

LOG NO: 09-24	RD.
ACTION:	
FILE NO:	

AIRBORNE GEOPHYSICAL REPORT

ON THE

PM GROUP OF CLAIMS

¹CARIBOO
OMINECA¹ MINING DIVISION

N.T.S. 93 J/13

Latitude: 54° 59'N
Longitude: 123° 44'W

NORANDA EXPLORATION COMPANY, LIMITED
(no personal liability)

By: T. Walker

GEOLOGICAL BRANCH
ASSESSMENT REPORT September, 1990

20,311

TABLE OF CONTENTS

INTRODUCTION:

General	1
Location & Access	1
Claims & Ownership	1
Topography & Vegetation	2
Regional Geology	2
Local Geology	2
Previous Work	2
GEOPHYSICAL SURVEY	3
RECOMMENDATIONS	3

APPENDIX I	Statement of Qualifications
APPENDIX II	Statement of Costs
APPENDIX III	Dighem Report

FIGURE 1	Location Map
FIGURE 2	Claim Map
FIGURE 3	Dighem EM Anomaly Map
FIGURE 4	Total Field Magnetic Contour Map
FIGURE 5	Apparent Resistivity Contour Map (900 Hz)
FIGURE 6	Apparent Resistivity Contour Map (7,200 Hz)
FIGURE 7	Apparent Resistivity Contour Map (56,000 Hz)

INTRODUCTION

GENERAL:

This report describes the results of an airborne EM-Magnetic survey flown over the claim group in November of 1989. The survey was carried out in an attempt to refine the local geology and outline magnetic +/- conductive bedrock areas which may be the source areas of the known soil anomalies and mineralized float (see previous Norex Assessment Reports).

The work described herein was carried out by Dighem Surveys & Processing Inc., Mississauga, Ontario under contract to Noranda Exploration Company, Limited (no personal liability).

LOCATION AND ACCESS:

The PM claim group is located on the headwaters of Philip Creek approximately 56 km southwest of Mackenzie and 135 km northwest of Prince George, B.C.

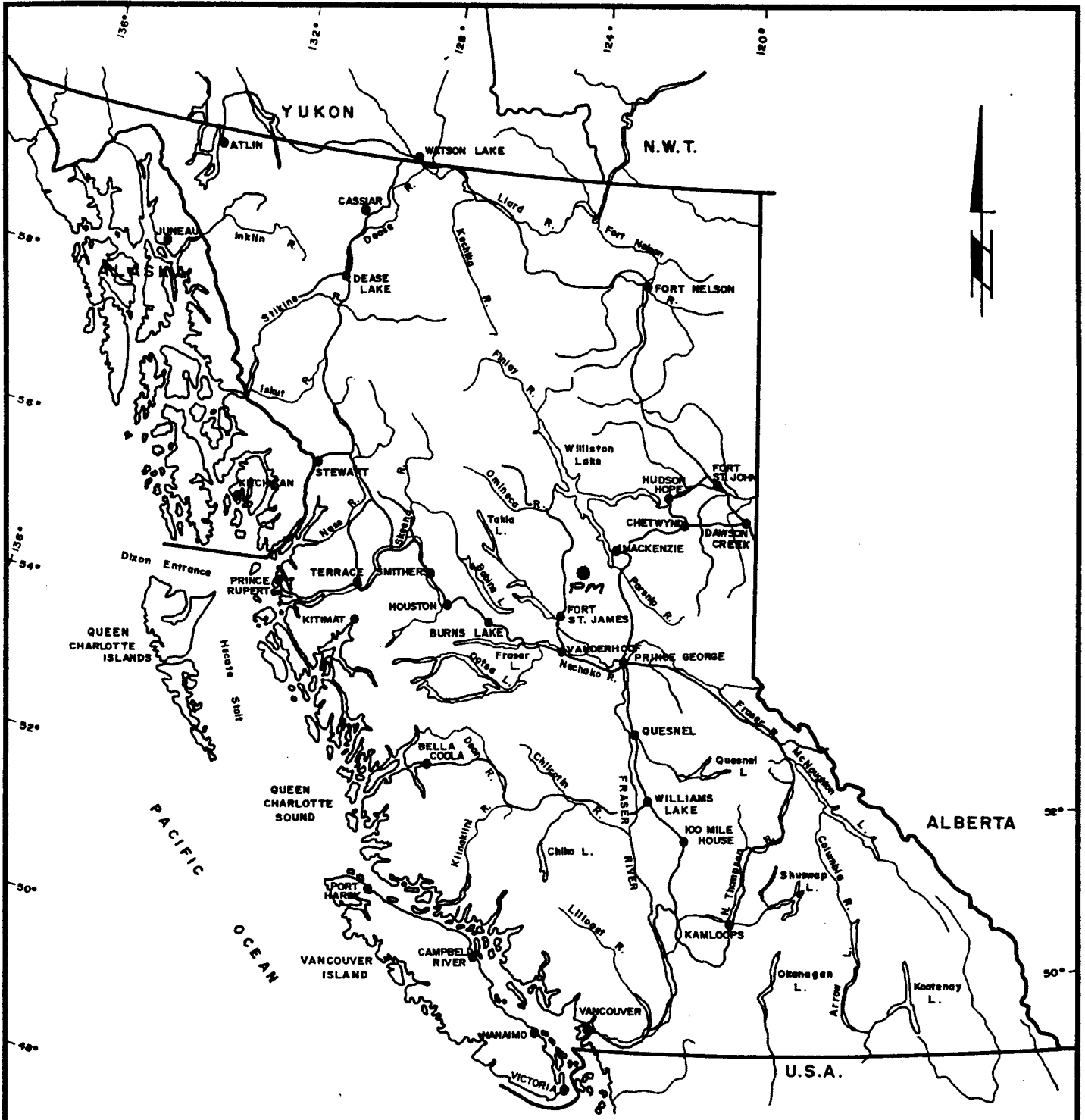
Access is gained by logging roads from Windy Point on Highway #97, 20 km south of Mackenzie.

CLAIMS AND OWNERSHIP:

The property consists of one 20 unit claim staked by Gerry Klein in 1987 and three surrounding claims totalling 56 units staked by Norex in 1989. The property is being explored by Norex under an agreement with Mr. Klein.

The relevant claim information is as follows:

<u>CLAIM NAME</u>	<u>RECORD #</u>	<u>UNITS</u>	<u>RECORD DATE</u>	<u>OWNER</u>
PM	08536	20	June 25, 1987	G. Klein
PM 1	10860	16	July 4, 1989	G. Klein
PM 2	10859	20	July 5, 1989	G. Klein
PM 3	09895	16	July 6, 1989	G. Klein



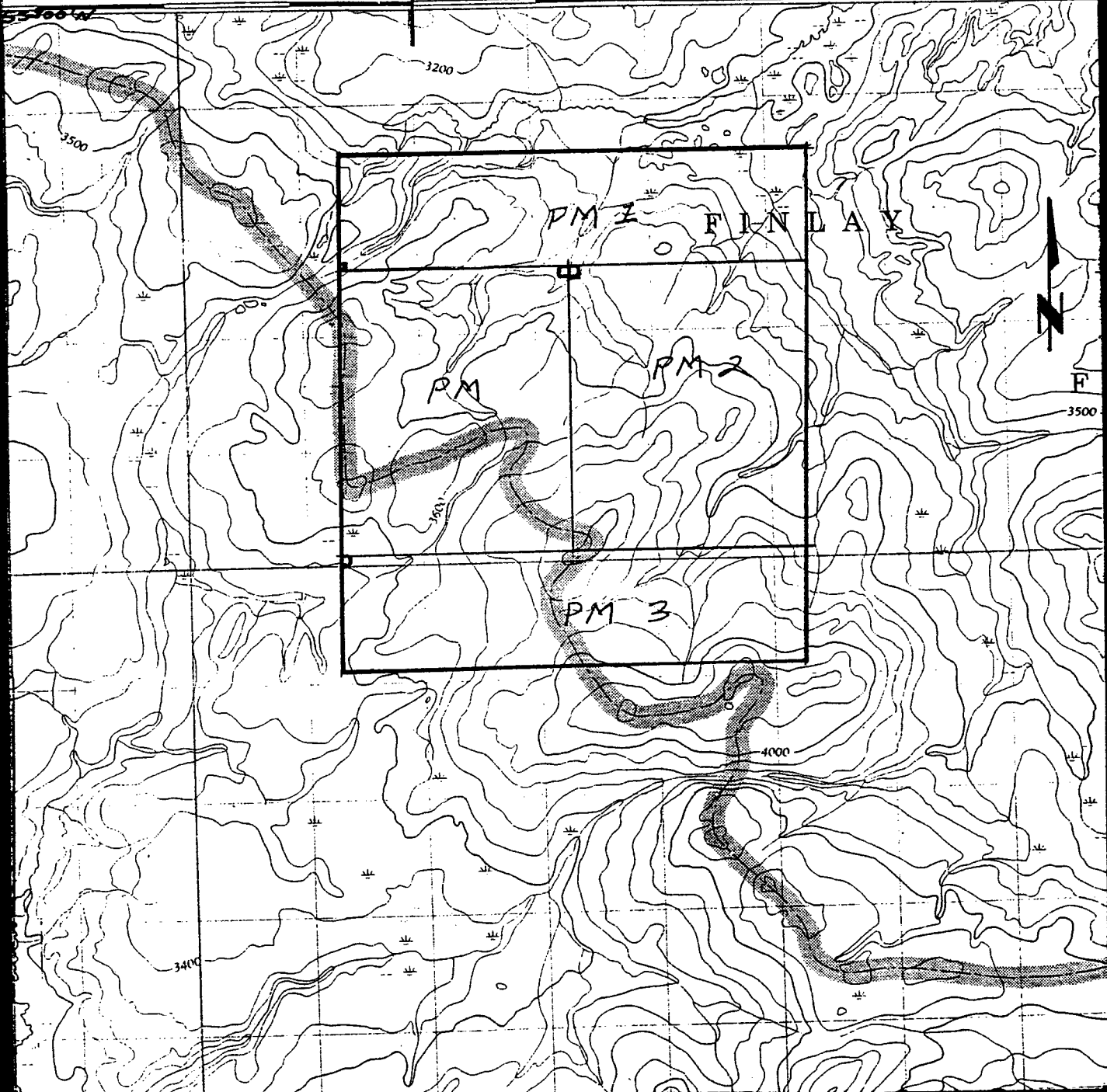
0 100 200 KILOMETRES
SCALE : 1 : 8,000,000

REVISED	<i>PM GROUP</i>	
	<i>LOCATION MAP</i>	
PROJ.No. <u>207</u>	SURVEY BY: _____	DATE: <u>SEPT. 1990</u>
N.T.S. <u>933/13</u>	DRAWN BY: <u>S.K.B.</u>	SCALE: <u>1 : 8,000,000</u>
DWG.No. <u>FIG 1</u>	NORANDA EXPLORATION	
	OFFICE: <u>PRINCE GEORGE, B.C.</u>	

VANCAL 11827

CANADA

19 50 51 123°15' 52 53 54 55 40'



REVISED	PM GROUP
	CLAIM LOCATION MAP
PROJ. No. 287	SURVEY BY: _____ DATE: SEPT / 1990
N.T.S. 935/13	DRAWN BY: _____ SCALE: 1:50,000
DWG. No. FIG 2	NORANDA EXPLORATION OFFICE: PRINCE GEORGE

K O

TOPOGRAPHY AND VEGETATION:

The area is one of moderate relief with elevations ranging from 1125 meters along the west side of the property to 975 meters in the valley near the northeast corner of the property. Hills are rounded and largely drift covered.

Until recently, the area was heavily forested with mature stands of spruce and balsam. Recent clear cutting has left large areas with no timber cover.

In most of the area, soil has developed from glacial drift which varies greatly in depth from less than one meter to in excess of 25 meters.

