

84-#259-12197

DIGHEM III AIRBORNE GEOPHYSICAL SURVEY REPORT

on

MEL 1-5, MEL 8 MOF 1-6

RAN 1, BAR 1-2, DUN 1-10, DUN 21

MINERAL GRIEF

SKEENA MINING DIVISION

NTS 103J/7E-W

LATITUDE $54^{\circ}25'N$

LONGITUDE $130^{\circ}45'W$

on

CLAIMS OWNED BY BILLITON CANADA LTD.

by

DIGHEM LIMITED

TORONTO, ONTARIO

**GEOLOGICAL BRANCH
ASSESSMENT REPORT**

12, 197

J.P. FRANZEN, P. ENG.

FEBRUARY 2, 1984

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INTRODUCTION

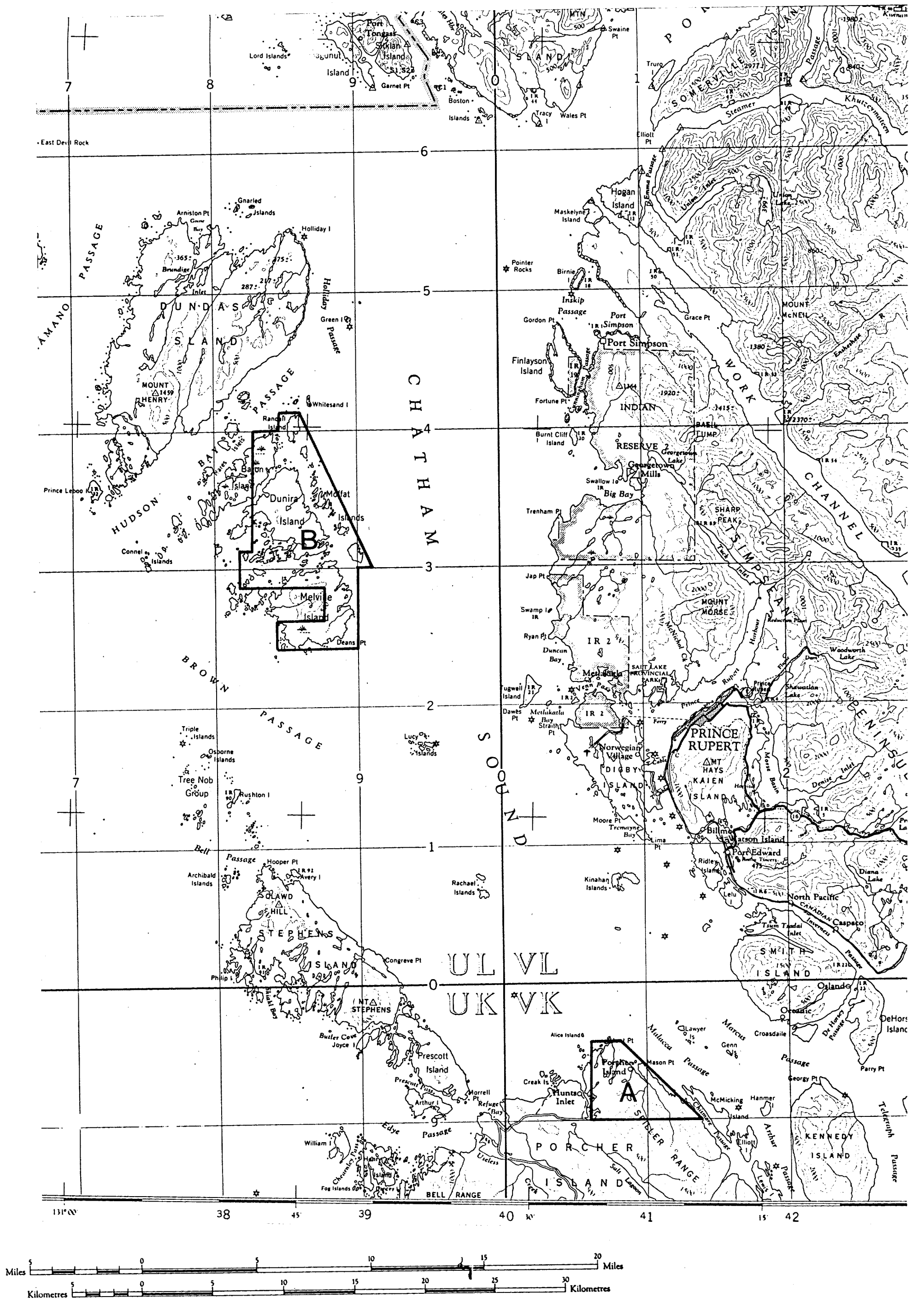
The DIGHEM survey area (Figure 1-Area B) is in the Melville, Dunira and Baron Islands, 32 km northwest of Prince Rupert, B.C. The survey area is accessible by boat and fixed-wing aircraft.

Billiton Canada Ltd. field geologists carried out prospecting and geochemical sampling programs in these islands during June, 1983. The MEL, DUN, BAR, MOF, RAN and MINERAL GRIEF claims (Figure 2) were staked to cover a northwest-southeast trending belt of metavolcanic and metasedimentary rocks. These poorly exposed rocks were considered to have potential for volcanogenic massive sulphide mineralization.

DIGHEM III surveys totalling 510 line km were flown, with 100 and 200 m line-spacing from August 29 to September 9, 1983 (Figure 3).

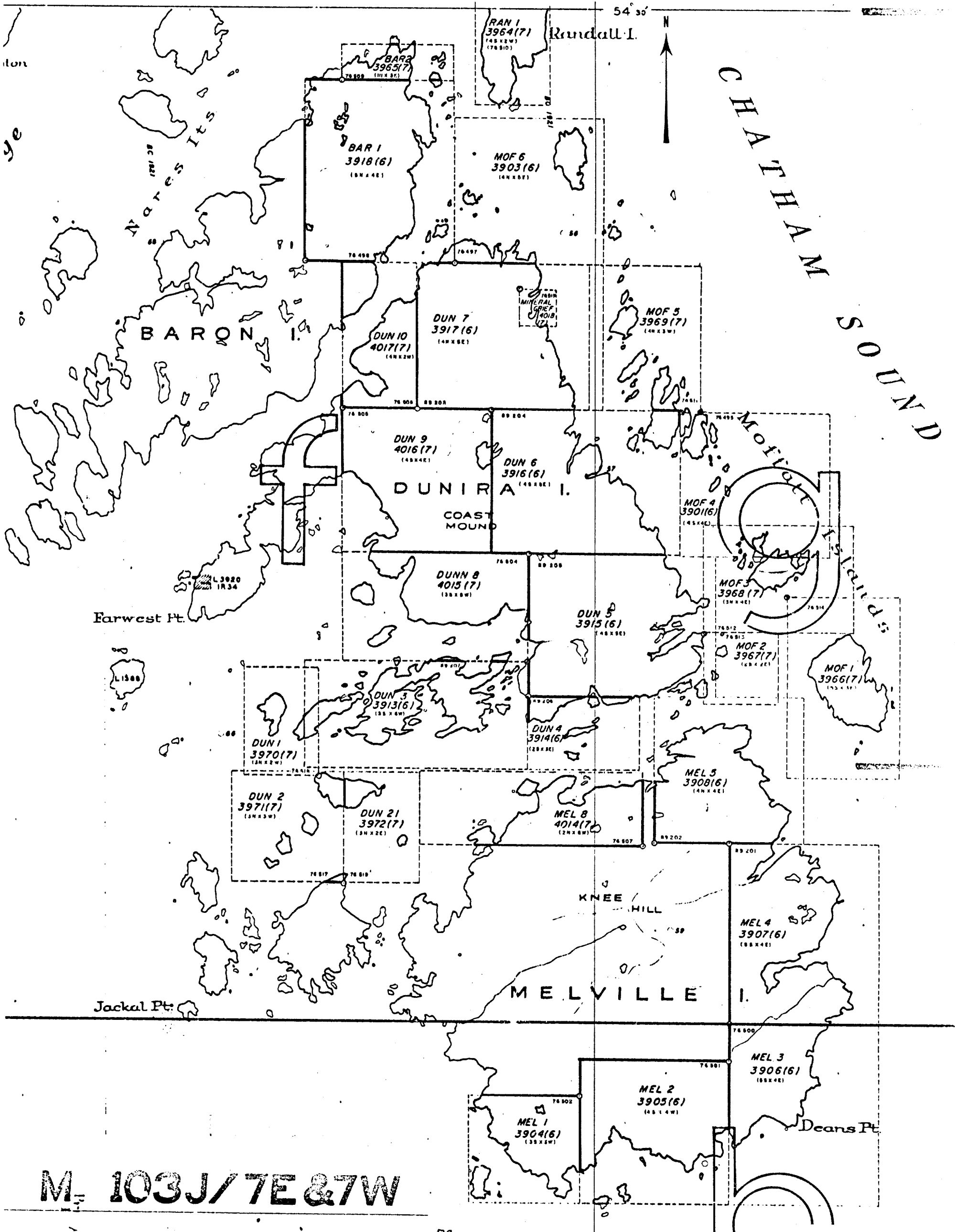
SURVEY METHOD

The Lama CG-DEM turbine helicopter flew at an average airspeed of 122 km/h, with an EM bird height of approximately 39 m. The flight line directions were 0° - 180° and 110° - 290° . Ancillary equipment consisted of a Sonotek PMH 5010 magnetometer with its bird at an average height of 54 m, a Sperry radio altimeter, a Geocam sequence camera, an RMS GR33 analog recorder, a Sonotek SDS 1200 digital data acquisition system, a DigiData 1640 9-track 800-bpi magnetic tape recorder, and a Herz Industries Totem-2A electromagnetometer with its sensor towed at an average height of 62 m. The analog equipment recorded four channels of EM data at approximately 900 Hz, two channels of EM data at approximately 7200 Hz, two ambient EM noise channels (for the coaxial and coplanar receivers), two channels of magnetics (coarse and fine count) and a channel of radio altitude. The digital equipment recorded the EM data with a sensitivity of 0.20 ppm at 900 Hz, and 0.40 ppm at 7200



AIRBORNE SURVEY AREA

FIGURE 1



M. 103J/7E&7W

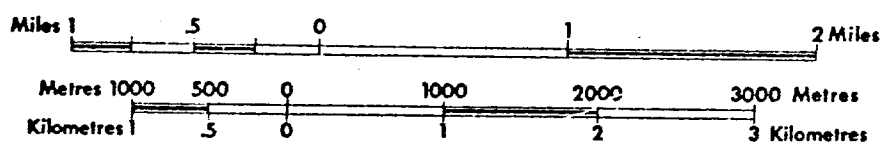


FIGURE 2

CLAIM MAP MELVILLE, DUNIRA AND BARON ISLAND

Hz and the magnetic field to one nT (i.e. one gamma).

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. The DIGHEM system nevertheless, can be flown under wind conditions that seriously degrade other AEM systems.

It should be noted that the anomalies shown on the electromagnetic anomaly map 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 are clearly evident on the resistivity map. The resistivity map, therefore, may be more valuable than the electromagnetic anomaly map, in areas where broad or flat-lying conductors are considered to be of importance.

In areas where magnetite causes the inphase components to become negative, the apparent conductance and depth of EM anomalies may be unreliable.

Areas, in which EM responses are evident only on the quadrature components, indicate zones of poor conductivity. Where these responses are coincident with strong 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.

These weak features are evident on the resistivity map, but may not be shown on the electromagnetic anomaly map. If it is expected that poorly-conductive sulphides may be associated with magnetite-rich units, some of these weakly anomalous features may be of interest.

SURVEY RESULTS (Figures 4, 5 and 6)

The survey of Baron, Dunira and Melville Islands consisted of two large blocks. The first block covered the northeast part of Baron Island, Randall Island, Moffatt Islands and the major portion of Dunira Island. This block was flown in the N70⁰W direction. However, the south part of Dunira Island was also flown along north-south oriented flight lines. This flight direction was the principal direction of the second block, which covered a major part of Melville Island, several small adjacent islands and the south part of Dunira Island. The east-central portion of Melville Island was surveyed in a grid fashion. Nine lines, 245 to 253, were flown in the east-west direction, in addition to four north-south oriented lines, 2350, 2360, 2370 and 2380, which were located at 100 m intervals with respect to the main grid.

