Technical Report

High-Resolution Heliborne Magnetic Survey

Native Copper Property, Chandler area,
Gaspésie region, Québec, 2022

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Prospectair Geosurveys

Dynamic Discovery Geoscience

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I. INTRODUCTION

Prospectair conducted a heliborne high-resolution magnetic (MAG) survey for the mineral exploration company 1844 Resources Inc. over its Native Copper Property located in the Chandler area, Gaspésie region, Province of Québec (Figure 1). The survey was flown from March 29 to April 5 2022.

One survey block was flown for a total of 2,678 l-km. A total of 14 production flights were performed using Prospectair's Eurocopter EC120B, registration C-GTAZ. The helicopter and survey crew operated out of the Bonaventure Airport, located about 60km to the southwest of the block (Figure 2).

Table 1: **Survey block particulars**

Block	NTS Mapsheet	Line-km flown	Flight numbers	Dates Flown
Native Copper	22A11	2,678 l-km	Flt 1 to 14	March 29 to April 5

Figure 1: **General Survey Location**

The Native Copper block was flown with traverse lines at 50 m spacing and control lines spaced every 500 m. The survey lines were oriented N171. The control lines were oriented perpendicular to traverse lines. The average height above ground of the helicopter was 41 m and the magnetic sensor was at 22 m. The average survey flying speed was 30.7 m/s. The survey area is mainly covered by forest and the topography is very dynamic, with some very challenging hills, like the Alexandre and de l'Observatoire mountains, and many deep depressions. The elevation is ranging from 269 to 760 m above mean sea level (MSL). The source of the Grand Pabos River is found in the vicinity of the block. From the ground, the Property can be easily accessed via secondary forestry roads connecting to the Route de Pellegrin, itself linked to Highway 132 in Chandler. Coordinates outlining the survey block are given in Appendix A, with respect to NAD-83 datum, UTM projection zone 20N. The location of the Native Copper Property claims (in red) and of the survey lines is shown on Figure 3.