In the southwest corner of the property, glacial stria indicating a northeasterly movement for ice in that area.

REGIONAL GEOLOGY:

Since most of the area is extensively drift covered, little is really known about the geology. The most detailed published map of the area is G.S.C. Map #1204A, at a scale of 1:253,440. This mapping indicates the area of the PM claim is probably underlain by rocks of the Wolverine Complex (granitoid gneiss, micaceous, garnetiferous chloritic schists, pegmatite, feldsparthized quartzite, etc.). This mapping also indicates a series of northwest and northeast trending fault structures that form fault bounded rhombohedral shaped blocks.

LOCAL GEOLOGY:

Observations made during the 1989 follow-up surveys suggests that at least the northwest half of the property is underlain by Jurassic-Triassic rocks of the Takla Group. Outcrops of andesitic flows and volcanoclastics typical of the Takla Group are quite numerous in this area.

PREVIOUS WORK:

The only record of previous work on the property are the geochem sampling programs carried out by Noranda in 1988 and 1989, plus boulder prospecting by G. Klein in 1987.

Small scale placer mining has been attempted in the Philip Creek Valley north of this claim.

GEOPHYSICAL SURVEY

In late November of 1989, 86 line km of Dighem IV electromagnetic/resistivity/magnetic/VLF survey was flown over the PM group using 200 m spaced E-W flight lines and nominal EM bird heights of 30 metres.

Details of the survey logistics, equipment, specifications and anomalies detected are given in Appendix III by Paul J. Gudjurgis of Dighem Surveys and Processing Inc.

Significant results worthy of note in relationship to the source of the Norex geochem anomalies and the mineralized boulders are: i) the circular magnetic high feature in the central portion of the claim group and roughly coincident resistivity low, ii) the linear NE trending resistivity low on the north flank of i) and, iii) the strong NE to ENE and NW breaks in the magnetic pattern particularly in the NW quadrant of the survey area (see figures 4 and 6).

In particular feature ii) underlies the Cu soil geochemical anomalies and at its NE end the up ice locus of the Cu-Mo-Au mineralized boulders. This together with its occurrence on the flank of the 'magnetic doughnut' (interpreted by Dighem as suggesting a magnetite auriol around an intrusive) highlights this feature as a possible mineralized shear zone.

RECOMMENDATIONS

Detailed geologic mapping, magnetometer and IP surveys should be carried out along the northern flank of the magnetic doughnut especially in the vicinity of the linear resistivity low. In addition more reconnaissance geochem sampling and prospecting is recommended around the southern parts of this magnetic feature.

APPENDIX I

STATEMENT OF QUALIFICATIONS

I, Terence Walker, of Saskatoon, Saskatchewan, hereby certify that:

1. I am a graduate of University College, London with a B.Sc. degree in Geology (1968) and a graduate of McGill University, Montreal with an M.Sc. in Mineral Exploration (1978).
2. I have practiced my profession with various mining companies in Europe and North America since graduation.
3. I am currently employed as a contract Geologist working for Noranda Exploration Company, Limited.
4. I am a member of the Canadian Institute of Mining and Metallurgy, the Geological Association of Canada, the Prospectors and Developers Associations and the British Columbia and Yukon Chamber of Mines.
5. The information contained in this report is based on published and unpublished reports on the property and surrounding area, and on work done by Noranda since 1988.
6. I have no current interest in the property.



Terence Walker
Consulting Geologist
Walker Geological Services Inc.

APPENDIX II
STATEMENT OF COSTS

A) DIGHEM SURVEY:

Data Acquisition	86 km @ \$61/km	\$ 5,246.00
Data Processing	86 km @ \$20/km	\$ 1,720.00
Interpretation, Maps, etc.		<u>\$ 1,700.00</u>
	Sub-Total:	\$ 8,666.00

B) ASSESSMENT REPORT PREPARATION:

Drafting		\$ 70.00
Typing		\$ 60.00
Author		<u>\$ 225.00</u>
	Sub-Total:	\$ 355.00

TOTAL COSTS: \$ 9,021.00

APPENDIX III
DIGHEM IV SURVEY

Report #1077

DIGHEM^{IV} SURVEY
FOR
NORANDA EXPLORATION COMPANY, LIMITED
PM AREA, BRITISH COLUMBIA

NTS 93J/13

DIGHEM SURVEYS & PROCESSING INC.
MISSISSAUGA, ONTARIO
January 2, 1990

Paul J. Gudjurgis
Geophysicist

CONTENTS

	<u>Section</u>
INTRODUCTION	1
SURVEY EQUIPMENT	2
PRODUCTS AND PROCESSING TECHNIQUES	3
SURVEY RESULTS	4
GENERAL DISCUSSION	4- 1
CONDUCTORS IN THE SURVEY AREAS	4-16
BACKGROUND INFORMATION	5
ELECTROMAGNETICS	5- 1
MAGNETICS	5-23
VLF	5-26
CONCLUSIONS AND RECOMMENDATIONS	6
APPENDICES	
A. List of Personnel	
B. Statement of Cost	
C. Statement of Qualifications	
D. EM Anomaly List	

SUMMARY

This report describes the logistics and results of a DIGHEM^{IV} airborne geophysical survey carried out for Noranda Exploration Company, Limited, over the PM block in the Fort St. James area, British Columbia. The survey consisted of 86 km of coverage and was flown on November 20, 1989.

The purpose of the survey was to detect zones of conductive mineralization and to provide information that could be used to map the geology and structure of the survey area. This was accomplished by using a DIGHEM^{IV} multi-coil, multi-frequency electromagnetic system, supplemented by a high sensitivity Cesium magnetometer and a two-channel VLF receiver. The information from these sensors was processed to produce maps which display the magnetic and conductive properties of the survey area.

The EM survey detected several conductors of possible bedrock origin.

Areas of interest may be assigned priorities on the basis of supporting geophysical, geochemical and/or geological information. After initial investigations have been carried out, it may be necessary to re-evaluate the remaining anomalies based on information acquired from the follow-up program.

INTRODUCTION

A DIGHEM^{IV} electromagnetic/resistivity/magnetic/VLF survey was flown for Noranda Exploration Company, Limited, on November 20, 1989, over the PM block in the Fort St. James area of British Columbia. The survey area is located on NTS map sheet 93J/13.

Survey coverage over the PM block consisted of approximately 86 line-km. Flight lines were flown east-west with a line separation of 200 metres.

The survey employed the DIGHEM^{IV} electromagnetic system. Ancillary equipment consisted of a magnetometer, radio altimeter, video camera, analog and digital recorders, a VLF receiver and an electronic navigation system. Details on the survey equipment are given in Section 2.

The instrumentation was installed in an Aerospatiale AS350B turbine helicopter (Registration CG-FHP) which was provided by Frontier Helicopters Ltd. The helicopter flew with an EM bird height of approximately 30 m.

Section 2 also provides details on the data channels, their respective sensitivities, and the navigation/flight path recovery procedure. Noise levels of less than 2 ppm are generally maintained for wind speeds up to 35 km/h. Higher winds may cause the system to be grounded because excessive bird swinging produces difficulties in flying the helicopter. The swinging results from the 5 m² of area which is presented by the bird to broadside gusts.

SURVEY EQUIPMENT

This section provides a brief description of the geophysical instruments used to acquire the survey data:

Electromagnetic System

Model: DIGHEM^{IV}

Type: Towed bird, symmetric dipole configuration operated at a nominal survey altitude of 30 metres. Coil separation is 8 metres for 900 Hz and 7200 Hz; 6.3 metres for 56,000 Hz.

Coil orientations/frequencies: coaxial / 900 Hz
 coplanar/ 900 Hz
 coplanar/ 7,200 Hz
 coplanar/56,000 Hz

Channels recorded: 4 inphase channels
 4 quadrature channels
 2 monitor channels

Sensitivity: 0.2 ppm at 900 Hz
 0.4 ppm at 7,200 Hz
 1.0 ppm at 56,000 Hz

Sample rate: 10 per second

The electromagnetic system utilizes a multi-coil coaxial/coplanar technique to energize conductors in different directions. The coaxial transmitter coil is vertical with its axis in the flight direction. The coplanar coils are horizontal. The secondary fields are sensed simultaneously by means of receiver coils which are maximum coupled to their respective transmitter coils. The system yields an inphase and a quadrature channel from each transmitter-receiver coil-pair.

Magnetometer

Model: Picodas 3340
Type: Optically pumped Cesium vapour
Sensitivity: 0.01 Nt
Sample rate: 10 per second

The magnetometer sensor is towed in a bird 15 m below the helicopter.

Magnetic Base Station

Model: Geometrics G-826A
Type: Digital recording proton precession
Sensitivity: 0.50 Nt
Sample rate: 0.2 per second

An Epson recorder is operated in conjunction with the base station magnetometer to record the diurnal variations of the earth's magnetic field. The clock of the base station is synchronized with that of the airborne system to permit subsequent removal of diurnal drift.

VLF System

Manufacturer: Herz Industries Ltd.
Type: Totem-2A
Sensitivity: 0.1%
Stations: Annapolis, Maryland; NSS, 21.4 Khz
Cutler, Maine; NAA, 24.0 Khz

The VLF receiver measures the total field and vertical quadrature components of the secondary VLF field. Signals from two separate transmitters can be measured simultaneously. The VLF sensor is towed in a bird 10 m below the helicopter.

Radio Altimeter

Manufacturer: Honeywell/Sperry
Type: AA 220
Sensitivity: 1 ft

The radio altimeter measures the vertical distance between the helicopter and the ground. This information is used in the processing algorithm which determines conductor depth.

Analog Recorder

Manufacturer:	RMS Instruments
Type:	GR33 dot-matrix graphics recorder
Resolution:	4x4 dots/mm
Speed:	1.5 mm/sec

The analog profiles were recorded on chart paper in the aircraft during the survey. Table 2-1 lists the geophysical data channels and the vertical scale of each profile.

Digital Data Acquisition System

Manufacturer:	RMS Instruments
Type:	DAS-8
Tape Deck:	RMS TCR-12, 6400 bpi, tape cartridge recorder

The digital data were used to generate several computed parameters. Both measured and computed parameters were plotted as "digital profiles" during data processing. These parameters are shown in Table 2-2.

In Table 2-2, the log resistivity scale of 0.06 decade/mm means that the resistivity changes by an order of magnitude in 16.5 mm. The resistivities at 0, 33 and 67 mm up from the bottom of the digital profile are respectively 1, 100 and 10,000 ohm-m.

