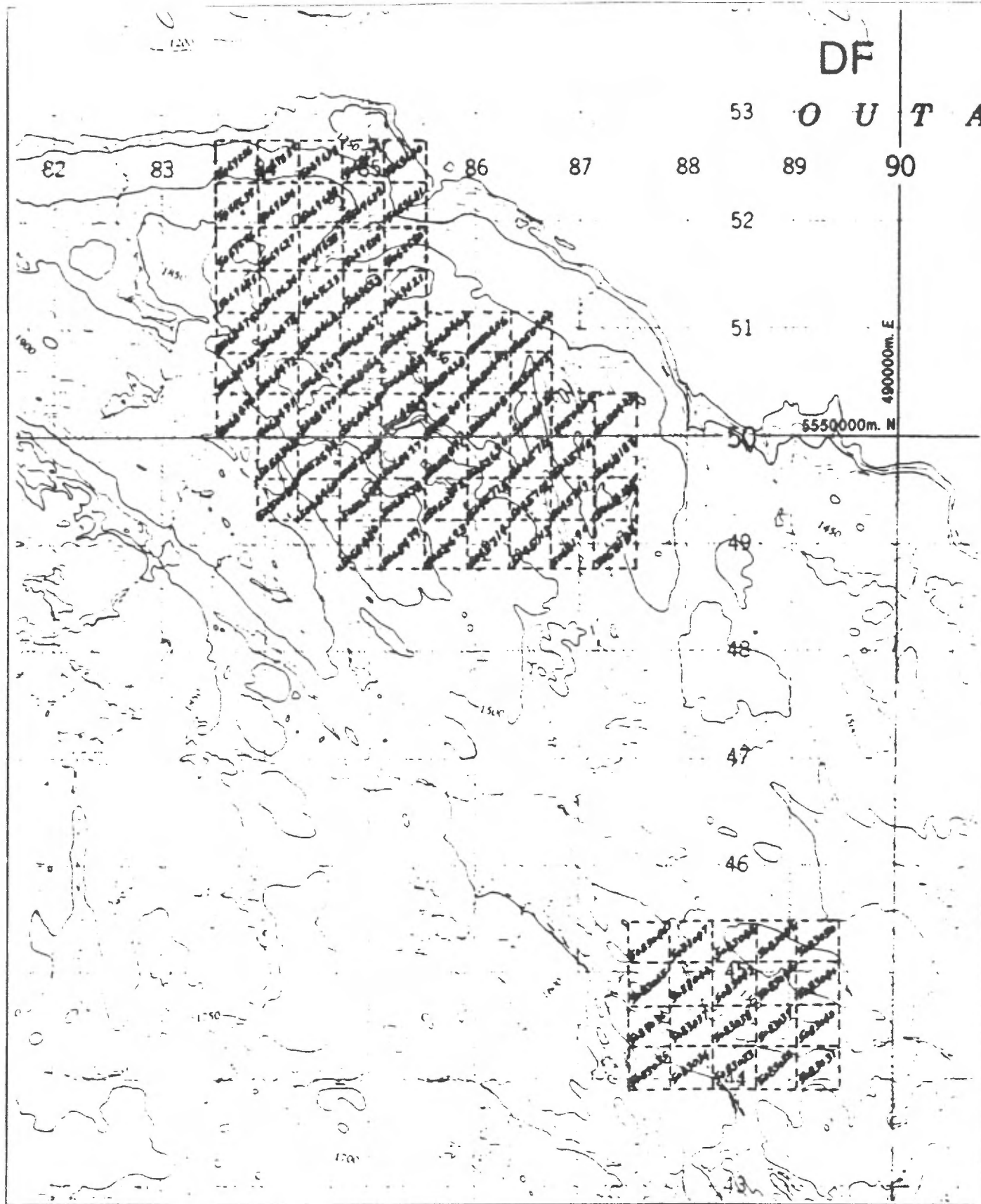
82 83 86 87 88 89 90

52

51

490000m. E

5550000m. N



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Supervisé :	R.Lemery	date: 21/11/91			
Approuvé :		date:			
Echelle 1:50 000			N.T.S. : 22 h/3	Zone U.T.M. : 19 U	
			No. Carte:	No. Micro :	

Regional Geology

The two blocks of claims lie within a mafic-ultramafic belt that fringe the edge of an anorthositic intrusion. The mafic belt is in turn enveloped by Archean gneisses (Avramtchev, 1983).

Inspection of the Geological Survey of Canada's airborne magnetic survey (1968) at scales of 1:63,360 and 1:250,000 reveals a mushroom-shaped structure with the anorthosite occupying the core. The two claim blocks are located on the northeast edge of the "cap" (Figure 7 and 8). Inspection of the magnetics map at a scale of 1:1,000,000 shows regional-scale NE- and NW-trending structures which intersect in the area (Lemery, 1990).

Reconnaissance geology performed during 1990 showed the mafic belt to consist of a variety of rock types, including quartz-feldspar-biotite gneiss, amphibolitic gneiss, fine-grained gabbro, mesogabbro and melanogabbro. Where the claim blocks are now located were also found olivine gabbro and peridotite, along with subordinate pyroxenite.