Figure 2: **Regional Survey location**

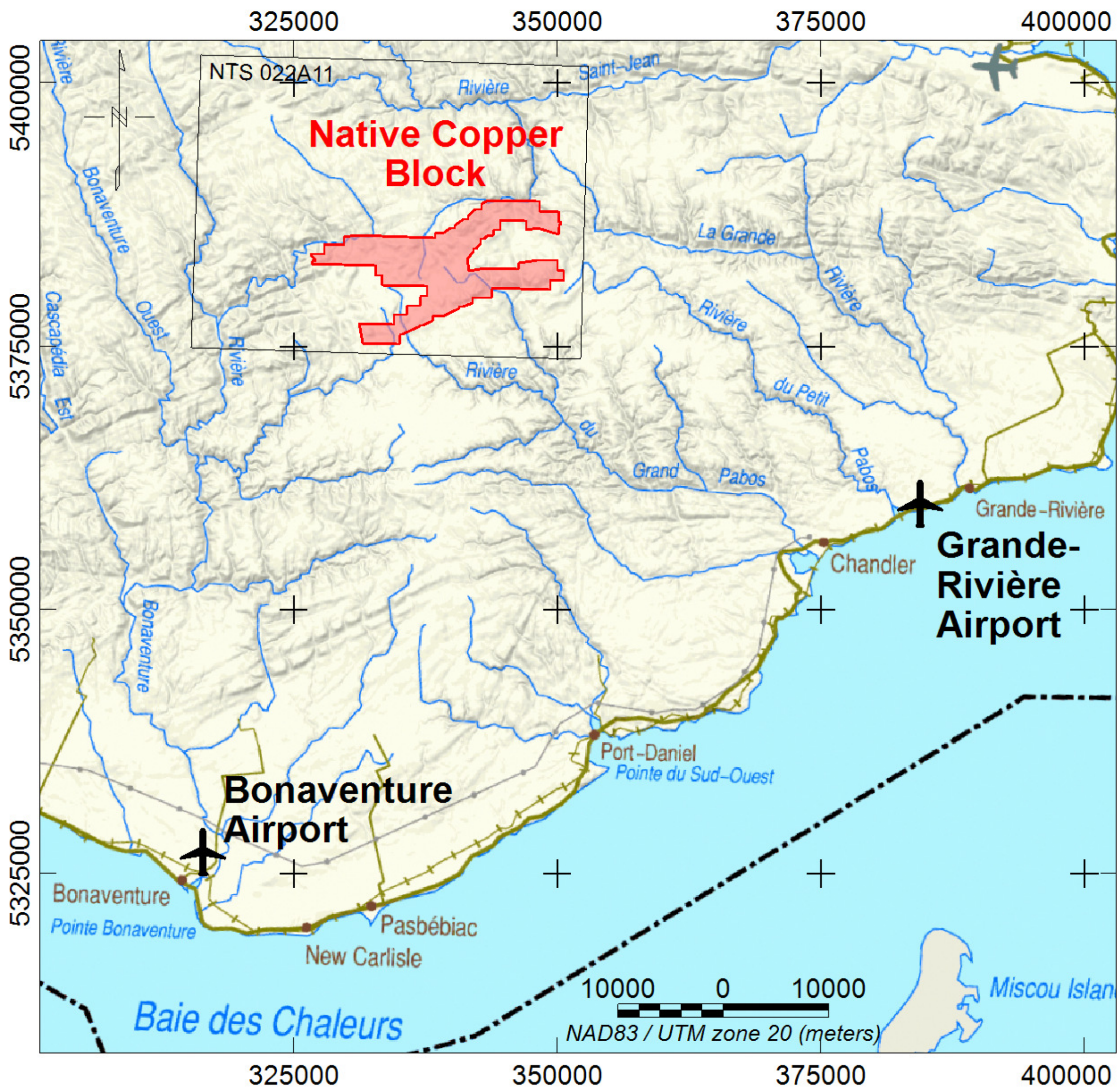
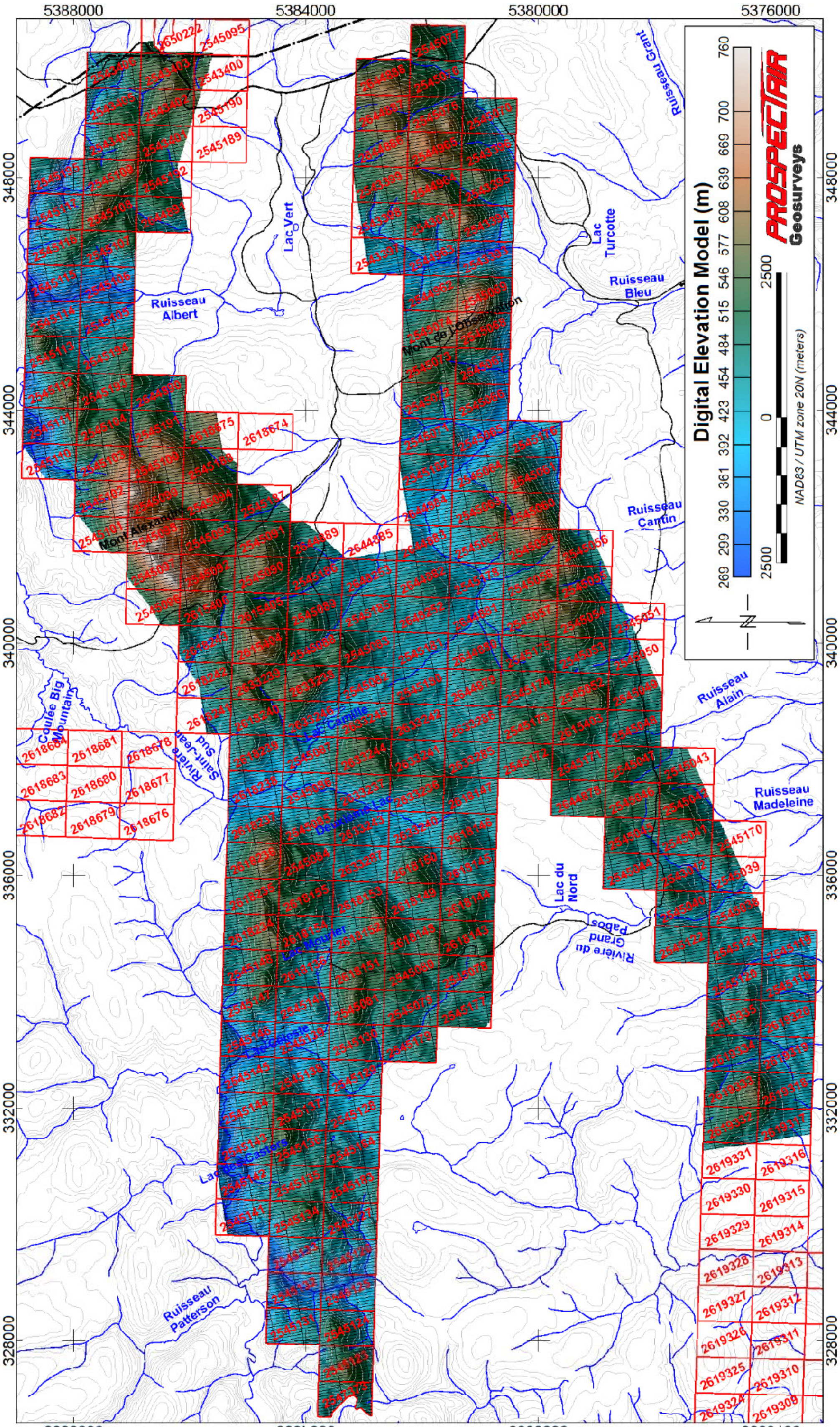