Table 2-1. The Analog Profiles

Channel Name	Parameter	Scale units/mm	Designation on digital profile
CX1I	coaxial inphase(900 Hz)	2.5 ppm	CXI (900 Hz)
CX1Q	coaxial quad(900 Hz)	2.5 ppm	CXQ (900 Hz)
CP2I	coplanar inphase(900 Hz)	2.5 ppm	CPI (900 Hz)
CP2Q	coplanar quad(900 Hz)	2.5 ppm	CPQ (900 Hz)
CP3I	coplanar inphase(7200 Hz)	5 ppm	CPI (7200 Hz)
CP3Q	coplanar quad(7200 Hz)	5 ppm	CPQ (7200 Hz)
CP4I	coplanar inphase(56000 Hz)	20 ppm	CPI (56000 Hz)
CP4Q	coplanar quad(56000 Hz)	20 ppm	CPQ (56000 Hz)
ALT	altimeter	3 m	ALT
VF1T	VLF-total: primary stn.	5%	
VF1Q	VLF-quad: primary stn.	5%	
VF2T	VLF-total: secondary stn.	5%	
VF2Q	VLF-quad: secondary stn.	5%	
CMGC	magnetics, coarse	20 Nt	MAG
CMGF	magnetics, fine	2 Nt	
CXSP	coaxial spherics monitor		
CXPL	coaxial powerline monitor		
CPPL	coplanar powerline monitor		

Table 2-2. The Digital Profiles

Channel Name (Freq)	Observed parameters	Scale units/mm
MAG	magnetics	10 Nt
ALT	bird height	6 m
CXI	(900 Hz)vertical coaxial coil-pair inphase	2 ppm
CXQ	(900 Hz)vertical coaxial coil-pair quadrature	2 ppm
CXS	ambient noise monitor (coaxial receiver)	
CPI	(900 Hz)horizontal coplanar coil-pair inphase	2 ppm
CPQ	(900 Hz)horizontal coplanar coil-pair quad	2 ppm
CPI	(7200 Hz)horizontal coplanar coil-pair inphase	4 ppm
CPQ	(7200 Hz)horizontal coplanar coil-pair quad	4 ppm
CPI	(56000 Hz)horizontal coplanar coil-pair inphse	10 ppm
CPQ	(56000 Hz)horizontal coplanar coil-pair quad	10 ppm
CXS	coaxial spherics monitor	
CXPL	coaxial powerline monitor	
CPPL	coplanar powerline monitor	

Computed Parameters

RES	(900 Hz)log resistivity	.06 decade
RES	(7200 Hz)log resistivity	.06 decade
RES	(56000 Hz)log resistivity	.06 decade
DP	(900 Hz)apparent depth	6 m
DP	(7200 Hz)apparent depth	6 m
DP	(56000 Hz)apparent depth	6 m

Tracking Camera

Type: Panasonic Video
Model: AG 2400/WVCD132

Fiducial numbers are recorded continuously and are displayed on the margin of each image. This procedure ensures accurate correlation of analog and digital data with respect to visible features on the ground.

Navigation System

Model: Del Norte 547
Type: UHF electronic positioning system
Sensitivity: 1 m
Sample rate: 0.5 per second

The navigation system uses ground based transponder stations which transmit distance information back to the helicopter. The ground stations are set up well away from the survey area and are positioned such that the signals cross the survey block at an angle between 30° and 150°. After site selection, a baseline is flown at right angles to a line drawn through the transmitter sites to establish an arbitrary coordinate system for the survey area. The onboard Central Processing Unit takes any two transponder distances and determines the helicopter position relative to these two ground stations in cartesian coordinates.

The cartesian coordinates are transformed to UTM coordinates during data processing. This is accomplished by correlating a number of prominent topographical locations with the navigational data points. The use of numerous visual tie points serves two purposes: to accurately relate the navigation data to the map sheet and to minimize location errors which might result from distortions in uncontrolled photomosaic base maps.

PRODUCTS AND PROCESSING TECHNIQUES

The following products are available from the survey data. Those which are not part of the survey contract may be acquired later. Refer to Table 3-1 for a summary of the maps which accompany this report, some of which may be sent under separate cover. Most parameters can be displayed as contours, profiles, or in colour.

Base Maps

Base maps of the survey area have been prepared from published topographic maps although photomosaics can also be used. Topographic maps provide an accurate, distortion-free base which facilitates correlation of the navigation data to the UTM grid. Photomosaics are useful for visual reference and for subsequent flight path recovery, but usually contain scale distortions. Orthophotos are ideal, but their cost and the time required to produce them, usually precludes their use as base maps.

Electromagnetic Anomalies

Anomalous electromagnetic responses are selected and analyzed by computer to provide a preliminary electromagnetic anomaly map. This preliminary EM map is used, by the geophysicist, in conjunction with the computer-generated digital profiles, to produce the final interpreted EM anomaly map. This map includes bedrock, surficial and cultural conductors. A map containing only bedrock conductors can be generated, if desired.

Table 3-1 Survey Map Products

Products for the PM survey block include one transparency^{*} and two paper prints of each block for each parameter at a scale of 1:10,000:

Dighem EM anomaly map	1 sheet
total field magnetic contour map	"
apparent resistivity contour map (900 Hz)	"
apparent resistivity contour map (7200 Hz)	"
apparent resistivity contour map (56000 Hz)	"

* Not related with electromagnetic

two coloured maps* at a scale of 1:10,000 of each block for each of the following parameters:

total field magnetics	1 sheet
apparent resistivity (900 Hz)	"
apparent resistivity (7200 Hz)	"
apparent resistivity (56000 Hz)	"

In addition to the above, the geophysical data are also presented as distance-based profiles (1:10,000) which have been generated from the digital data. The gridded data for the contoured parameters are also supplied on workstation compatible diskettes.

Resistivity

The apparent resistivity in ohm-m may be generated from the inphase and quadrature EM components for any of the frequencies, using a pseudo-layer halfspace model. A resistivity map portrays all the EM information for that frequency over the entire survey area. This contrasts with the electromagnetic anomaly map which provides information only over interpreted conductors. The large dynamic range makes the resistivity parameter an excellent mapping tool.

EM Magnetite

The apparent percent magnetite by weight is computed wherever magnetite produces a negative inphase EM response.

Total Field Magnetics

The aeromagnetic data are corrected for diurnal variation using the magnetic base station data. The regional IGRF gradient is removed from the data, if required under the terms of the contract.

Enhanced Magnetics

The total field magnetic data are subjected to a processing algorithm. This algorithm enhances the response of magnetic bodies in the upper 500 m and attenuates the response of deeper bodies. The resulting enhanced magnetic map provides better definition and resolution of near-surface magnetic units. It also identifies weak magnetic features which may not be evident on the total field magnetic map. However, regional magnetic variations, and magnetic lows caused by remanence, are better defined on the total field magnetic map. The technique is described in more detail in Section 5.

Magnetic Derivatives

The total field magnetic data may be subjected to a variety of filtering techniques to yield maps of the following:

- vertical gradient (first vertical derivative)
- second vertical derivative
- magnetic susceptibility with reduction to the pole
- upward/downward continuations

All of these filtering techniques improve the recognition of near-surface magnetic bodies, with the exception of upward continuation. Any of these parameters can be produced on request. Dighem's proprietary enhanced magnetic technique is designed to provide a general "all-purpose" map, combining the more useful features of the above parameters.

VLF

The VLF data are digitally filtered to remove long wavelengths such as those caused by variations in the transmitted field strength.

Digital Profiles

Distance-based profiles of the digitally recorded geophysical data are generated and plotted by computer. These profiles also contain the calculated parameters which are used in the interpretation process. These are produced as worksheets prior to interpretation, and can also be presented in the final corrected form after interpretation. The profiles display electromagnetic anomalies with their respective interpretive symbols. The differences between the worksheets and the final corrected form occur only with respect to the EM anomaly identifier.

Contour, Colour and Shadow Map Displays

The geophysical data are interpolated onto a regular grid using a cubic spline technique. The resulting grid is suitable for generating contour maps of excellent quality.

Colour maps are produced by interpolating the grid down to the pixel size. The parameter is then incremented with respect to specific amplitude ranges to provide colour "contour" maps.

Monochromatic shadow maps are generated by employing an artificial sun to cast shadows on a surface defined by the geophysical grid. There are many variations in the shadowing technique. The various shadow techniques may be applied to total field or enhanced magnetic data, magnetic derivatives, VLF, resistivity, etc. Of the various magnetic products, the shadow of the enhanced magnetic parameter is particularly suited for defining geological structures with crisper images and improved resolution.

SURVEY RESULTS

GENERAL DISCUSSION

The survey results are presented on separate map sheets for each parameter at a scale of 1:10,000. Tables 4-1a and 4-1b summarize the EM responses with respect to conductance grade and interpretation for the PM survey block.

The anomalies shown on the electromagnetic anomaly maps are based on a near-vertical, half plane model. This model best reflects "discrete" bedrock conductors. Wide bedrock conductors or flat-lying conductive units, whether from surficial or bedrock sources, may give rise to very broad anomalous responses on the EM profiles. These may not appear on the electromagnetic anomaly map if they have a regional character rather than a locally anomalous character. These broad conductors, which more closely approximate a half space model, will be maximum coupled to the horizontal (coplanar) coil-pair and should be more evident on the resistivity parameter. Resistivity maps, therefore, may be more valuable than the electromagnetic anomaly maps, in areas where broad or flat-lying conductors are considered to be of importance. Contoured resistivity maps, based on the 900 Hz, 7200 Hz and 56000 Hz coplanar data, are included with this report.

TABLE 4-1a

EM ANOMALY STATISTICS

PM AREA, BRITISH COLUMBIA

CONDUCTOR	CONDUCTANCE RANGE SIEMENS	NUMBER OF RESPONSES
7	> 100.	0
6	50.0 - 100.	0
5	20.0 - 50.	0
4	10.0 - 20.	0
3	5.0 - 10.	0
2	1.0 - 5.0	13
1	< 1.0	9
*	INDETERMINATE	12
TOTAL		34

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
B	DISCRETE BEDROCK CONDUCTOR	1
S	CONDUCTIVE COVER	32
H	ROCK UNIT OR THICK COVER	1
E	EDGE OF WIDE CONDUCTOR	0
TOTAL		34

(SEE EM MAP LEGEND FOR EXPLANATIONS)

Excellent resolution and discrimination of conductors was accomplished by using a fast sampling rate of 0.1 sec and by employing a common frequency (900 Hz) on two orthogonal coil-pairs (coaxial and coplanar). The resulting "difference channel" parameters often permit differentiation of bedrock and surficial conductors, even though they may exhibit similar conductance values.

Zones of poor conductivity are indicated where the inphase responses are small relative to the quadrature responses. Where these responses are coincident with strong magnetic anomalies, it is possible that the inphase amplitudes have been suppressed by the effects of magnetite. Most of these poorly-conductive magnetic features give rise to resistivity anomalies which are only slightly below background. If it is expected that poorly-conductive economic mineralization may be associated with magnetite-rich units, most of these weakly anomalous features will be of interest. In areas where magnetite causes the inphase components to become negative, the apparent conductance values may be understated and the calculated depths of EM anomalies may be erroneously shallow.

Anomalies which occur near the ends of the survey lines (i.e., outside the survey area), should be viewed with caution. Some of the weaker anomalies could be due to aerodynamic noise, i.e., bird bending, which is created by abnormal stresses to which the bird is subjected during the climb and turn of the aircraft between lines. Such aerodynamic noise is usually manifested by an anomaly on the coaxial inphase channel only, although severe stresses can affect the coplanar inphase channels as well.

Magnetics

A Geometrics 826 proton precession magnetometer was operated at the survey base to record diurnal variations of the earth's magnetic field. The clock of the base station was synchronized with that of the airborne system to permit subsequent removal of diurnal drift.

The background magnetic levels have been adjusted to the mean IGRF value for the survey area. However, the IGRF gradient across the survey blocks has not been removed. A common base station has been used for both blocks to ensure accurate levelling of the data.

The total field magnetic data have been presented as contours on the base maps using a contour interval of 5 Nt where gradients permit. The maps show the magnetic properties of the rock units underlying the survey area.

A series of discontinuous, weakly to moderately magnetic bodies which occur along a poorly defined northwest trending zone are notable on the contour map.

Much of the survey block is characterized by subdued magnetic relief and generally weak magnetic anomalies. Some of these weak anomalies appear to be associated with structures. For example, a group of discontinuous, weak anomalies spanning lines 10090 to 10210 form a linear, northeast trend. These magnetic anomalies correlate with EM anomalies which include 10090E, 10210H and 10160H. Conceivably the magnetic anomalies (and correlating EM anomalies) occur along or adjacent to a northeast striking structure.

Two circular magnetic trends are notable. One trend is a magnetic low surrounding a weak positive anomaly centered approximately at fiducial 1180 on line 10180. The other is a positive trend defined by magnetic anomalies correlating with EM anomalies which include 10110J, 10140H, 10160H, 10170E, 10150G. This annular magnetic feature could reflect a contact aureole.

