



**Mineral Resources Division**

**Summary and Evaluation of the  
Geophysical Data  
from the Open Assessment Files  
of the Bird River Greenstone Belt**

**Portions of N.T.S. Sheets 52L/5,6,11 and 12**

**By**

**I. T. Hosain**

**1978**

SUMMARY AND EVALUATION OF THE GEOPHYSICAL DATA  
FROM THE OPEN ASSESSMENT FILES  
OF THE  
BIRD RIVER GREENSTONE BELT  
(PORTIONS OF N.T.S. SHEETS 52L/5, 6, 11 and 12)

MRD OPEN FILE REPORT 78/4

Manitoba Department of Mines, Natural Resources and Environment

## ABSTRACT

This report is a compilation and preliminary interpretation of geophysical data contained within 35 open assessment files of the Mineral Resources Division. It has been prepared to assist exploration and mining companies in their research for base metal deposits in the Bird River area.

Ground and airborne geophysical surveys have been interpreted in a qualitative manner, have been plotted on 1:50 000 geological maps, and are summarized in tables with recommendations for further work, if warranted.

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## INTRODUCTION

The objective of this report is to present geophysical data contained in open assessment files of the Mineral Resources Division, in a format which will serve as a guide for mining companies contemplating or already carrying out exploration for base metals in the Bird River area.

### Scope

The analysis, interpretation and compilation of geophysical data from open and confidential assessment files is being carried out to assist in evaluating the mineral potential of various areas of Manitoba under the Federal/Provincial Non-Renewable Resource Evaluation Program. Between May 1977 and September 1978, approximately 59 surveys were evaluated from assessment files dealing with N.T.S. sheets 52L/5, 6, 11 and 12 (Fig. 1). The data presented in this report are restricted to the 35 open assessment files. The data in this report cover the period 1949 to 1974.

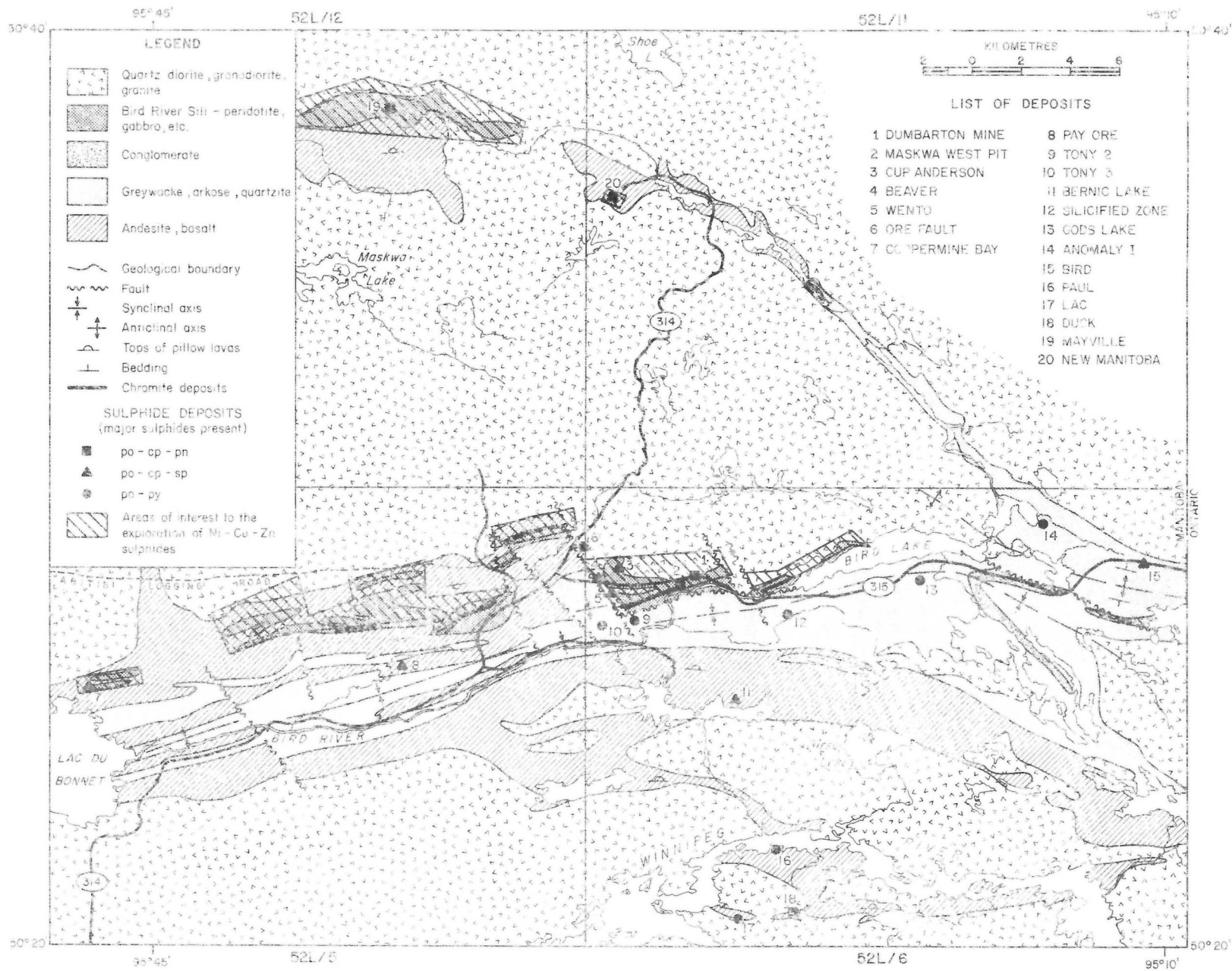
This report is essentially an open file geophysical report of the work carried out by various mining companies and contains information regarding preliminary anomaly interpretation, probable cause of the anomalies as indicated by the diamond drill logs, ground follow-up of airborne anomalies, and recommendations for further work.