Figure 3: **Survey lines and Native Copper Property claims**



II. SURVEY EQUIPMENT

Prospectair provided the following instrumentation for this survey:

Airborne Magnetometer

Geometrics G-822A

The heliborne system used a non-oriented (strap-down) optically-pumped Cesium split-beam sensor. These magnetometers have a sensitivity of 0.005 nT and a range of 15,000 to 100,000 nT with a sensor noise of less than 0.02 nT. The heliborne sensor was mounted in a bird made of non-magnetic material located 19 m below the helicopter when flying. Total magnetic field measurements were recorded at 10 Hz in the aircraft.

Real-Time Differential GPS

Omnistar DGPS

Prospectair uses an OmniStar differential GPS navigation system to provide real-time guidance for the pilot and to position data to an absolute accuracy of better than 5 m. The *Omnistar* receiver provides real-time differential GPS for the Agis on-board navigation system. The differential data set was relayed to the helicopter via the Omnistar network appropriate geosynchronous satellite for the survey location. The receiver optimizes the corrections for the current location.

Airborne Navigation and Data Acquisition System

Pico-Envirotec AGIS-XP system

The Airborne Geophysical Information System (AGIS-XP) is advanced, software driven instrument specifically designed for mobile aerial or ground geophysical survey work. The AGIS instrumentation package includes an advanced navigation system, real-time flight path information that is displayed over a map image of the area, and reliable data acquisition software. Thanks to simple interfacing, the radar and barometric altimeters and the Geometrics magnetometer are easily integrated into the system and digitally recorded. Automatic synchronization to the GPS position and time provides very close correlation between data and geographical position. The AGIS is equipped with a software suite allowing easy maintenance, upgrades, data QC, and project and survey area layout planning.

Magnetic Base Station

GEM GSM-19

A GEM GSM-19 Overhauser magnetometer, a computer workstation and a complement of spare parts and equipment serve as the base station. Prospectair establish the base station in a secure location with low magnetic noise. The GSM-19 magnetometer has resolution of 0.01 nT, and 0.2 nT accuracy over its operating range of 20,000- to 100,000 nT. The ground system was recording magnetic data at 1 Hz.