Faults trending north-northeast to northeast and northwest are interpreted to transect the survey area. It should be noted here that disruptions in VLF trends suggest the presence of northeast faulting* .

Resistivity

Resistivity maps, which display the conductive properties of the survey area, were produced from the 900 Hz, 7200 Hz and 56,000 Hz coplanar data.

In areas where several conductors or conductive trends appear to be related to a common geological unit, these have been outlined as "zones" on the EM anomaly maps. These zone outlines usually approximate the limits of conductive units defined by the resistivity contours, but may also be related to possible contacts inferred from the magnetic data. The zones may consist of a single conductive horizon, or may contain numerous banded or segmented conductors.

* VLF data was recorded over the Chuchi and Alpha-PM survey blocks. The VLF results (station NLK for the Alpha-PM area and station NAA for the Chuchi block) have geological utility, and are a recommended survey product.

These zones can be quite extensive and often reflect "formational" conductors which may be of minor interest as direct exploration targets. However, attention may be focused on areas where these zones appear to be faulted or folded or where anomaly characteristics differ along strike.

The PM area is fairly conductive, reflecting swampy conditions in this region of the Nechako Plateau. Apparent resistivities less than 500 ohm-m are observed over much of the survey block at all three frequencies. Some, but not all, of the discrete resistivity low zones correlate with streams flowing through the area. For example, a stream in the southeast corner of the survey block is associated with a fairly broad zone of low resistivity (apparent resistivities less than 200 ohm-m at 7200 Hz).

The NLK inphase contour map complements the EM and resistivity maps and displays reasonably coherent trends. These trends could be of geological interest in spite of their apparent surficial origin; some could reflect underlying faults/contacts.

Electromagnetics

The EM anomalies resulting from this survey appear to fall within one of three general categories. The first type consists of discrete, well-defined anomalies which yield marked inflections on the difference channels. These anomalies are usually attributed to conductive sulphides or graphite and are generally given a "B", "T" or "D" interpretive symbol, denoting a bedrock source.

The second class consists of moderately well-defined quadrature responses which coincide with low amplitude or negative polarity inphase responses. The positive quadrature is attributed to poorly conductive material which overlies, or is associated with, a magnetite-rich host. These anomalies often yield very weak conductance values but show moderate to strong magnetic correlation. Interpretive symbols may vary from "B?" to "S?".

The third class of anomalies comprises broad responses which exhibit the characteristics of a half space and do not yield well-defined inflections on the difference channels. Anomalies in this category are usually given an "S" or "H" interpretive symbol. The lack of a difference channel response usually implies a broad or flat-lying conductive source such as overburden.

The effects of conductive overburden are evident over portions of the survey area. Although the difference channels (DIFI and DIFQ) are extremely valuable in detecting bedrock conductors which are partially masked by conductive overburden, sharp undulations in the bedrock/overburden interface can yield anomalies in the difference channels which may be interpreted as possible bedrock conductors. Such anomalies usually fall into the "S?" or "B?" classification but may also be given an "E" interpretive symbol, denoting a resistivity contrast at the edge of a conductive unit.

In areas where EM responses are evident primarily on the quadrature components, zones of poor conductivity are indicated. Where these responses are coincident with magnetic anomalies, it is possible that the inphase component amplitudes have been suppressed by the effects of magnetite. Most of these poorly-conductive magnetic features give rise to resistivity anomalies which are only slightly below background. If it is expected that poorly-conductive economic mineralization may be associated with magnetite-rich units, most of these weakly anomalous features will be of interest. In areas where magnetite causes the inphase components to become negative, the apparent conductance and depth of EM anomalies may be unreliable.

As economic mineralization within the area may be associated with massive to weakly disseminated sulphides, which may or may not be hosted by magnetite-rich rocks, it is difficult to assess the relative merits of EM anomalies on the basis of conductance. It is recommended that an attempt be made to compile a suite of geophysical "signatures" over areas of interest. Anomaly characteristics are clearly defined on the computer-processed geophysical data profiles which are supplied as one of the survey products.

Even weak conductors may be of economic significance in this survey area. A complete assessment and evaluation of the survey data should be carried out by one or more qualified professionals who have access to, and can provide a meaningful compilation of, all available geophysical, geological and geochemical data.

CONDUCTORS IN THE SURVEY AREA

A number of weak conductive responses are observed on the survey block. Many are broad, surficial features of no exploration interest.

Anomalies 10090E-10100F, 10100H,
10110H-10120H, 10150G, 10160G, 10160H and
10180F

The anomalies in this group are isolated and discontinuous. One anomaly in this group, 10100H, is interpreted as a possible bedrock (B?) feature. Anomaly 10100H displays inphase and quadrature coaxial response near the noise level and must therefore be viewed with caution. It does, however, lie along a weak VLF trend.

The remaining anomalies are interpreted to fall in the "S?" category. A number of these EM anomalies show direct or close correlation with magnetic anomalies, and most are fairly sharp.

Anomalies 10090E-10100F show direct correlation with a discrete magnetic anomaly and lie along a weak VLF trend. They are a potential ground follow-up target. However, they lie within the Finlay Provincial Forest as do the other anomalies located to the northeast.

Other anomalies having direct magnetic correlation include 10150G, 10160G and 10160H. As discussed previously, in the Magnetics Section, it is possible that a number of the anomalies lie adjacent to a northeast trending structure which can be interpreted from the magnetic contours.

CONCLUSIONS AND RECOMMENDATIONS

This report provides a very brief description of the survey results and describes the equipment, procedures and logistics of the survey.

The survey was successful in locating several conductors of interest. The various maps included with this report display the magnetic and conductive properties of the survey area. It is recommended that the survey results be reviewed in detail, in conjunction with all available geophysical, geological and geochemical information. Particular reference should be made to the computer generated data profiles which clearly define the characteristics of the individual anomalies.

The conductors detected by the survey show some variations in magnetic correlation, strike length and conductance. It is obvious that the causative sources may also be variable.

Weak and poorly defined conductors, some of which appear to transect the local geological strike, may reflect faults or shears. Such structural breaks are considered to be of particular interest as they may have influenced mineral deposition within the survey areas. For the same reason, any anomalies which appear to be associated with structural deformation, should be considered potential target areas.

It is also recommended that additional processing of existing geophysical data be considered, in order to extract the maximum amount of information from the survey results. Colour maps and enhanced shadow maps often provide valuable information on structure and lithology, which may not be clearly evident on the contour maps. Current processing techniques can yield images which define subtle, but significant, structural details.

Respectfully submitted,

DIGHEM SURVEYS & PROCESSING INC.

Paul J. Gudjurgis
Geophysicist

PJG/sdp

APPENDIX A

LIST OF PERSONNEL

The following personnel were involved in the acquisition, processing, interpretation and presentation of data, relating to a DIGHEM^{IV} airborne geophysical survey carried out for Noranda Exploration Company, Limited in the Fort St. James area of British Columbia.

Steve Kilty	Vice President, Operations
Dave Pritchard	Survey Operations Supervisor
Philip Miles	Geophysical Operator
Dave Miles	Second Geophysical Operator
Ben Rook	Pilot (Frontier Helicopters Ltd.)
Gord Smith	Data Processing Supervisor
Paul Gudjurgis	Geophysicist/Interpreter
R. Zimmermann	Drafting Supervisor
Susan Pothiah	Word Processing Operator

The survey consisted of 26 km of coverage over the PM block, flown on November 20, 1989.

All personnel are employees of Dighem Surveys & Processing Inc., except for the pilot who is an employee of Frontier Helicopters Ltd.

DIGHEM SURVEYS & PROCESSING INC.

Paul J. Gudjurgis
Geophysicist

PJG/sdp

Ref: Report #1077

APPENDIX C

STATEMENT OF QUALIFICATIONS

I, Paul J. Gudjurgis of the City of Brampton, Province of Ontario, do hereby certify that:

1. I am a geophysicist, residing at 6 Core Crescent, Brampton, Ontario L6W 2G7.
2. I have an M.Sc. in Physics from the University of Alberta (1971).
3. I have been actively engaged in geophysical exploration since 1972.
4. I am presently employed by Dighem Surveys & Processing Inc., I-POWER division.
5. The statements made in this report represent my best opinion and judgment.

Dated at Mississauga this 2nd day of January, 1990.

Paul J. Gudjurgis
Geophysicist

PJG/sdp

L.10230
L.10220
L.10210
L.10200
L.10190
L.10180
L.10170
L.10160
L.10150
L.10140
L.10130
L.10120
L.10110
L.10100
L.10090
L.10080



CONTOUR LEVELS

Contours in ohm-m
at 10 intervals per decade

**GEOLOGICAL BRANCH
ASSESSMENT REPORT**

20,311

FLIGHT LINES WITH EM ANOMALIES

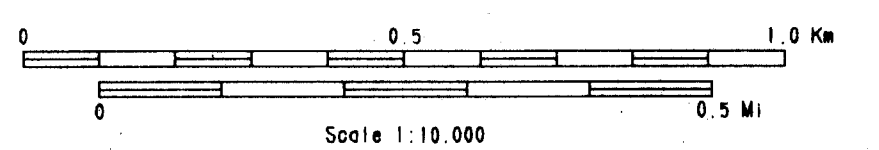
Grade	Anomaly	Conductance
7	●	≥ 100 siemens
6	●	50-100 siemens
5	●	20-50 siemens
4	⊙	10-20 siemens
3	⊙	5-10 siemens
2	⊙	1-5 siemens
1	⊙	< 1 siemens
-	*	Questionable anomaly

Anomaly identifier	Interpretive symbol	Interpretive symbol	Conductor ('model')
●	B	B	Bedrock conductor
⊙	D	D	Narrow bedrock conductor ('thin dike')
⊙	S	S	Conductive cover ('horizontal thin sheet')
⊙	H	H	Broad conductive rock unit, deep conductive weathering, thick conductive cover ('half space')
⊙	E	E	Edge of broad conductor ('edge of half space')
⊙	L	L	Culture, e.g. power line, building, fence