The general geology and mineral deposits of the Bird River area have been summarized by P. Theyer (1977), and are shown in Figure 1 and Table 1.

## ACKNOWLEDGEMENTS

The author acknowledges with thanks contributions made to this report by the following staff: F. J. Elbers, H. Ambach, D. Navitka, D. Kleinholz, E. Truman, J. Elston, S. Keast, L. McKnight and K. Kube. Many thanks are due to J. Bamburak for assisting in the preparation of this manuscript.

Figure 1: Sulphide deposits of the Bird River Sill Area and outline of areas covered by the present compilation. (Geology adapted from Davies et al (1962) after Meyer 1977.)





NM 7504 TABLE 1 SULPHIDE DEPOSITS IN THE BIRD RIVER SILL AREA. (Only (1) and (2) were mined)  
(after Theyer 1977)

Name of Deposit	Deposit Type	Sulphides						Oxides				Tonnage, Grade and Width	Main Rock Types	Surface Openings	Drilling	References
		po	cp	sp	pn	py	cbn	mag	il	cr	hem					
Dumbarton Mine (1)	A	x	x	x	x	x	x	x	x			1 500 000 tons 1.16% Ni, 0.33% Cu	Andesite, iron formation, tuff, basalt	Decline	x	Various, cited in text
Maskwa West (2)	B	x			x	x				x	x	400 000 tons 1.11% Ni, 0.23% Cu	Peridotite	Open Pit	x	Northern Miner, July 15, 1976
Cup Anderson (3)	A	x	x	x		x		x			x	Cu 4.1%, 30 m Cu 3.8%, 10 m	Crystall tuff, iron formation, quartzite layers	Trenching	x	Wright (1932)
Beaver (4)	A	x	x	x		x		x				Cu 2% (estimate)	Tuff, pyroxenite, iron formation, amphibolite	Trenching	x	Wright (1932)
Wento (5)	A	x	x	x			x						Amphibolite, iron formation	Shaft	x	Wright (1932)
Ore Fault (6)	A & B	x	x	x	x	x		x				1640 000 tons 0.48% Ni	Amphibolite, tremolite-calcite rocks, tuff		x	Prospectus Bird River Mines Co. Ltd. (1972)
Coppermine Bay (7)	B		x	?	x							0.46% Ni, 0.27% Cu 30 m	Basic volcanics, gabbro		x	Ritchie (1972); Juhas (1973) Dept. of Mines, open file
Pay Ore (8)	A	x	x		x	x							Andesite, quartzite, basalt		x	Dept. of Mines, open file
Tony 2 (9)	C	x				x		x					Chert, greywacke, tuff, iron formation, quartzite			Juhas (1973)
Tony 3 (10)	C	x						x					Iron formation			Juhas (1973)
Bernic Lake (11)	C	x	x	x				x					Andesite, iron formation		x	Dept. of Mines, open file
Silicified Zone (12)	C	x	x			x		x					Iron formation			Juhas (1973)
Gods Lake (13)	C	x	x			x		x					Garnet-mica-kyanite schist			Juhas (1973)
Anomaly 1 (14)	C					x							Iron formation		x	Dept. of Mines, open file
Bird (15)	B		x			x							Ultramafic to mafic rocks		x	Dept. of Mines, open file
Paul (16)	C	x	x			x							Gabbro, quartzite, greenstone, metasediments		x	Dept. of Mines, open file
Lac (17)	C	x	x			x							Gabbro, mineralized, quartzite, gneiss		x	Dept. of Mines, open file
Duck (18)	C	x	x		x	x							Gabbro, iron formation, andesite		x	Dept. of Mines, open file
Mayville (19)	B	x	x		x							Small tonnages of Cu and Ni	Gabbro, mafic volcanics	Trenching	x	Davies et al. (1962)
New Manitoba (20)	B	x	x		x							646 000 tons 0.24% Ni, 0.54% Cu	Gabbro			Canadian Mines Handbooks — 1976/77; Davies et al. (1962)