Altimeters

Free Flight Radar Altimeter

The Free Flight radar altimeter measures height above ground to a resolution of 0.5 m and an accuracy of 5% over a range up to 2,500 ft. The radar altimeter data is recorded and sampled at 10 Hz.

Digital Barometric Pressure Sensor

The barometric pressure sensor measures static pressure to an accuracy of ± 4 m and resolution of 2 m over a range up to 30,000 ft above sea level. The barometric altimeter data are sampled at 10 Hz.

Survey helicopter

Eurocopter EC120B (registration C-GTAZ)

The survey was flown using Prospectair's EC120B helicopter that handles efficiently the equipment load and the required survey range. Table 2 presents the EC120B technical specifications and capacity, and the aircraft is shown in Figure 4.

Table 2: **Technical specifications of the EC120B Eurocopter helicopter**

Item	Specification
Powerplant	One 376kW (504hp) Turbomeca Arrius 2F
Rate of climb	1,150 ft/min
Cruise speed	223 km/h – 120 kts
Service ceiling	17,000 ft
Range with no reserve	710 km
Empty weight	991 kg
Maximum takeoff weight	1,715 kg

Figure 4: **C-GTAZ Eurocopter EC120B**

III. SURVEY SPECIFICATIONS

Data Recording

The following parameters were recorded during the course of the survey:

In the helicopter:

- GPS positional data: time, latitude, longitude, altitude, heading and accuracy (PDOP) recorded at intervals of 0.1 s;
- Total magnetic field: recorded at intervals of 0.1 s;
- Pressure as measured by the barometric altimeter at intervals of 0.1 s;
- Terrain clearance as measured by the radar altimeter at intervals of 0.1 s;

At the base and remote magnetic ground stations:

- Total magnetic field: recorded at intervals of 1 s;
- GPS time recorded every 1s to synchronize with airborne data.

Technical Specifications

The data quality control was performed on a daily basis. The following technical specifications were adhered to:

- *Height* – 50m mean terrain clearance for the helicopter except in areas where Transport Canada regulations prevent flying at this height, or as deemed by the pilot to ensure safety. Traverse lines and control lines must be flown at the same altitude at points of intersection; the altitude tolerances are limited to no more than 30 m difference between traverse lines and control lines.
- *Airborne Magnetometer Data* – A 0.5 nT noise envelope not to be exceeded for more than 500 m line-length without a reflight.
- *Diurnal Specifications* – A maximum tolerance of 5.0 nT (peak to peak) deviation from a long chord of one minute at the base station.
- *Flying Speed* – The average ground speed for the survey aircraft should be 120 kph. The acceptable high limit is 180 kph over flat topography.
- *Radar Altimeter* – minimal accuracy of 5%, minimum range of 0-2500 m.
- *Barometer* – Absolute air pressure to 0.1 kPa.
- *Flight Path Following* – The line spacing not to vary by more than 30% from the ideal spacing over a distance of more than 300 m, except as required for aviation safety.

  For the Native Copper Block:

  Traverse lines: Azimuth N171, 50 m spacing.
  Control Lines: Azimuth N081, 500 m spacing.

IV. SYSTEM TESTS

Magnetometer System Calibration

The survey configuration using a bird towed 19 m below any magnetic piece of the helicopter allows the simplification of the magnetic calibration requirement. Consequently, heading error and aircraft movement noise was considered negligible and no correction was applied to the data.

Instrumentation Lag

The magnetometer lag is a combination of two factors: 1) the time difference between when a reading is sensed, and when that value is recorded by the acquisition system, and 2) the time taken for the sensor to arrive at the location of the GPS antenna. The second factor is defined by the physical distance between the GPS antenna and any given sensor, and the speed of the aircraft. The average total magnetic lag value for the AGIS acquisition system has been calculated to 1.75 s for this survey.

V. FIELD OPERATIONS

The survey operations were conducted out of the Bonaventure Airport from March 29 to April 5, 2022. The data acquisition required 14 flights. At the end of each production day, the data were sent to the Dynamic Discovery Geoscience office via internet. The data were then checked for Quality Control to ensure they fulfilled contractual specifications. The full dataset was inspected prior to provide authorization for the field crew to demobilize. The GSM-19 magnetic base station was set up close to the Airport, in a magnetically quiet area, at latitude 48.0695290°N, longitude 65.4622330°W. The survey pilot was Dominic Latour and the survey system technician was Jonathan Drolet.