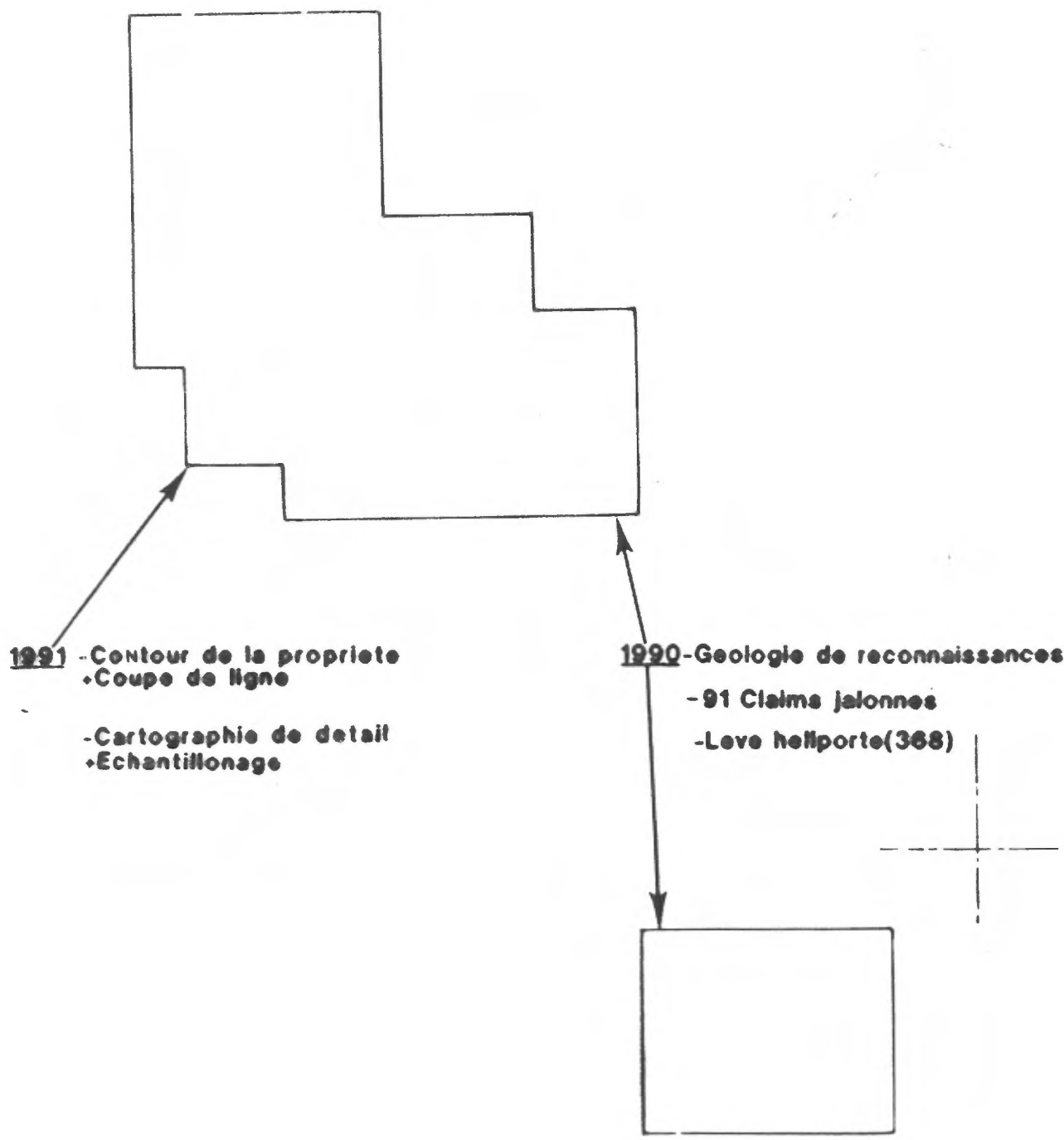
Local Geology

To date, only reconnaissance geology has been performed on the southern block of claims. The most common rock types observed here include gneiss and gabbro. The gneiss can range in makeup from felsic to mafic composition, with the latter often being quite magnetic.

The gabbro are sometimes massive but more often have developed a gneissic foliation and varying degrees of recrystallization. At the eastern shore of the lake located near the eastern boundary of the claim block are found outcrops and boulders of peridotite.

Grid laying and detailed mapping were carried out on the northern block of claims in the 1991 field season. The most pervasive types of rocks seen were gabbro, olivine gabbro and peridotite.

In general, the northern claim block appears to consist of two geological regimes, with the Base Line positioned approximately along the dividing line. The northern sector is composed entirely of gabbro. The rock is resistant to erosion and thus mountainous terrain is seen here. Varying degrees of gneissic foliation are observed and recrystallization of the matrix is sometimes noted. In places, the rock is so fine-grained that our crews at first thought them to be volcanics, but thin section analysis (see Appendix 1) showed them to be intrusives. These units are designated as 3G₂ in the Compilation Map.

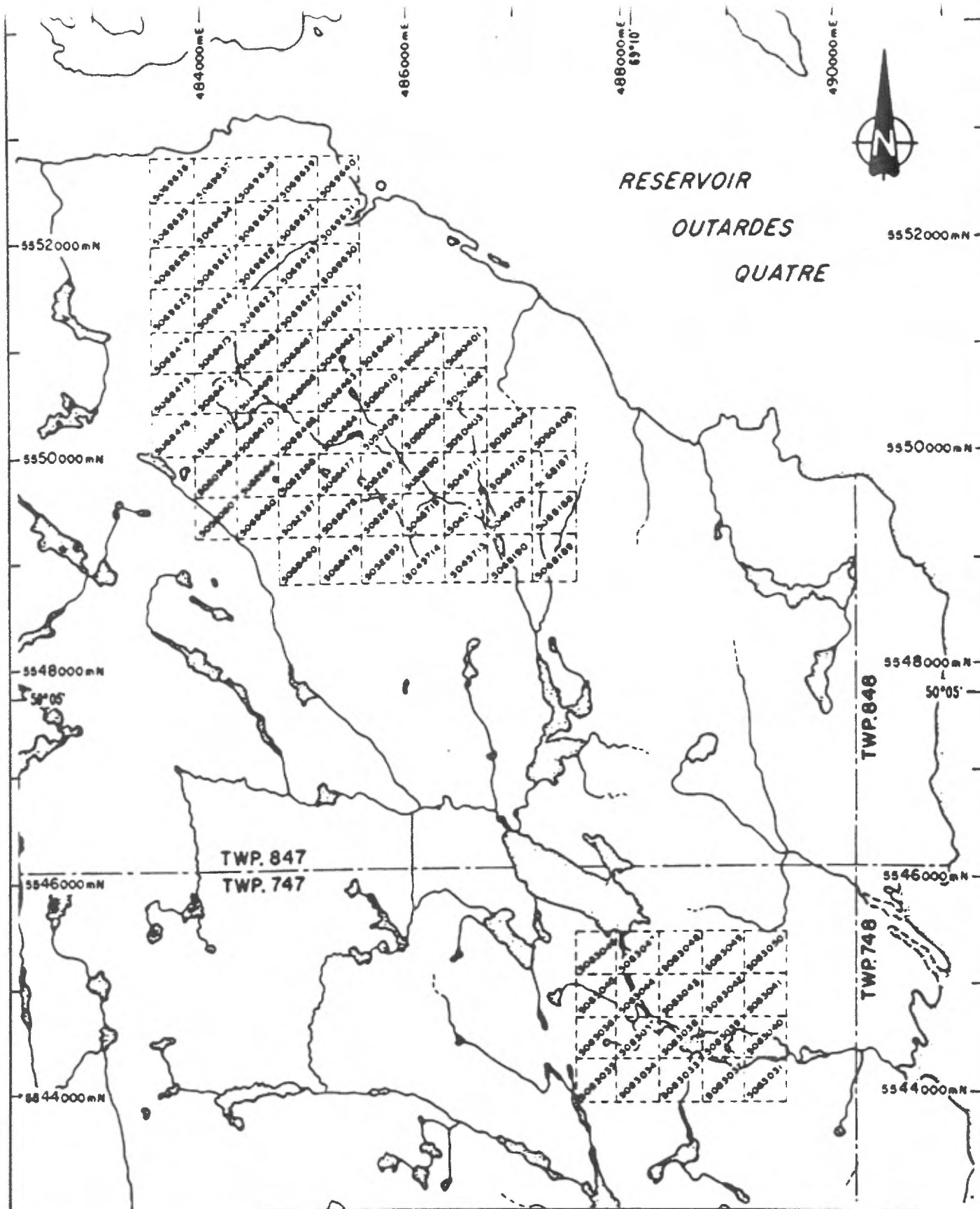


1991 - Contour de la propriété
 • Coupe de ligne

 - Cartographie de détail
 • Échantillonnage

1990 - Géologie de reconnaissance
 - 91 Claims jalonnées
 - Leve hélicoptère (368)