Deposit Types

- Type A Fe-Ni-Cu-Zn sulphide assemblages in volcanic-sedimentary rocks  
Type B Fe-Ni-Cu sulphides in mafic to ultramafic intrusions  
Type C Generally barren Fe-sulphide associated with sulphide iron formation



## METHODOLOGY

For the purpose of this report the geophysical surveys have been assessed in a qualitative manner as this is sufficient to give an indication of the relative importance of an anomaly. Qualitative analysis of an anomaly involves determination of the strike length, strength, direction of dip, and width, while quantitative analysis will, in addition to the above, involve determination of the angle of dip, depth, conductivity thickness product, and would entail using master curves, phasor diagrams, tables, nomograms, computer programs, etc. In some of the older surveys quantitative analysis cannot be undertaken on account of the incomplete data provided by the companies; the more recent surveys submitted have a better data base.

### Ground Surveys

Interpretation of the ground data was carried out directly on maps filed by exploration companies with the Department. Most of these maps are on a scale of 1 inch to 200 or 400 feet. The interpreted data were then transferred to a half-tone geological 1:50 000 base map which shows all the relevant geophysical information, the assessment file numbers and the areas covered by the surveys. Table 2, which provides information on anomalies shown on Map 1A, gives the assessment file number, N.T.S. area, name of the company registering the property, the year in which the survey was carried out, geophysical methods used, the instruments employed and their specifications, anomalies and their characteristics, past drilling activity, probable cause of the anomaly, recommendations for further geophysical work, if warranted, and comments on the geology.

The specifications of instruments, included in Table 2, are as given in the reports in the assessment files. The specifications of instruments employed in the surveys are listed in Appendix A (Hood, 1972 and 1977). The abbreviations are explained in Appendix B.

Most of the ground geophysical data in the assessment files have been obtained from magnetic surveys or from some form of electromagnetic (EM) survey. An attempt has been made to standardize the results of the different geophysical surveys in a manner which will allow comparison of the anomaly intensity produced by systems measuring the same physical parameters. Magnetic surveying being a passive method, i.e. measurements are carried out in natural fields, provides data which are directly comparable; however, difficulties arise in comparing EM surveys, as they are active methods whereby transmitters with varying power output and frequencies are used to artificially create primary fields. In addition the coil configuration and coil separation can be varied.