Most of the flight lines extended over the ocean, resulting in saturation of the EM equipment, due to strong EM responses caused by high sea water conductivity. The associated EM anomalies, which were generally interpreted as H, are of little importance for the present mineral oriented exploration project.

SHEET I (Figures 4A, 5A and 6A)

The ground on Baron, Randall and Moffatt Islands is highly resistive. Typical values are in the range of 2,000 ohm-m to in excess of 6,000 ohm-m. However, lower values over several small Moffatt Islands are believed to be the result of the side-looking ability of DIGHEM's coplanar coils.

The north tip of Dunira Island contains a north-south oriented zone of 250+ ohm-m resistivities, which extends from 25B towards 22D, and possibly further south to 21B on Sheet 2. A cross-cutting, poorly defined zone appears to exist in a discontinuous fashion between 22xA and 30E.

Magnetic field is relatively active, showing a variety of trends striking from northwest to northeast. They are particularly well defined on the magnetic map. A well defined northwesterly high extends across Randall Island and several Moffatt Islands portrayed on Sheet I. A parallel, secondary trend lies between 43B and 30F. A well defined cross-cutting trend of northeasterly strike occurs between 34P and line 23 at the sheet boundary. Complex structures occur along the southeast shore of Baron Island.

SHEET 2 (Figures 4B, 5B and 6B)

Similar to Sheet I, ground in the area of Sheet 2 is resistive. The typical resistivity values are in the range of 5,000 to 8,000 + ohm-m. What distinguishes Sheet 2 from the other two sheets is the presence of two, possibly three, conductive features. The first of these zones occurs in the centre of the sheet and appears to consist of a north-southerly portion in the south, and a northeasterly part in the north. The lowest resistivities observed in this zone were of the order of 20 ohm-m.

The second conductive zone occurs in the south-central part of Dunira Island. It is centered at about the intersection of lines 6 and 223. The lowest resistivities in this zone are of the order of 30 ohm-m.

The third conductive feature appears to parallel the coast at the north end of lines 227 and 228. The lowest resistivities here are in the range of 15 to 30 ohm-m.

The magnetic field in the area of Sheet 2 is active in the northwest corner, in the southeast part where an 800 to 1,000 m broad band of a northeasterly strike exist, and at a few other places. For example, the most pronounced anomaly is confined between 20U and 23F. It is a well defined oval-like anomaly, with amplitude of about 750 nT.

The central part of the sheet is relatively quiet. This contrast in magnetic activity would suggest that a geologic contact may extend along an imaginary line, going through anomalies 12A and 24A. The band of magnetic anomalies in the southeast part of the sheet may reflect a dike, striking from line 219 at the sheet boundary, toward anomaly 231J, as best portrayed on the magnetic map.

SHEET 3 (Figures 4C, 5C and 6C)

Melville Island, which is covered by Sheet 3, almost entirely is highly resistive. Only a few zones display resistivities lower than 800 ohm-m. These occur in the west (in association with 214xB-217F), in the south (near 222F and 230D, 231E), and in the southeast part of the island (in conjunction with 232J and 234F). These zones appear to be caused by both bed-rock and near-surface conductive features.

The magnetic field is active, showing that complex geologic structures may be present. The magnetic map shows a number of narrow trends to exist, whose strikes vary from west-northwest to east-northeast.

A handwritten signature in black ink, consisting of a stylized 'JPF' followed by the name 'FRANZEN' in a cursive script.

J.P. Franzen, P.Eng.

COST STATEMENT

FERRY MOBILIZATION-DEMobilIZATION	\$3,705.00
MAPS	355.00
SURVEY (510 line km @\$85.20 line km)	<u>43,340.00</u>
TOTAL	\$47,400.00

A handwritten signature in black ink, consisting of the letters 'J.P.' followed by a stylized 'F' and the name 'Franzen' written in a cursive script.


J.P. Franzen, P.Eng.

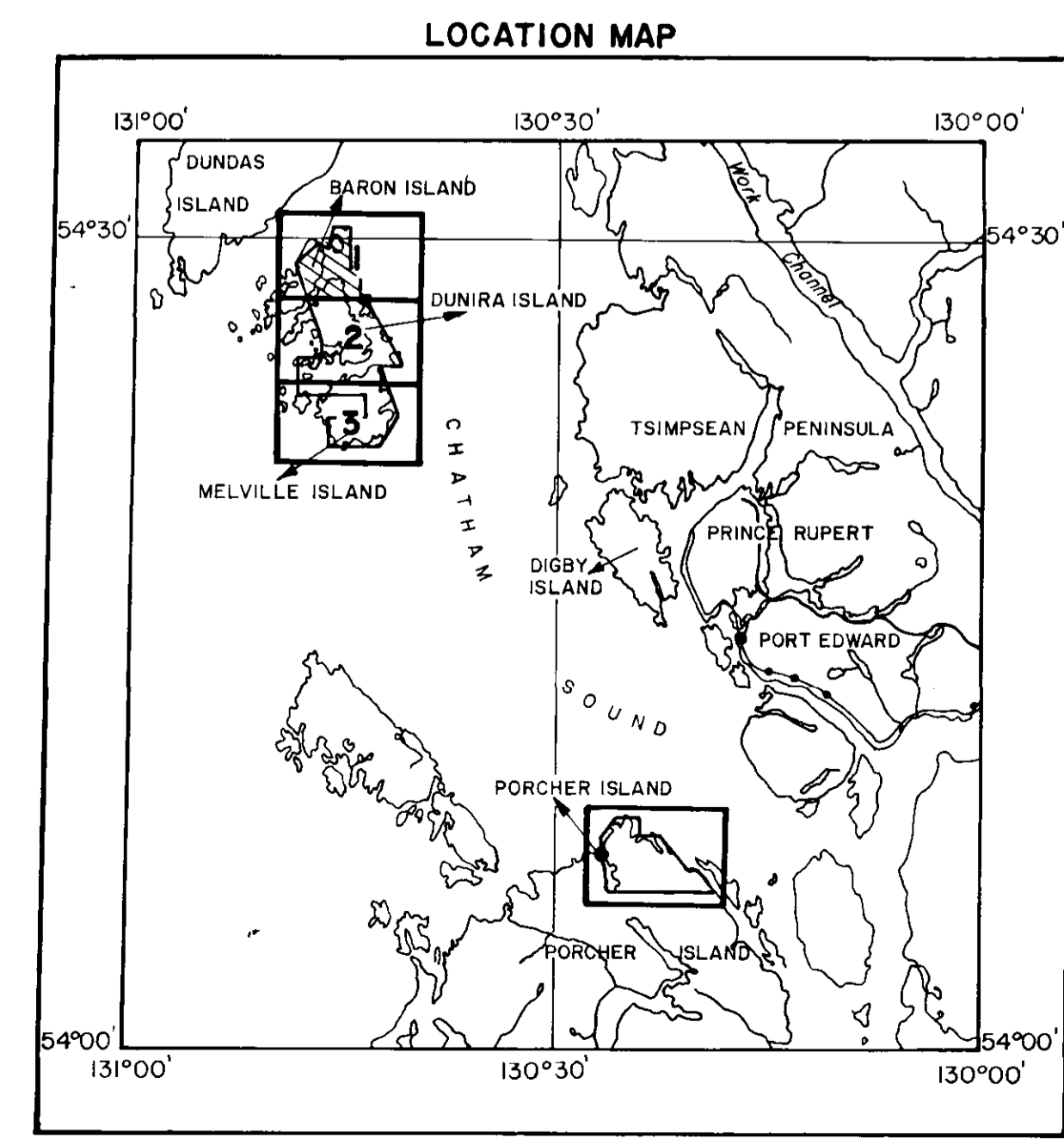
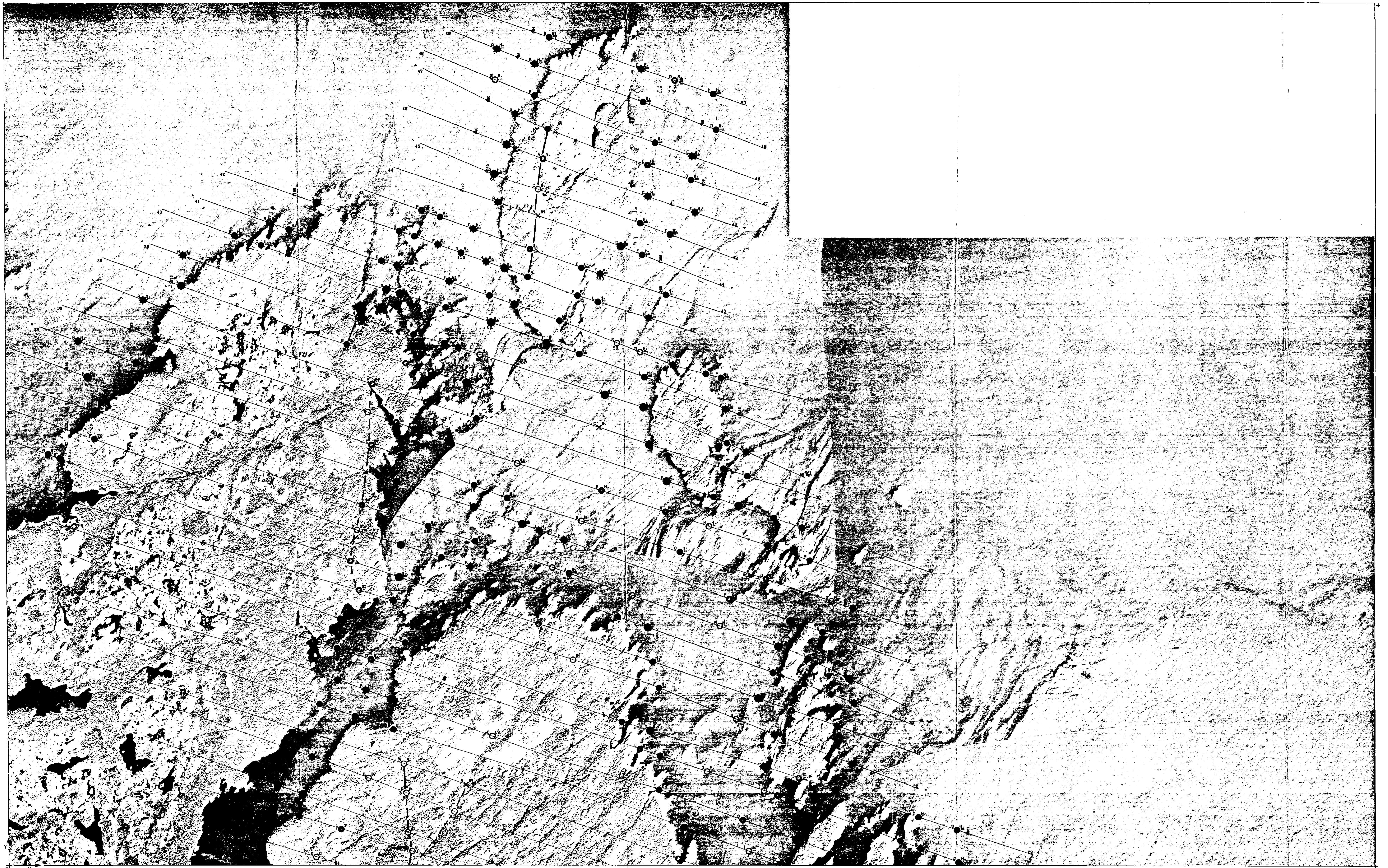
CERTIFICATE OF QUALIFICATIONS

I, Jeffrey Paul Franzen, of 4990 Cedarcrest Avenue, North Vancouver, B.C., hereby certify that:

1. I am Regional Geologist for Billiton Canada Ltd., with offices at 460- 601 West Cordova Street, Vancouver, B.C.
2. I am a graduate of the University of British Columbia (B.Sc. Geology 1972) and Carleton University (M.Sc. Geology 1974).
3. I have practiced my profession continuously since 1974.
4. I am a member in good standing of the Association of Professional Engineers of B.C. and a Fellow of the Geological Association of Canada.

February 2, 1984


J.P. Franzen, P.Eng.