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Supervisé :	R.Lemery	date :	21/11/91			
Approuvé :		date :		TRAVAUX DE FALCONBRIDGE		
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Carte exécutée :		date:			
Dessiné	: GEODES inc	date:	04/91	OUTARDES CARTE DE CLAIM	
Supervisé	: R.Laplante	date:	04/91		
Approuvé	:	date:			
Echelle		0 0.5 1.0 1.5 2.0 Km		No. Projet 111	
1: 50 000				M.T.S. : 22 k/ 3	
				Zone U.T.M. : 19 U	
				No. Carte:	
				No. Micro :	
					

RÉSERVOIR OUTARDES QUATRE

GNEISSIC ROCK

MAFIC &
ULTRAMAFIC
ROCKS

MINERALIZED ZONE

ANORTHOSITIC
ROCK

OLIVINE GABBRO	0.7 Ni%
Up to	0.4 Cu%
PERIDOTITE	Up to 0.4 Ni%
	0.2 Cu%

TWP. 847
TWP. 747

TWP. 848

TWP. 748

0.2 Ni%

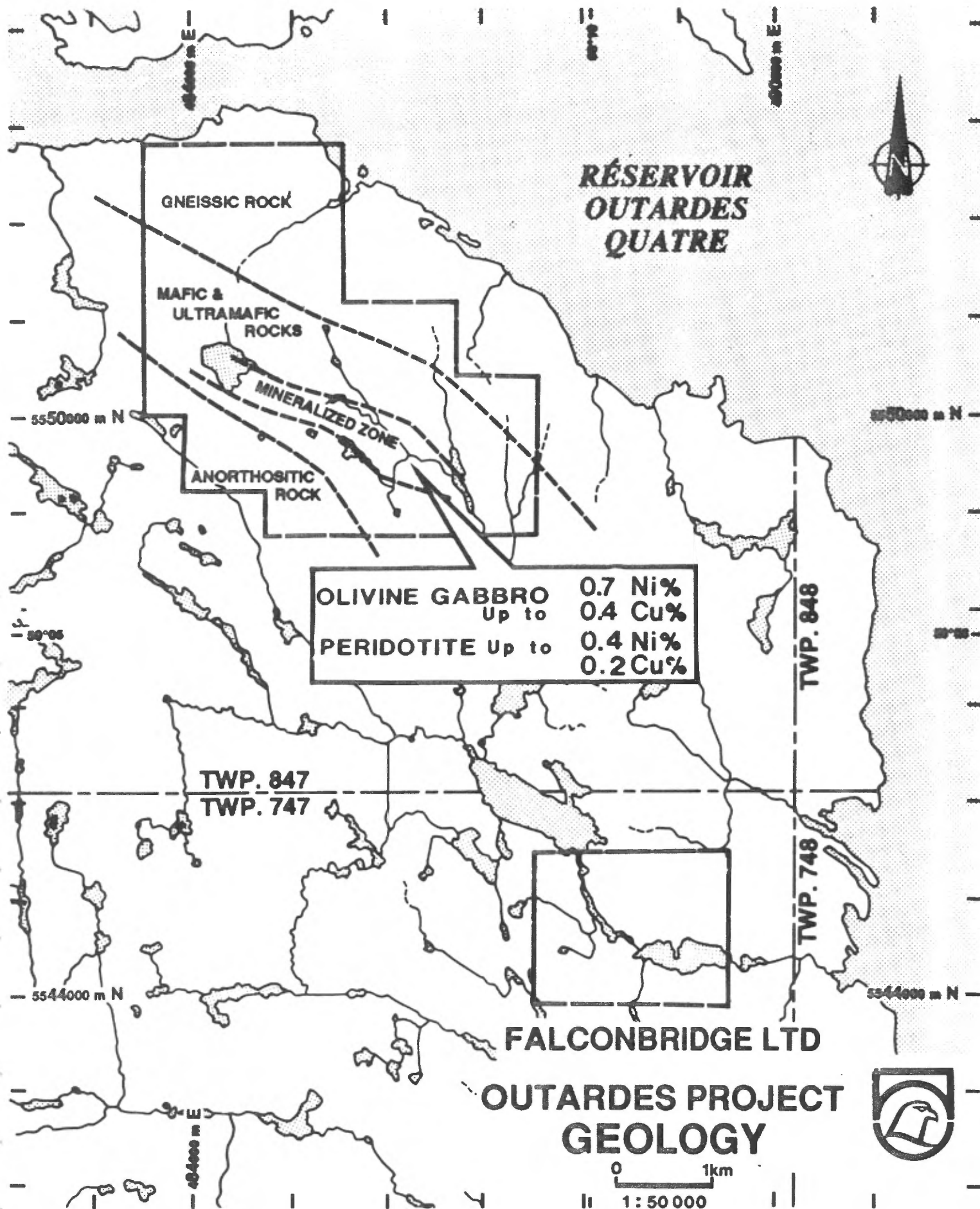
FALCONBRIDGE LTD

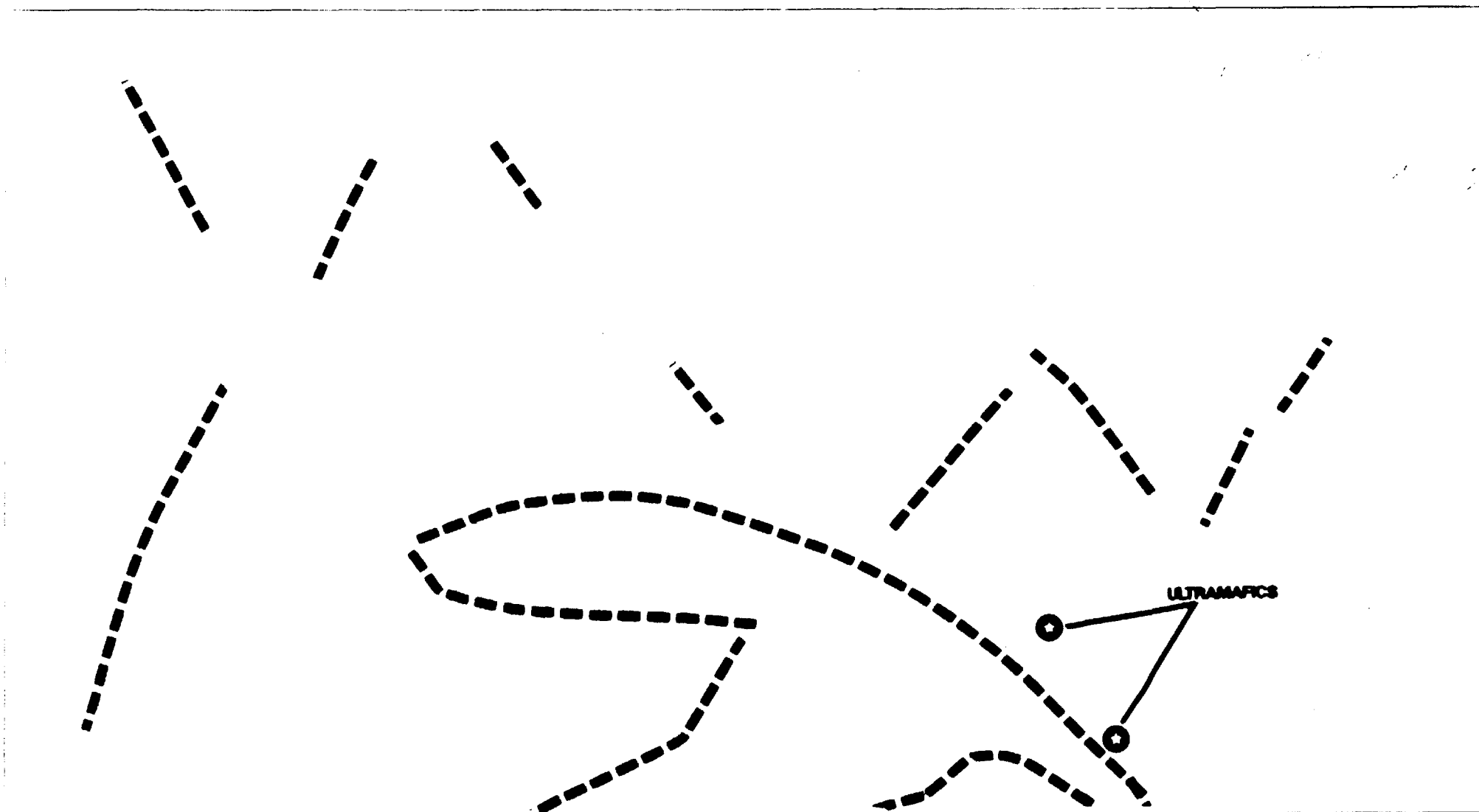