The depth of penetration of an EM survey is dependent on the instrument's specifications, method of conducting the survey and the geological and topographic environments. For example, an increase in the frequency decreases the penetration of the EM waves. Also, with decreasing resistivity of the material the depth of penetration decreases. Therefore, in swampy areas a high frequency unit may produce false conductors. The coil separation also has an effect on the depth of penetration. A larger coil separation will increase the depth of penetration of the EM waves. The coil configuration plays a very important part in determining how well the

Table 2 - Bird River Area 52L/5, 6, 11 and 12 - Ground Geophysics - Open File

CLASS FILE NO.	COMPANY	YEAR	VLF & VLEM	HLEM	MAG.	OTHER GEOPHYSICS	DRILLING	CAUSE OF ANOMALY	COMMENTS ON GEOPHYSICS	COMMENTS ON GEOLOGY
91318	Bird River Syndicate 52L/5	1953			Watts, 29.2 γ/sc. div. A 500 γ regional N.S. trend to the west of claim block				The regional trend probably caused by a change in the lithology. No work warranted	Underlain by clastic sediments of the Rice Lake Group. Mag. anomaly on the northwestern fringes of the survey (91318) probably caused by mafic to ultramafic intrusions of the Bird River Sill
91343	Hudson Bay 52L/5	1959		2400 hz, Coil sep. 300'. One weak cond.			One hole drilled. No mineralization		The wk. cond. is caused by the swamp. No work warranted	
91327	Hudson Bay 52L/5	1971			Askania GFZ torsion type, 2.4 γ/sc. div. No mag. anomalies				No work warranted	
91705	Cerro Mineral Expl. 52L/5	1968			Barringer GM-102. One linear 300 γ mag. trend coincident with northern AFMAG condr.	Long wire AFMAG. One strong and one med. strength condr.	Four holes drilled to test the condr.	Py, Po, with trace Cp	The strong condr. with mag. association swings north at its eastern end and is open at its western end. More work warranted	Northern part of area dominated by a "young" granodioritic intrusion (Great Falls Pluton) into mafic volcanic rocks of the Rice Lake Group. Strong condrs. caused by concentrations of sulphides along this interface. Med. condr. outlines the gabbro-andesite contact
91382	Canex Placer 52L/5	1973	EM-16, Tx-NAA Maine. Many discontinuous str. condrs. which de- lineate the gabbro contact	Scintrex SE-600, 1600 hz, Coil sep. 200'. Very noisy. No condrs.	MF-1. A trend of 2000 γ to 4000 γ anomalies coincide with the gabbro, Cu, Ni, mineralization		Drilled one hole to test a VLF condr.	Po, Py, Cp (2% Ni, 2% Cr over 100')	More work warranted	Underlain by mafic volcanic rocks, a band of clastic sediments - Rice Lake Group, and small enclaves of ultramafics containing chromite. The ultramafics cause the isolated mag. highs. Small intrusions of the Cat Lake granodiorite produce the VLF-EM condrs.
92058	Canex Placer 52L/5	1973	EM 16, Tx-NAA Maine. Three str. condrs. which de- lineated the gabbro contact	SE-600, 1600 hz, Coil sep. 200'. Only three lines surveyed geologic noise	MF-1. A 1000 γ anomaly on the western grid which is open towards the west. No anomalies on eastern grid				More work warranted on the western mag. anomaly	
91321	God's Lake Gold Mines Ltd. 52L/6	1954			Watts, 30 γ/sc. div. Sharpe, 50 γ/sc. div. A general rise of 200 γ going from north to south over the lake				Over the lake the mag. would be of greater amplitude but not high enough to reflect peridotites. VLEM is warranted	Underlain by clastic sediments of the Rice Lake Group in south and by mafic intrusives of the Bird River Sill along north shore of Bird Lake. Northern margins underlain by Great Falls granodiorite
91325	Red River Mining Expl. 52L/6	1960			Sharpe A3. No mag. anomalies				VLEM is warranted	
91323	God's Lake Gold Mines Ltd. 52L/6	1954			Sharpe D1-M, Sens. 80 γ/sc. div. A few E.W. trending mag. anomalies of up to 20 000 γ		The eastern mag. anomaly has been drilled	The central and east- ern holes intersected Po. Nothing of value in assays	No work warranted	Most of area underlain by clastic sediments of the Rice Lake Group. Mag. high located on garnet-mica schists caused by Py, Po and Mag. This type of mineralization fairly common in these sediments in combination with iron formation