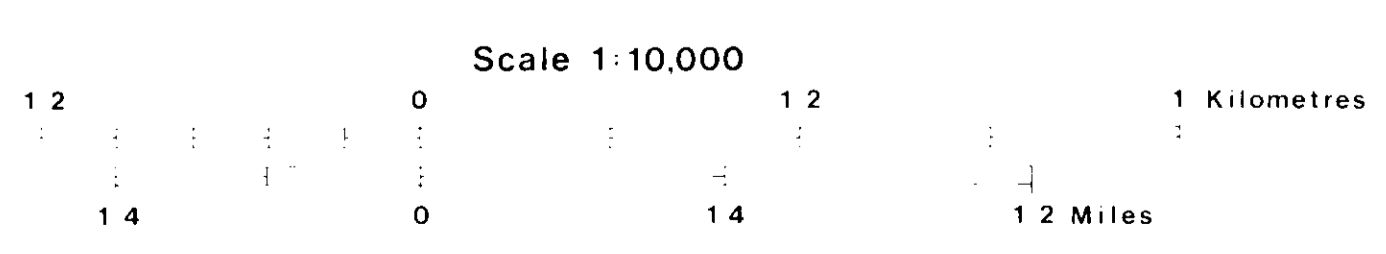
DIGHEM^{III} SURVEY

BARON, DUNIRA AND MELVILLE ISLANDS

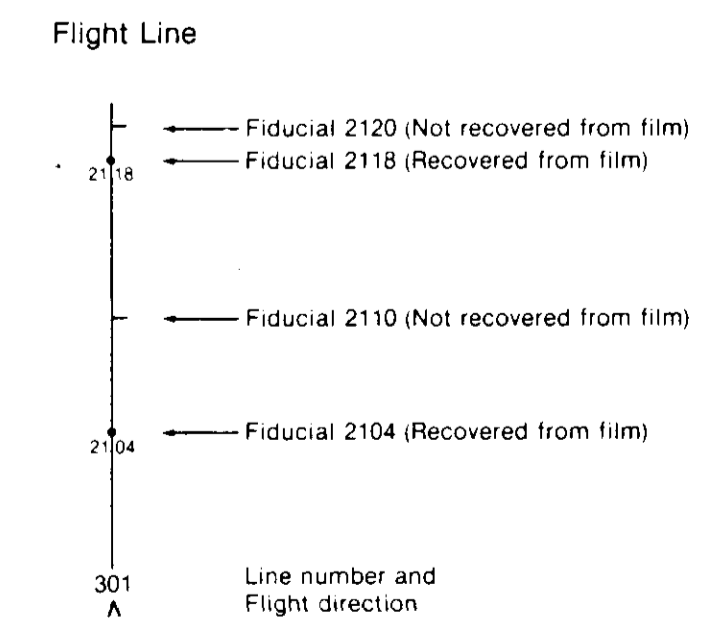
ELECTROMAGNETIC ANOMALIES

FOR

BILLITON CANADA LIMITED



SHEET 1



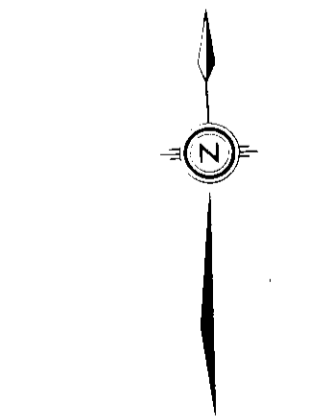
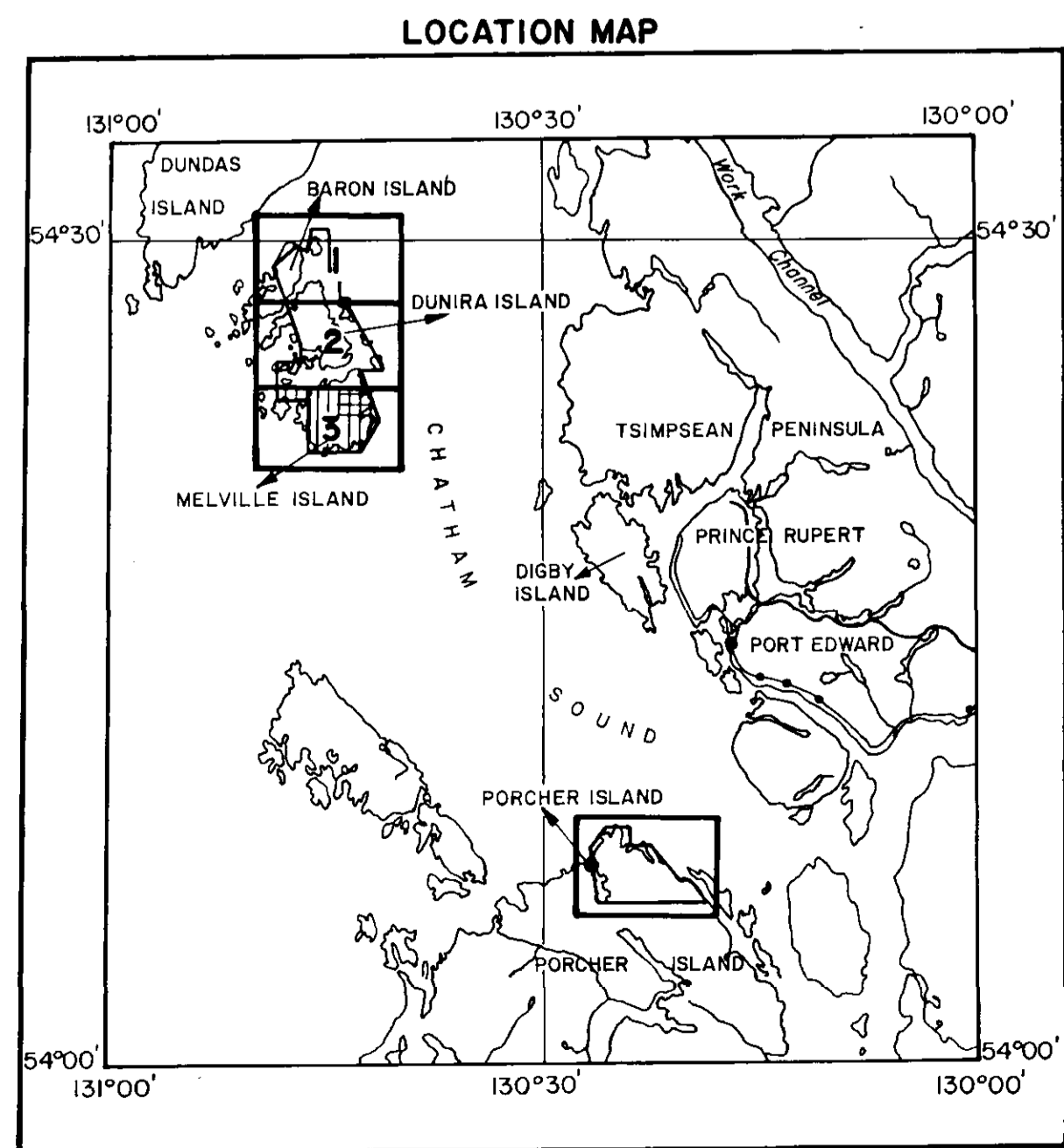
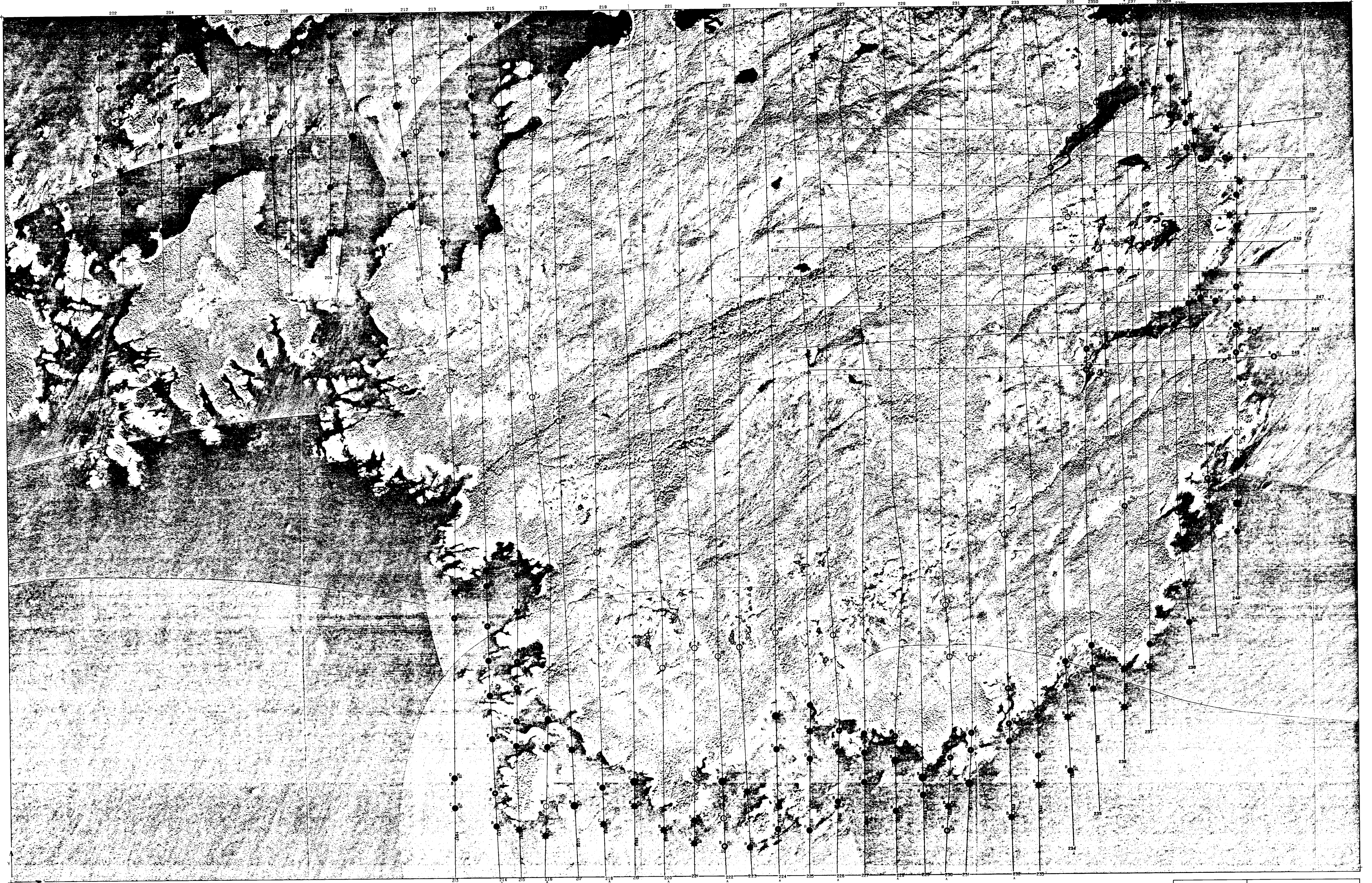
**GEOLOGICAL BRANCH
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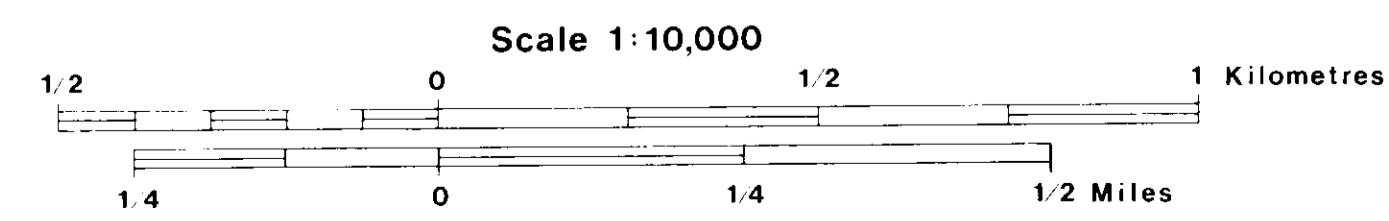
ANOMALY GRADE	EM GRADE SYSTEM	CONDUCTANCE RANGE (MOHMS)	INTERPRETATION
4	●	10-15	DIGHEM anomalies are plotted on six grades of conductivity. The horizontal bars or dots indicate anomaly amplitude on the flight record and the vertical column gives the estimated depth. The depth may be variable because the steeper part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or conductive overburden effects.
3	●	15-20	
2	●	20-25	
1	●	25-30	
0	○	30-40	
	○	40-50	
	○	50-60	
	○	60-70	
	○	70-80	
	○	80-90	
	○	90-100	
	○	100-110	
	○	110-120	
	○	120-130	
	○	130-140	
	○	140-150	
	○	150-160	
	○	160-170	
	○	170-180	
	○	180-190	
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	○	790-800	
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	○	810-820	
	○	820-830	
	○	830-840	
	○	840-850	
	○	850-860	
	○	860-870	
	○	870-880	
	○	880-890	
	○	890-900	
	○	900-910	
	○	910-920	
	○	920-930	
	○	930-940	
	○	940-950	
	○	950-960	
	○	960-970	
	○	970-980	
	○	980-990	
	○	990-1000	