**OUTARDES PROJECT
GEOLOGY**



0 1km

1:50 000





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Carte exécutée :	date :
Dessiné :	date :
Supervisé : R. Lemery	date : 21/11/01
Approuvé :	date :
Echelle	(mètres)

FALCONBRIDGE LTEE. - EXPLORATION
ROUYN-NORANDA

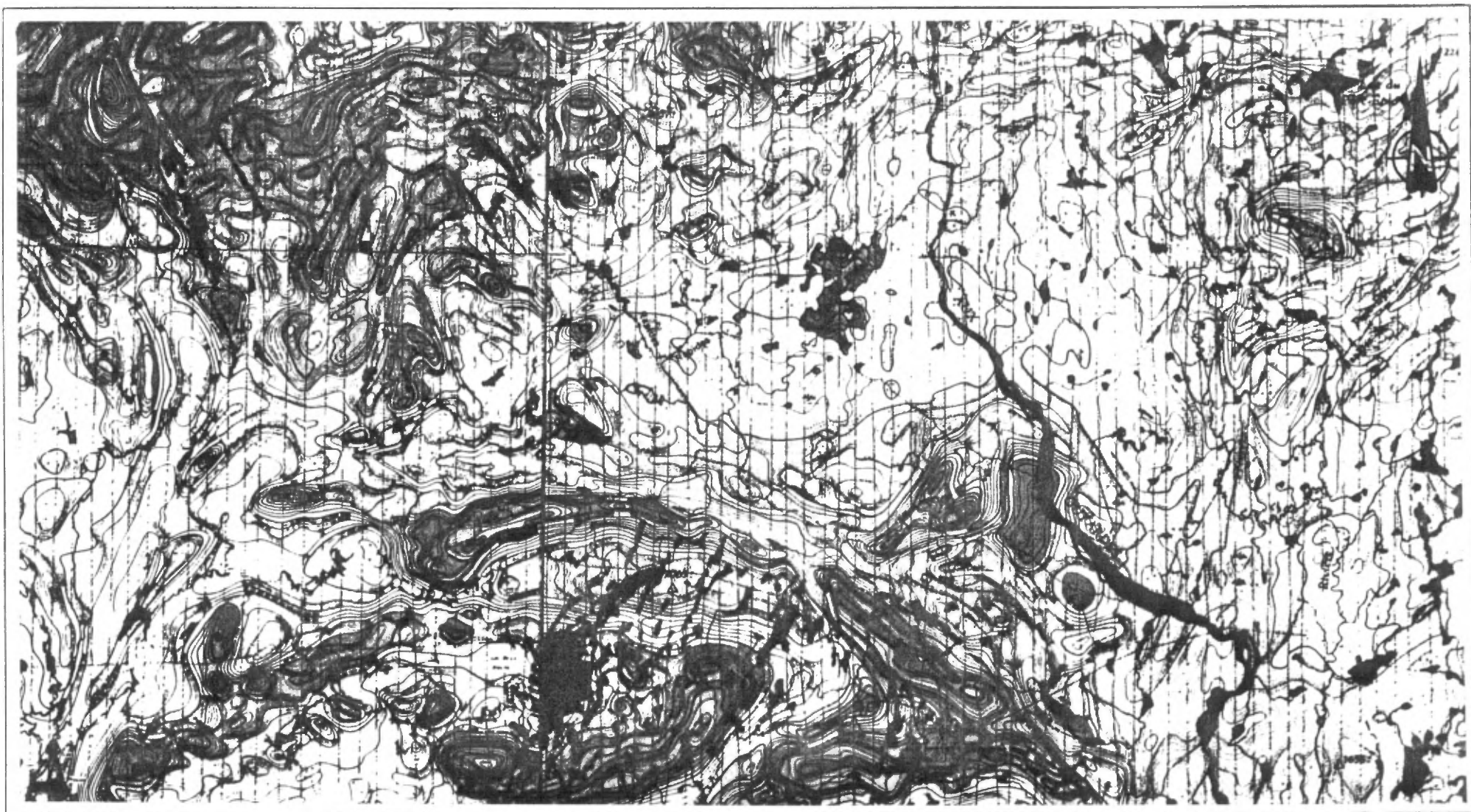
INTERPRETATION

No.
Projet

N.T.S. :
No. Carte :

Zone U.T.M. :
No. Micro :





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	Dessiné :		date:		OUTARDES		
	Supervisé :		date:				
	Approuvé :		date:				
	Echelle			N.T.S. :	22 K/3	Zone U.T.M.:	19 U
1: 250 000	 (mètres)		No. Carte:		No. Micro :		

The gabbro north of the Base Line can vary from being moderately magnetic to non-magnetic, depending on the amount of magnetite present. No evidence of differentiation was seen by our crews.