Table 2 - Bird River Area 52L/5, 6, 11 and 12 - Ground Geophysics - Open File (Cont'd)

CLASS FILE NO.	COMPANY	YEAR	VLF & VLEM	HEM	MAG.	OTHER GEOPHYSICS	DRILLING	CAUSE OF ANOMALY	COMMENTS ON GEOPHYSICS	COMMENTS ON GEOLOGY
91447	Bernic Lake Mines Ltd. 52L/6	1968			MF-1. A few narrow isolated magnetic highs		Previously drilled a few holes to test a pegmatite dyke for SnO <sub>2</sub> and Ta <sub>2</sub> O <sub>5</sub>		No work warranted	Underlain by clastic sediments of the Rice Lake Group intruded by pegmatites. Mag. highs trend conformably with biotite schists and are probably caused by dissem. Po occurring in narrow steeply dipping to vertical schist layers
91312	Bernic Lake Mines Ltd. 52L/6	1968			MF-1. No mag. anomalies		Three holes drilled. Pegmatite		No work warranted	
91313	Tantalum Mining Corp. 52L/6	1969			MF-1. One mag. trend of approx. 2000 γ				Further geophysical work warranted on claim block	
91314	Bernic Lake Mines Ltd. 52L/6	1969			MF-1. A few isolated narrow mag. highs		Three holes drilled. Pegmatite		No work warranted	
91342	Tantalum Mining Corp. 62L/6	1968			MF-1. A few narrow anomalies of 2000 γ				More work warranted	
91315	Hudson Bay 52L/6	1973		2400 Hz. Coil sep. 200'. Three strong condrs.			Drilled the 3 strong condrs.	Py, Po, Mag.	No work warranted	Underlain by andesite, basalt and quartz- ite stringers in quartz monzonite. Mineralized quartzite contains Po and Py with traces of Cp
91304	Tantalum Mining Corp. 52L/6	1969			MF-1. A few east-west trend- ing linear mag. anomalies of over 10 000 γ				Further geophysical work warranted on the claim block	Underlain by gabbro, iron formation and andesite. Trend of mag highs is con- formable with mineralization in iron formation containing Po and Py with traces of Cp
91791	Hudson Bay Expl. 52L/6	1974		1600 Hz. Coil sep. 300'. No condrs.			Four holes drilled on geology - Pegmatite dyke		No work recommended	Pegmatite dyke
91765	Gunnex Ltd. 52L/11	1969	SE 300, 1600 Hz. Broadside Two short med. strength condrs. with coincident mag. highs.		ABEM model M24, 10 γ/sec. div. Four magnetic anomalies of up to 3000 γ				More work warranted	Three sulphide zones (Cu, Ni) associated with the magnetic and EM anomalies
91099	Maskwa Nickel Chrome Mines 52L/11,12	1951			Sharpe Schmidt- type, 30 γ/sec. div. Western claims block - one 10 000 γ anomaly over 2400'. Central block-one 5000 γ anomaly over 1600' in the gabbro				EM is warranted over the gabbro in the central block. EM or I.P. is warranted over the eastern block	Erratic zones of disseminated sulphides in the eastern block-1% combined Ni and Cu
91100	Canadian Nickel Company 52L/12	1949			Sharpe, Sen. 30 γ/sec. div. Few isolated highs				No work warranted	Underlain by mafic volcanic rocks of the Rice Lake Group and by a "young" grano- dioritic intrusion (Great Falls Pluton). Sulphide mineralization in the assemblage of andesite and basalt. Mag. highs possi- bly due to gabbroic enclaves in the Great Falls Pluton

EM waves couple with conducting bodies. The primary electromagnetic waves emanating from a horizontal transmitter couple very well with flat-lying conducting bodies which makes the horizontal loop EM method very susceptible to the effects of lake bottom clays, conducting overburden, etc. Therefore, in surveying over lakes the vertical loop EM would be a more effective exploration method. On the other hand, the ratio of the in-phase to the quadrature component (obtainable with the horizontal loop) would be a better method of interpreting the strength of the conductor.