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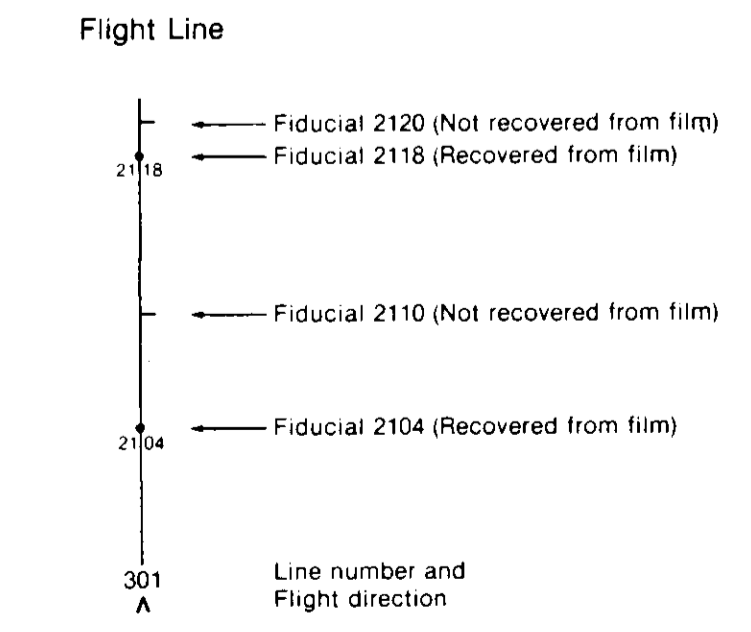
FIGURE 4a



DIGHEM^{III} SURVEY
BARON, DUNIRA AND MELVILLE ISLANDS
ELECTROMAGNETIC ANOMALIES
FOR
BILLITON CANADA LIMITED



SHEET 3



ANOMALY GRADE	EM GRADE	CONDUCTANCE RANGE (WEDG)
6	●	> 30
5	●	20-30
4	●	10-20
3	○	5-10
2	○	1-5
1	○	0.5-1
0	○	0.1-0.5
+	○	0.05-0.1
-	○	0.01-0.05
X	○	0.001-0.01

DIGHEM anomalies are divided into six grades of conductivity — thickness product. This product is proportional to the reciprocal of resistivity in ohms. The ratio is a measure of conductivity and is a geologic parameter.

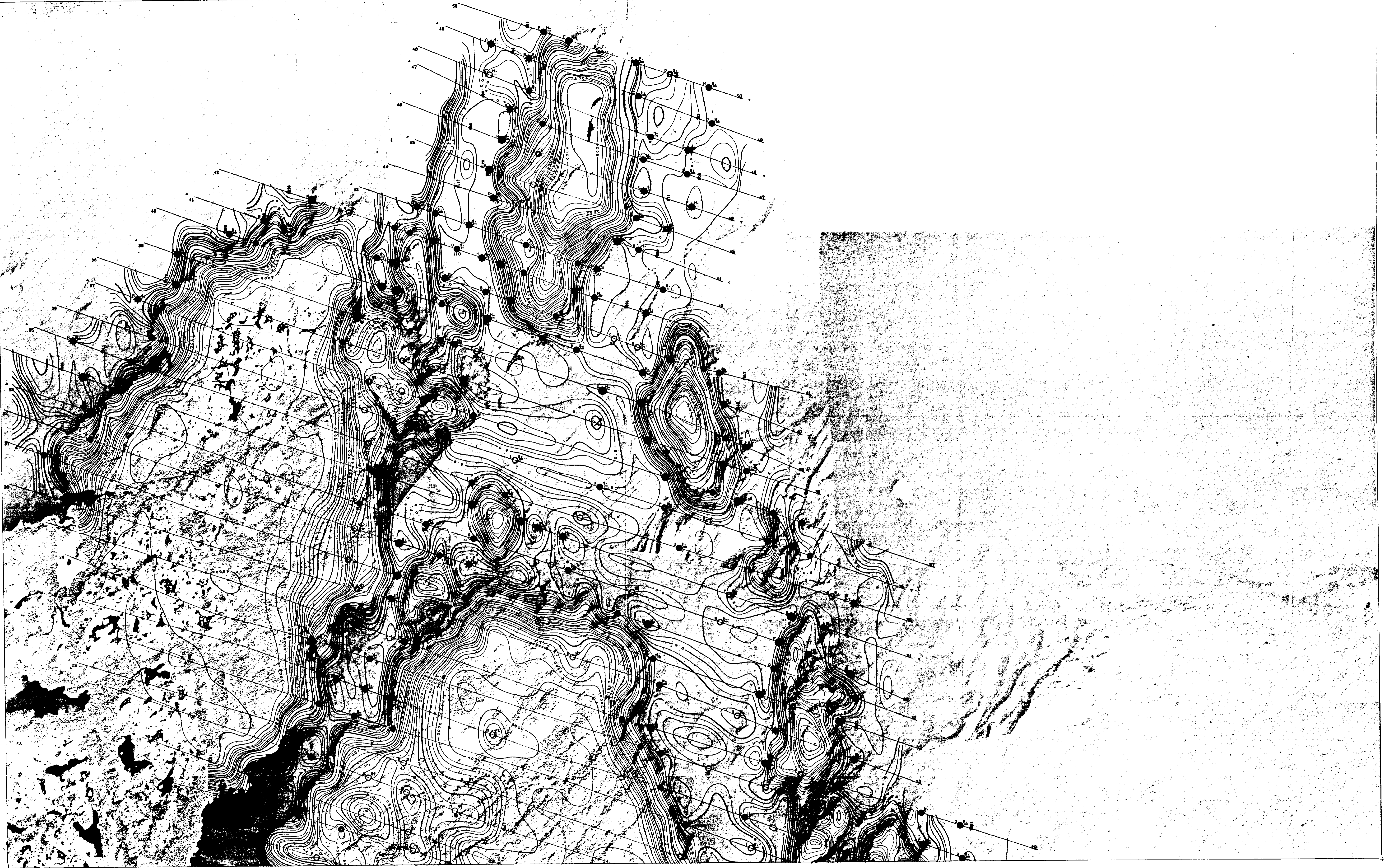
Interpretation is shown by the interpretive symbol (see legend). The symbol is placed on the map at the location of the anomaly. The horizontal lines of dots indicate anomaly amplitude on the right side and the vertical lines on the left side of the flight line. The depth may be variable because the change in resistivity of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or conductive overburden effects.

SYMBOL	GEOPHYSICAL MODEL	BEDROCK CONDUCTOR	NON-BEDROCK CONDUCTOR	MODEL
D ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
T ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
R ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
E ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
H ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
G ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
S ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
L ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
A ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion
P ₁	Shallow dipping granitic intrusion	Highly conductive granitic intrusion	Highly conductive granitic intrusion	Granitic intrusion

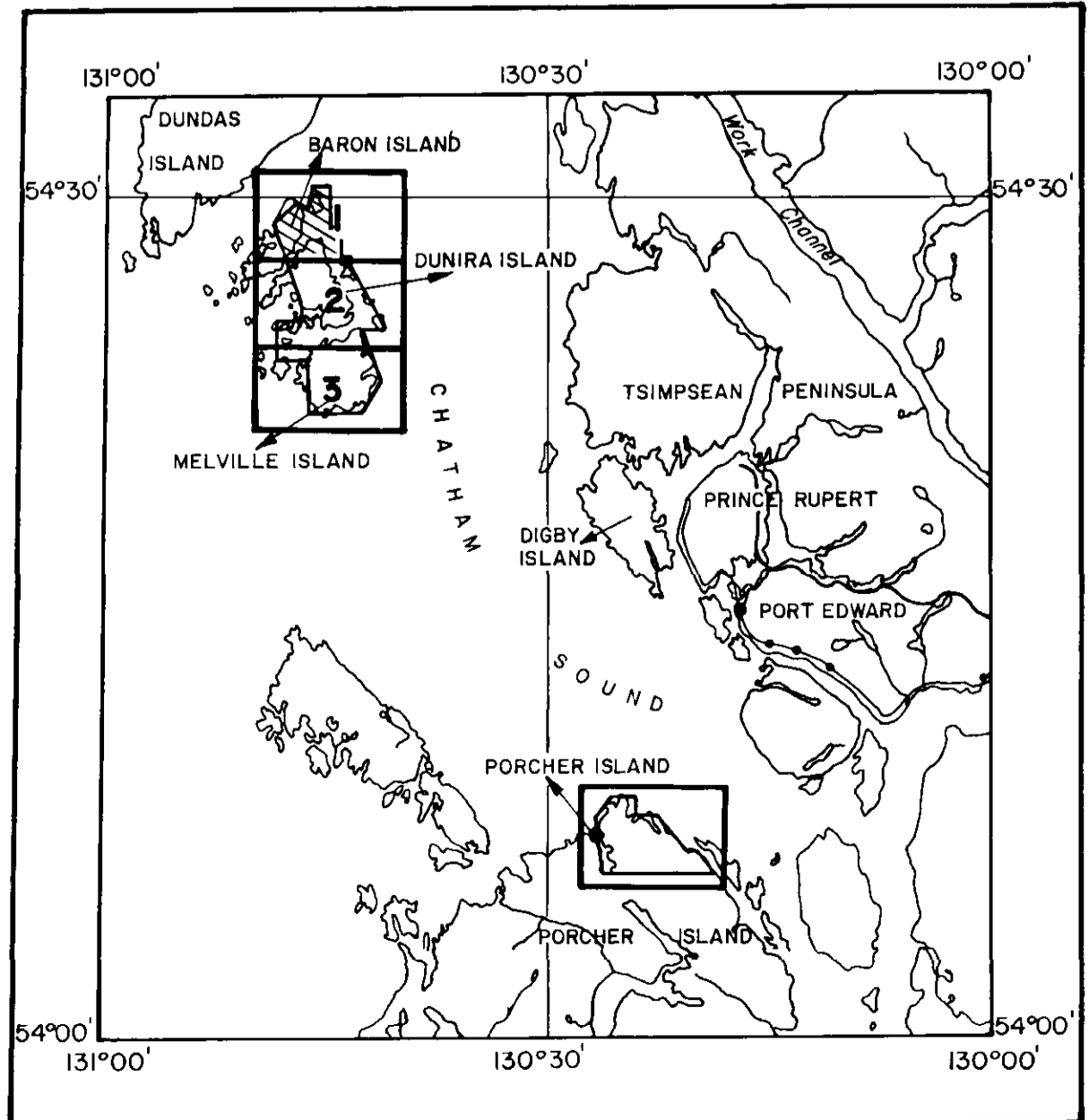
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FIGURE 4c