South of the Base Line the land slopes down towards a drainage system which runs through the property. This system corresponds to the position of an ultramafic horizon, composed mostly of peridotite. From here southwestward the land then rises again, and olivine gabbro and then gabbro are observed. This therefore represents a well-differentiated sequence, with the lower part occurring to the north.

Several mafic dykes were observed on the property. These are dark-grey to black and one to several meters wide, which cut through the gabbroic units. Analysis of their attitudes by stereonet suggests that they are late-stage, post-folding events.

Several thin quartz-rich units were seen, but no analyses were made of these. They may represent units of quartzite which were intercalated with the magmatic rocks.

Something of interest seen throughout the property was the presence of xenoliths hosted within gabbroic rock. The xenoliths are angular and usually 20 to 30 cm. across. They are generally composed of pyroxenite or melanogabbro (?).

Whole rock analysis was performed on eight samples. The results were then plotted on an AFM diagram and a Jensen plot (Figures 10 and 11). The plots indicate that the gabbros and mafic dykes have high-iron tholeiitic origin, while the ultramafics are of true komatiitic affinity.

Thin sections were made of several rock types; see Appendix I. Investigation showed that the OPX:CPX ratio of the gabbros in fact qualifies them as being of noritic affinity. The silicates are quite fresh and the typical An content is An 60-65 (Labradorite). The thin sections provide strong evidence that the suite represents a layered intrusion.

Structure

Foliations measured in the field were plotted on a stereonet. The claim block was divided into several domains in order to avoid a "shotgun" scatter effect. In addition, regional foliations taken from the 1:250,000 geology map (Avramtchev, 1983) were plotted on separate diagrams, again using domains. Together the local and regional structures gave over one hundred and forty readings.

Fold axis positions were obtained from some half-dozen stereonet drawings. These were then plotted together, and the results are shown in Figure 12. The plot shows that the F_1 fold axes, originally trending approximately east-west, have now been rotated about a second fold axis or F_2 oriented at 021/20. Not only is the fit of Figure 12 remarkably good, but it also conforms to the general mushroom pattern seen in the regional magnetics map (Figure 12).

Unfortunately there is as yet no indication of the dip of units in the claim blocks. The majority of the foliations dip to the southwest 40 to 80 degrees, but there are exceptions. Mag signatures generally appear as symmetrical to the northeast as they are to the southwest. It may be that the units dip steeply, or that the dips change because of folding.

Interpretation of air photos, topographic maps and the 1:5,000 airborne Vertical Gradient Magnetics map shows that the northern block of claims are host to several large-scale north-south lineaments, with subordinate structures oriented NE-SW. These two sets of fractures could represent fault systems. They do not seem to provide a control on mineralization, although this has as yet to be established conclusively.

Geophysics

Ground geophysics at a scale of 1:5,000 has been performed on the northern claim block, and airborne geophysics at 1:10,000 and 1:5,000 on both claim blocks. Studies included magnetics, VLF and EM.

In the northern block, magnetic studies indicate the presence of a large arcuate structure with the convex side pointing toward the NE. This corresponds to the F_2 phase of folding mentioned above. Convolutions in the mag signature suggest remnant F_1 folds on a local basis. The ultramafics appear confined to a signature of less than 56,500 gammas; greater than this the mag corresponds to gabbroic rocks.

The higher signature is presumed due to the presence of magnetite in gneissic gabbro. In the Grenville our experience has been that high mag signatures are generally due to Mt-rich gneissic rocks, while ultramafics are found in low magnetic depressions (Lemery, 1990).

Ground geophysics EM-VLF studies show two main axes of anomalies. The axes are arcuate and compliment the magnetic signature. The more northern axis is located from 100 to 200 meters north of the Base Line. It is fairly continuous and extends from cross lines 1+00E to 22+00E. The southern axis is found from 100 to 300 meters south of the Base Line; it extends from cross

**RÉSERVOIR
OUTARDES
QUATRE**

GNEISSIC ROCK

MAFIC &
ULTRAMAFIC
ROCKS

MINERALIZED ZONE

ANORTHOSITIC
ROCK

OLIVINE GABBRO	0.7 Ni%
Up to	0.4 Cu%
PERIDOTITE	Up to 0.4 Ni%
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TWP. 847
TWP. 747