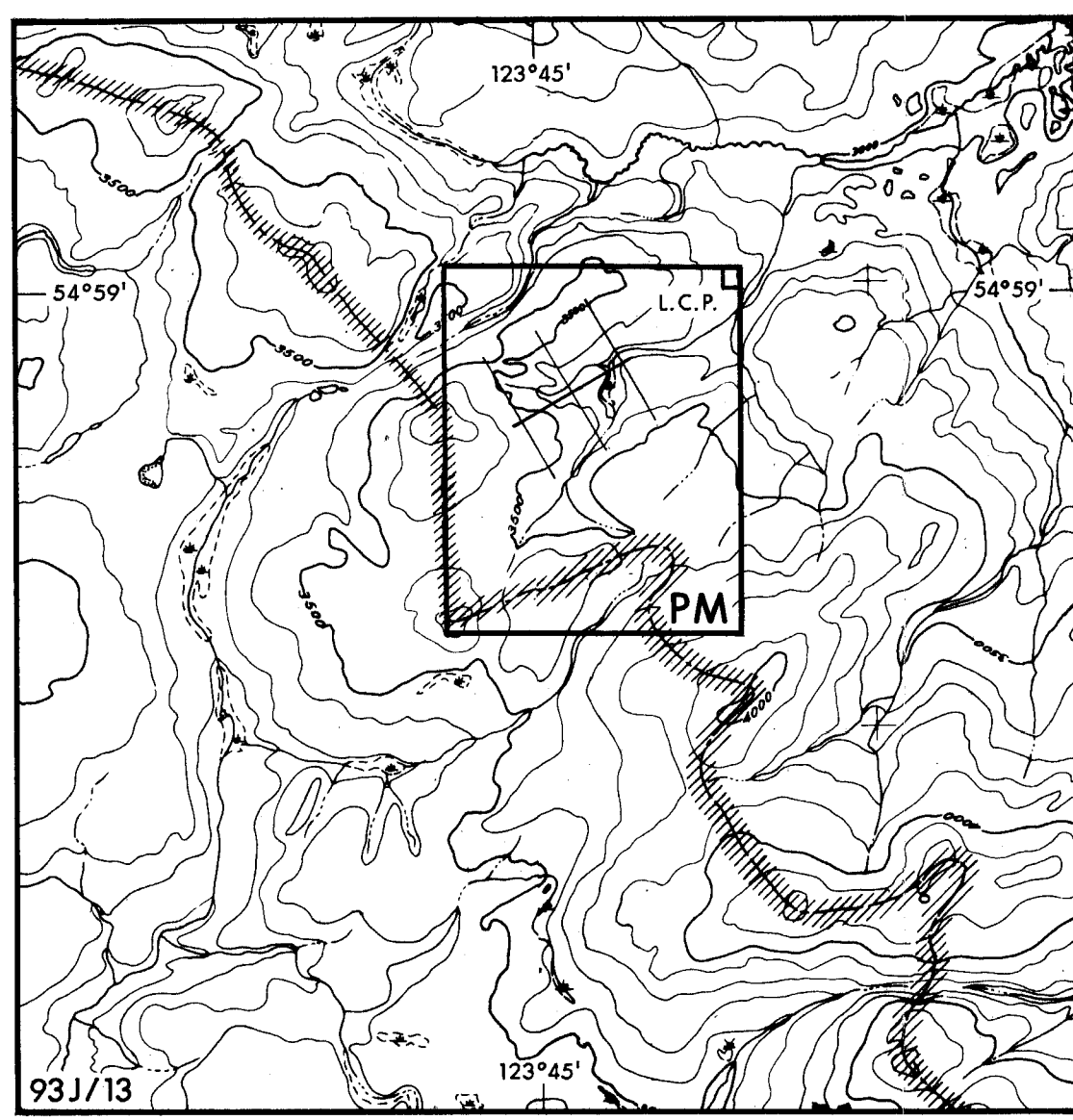
Depth is greater than:
 15 m ... 5 ppm
 30 m ... 10 ppm
 45 m ... 15 ppm
 60 m ... 20 ppm

Inphase and Quadrature of coaxial coil is greater than:
 5 ppm
 10 ppm
 15 ppm
 20 ppm

L.10050
L.10040



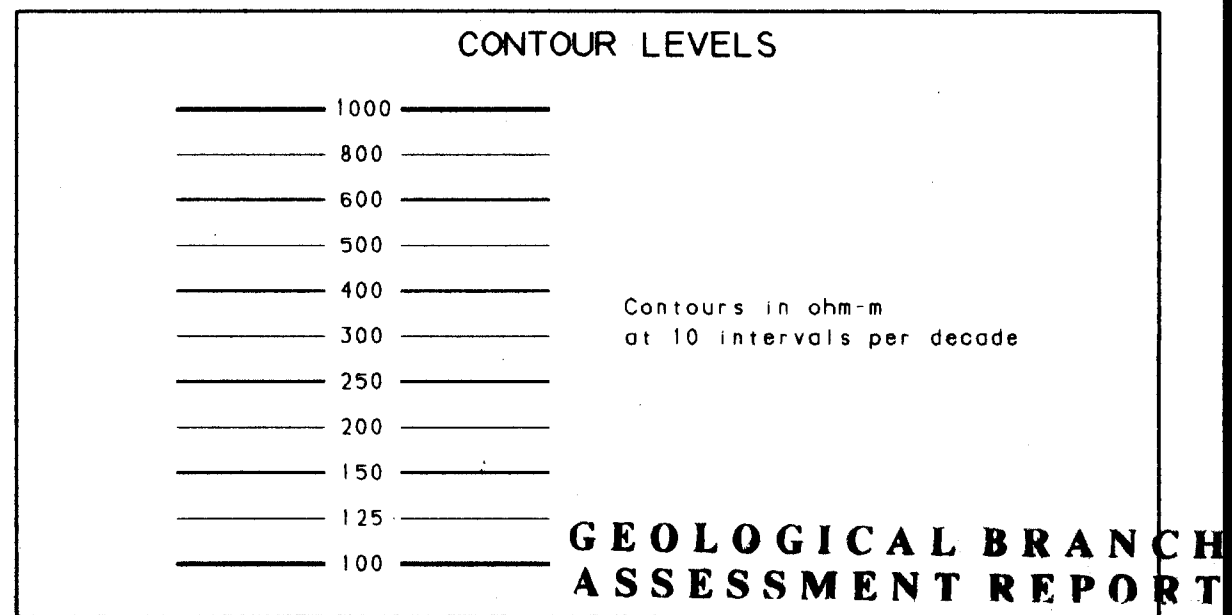
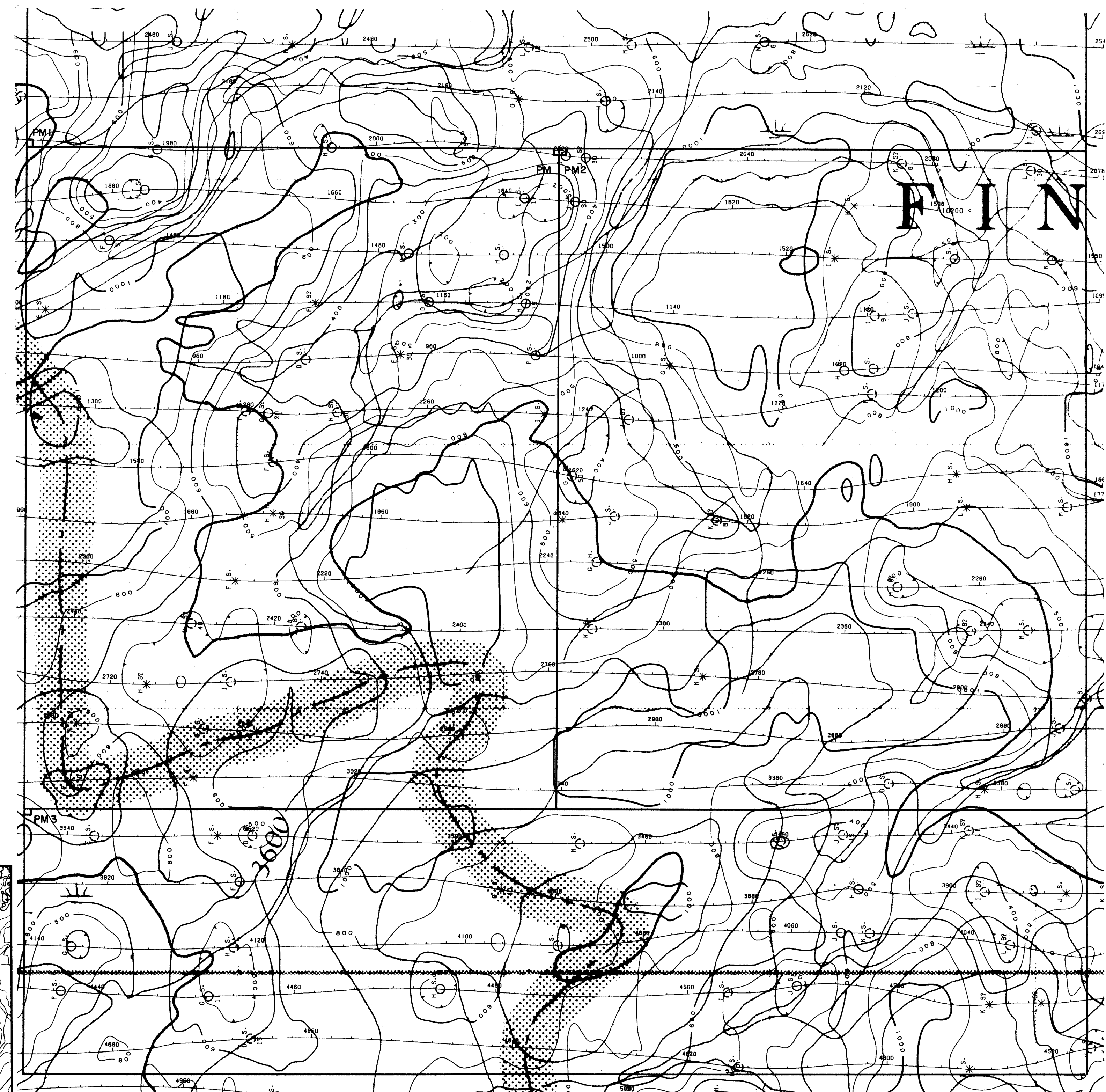
LOCATION MAP