Figure 5: **Example of a magnetic base station setup**

VI. DIGITAL DATA COMPILATION

Data compilation including editing and filtering, quality control, and final data processing was performed by Joël Dubé, P.Eng. Processing was performed on high performance desktop computers optimized for quick daily QC and processing tasks. Geosoft software Oasis Montaj version 2021.2.1 was used.

Magnetometer Data

General

The airborne magnetometer data, recorded at 10 Hz, were plotted and checked for spikes and noise on a flight basis. An average of 1.75 second lag correction was applied to the data to correct for the time delay between detection and recording of the airborne data.

Ground magnetometer data were recorded at 1 sample per second and interpolated by a spline function to 10 Hz to match airborne data. Data were inspected for cultural interference and edited where necessary. Low-pass filtering was deemed necessary on the ground station magnetometer data to remove minor high frequency noise. The diurnal variations were removed by subtracting the ground magnetometer data to the airborne data and by adding back the average of the ground magnetometer value.

The levelling corrections were applied in several steps. First of all, a correction for altitude was applied by multiplying the First Vertical Derivative (FVD) of the Total Magnetic Intensity (TMI) by the difference between the actual survey altitude and the average survey altitude. Standard levelling corrections were then performed using intersection statistics from traverse and tie lines. After statistical levelling was considered satisfactory, decorrugation was applied on the data to remove any remaining subtle non-geological features oriented in the direction of the traverse lines.

Once the Total Magnetic Intensity (TMI) was gridded, its First Vertical Derivative (FVD) and Second Vertical Derivative (SVD) were calculated to enhance narrow and shallow geological features. Finally, the component of the normal Earth's magnetic field, described by the International Geomagnetic Reference Field (IGRF), has been removed from the TMI to yield the residual TMI.

Tilt Angle Derivative

In order to enhance the subtle magnetic features some more, the Tilt Angle Derivative (TILT) was also computed for this project.

It has been shown that it is possible to use the Tilt Angle Derivative to estimate both the location and depth of magnetic sources (Salem et al., 2007).

When two body of different magnetic susceptibility are in contact, the vertical and horizontal gradients along a horizontal line perpendicular to the vertical contact are governed by the following equations:

$\delta M/\delta h=2KFc(z_c/(h^2+z_c^2))$
$\delta M/\delta z=2KFc(h/(h^2+z_c^2))$

where
K = susceptibility contrast
F = magnetic field's strength
c = 1-$\cos^2$(field Inclination)$\sin^2$(field Declination)
h = location along an horizontal axis perpendicular to the contact
z_c = contact depth
$\delta M/\delta h = \mathrm{sqrt}((\delta M/\delta x)^2+(\delta M/\delta y)^2)$

The Tilt Angle (θ) is defined as
$\theta = \tan^{-1}[(\delta M/\delta z)/(\delta M/\delta h]$

By substitution of the gradients we get
$\theta = \tan^{-1} [h/z_c]$

This has two main implications for any given anomaly:

1- The 0° angle line is located directly above the contact between a magnetic source and the surrounding rock. This allow for accurate estimation of source location.
2- The distance between the 0° and the +45° contour lines as well as the distance between the -45° and the 0° contour lines are equal to the depth of the source at the contact. This allow for a direct estimation of the depth of the source of the anomaly. The depth estimated with this method is actually the distance between the magnetic sensor and the top of the source. Knowing that the sensor was 22 m above the ground in average enables direct depth estimates.

In practice, the signal originating from multiple sources at different depth within a same area will cause juxtaposition of the Tilt Angle values, and complicate location and depth estimation. Nevertheless, the method remains an excellent tool for rapid assessment of sources characteristics, without the need for complex assumptions to be made or heavy computer requirements, as is the case with 3D Euler deconvolution or 3D data inversions.