All, or most of these factors have been taken into consideration before an anomaly is classified according to arbitrarily chosen levels of intensity, as strong, medium or weak.

### Airborne Surveys

Airborne surveys are essentially reconnaissance methods and therefore qualitative interpretation is sufficient in handling the data. For the purposes of this report the flight records (tapes) were not checked to determine whether all the anomalies have been recognized and transferred on to the final map (in many surveys the tapes were not submitted). Therefore, the company maps in the assessment files outlining the anomalies were used exclusively in the interpretation and in selecting anomalies that may have been overlooked during subsequent surface exploration.

Most of the airborne geophysical data in the assessment files have been obtained from magnetic, or some form of EM survey. In classifying the anomalies as strong, medium or weak, the system and the frequencies employed have been taken into consideration. An evaluation of some of the systems has been carried out by Paterson (1970), and Bosschart and Pemberton (1969).

The airborne anomalies from the company maps have been transferred to half-tone aeromagnetic 1:50 000 base maps. These latter maps (Maps 1B to 4B), show all the relevant geophysical surveys and are summarized in Table 3 of this report. Table 3 gives the assessment file number, N.T.S. area, name of the company for whom the survey was carried out, the year in which the survey was flown, flight altitude and line spacing, the system and specifications employed, anomalies and their characteristics, ground follow-up activity and comments. Because the magnetic surveys constitute a passive method, they are directly comparable and correlate with the Federal-Provincial Aeromagnetic Map Series. Therefore, these latter maps were used as a base as they have continuous coverage over the area, and the flight altitude, line spacing and contour interval are constant.

Table 2 - Bird River Area 52L/5, 6, 11 and 12 - Airborne Geophysics - Open File

CLASS FILE NO.	AREA	COMPANY	YEAR	ALTITUDE	LINE SPACING	EM	MAG.	GROUND GEOPHYSICAL FOLLOW-UP	COMMENTS
90008	52L/5, 6, 11, 12	Canadian Nickel	1964	Aircraft 500' Bird 275'	1/4 mile	Two frequency max. coupled orthogonal coils. TX in aircraft, RC in bird. The difference in the signal in the 2 receiver coils and the out-of-phase recorded. Two str., many med. and wk. condrs. The condrs. are mostly situated on or along the flanks of mag. highs.		Condr. #1 - Pay Ore deposit Condr. #3 - Dumbarton and Maskwa deposits Condr. #4 - Tony deposits Condr. #5 - Bernic Lake deposit Condr. #6 - Gods Lake deposit Condr. #7 - Paul deposit Condr. #8 - Duck deposit Condr. #9 - New Manitoba Condr. #10 - Mayville deposit Ground follow-up warranted on remaining condrs.	It seems that the str., med. and wk. condrs. have equal priorities with regard to mineral potential. Deposit locations are shown on Figure 1.
91095	52L/6, 11	Anglo Barrington	1955	Because report and map are incomplete, this survey not included in compilation (Lundberg Survey).					
91564	52L/5, 6	Falconbridge Nickel	1974	Helicopter Bird 100'	1/8 mile	Aerodat - 918 Hz, coil sep. 30'. Vertical coaxial coupled. Many str., med. & wk. condrs. (same as Canadian Nickel, 1964 survey).	Barringer AM-10A, proton precession. The mag. data is not presented.	See 90008 & 91627	
91627	52L/5, 12	Canadian Nickel	1964	Aircraft 500' Bird 275'	1/4 mile	Two frequency max. coupled orthogonal coils. TX in aircraft, RC in bird. The difference in the signal in the 2 receiver coils and the out-of-phase recorded. Many med. and wk. condrs.		Condr. #2 - Coppermine Bay deposit. Ground follow-up warranted on remaining condrs.	
91645	52L/5 12	Canadian Nickel	1964	Aircraft 500' Bird 275'	1/4 mile	Two frequency max. coupled orthogonal coils. TX in aircraft, RC in bird. The difference in the signal in the 2 receiver coils and the out-of-phase recorded. Many med. and wk. condrs.		The med. condr. north of Lac du Bonnet has been drilled. Ground follow-up warranted on remaining condrs.	
91649	52L/5, 12	Canadian Nickel	1965	Aircraft 500' Bird 275'	1/4 mile	Two frequency max. coupled orthogonal coils. TX in aircraft, RC in bird. The difference in the signal in the 2 receiver coils and the out-of-phase recorded. Many med. and wk. condrs.		Ground follow-up warranted on the condrs.	
91681	52L/11	Kennecott Expl.	1970	Aircraft 400'	1/4 mile	Input Mark V. 2 str. and a few med. condrs. (Same as Canadian Nickel, 1964 survey).	Barringer AM-101A nuclear precession. The mag. data is not presented.	See 90008.	
91686	52L/5, 6, 11, 12	Hudson Bay	1971	Helicopter 200' Bird 100'	1/8 mile	4000 Hz. TX and RC vertical coaxial in bird. Coil sep. 20'. In phase and out-of-phase recorded. Many med. and wk. condrs. (All the condrs. are the same as Canadian Nickel, 1964, 65 surveys).		See 90008, 91627 and 91645	
91687	52L/11	Cerro Mining	1971	Aircraft 150'	1/8 mile	Canadian Aero Mark III, 390 Hz. TX in nose and RC in tail of aircraft. Vertical coaxial. In phase and out-of-phase recorded. A few med. condrs. (same as Canadian Nickel, 1964 survey).	Gulf Mark III, Fluxgate. The mag. data is not presented.	See 90008	
91987	52L/5,	Imperial Oil	1973	Aircraft 150- 200'	1/8 mile	Canadian Aero Mark III, 390 Hz. TX in nose and RC in tail of aircraft. Vertical coaxial. In phase and out-of-phase recorded. A med. condr. north of Lac du Bonnet (same as Canadian Nickel, 1964 survey).	Gulf Mark III, Fluxgate. The mag. data is not presented in the compilation as the trends are similar to those shown on the base maps.	See 91645	
92066	52L/5	Anglo Barrington	1955	Because report and map are incomplete, this survey not included in compilation (Lundberg Survey).					