TWP. 848

TWP. 748

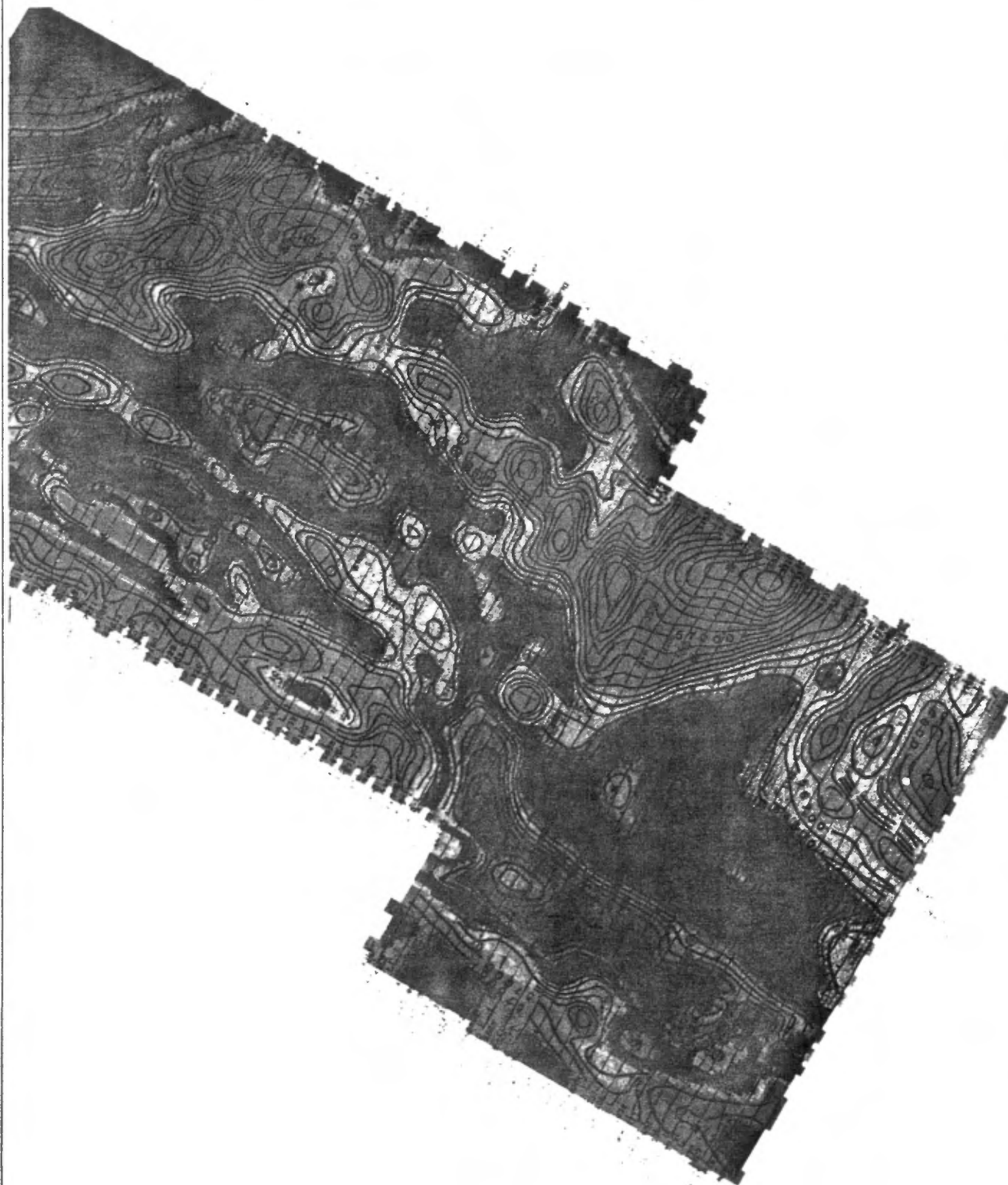
FALCONBRIDGE LTD

**OUTARDES PROJECT
GEOLOGY**

0 1km

1:50 000





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Carte exécutée : DIGHEM		date: 01/91						
Dessiné :		date:		OUTARDES MAG CHAMP TOTAL				
Supervisé :		date:						
Approuvé :		date:						
Echelle				N.T.S. : 22 K/3		Zone U.T.M. : 19 U		
1: 50 000  (mètres)				No. Carte:		No. Micro :		
				No. Projet 111				

Outardes

Irvin & Baragar 1971 (fig 2)

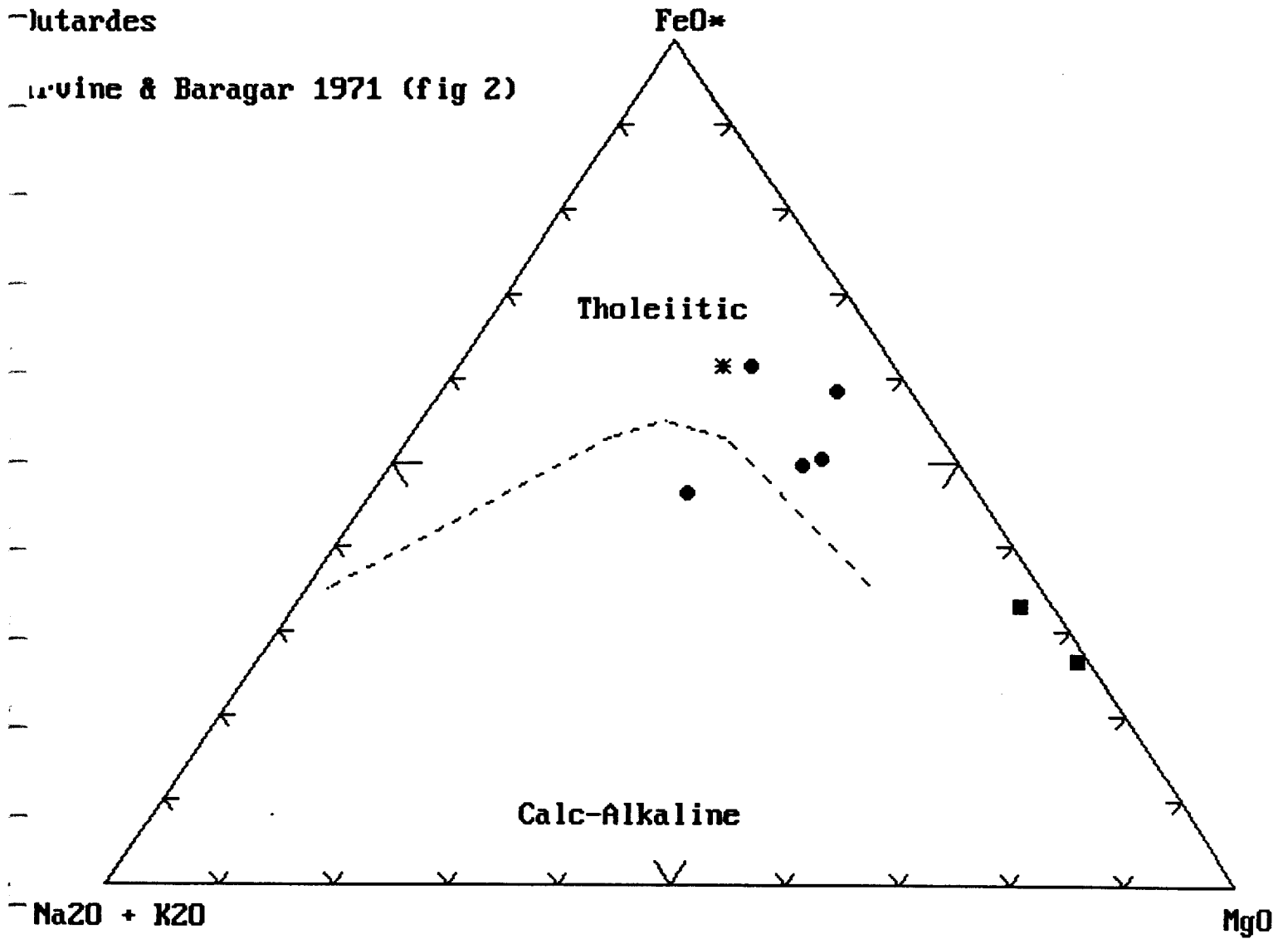


FIGURE 10: AFM DIAGRAM OF EIGHT SAMPLES TAKEN FROM THE OUTARDES PROPERTY. CIRCLES : GABBRO, SQUARES : PERIDOTITE, ASTERIX : MAFIC DYKE.