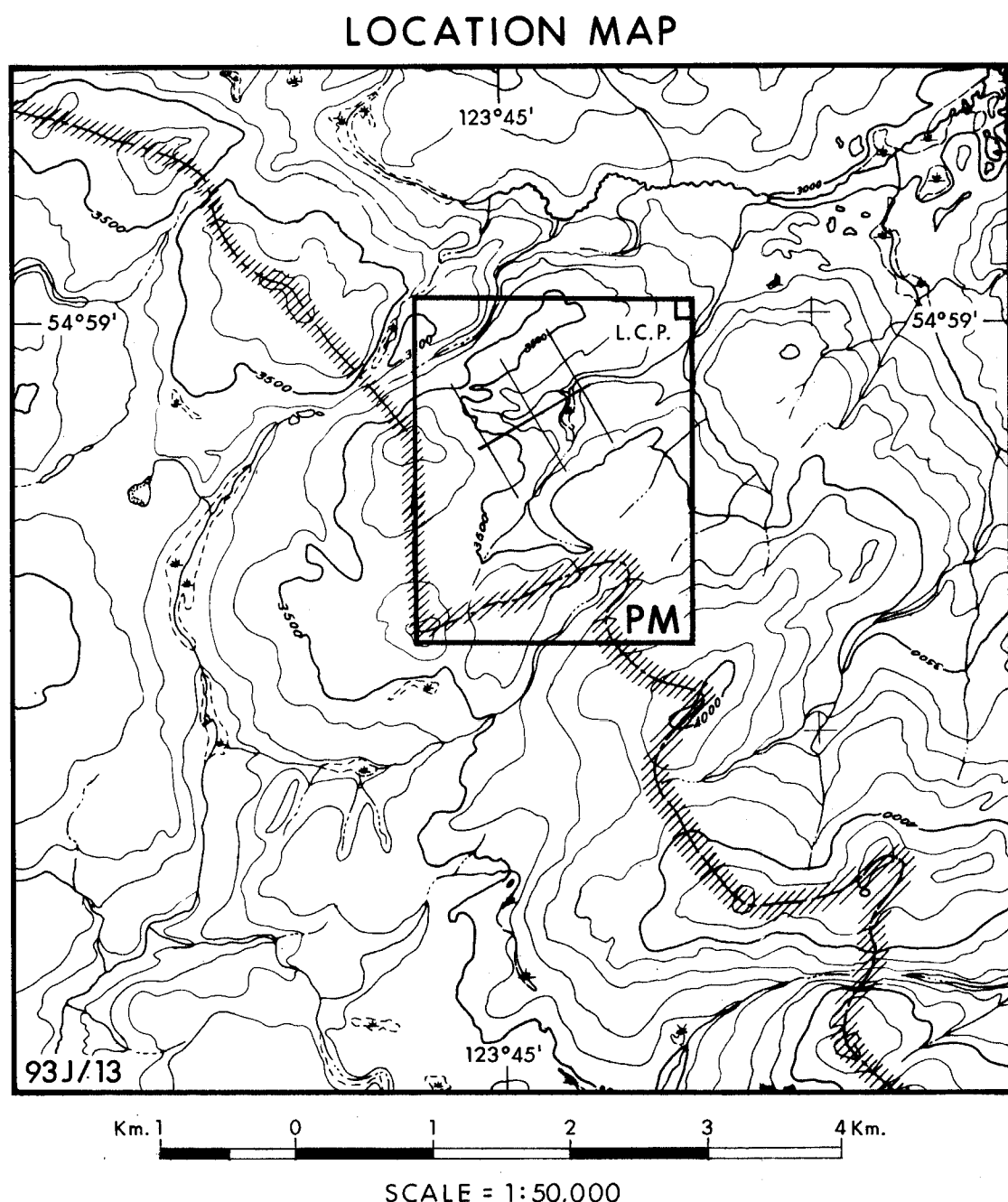
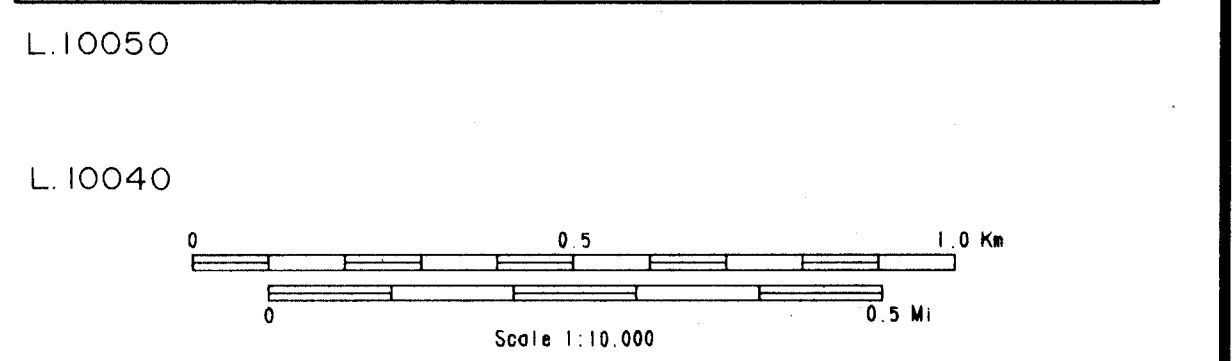
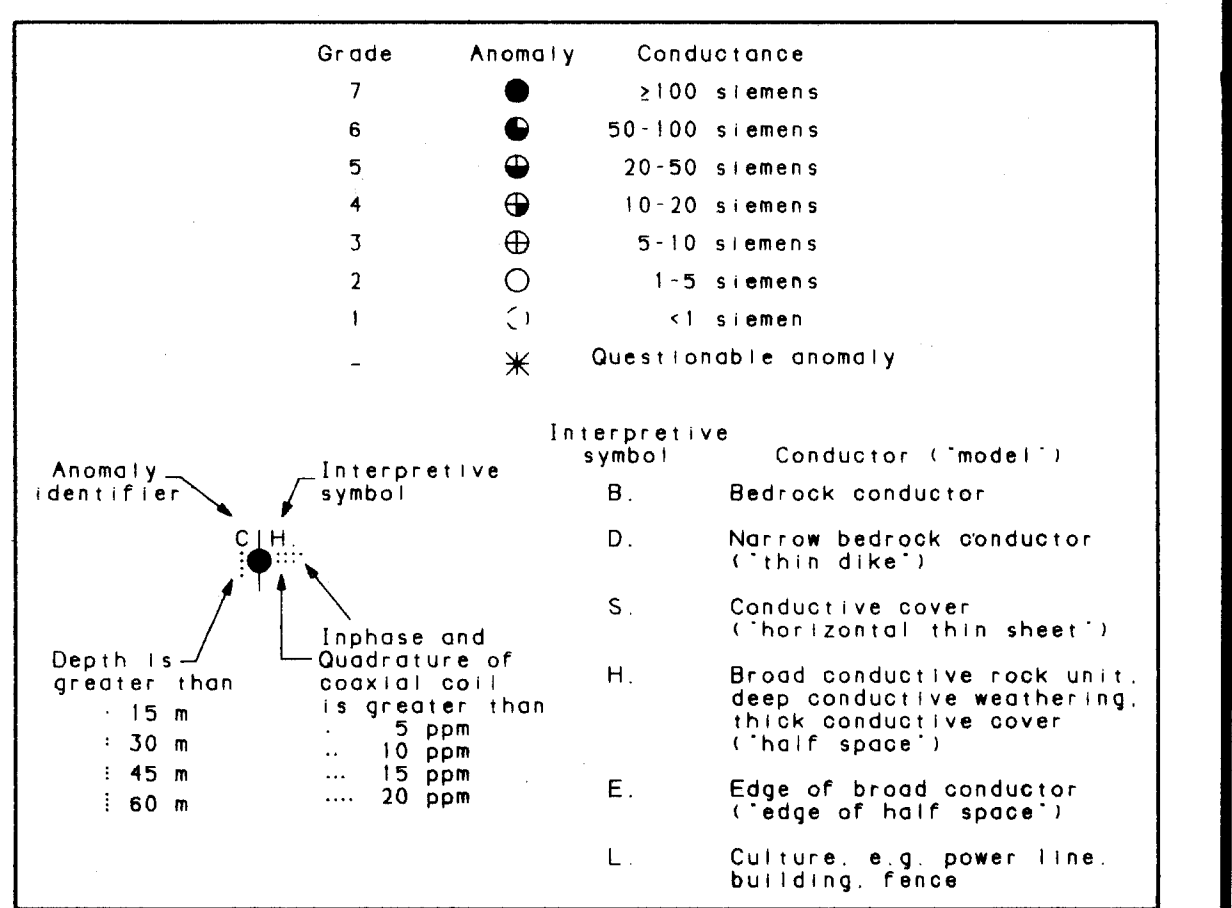
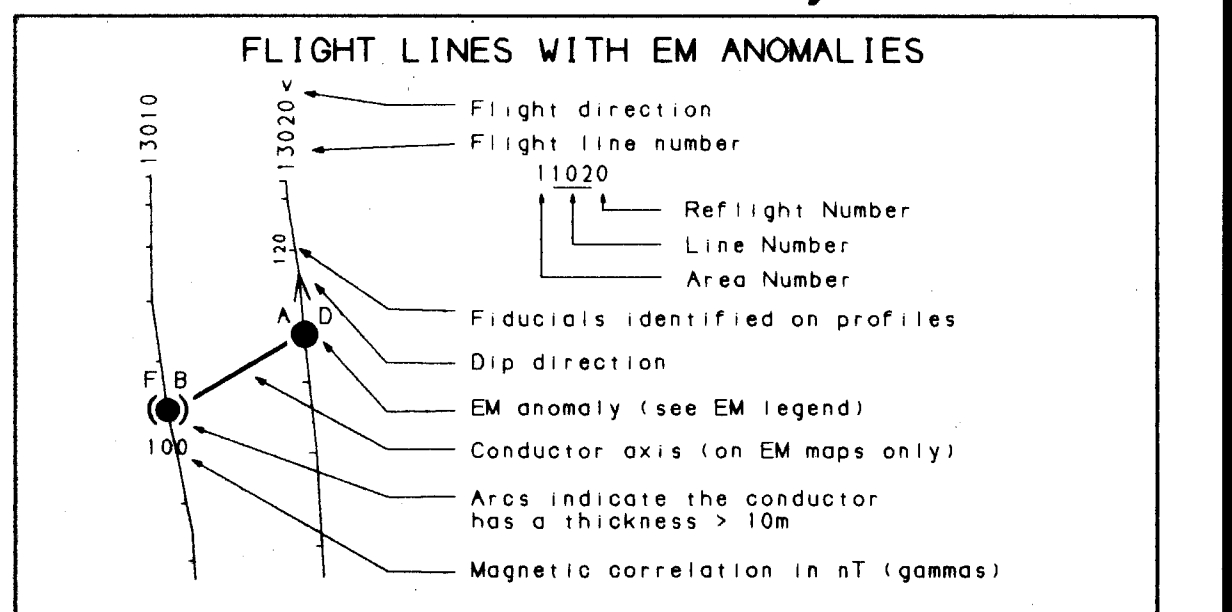
SCALE = 1:50,000

REVISED	'PM' GROUP	
	RESISTIVITY (7,200 Hz)	
PROJ. No. 0287	SURVEY BY: DIGHEM IV	DATE: AUG./90
N.T.S. 93N/12-93J/13	DRAWN BY: DIGHEM & P.J.A.	SCALE: 1:10,000
DWG. No.	NORANDA EXPLORATION	
Fig. 6	OFFICE: Vancouver	

L.10230
L.10220
L.10210
E.10200
L.10190
L.10180
L.10170
L.10160
L.10150
L.10140
L.10130
L.10120
L.10110
L.10100
L.10090
L.10080

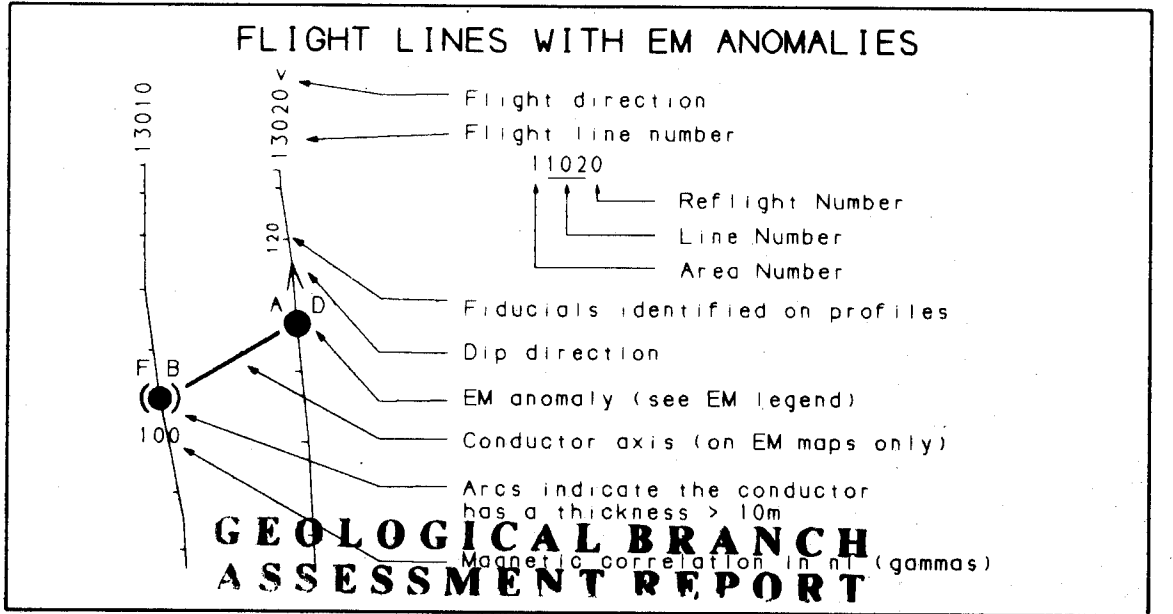
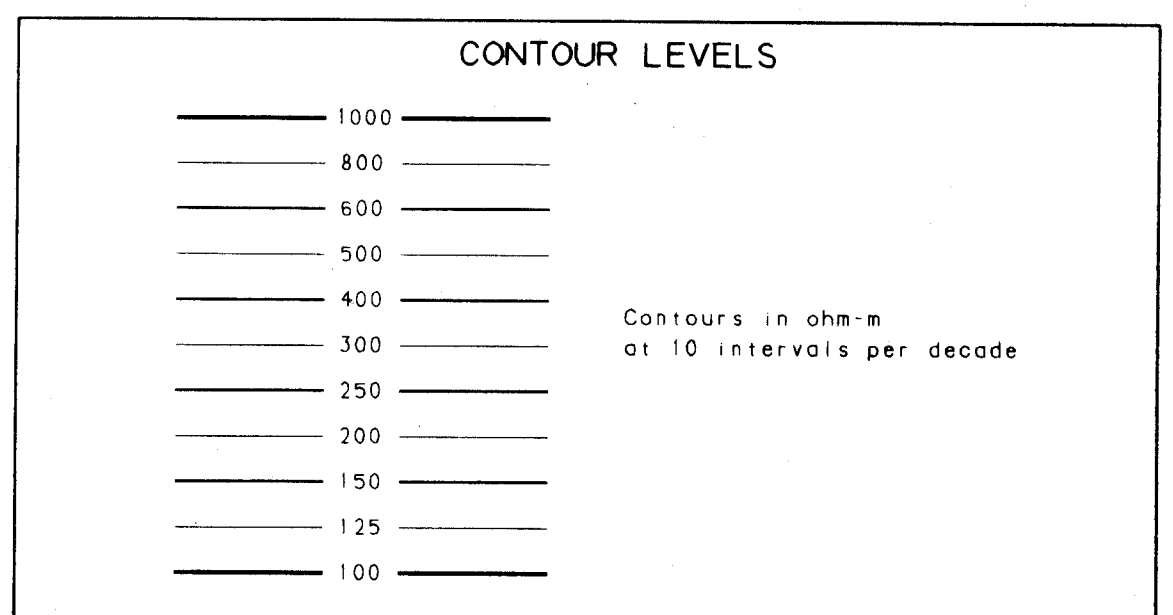