Gridding
The magnetic data were interpolated onto a regular grid using a bi-directional gridding algorithm to create a two-dimensional grid equally incremented in x and y directions. The final grids of the magnetic data were created with 10 m grid cell size. Traverse lines were used in the gridding process.

Radar Altimeter Data
The terrain clearance measured by the radar altimeter in metres was recorded at 10 Hz. The data were filtered to remove high frequency noise using a 1 sec low pass filter. The final data were plotted and inspected for quality.

Positional Data
Real time DGPS correction provided by Omnistar was applied to the recorded GPS positional data.

Positional data were originally recorded at 10 Hz sampling rate in geographic longitude and latitude with respect to the WGS-84 datum. The delivered data locations are provided in X and Y using the UTM projection zone 20 North, with respect to the NAD-83 datum. Altitude data were initially recorded relative to the GRS-80 ellipsoid, but are delivered as orthometric heights (MSL elevation).

Terrain Data
Terrain elevation data (also referred to as digital elevation model, or DEM) are computed from the altitude of the helicopter, given by DGPS recordings, and the radar altimeter data.

VII. RESULTS AND DISCUSSION

The residual Total Magnetic Intensity (TMI) of the Native Copper block, presented in Figure 6, is relatively active and varies over a range of 2,909 nT, with an average of -119 nT and a standard deviation of 328 nT.

The magnetic field depicts two distinct active bands, one to the north, larger in its central part, and one to the south, affected by linear magnetic features characteristic of alternating sequences of mafic volcanic rocks with sedimentary or intermediate to felsic volcanic rocks, with possibly some intrusive stocks, sills or dykes locally. Stronger anomalies are found in the southern band, but are not very strong in absolute terms. Stronger anomalies are best seen on Figure 7 which shows the residual TMI data with a linear color distribution. Remaining areas with lower background values and decreased signal variability are likely to be dominated by sedimentary or felsic volcanic rocks.

Magnetic lineaments are generally trending ENE-WSW in the area, but can vary significantly locally, especially within the northern magnetic band where dynamic folding structures are seen. There are also some discrete lineaments striking against the dominant geological trends. These outlier lineaments are mostly oriented from NNW-SSE to NNE-SSW and likely pertain to mafic dykes. Several magnetic lineaments are curved throughout the area, most likely by shearing or folding structures, attesting that the area underwent strong deformation events in the past. In general terms, magnetic lineaments are related to rock formations that are enriched in magnetic minerals (magnetite and/or pyrrhotite).

In many areas, it is possible to detect structural features offsetting observed magnetic lineaments and causing abrupt interruption or changes of the magnetic response. These features are typically caused by faults, fractures and shear zones. If they are thought to be favorable structures in the exploration context of the Native Copper project, they should be paid particular attention and should be the object of a comprehensive structural interpretation, which is beyond the scope of this report.

Shorter wavelength anomalies are greatly enhanced on the FVD (Figure 8) and on the TILT (Figure 9) products. Since the FVD attenuates longer wavelength anomalies, and the TILT enhances very weak amplitude anomalies, they are the preferred products for structural interpretation.

Regarding cultural interference, human infrastructures such as the power line, found at the northeastern tip of the block, are known to be possible sources of non-geological noise in the magnetic data. There is also the possibility for large vehicles or pieces of equipment located on or beside forestry roads, elsewhere within the block, to be causing local perturbation of the magnetic field. As a consequence, high frequency anomalies located near such features could actually originate from cultural sources and should be treated with caution when planning ground investigations of magnetic anomalies.