LOCATION MAP



SCALE 1:500,000



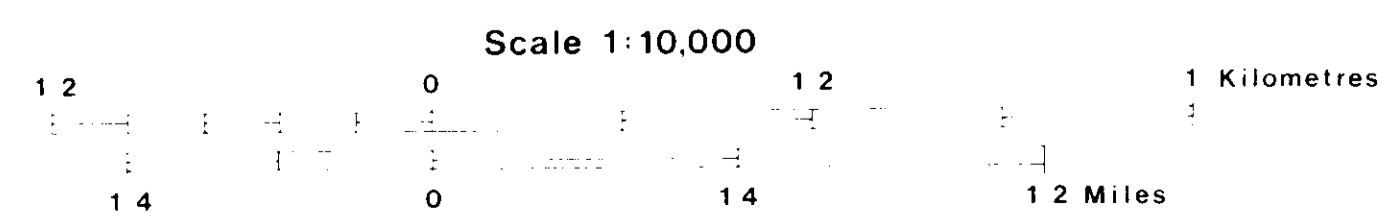
DIGHEM SURVEY

BARON, DUNIRA AND MELVILLE ISLANDS

RESISTIVITY

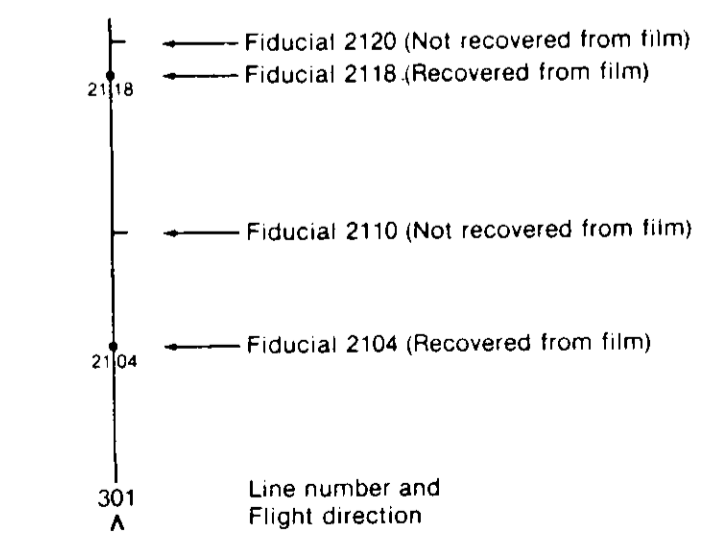
FOR

BILLITON CANADA LIMITED



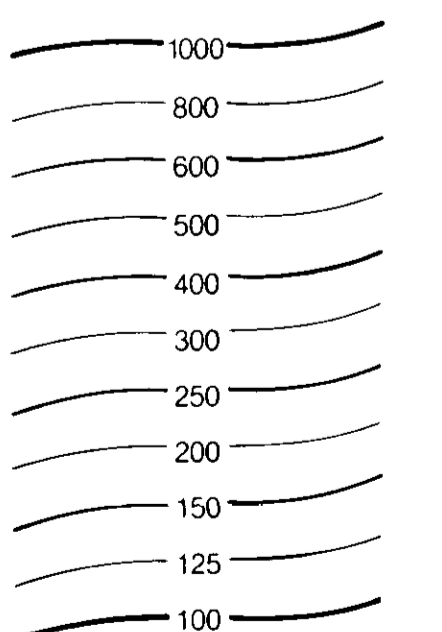
SHEET 1

Flight Line



LEGEND

Contours in ohm - m at ten intervals per decade

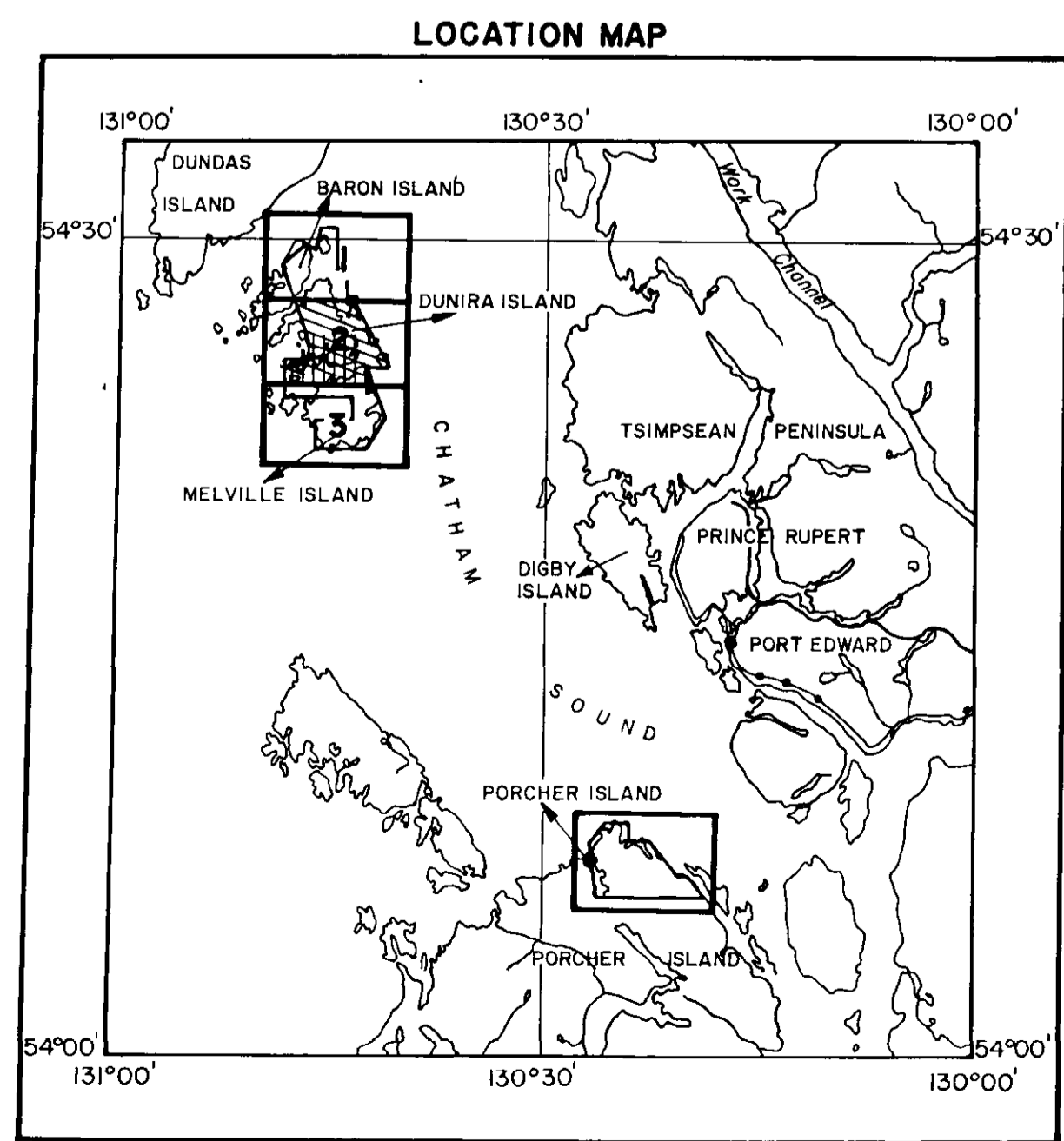
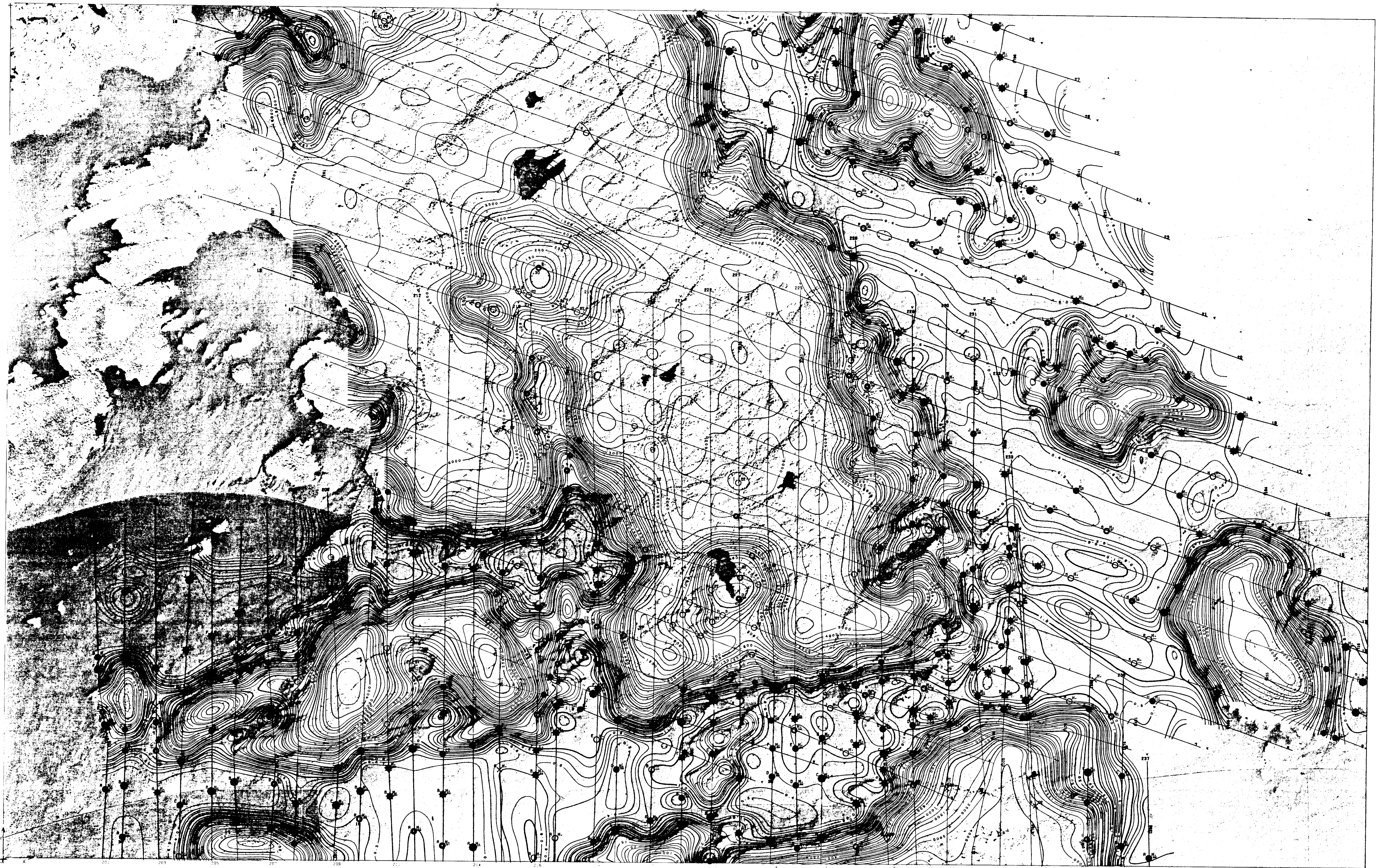


Note
The numbers face in the direction of increasing value.