20,311



REVISED	'PM' GROUP	
	RESISTIVITY (900Hz)	
PROJ. No. 0287	SURVEY BY: DIGHEM IV	DATE: AUG./90
N.T.S. 93N/12-93J/13	DRAWN BY: DIGHEM & P.J.A.	SCALE: 1:10,000
DWG. No.	NORANDA EXPLORATION	
Fig. 5	OFFICE: Vancouver	

L.10230
L.10220
L.10210
L.10200
L.10190
L.10180
L.10170
L.10160
L.10150
L.10140
L.10130
L.10120
L.10110
L.10100
L.10090
L.10080

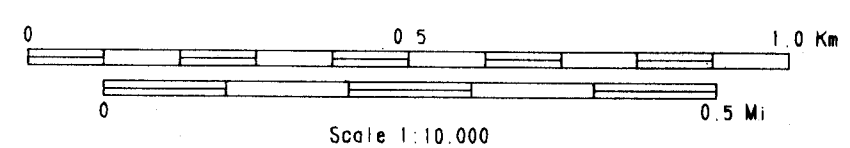


20,311

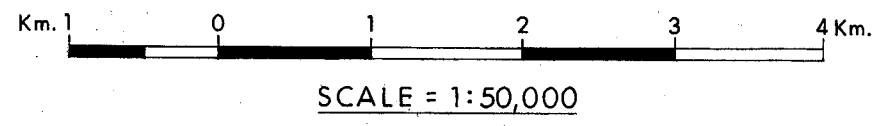
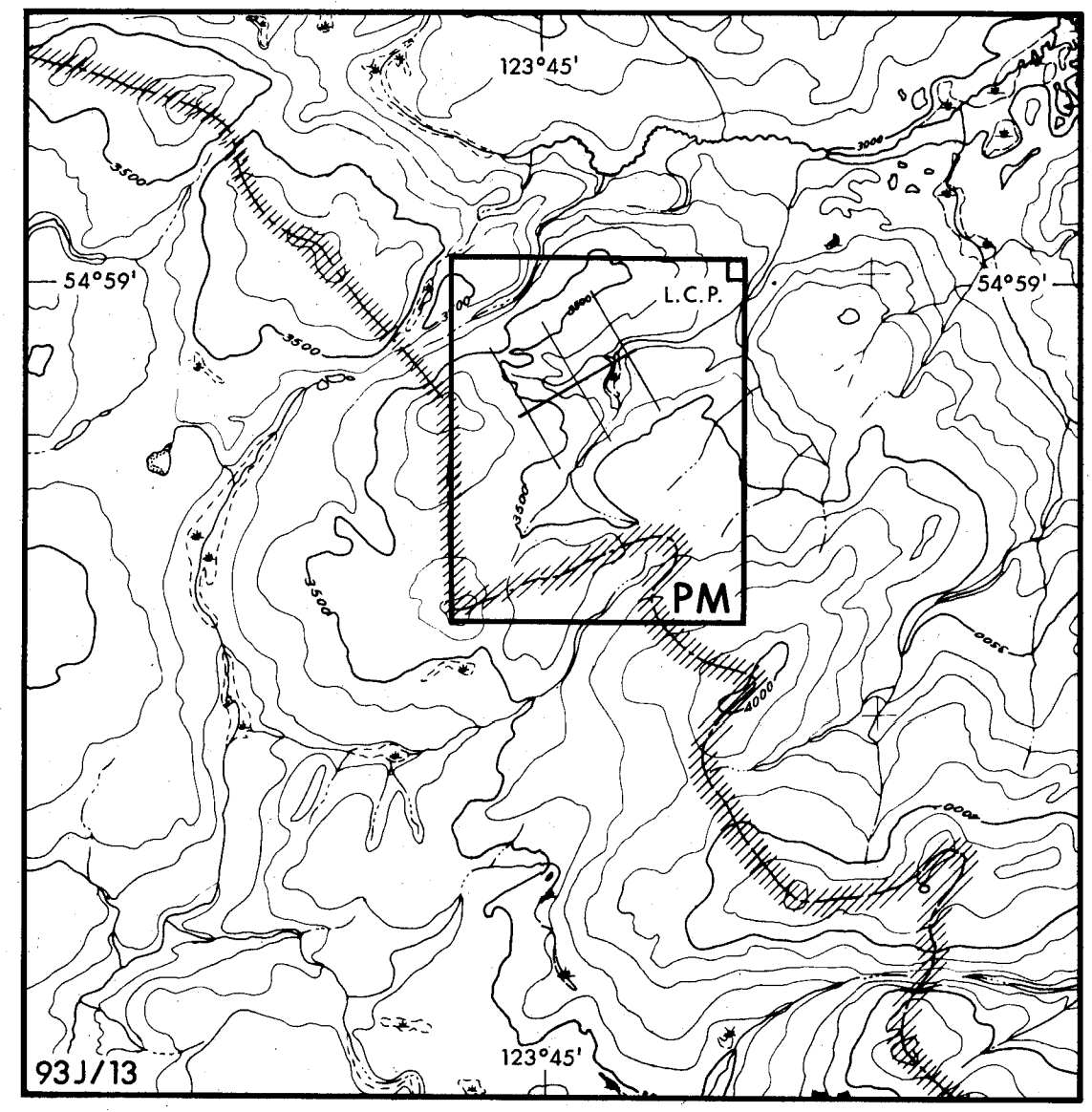
Grade	Anomaly	Conductance
7	●	≥100 siemens
6	●	50-100 siemens
5	●	20-50 siemens
4	●	10-20 siemens
3	●	5-10 siemens
2	●	1-5 siemens
1	●	<1 siemen
-	*	Questionable anomaly

Anomaly identifier	Interpretive symbol	Conductor ('model')
B	●	Bedrock conductor
D	○	Narrow bedrock conductor ('thin dike')
S	○	Conductive cover ('horizontal thin sheet')
H	○	Broad conductive rock unit, deep conductive weathering, thick conductive cover ('half space')
E	○	Edge of broad conductor ('edge of half space')
L	○	Culture, e.g. power line, building, fence

L.10050
L.10040

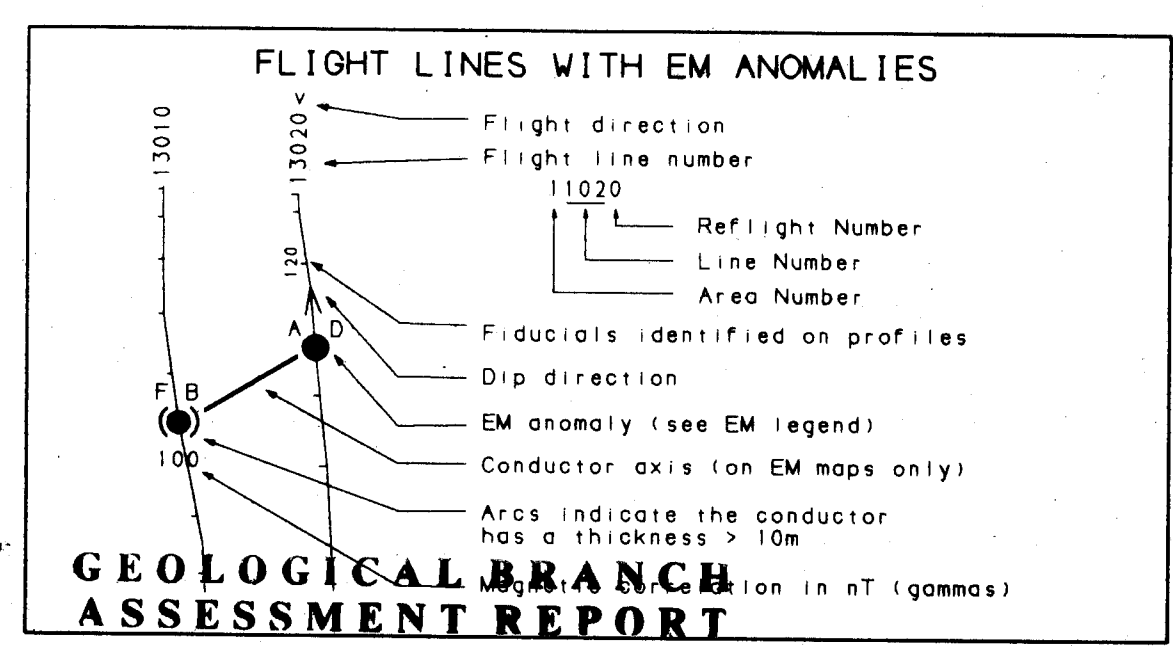
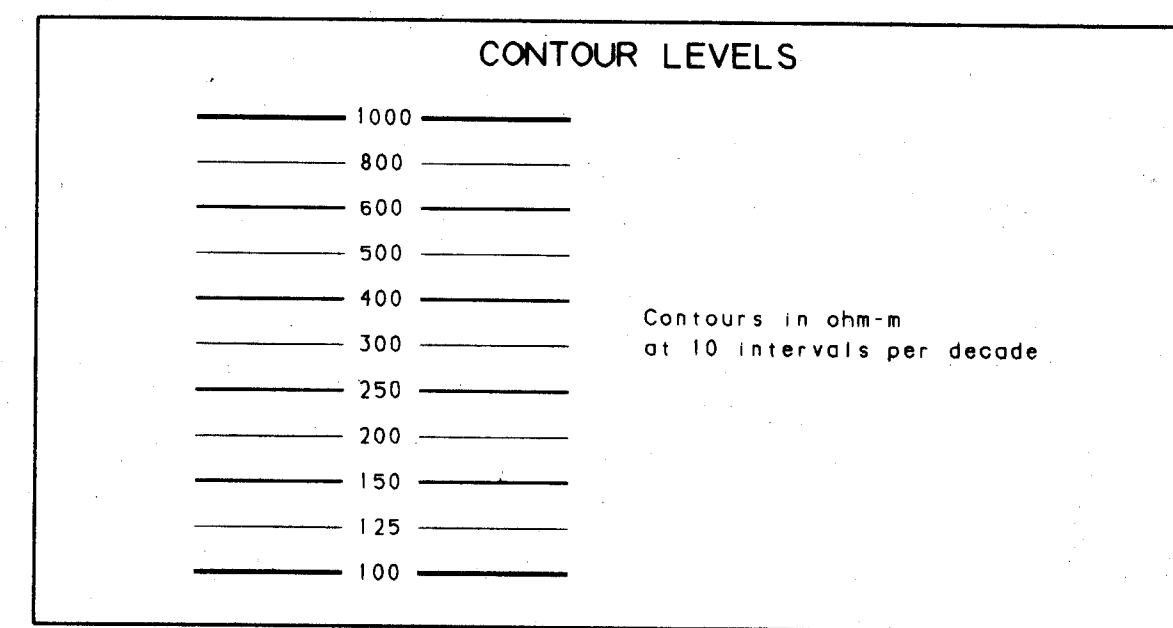
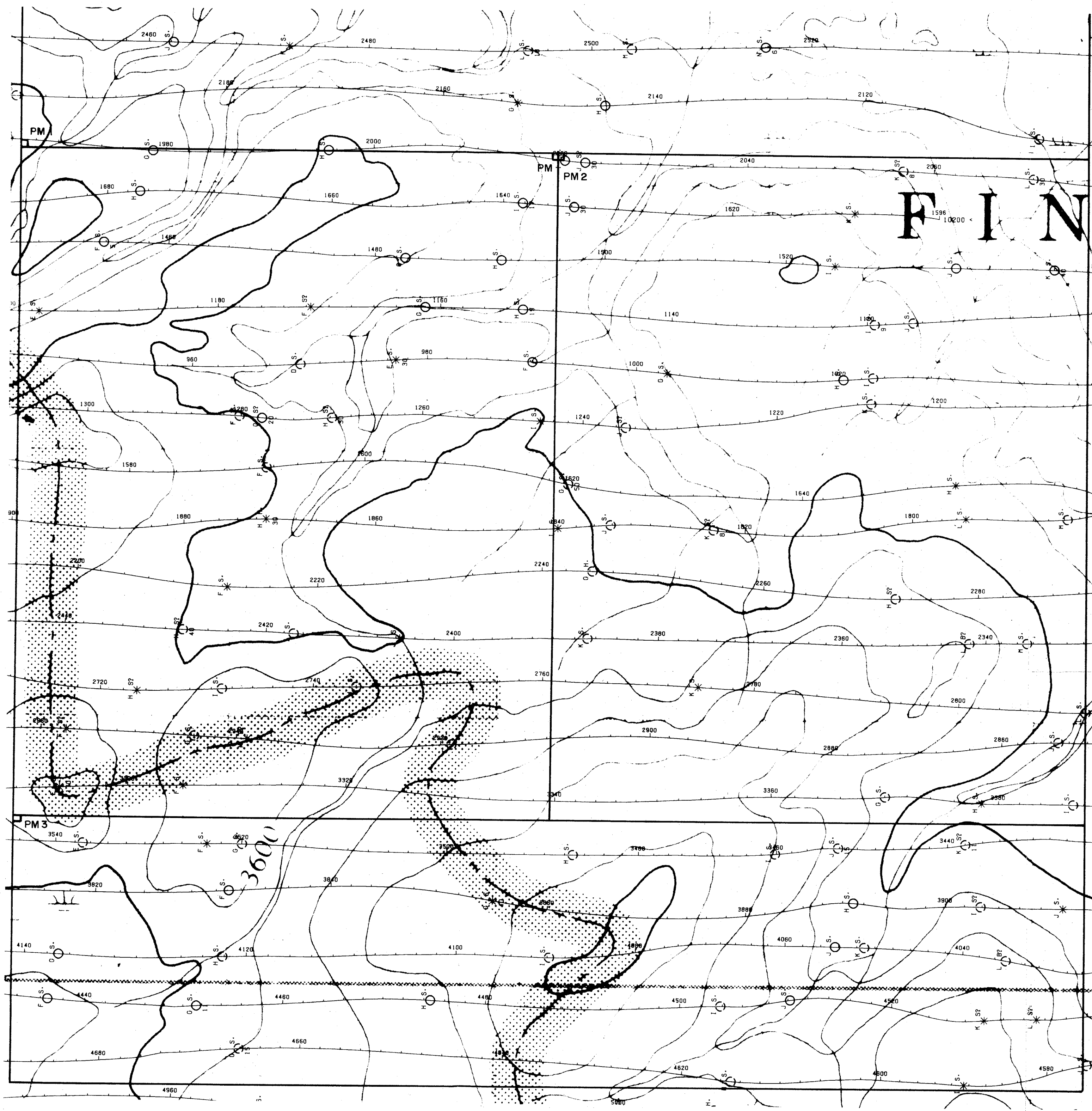