Putardes

Jensen 1976

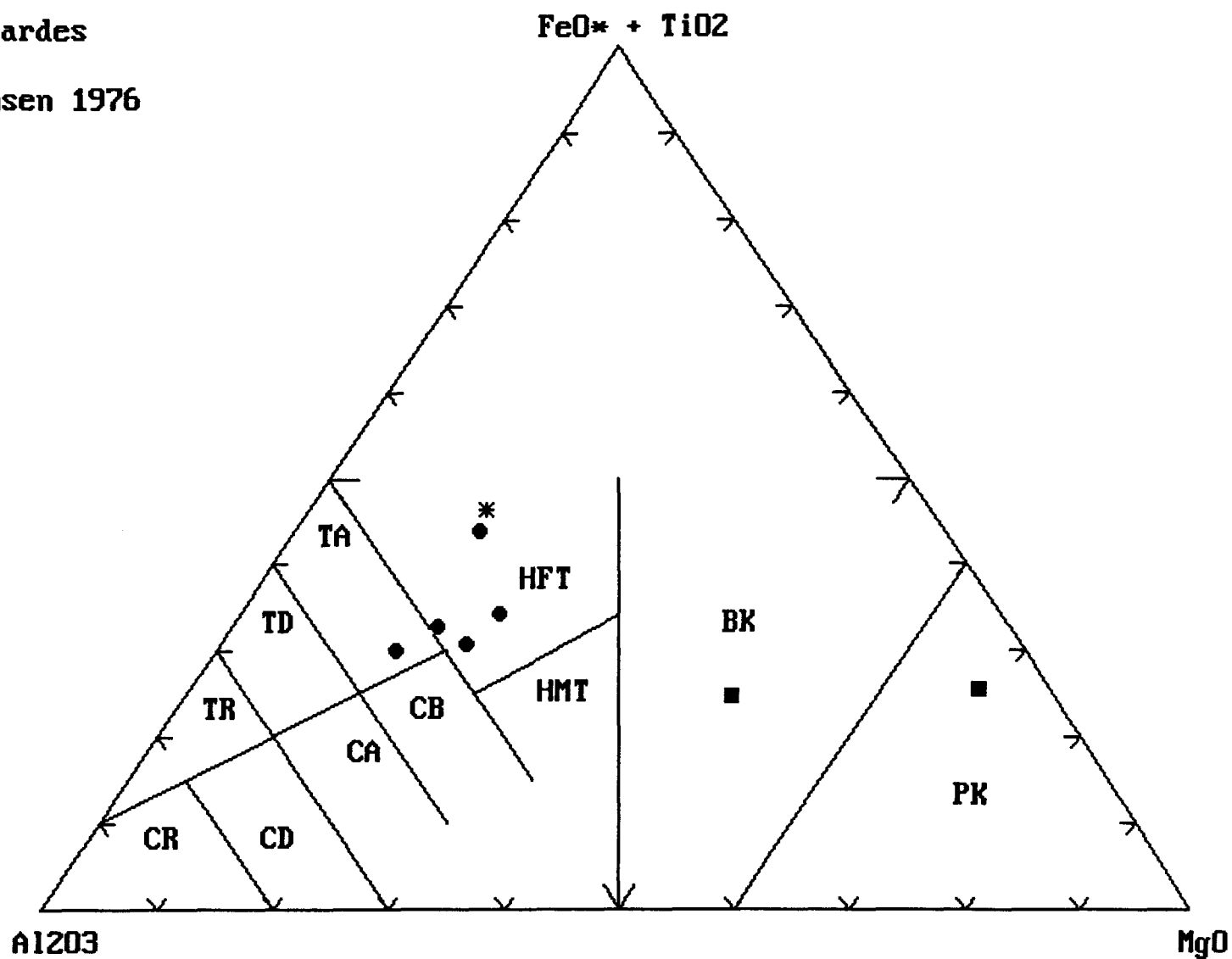
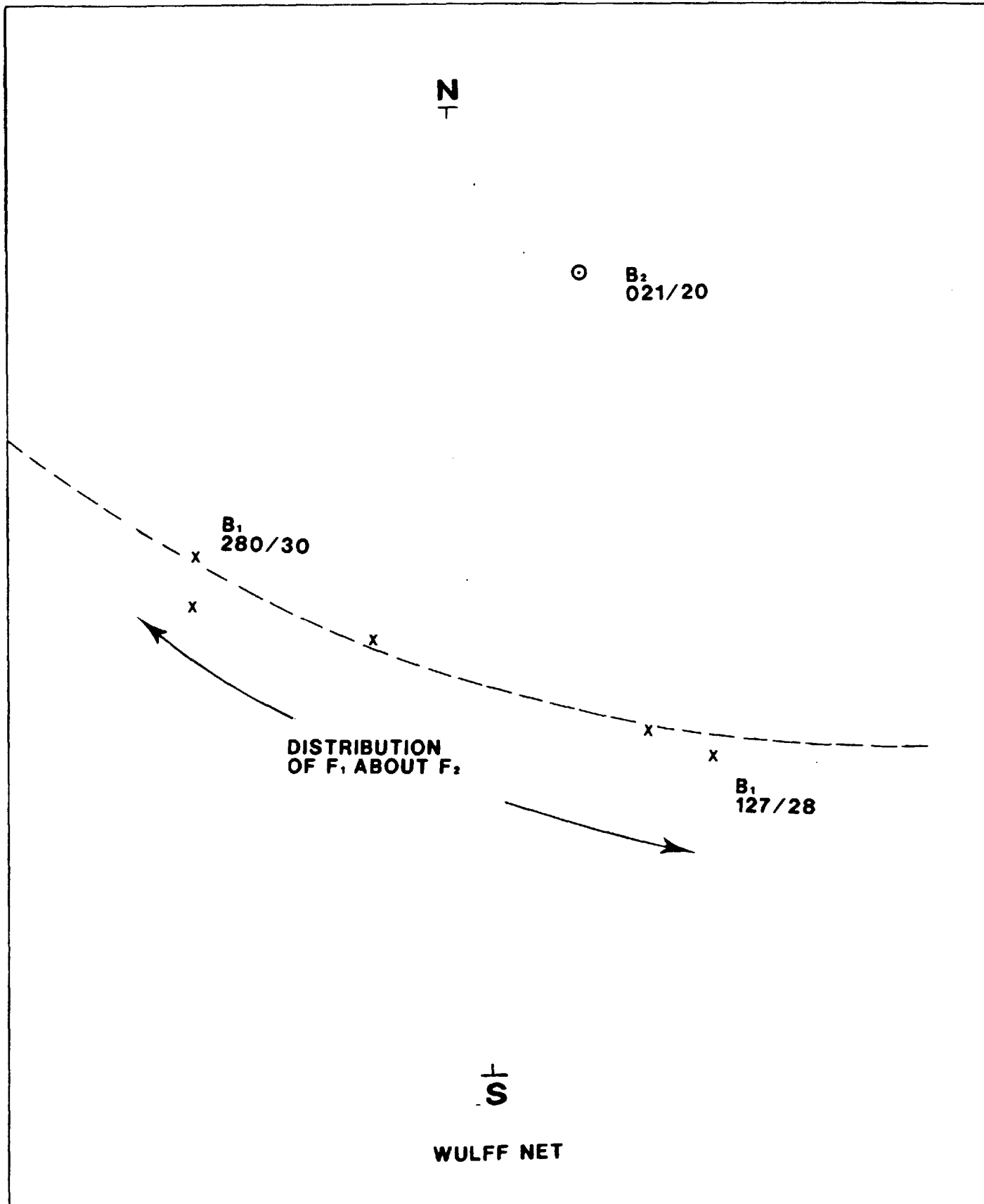