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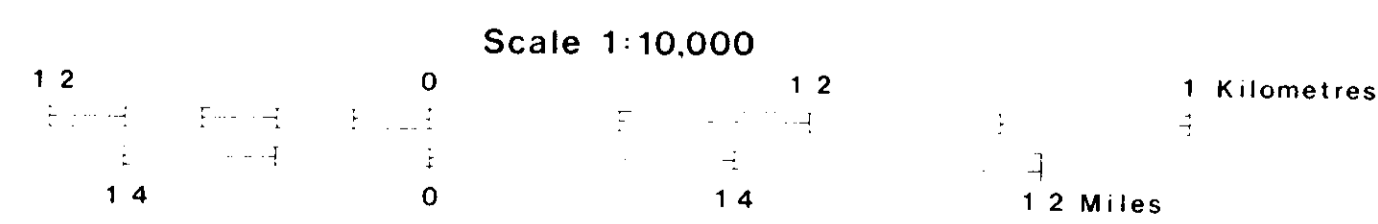
FIGURE 5a



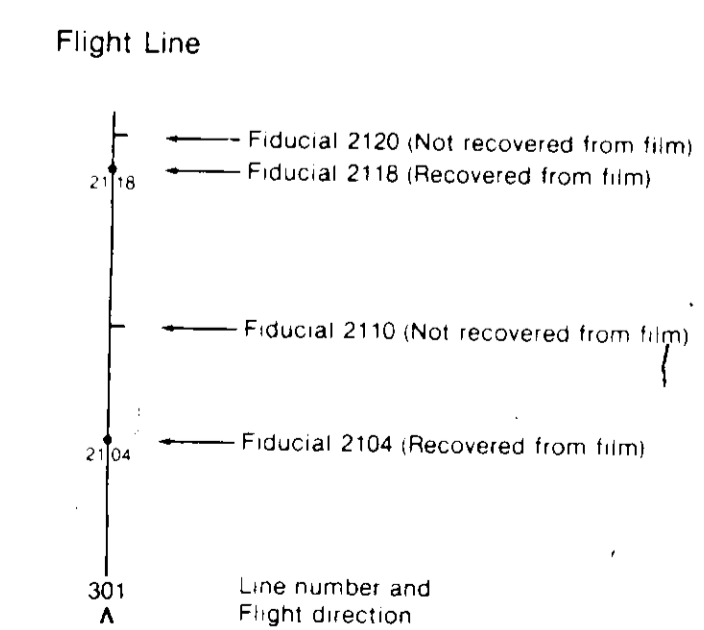
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DIGHEM^{III} SURVEY
 BARON, DUNIRA AND MELVILLE ISLANDS
 RESISTIVITY
 FOR
 BILLITON CANADA LIMITED



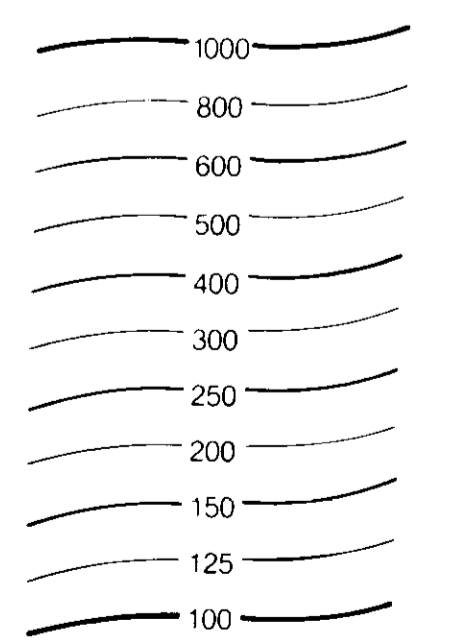
SHEET 2



GEOLOGICAL BRANCH
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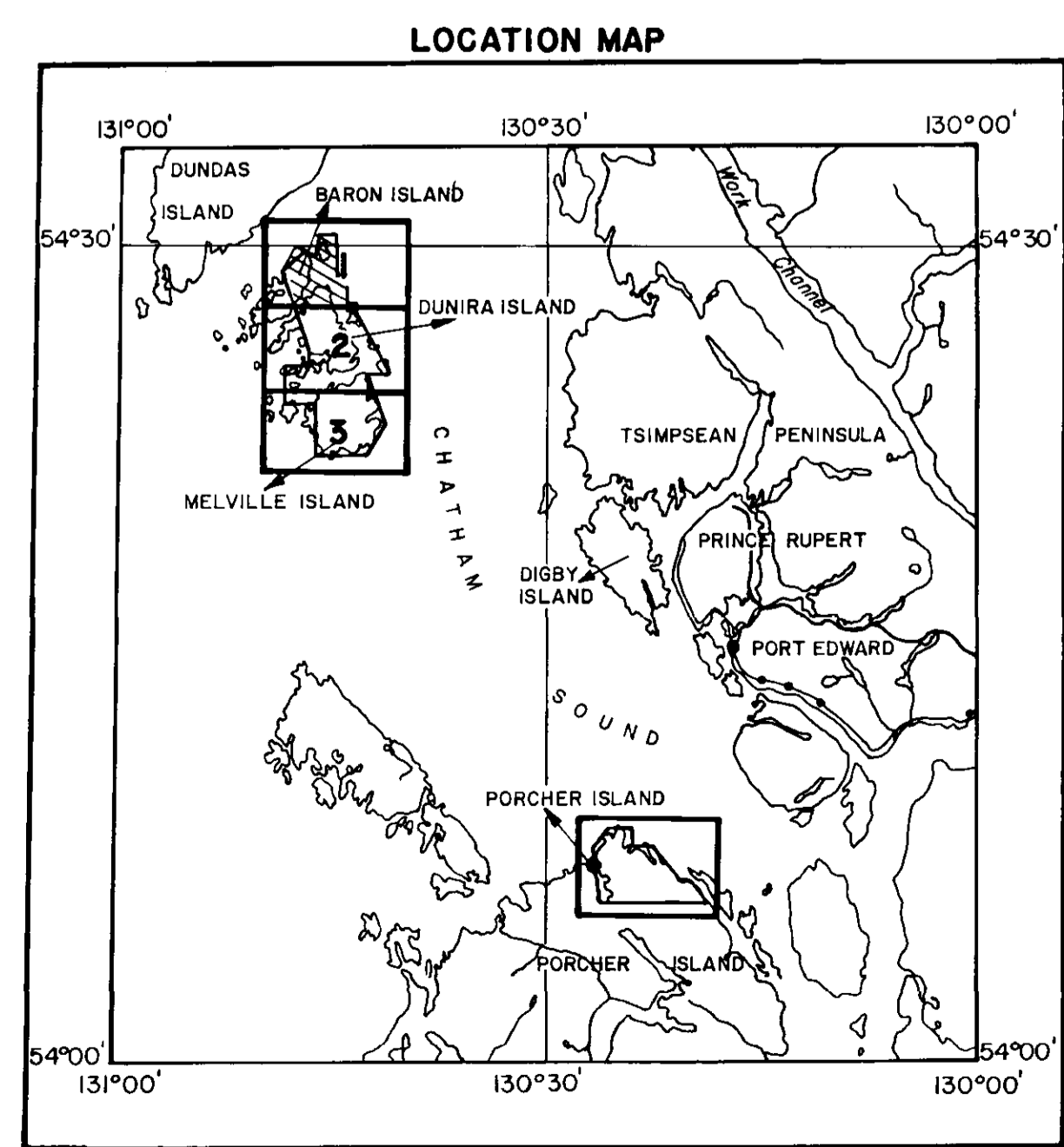
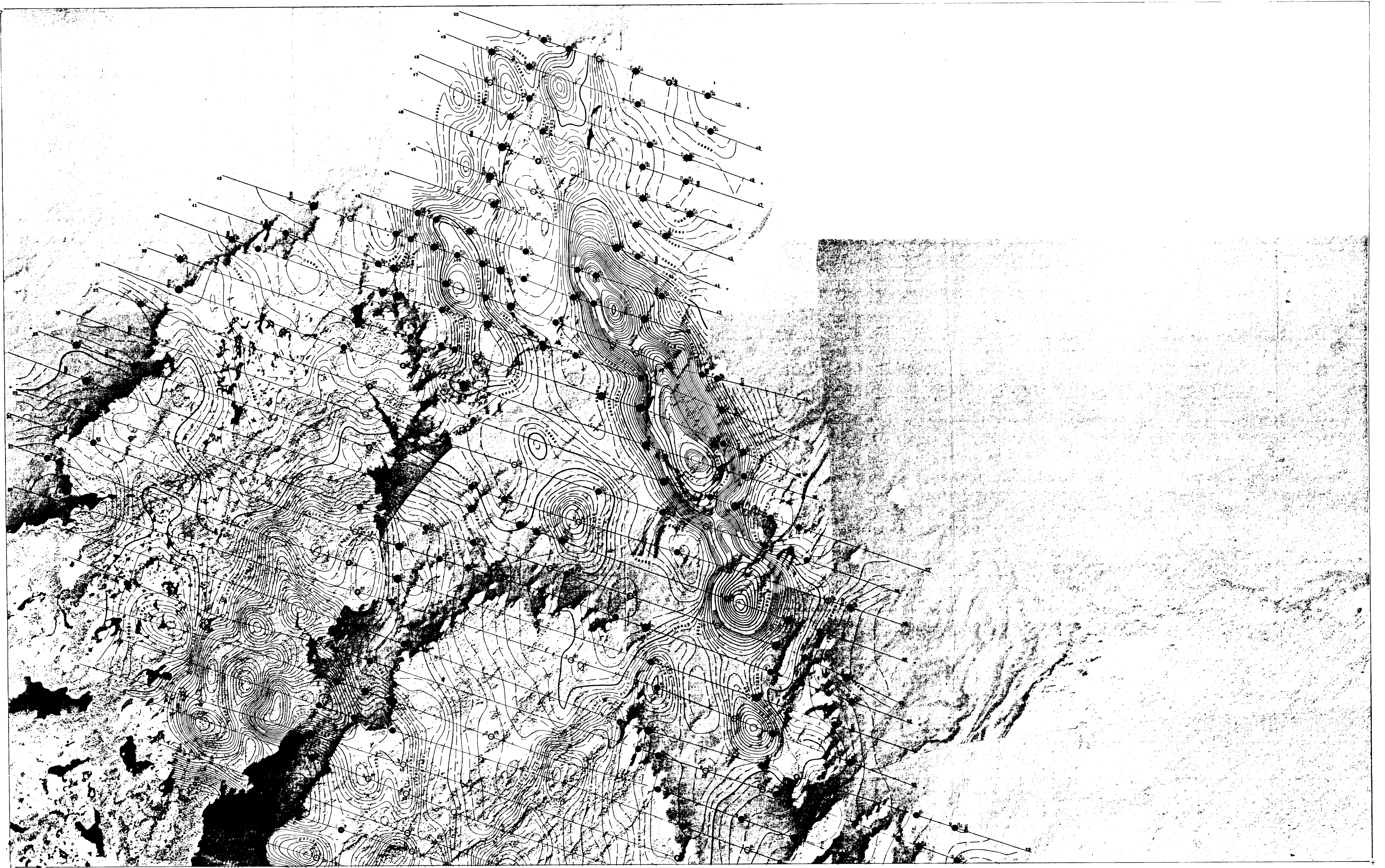
LEGEND
 Contours in ohm — m
 at ten intervals per decade



Note
 The numbers face in the
 direction of increasing value.

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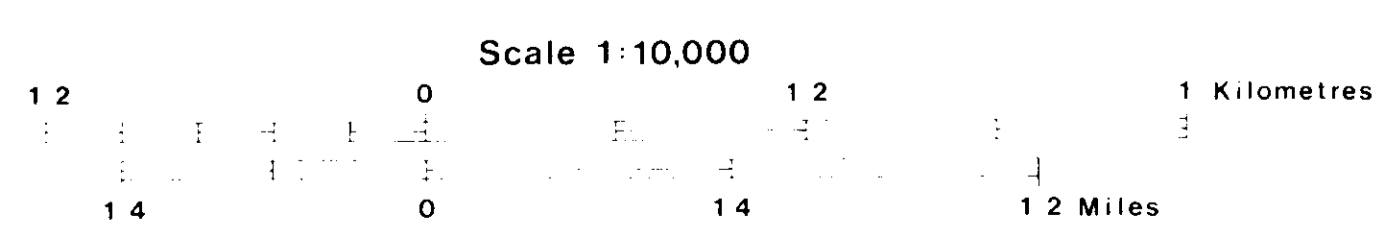
FIGURE 5b



SCALE 1:500,000

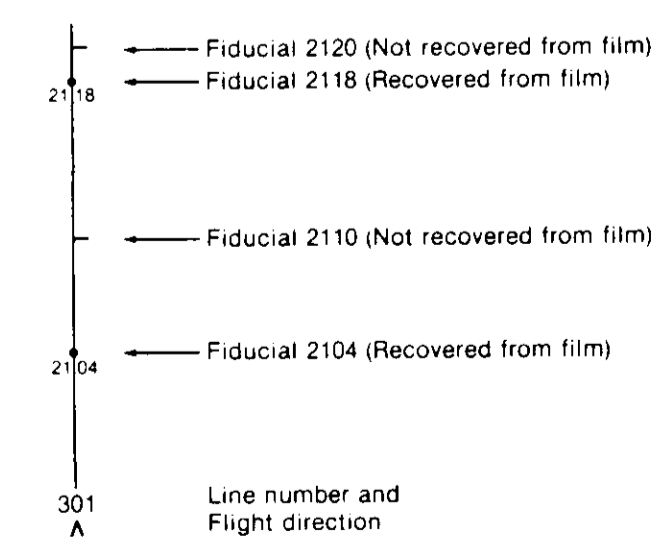


DIGHEM^{III} SURVEY
BARON, DUNIRA AND MELVILLE ISLANDS
MAGNETICS
FOR
BILLITON CANADA LIMITED

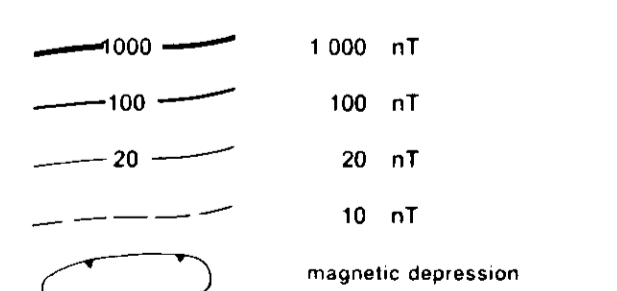


SHEET 1

Flight Line



ISOMAGNETIC LINES
(total field)