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## Appendix A

### GROUND GEOPHYSICAL INSTRUMENTS USED IN THE BIRD RIVER AREA

(after Hood, 1972 & 1977)

#### VLF & Vertical Loop EM Units

<u>Manufacturer and Model</u>	<u>Frequency (hz)</u>	<u>Max. Coil Sep. (ft)</u>	<u>Transmitter Power (amp. turns m<sup>2</sup>)</u>
Sharpe SE-300	400/1600	1000	36 inm <sup>2</sup> at 400 hz 30 inm <sup>2</sup> at 1600 hz
Geonics	15 000-25 000	-	-

#### Horizontal Loop EM Units

Geonics EM-17	1600	400	25 inm <sup>2</sup> at 1600 hz
Ronka MK-III	876/2400	300	-
Sharpe SE-600	1600	300	27 inm <sup>2</sup> at 1600 hz



## Appendix B

### ABBREVIATIONS

#### Mineralization

Asp	arsenopyrite	Mag	magnetite
Ch	chlorite	Mg	magnesium
Cp	chalcopyrite	Ni	nickel
Cu	copper	Pb	lead
Fe	iron	Po	pyrrhotite
Gf	graphite	Py	pyrite
Hem	hematite	Sp	sphalerite
Lm	limonite	Zn	zinc

#### Extent and Nature of Mineralization

tr	trace
N.S.	nearly solid
N.S.S.	nearly solid sulphide
'	foot (feet)
"	inch(es)

#### Geophysical

assoc.	association	sc. div.	scale division
condrs.	conductors	sen.	sensitivity
EM	electromagnetic	sep.	separation
freq.	frequency	specs.	specifications
hz	hertz	str.	strong
mag.	magnetic	TX.	transmitter
med.	medium	wk.	weak
RC.	receiver	γ	gamma(s)
VLEM	vertical loop electromagnetic survey		
HLEM	horizontal loop electromagnetic survey		

#### Miscellaneous

blk.	(claim) block
D.D.H.	diamond drill hole
M.M.B.	Manitoba Mines Branch
M.R.D.	Mineral Resources Division
CLASS file	claims assessment file