FIGURE 11. JENSEN PLOT OF THE SAME SAMPLES AS FIGURE 10.
TA THOLEIITIC ANDESITE, HFT HIGH-FE THOLEIITE,
BK BASALTIC KOMATIITE, PK PERIDOTITIC KOMATIITE.



Travaux exécutés:		date:	FALCONBRIDGE LTEE. - EXPLORATION ROUYN-NORANDA		
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Supervisé :	R.Lemery	date: 21/11/91			
Approuvé :		date:			
Echelle	0 0.5 1.0 1.5 2.0 Km		N.T.S. : NTS: 22 K/3	Zone U.T.M. : 19 U	
1: 50 000			No. Carte:	No. Micro :	

OUTARDES PROPERTY PROPOSED DRILL HOLES

NUMBER	LINE	STATION	AZIMUTH	DIP	LENGTH (m)	COMMENTS
PDDH-1	16+00E	4+00S	Grid north	-50°	100	-ground EM-VLF anomaly -best grab results for Ni (0.67%)
PDDH-2	11+00E	3+75S	Grid north	-50°	120	-three ground EM-VLF conductors
PDDH-3	11+00E	3+00S	Grid north	-50°	120	-minor airborne EM anomaly
PDDH-4	11+00E	2+25S	Grid north	-50°	120	-several mineralized zones in the area
PDDH-5	11+00E	1+50S	Grid north	-50°	150	(6-12% sulphides)
PDDH-6	6+75E	3+15S	Grid north	-50°	100	-ground EM-VLF anomaly -airborne EM anomalies -trace sulphides
PDDH-7	4+00E	1+75S	Grid north	-50°	120	-ground EM-VLF anomaly
PDDH-8	4+00E	1+00S	Grid north	-50°	100	-airborne EM anomaly -poor outcrop exposure
PDDH-9	3+00E	2+25S	Grid north	-50°	100	-strong airborne EM anomalies -3 mineralized zones nearby (1-7%)

lines 5+00E to 13+00E, is then broken, and reappears from 18+00E to 21+00E. The anomalies often but do not always correspond to the presence of mineralized zones observed in the field.

Mineralization

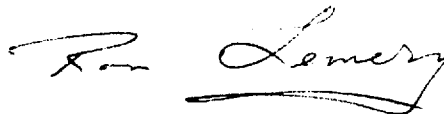
As a result of detailed mapping, over forty showings have been found in the northern claim block. The showings consist of from 2% to 15% sulphides and occasionally more. The average content is from 2% to 4%. The most common minerals observed are pyrrhotite and chalcopyrite. The sulphides are disseminated and show primary texture resulting from magmatic segregation; evidence of secondary enrichment is rare. Associated rock types are peridotite and olivine gabbro, although in the eastern sector north of the Base Line the host rock is melanogabbro.

Of all the samples taken more than forty gave results of greater than 0.20% Ni. The best assay to date is 0.36% Cu and 0.66% Ni, taken from line 16+00E. For all samples, results for Co, Pt, Pd and Au have been negligible.

Conclusions and Recommendations

Over forty mineralized showings have been discovered in the northern claim block of the Outardes property. The majority of showings are associated with hosts of olivine gabbro and peridotite. The ultramafic horizon roughly follows the creek which runs through the grid south of the base line. Travelling southwestward from here one encounters a succession of olivine gabbro followed by gabbro and then fine-grained gabbro. The succession thus appears to represent a layered intrusion, with the base located to the northeast. The gabbros north of the Base Line do not seem to be differentiated and may be the result of an entirely different magmatic event.

Mapping and geophysics indicate that the area which shows the best potential for mineralization is located between the base line and tie line 5+00S, and is confined between cross-lines 1+00E and 25+00E. The accompanying table provides the suggested positions for the first round of drill holes.



Ron Lemery
January, 1992

Bibliography

Avramtchev, L., 1983: Région de la Côte Nord. Ministère de l'Energie et des Ressources. DV 83-14.

Choinière, J., 1987: Géochimie des sédiments de lac - région de Manicouagan - Ministère de l'Energie et des Ressources. DP 86-18.

Lemery, R., 1990: The 1990 Exploration Program of the Grenville Geological Province, Québec, Canada. Presented to Falconbridge Limited October 1990.

APPENDIX 1

THIN SECTION ANALYSES

(Performed by Bob Buchan, Lakefield Research, Ont.)

Estimated Mineral Proportions in Falconbridge Thin Sections

8900-411

OUTARDES Section No.	Fp.	O'Pyx.	C'Pyx.	Amph.	Biot.	Pleo.*	Garn.	Carb.	Otz.	Opag.	Others
LM- 1	40	3	10	40	<1	-	-	<1	-	5	
2	40	15	10	30	-	-	-	-	-	5	
3	54	33	10	2	Tr	-	-	-	-	1	
4a	46	20	20	10	Tr	-	-	-	-	4	
4b	48	10	32	5	<1	<1	-	Tr	-	3	
5	25	48	24	-	<1	-	-	-	-	2	
6	54	6	15	-	5	-	-	-	-	20	
7	58	15	5	6	3	2	-	-	-	8	Olivine (3)
											Serpentine (Trace)
PETIT LAC MANIC 50	40	25	10	20	4	-	-	-	-	<1	Apatite (Trace)
148	25	33	30	3	-	8	-	-	-	<1	
220	35	-	-	-	-	-	15	-	38	10	Sericite (2)
											Zircon (Trace)
224	33	-	-	-	2	-	20	-	44	<1	Rutile (Trace)
											Zircon (Trace)
243	15	10	-	70	2	-	-	-	-	3	
253	34	4	12	50	Tr	-	-	-	-	Tr	
6201	Tr	58	24	5	2	-	-	5	-	6	

* Pleonaste