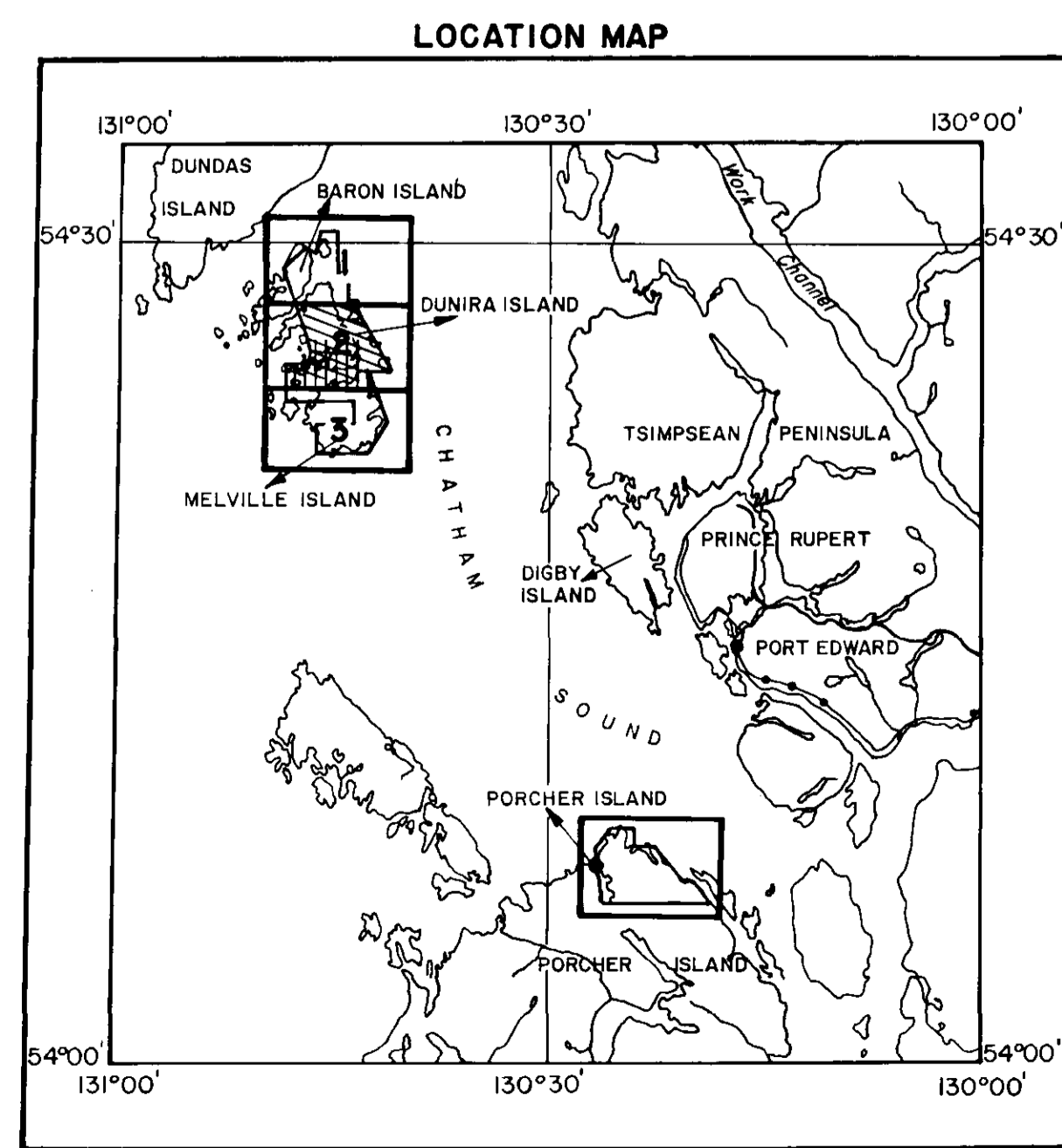
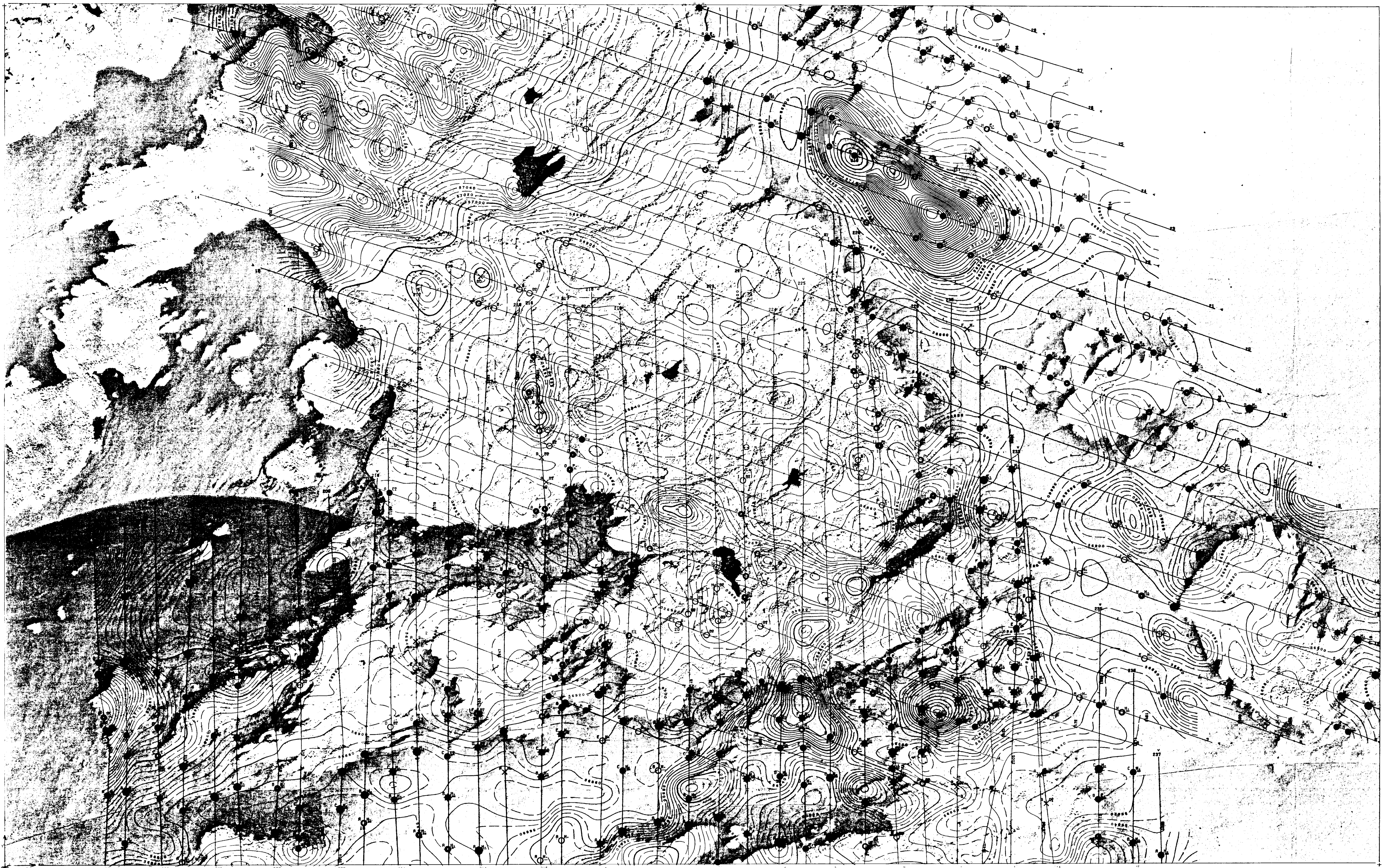
Magnetic inclination within the survey area: 75°

GEOLOGICAL BRANCH
 ASSESSMENT REPORT

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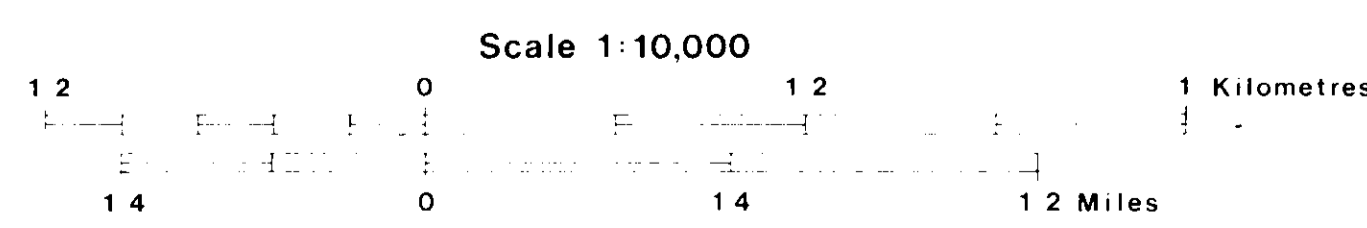
FIGURE 6a



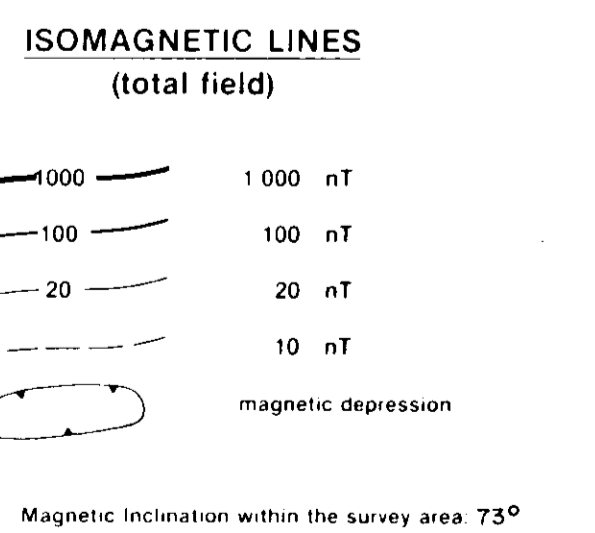
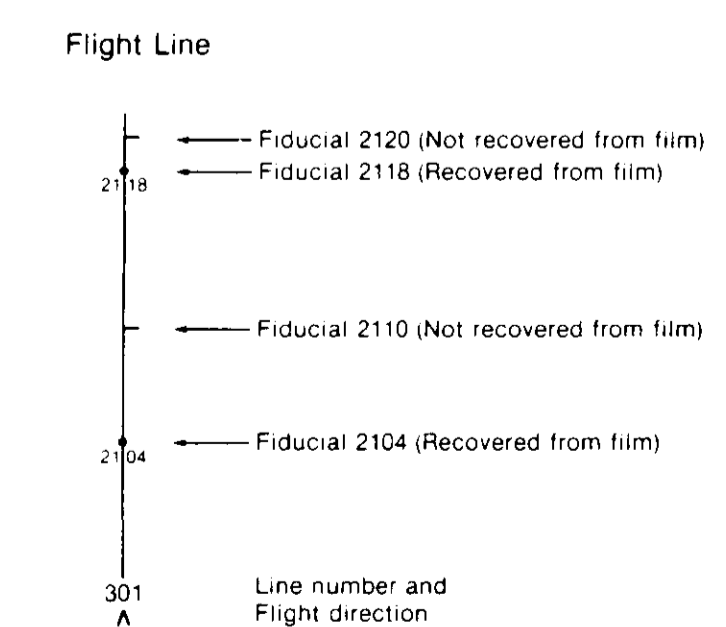
SCALE 1:500,000