LOCATION MAP



REVISED	'PM' GROUP	
	TOTAL FIELD MAGNETICS	
PROJ. No. 0287	SURVEY BY: DIGHEM IV	DATE: AUG./90
N.T.S. 93N/12-93J/13	DRAWN BY: DIGHEM & P.J.A.	SCALE: 1:10,000
DWG. No.	NORANDA EXPLORATION	
Fig. 4	OFFICE: Vancouver	

L 10230
L 10220
L 10210
L 10200
L 10190
L 10180
L 10170
L 10160
L 10150
L 10140
L 10130
L 10120
L 10110
L 10100
L 10090
L 10080



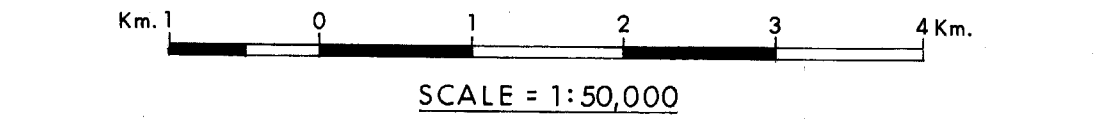
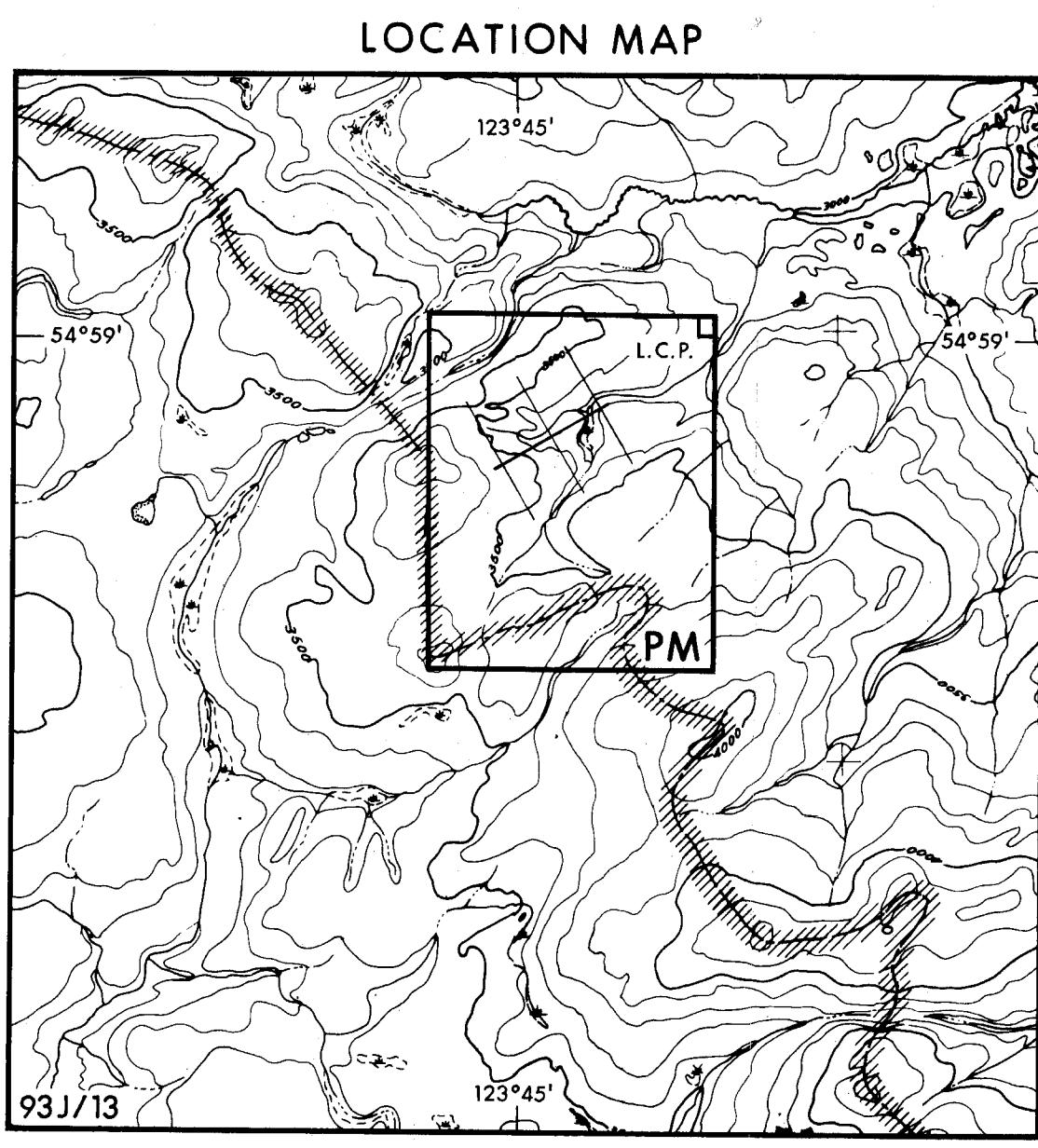
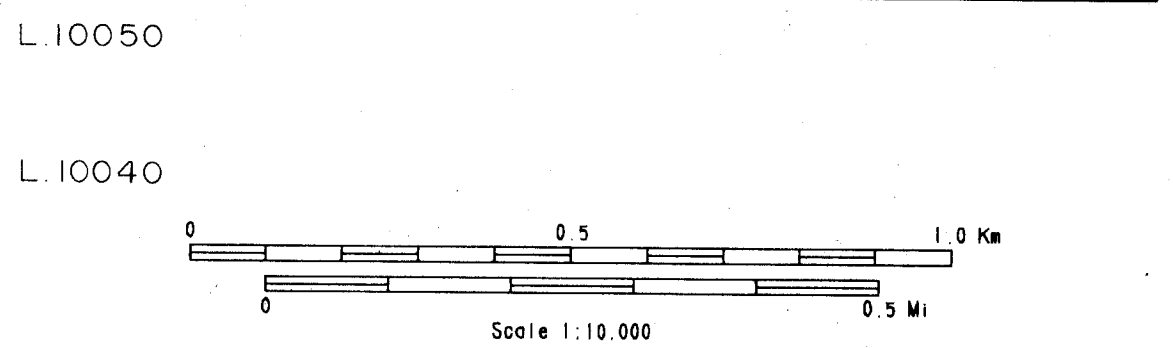
20,311

Grade	Anomaly	Conductance
7	●	≥100 siemens
6	●	50-100 siemens
5	●	20-50 siemens
4	●	10-20 siemens
3	●	5-10 siemens
2	●	1-5 siemens
1	●	<1 siemen
-	*	Questionable anomaly

Anomaly identifier	Interpretive symbol	Interpretive Conductor ('model')
B	●	Bedrock conductor
D	○	Narrow bedrock conductor ('thin dike')
S	○	Conductive cover ('horizontal thin sheet')
H	○	Broad conductive rock unit, deep conductive weathering, thick conductive cover ('half space')
E	○	Edge of broad conductor ('edge of half space')
L	○	Culture, e.g. power line, building, fence

Depth is greater than:
 : 15 m
 : 30 m
 : 45 m
 : 60 m

Inphase and Quadrature of coaxial coil is greater than:
 : 5 ppm
 : 10 ppm
 : 15 ppm
 : 20 ppm



REVISED	'PM' GROUP	
	ELECTROMAGNETIC ANOMALIES	
PROJ. No. 0287	SURVEY BY: DIGHEM IV	DATE: AUG./90
N.T.S. 93N/12-93J/13	DRAWN BY: DIGHEM & P.J.A.	SCALE: 1:10,000
DWG. No.	NORANDA EXPLORATION	
Fig. 3	OFFICE: Vancouver	