DIGHEM SURVEY
 BARON, DUNIRA AND MELVILLE ISLANDS
 MAGNETICS
 FOR
 BILLITON CANADA LIMITED



SHEET 2

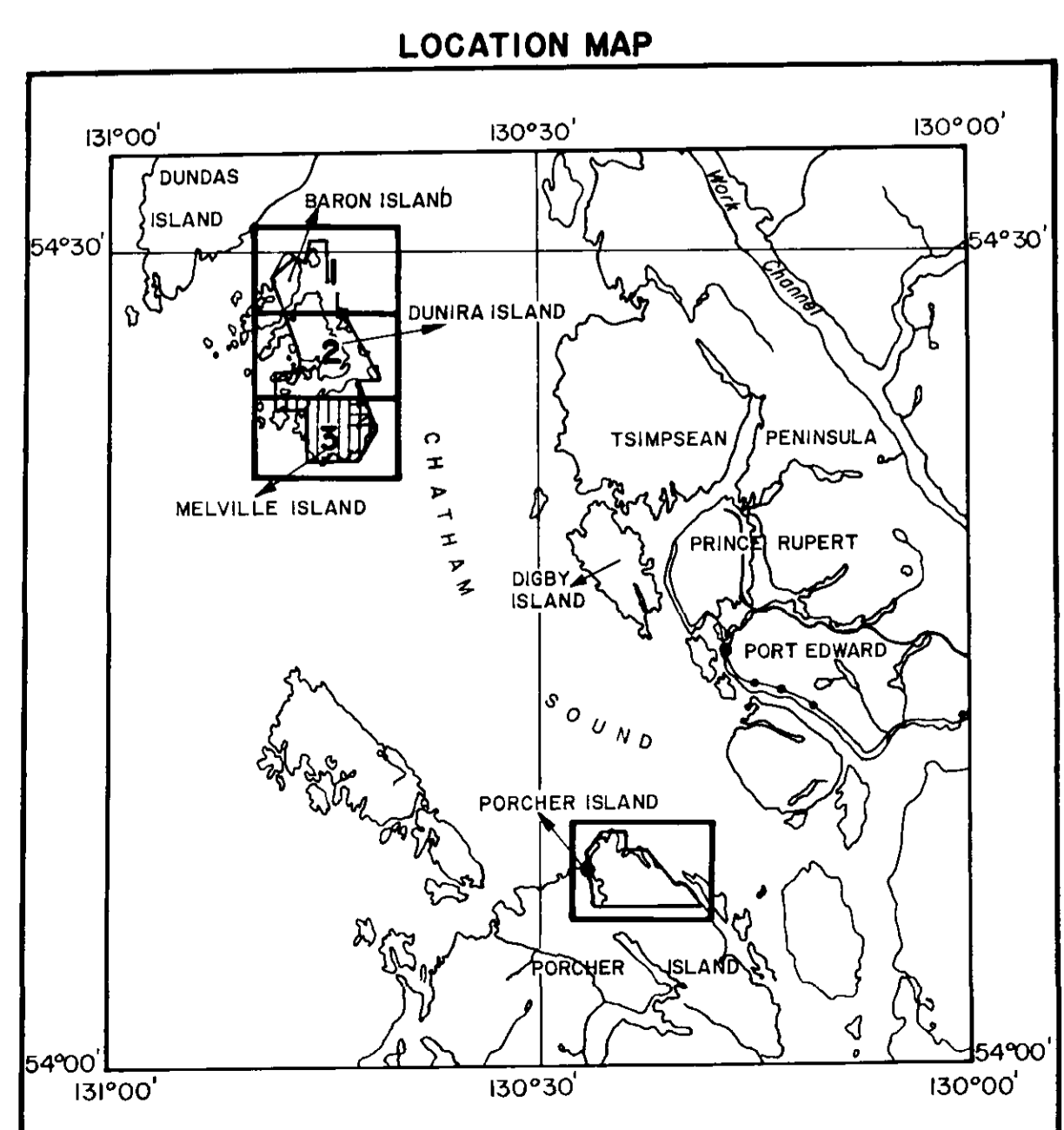
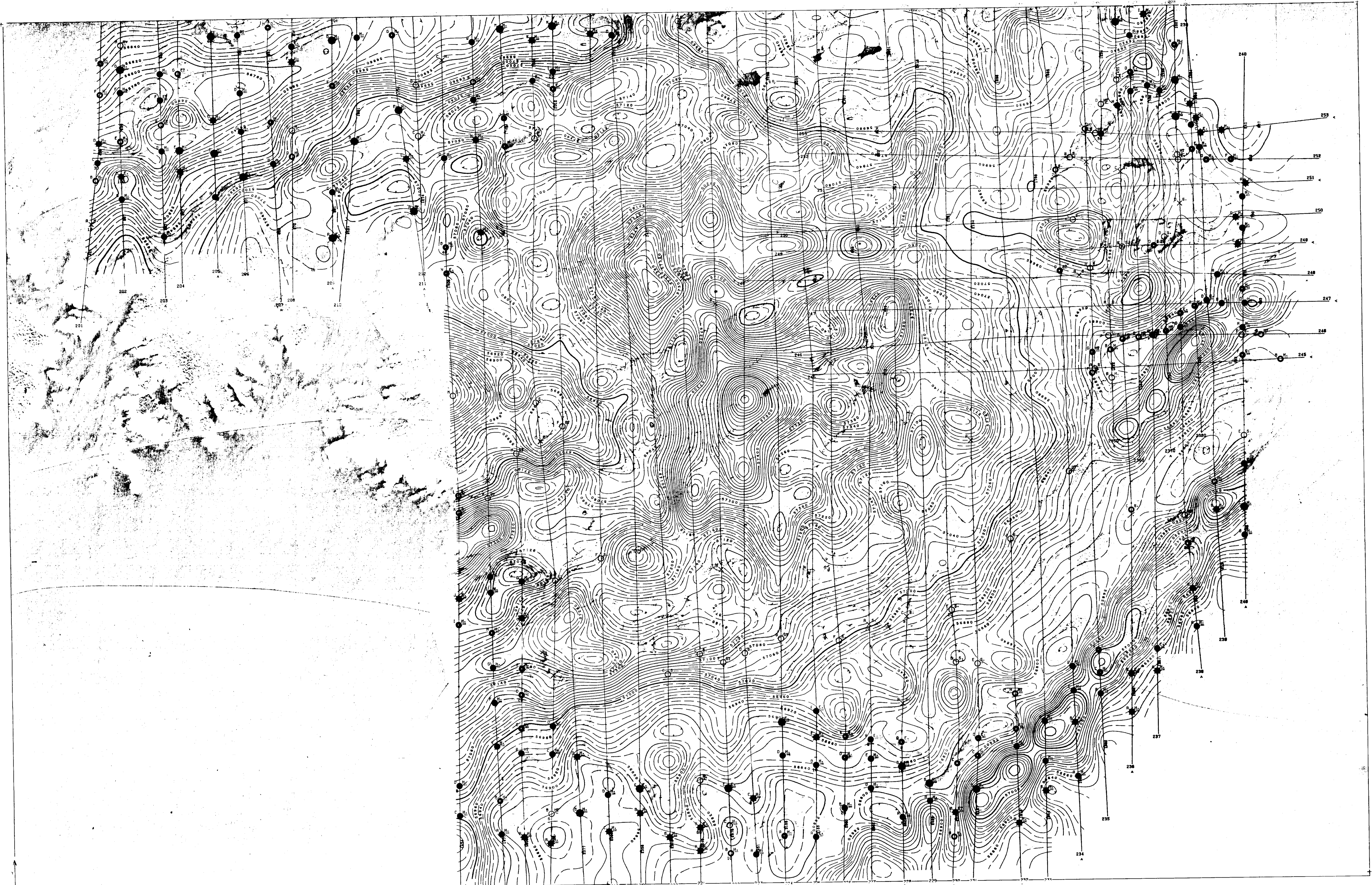


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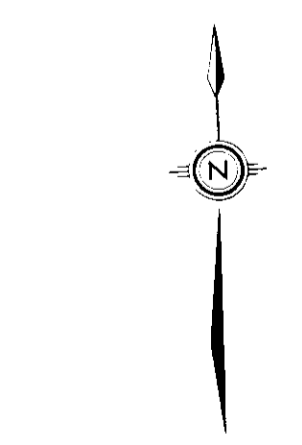
12,197

JOB 127	DATE NOV 85	DRAWN BY [Signature]	CHECKED BY [Signature]
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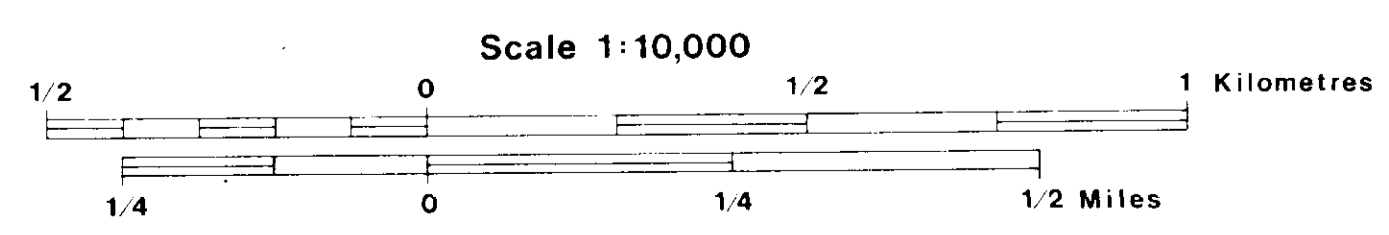
FIGURE 6b



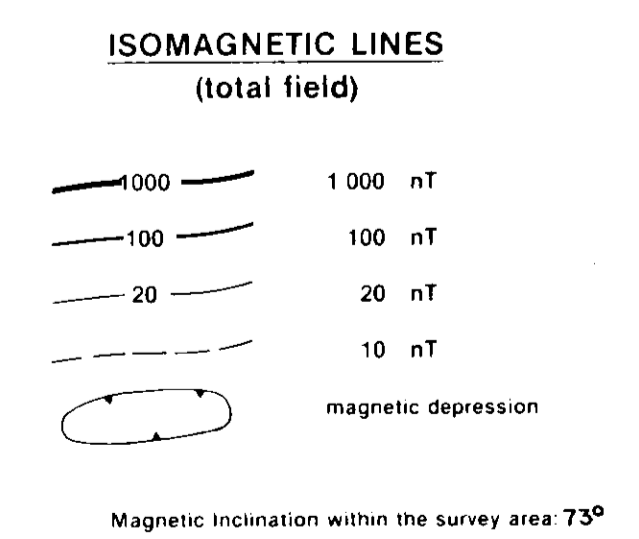
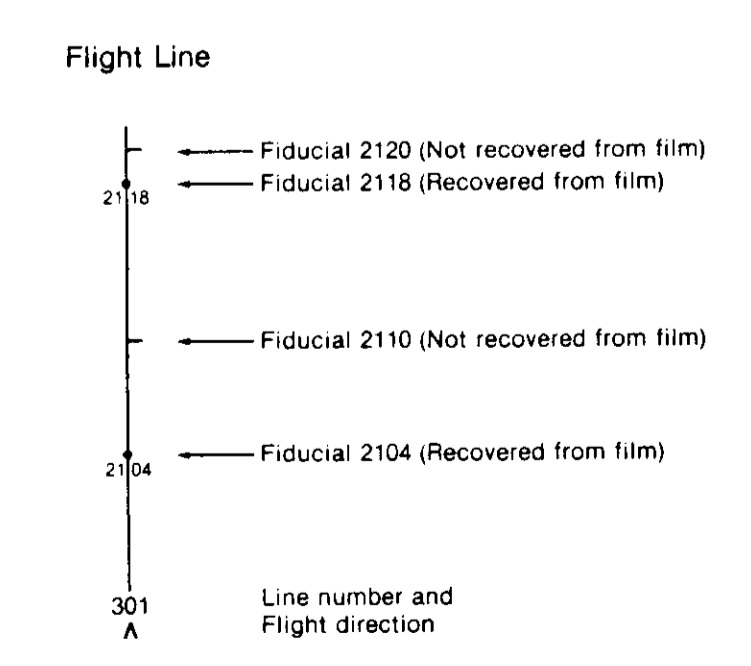
SCALE 1:500,000



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SHEET 3



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FIGURE 6C