In addition, when the helicopter had to steeply climb up above the power line for obvious safety reasons, the magnetic response can appear somewhat blurred, with anomalies being attenuated in amplitude and increased in wavelength because of the greater sensor distance from the ground. This can also result in local stripes parallel to survey lines in the data. This effect is really local and quickly fades out on either sides of the overflown obstacle, but must be nevertheless considered when following-up on the results

Figure 6: **Residual Total Magnetic Intensity with equal area color distribution**

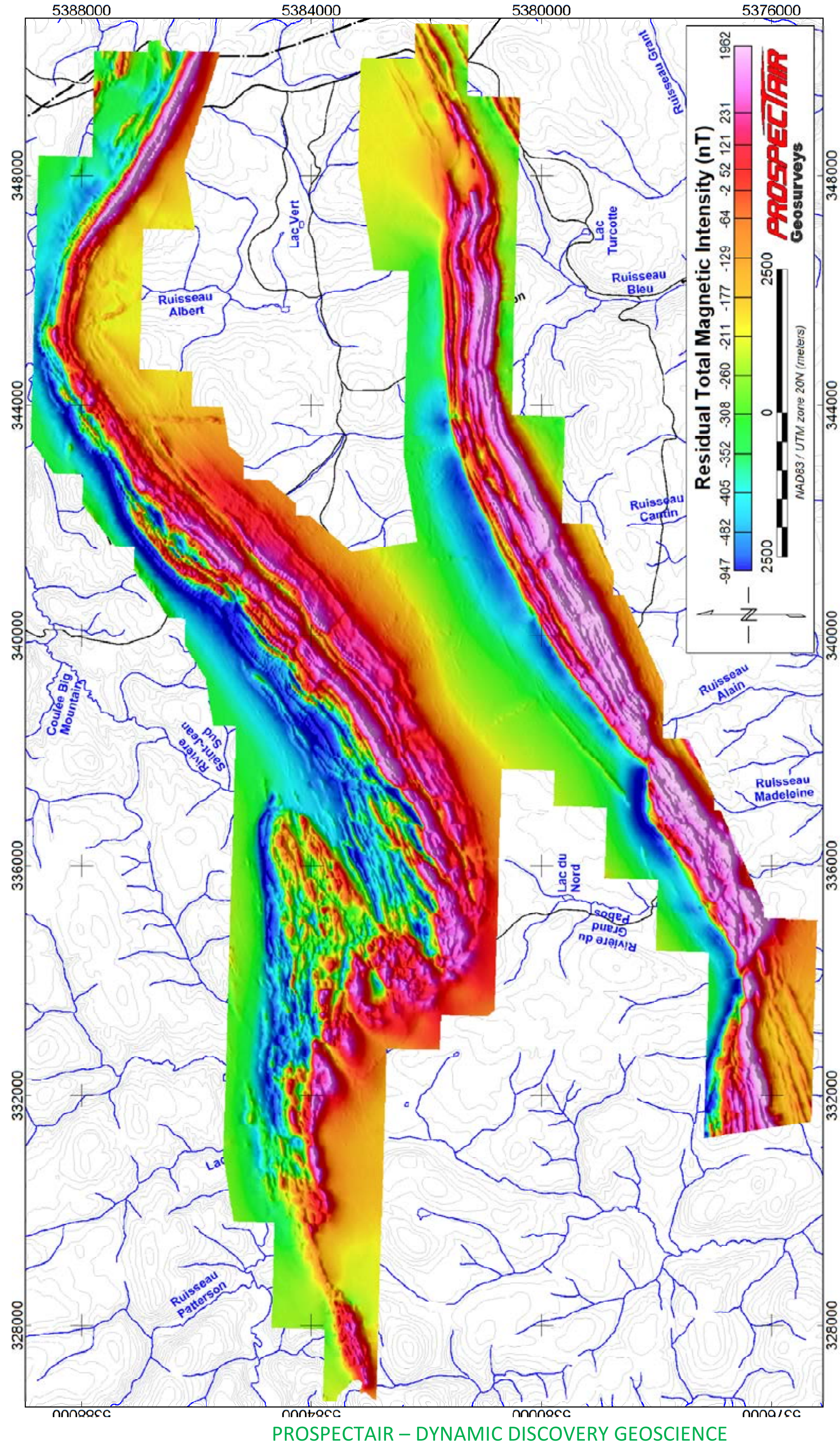


Figure 7: **Residual Total Magnetic Intensity with linear color distribution**

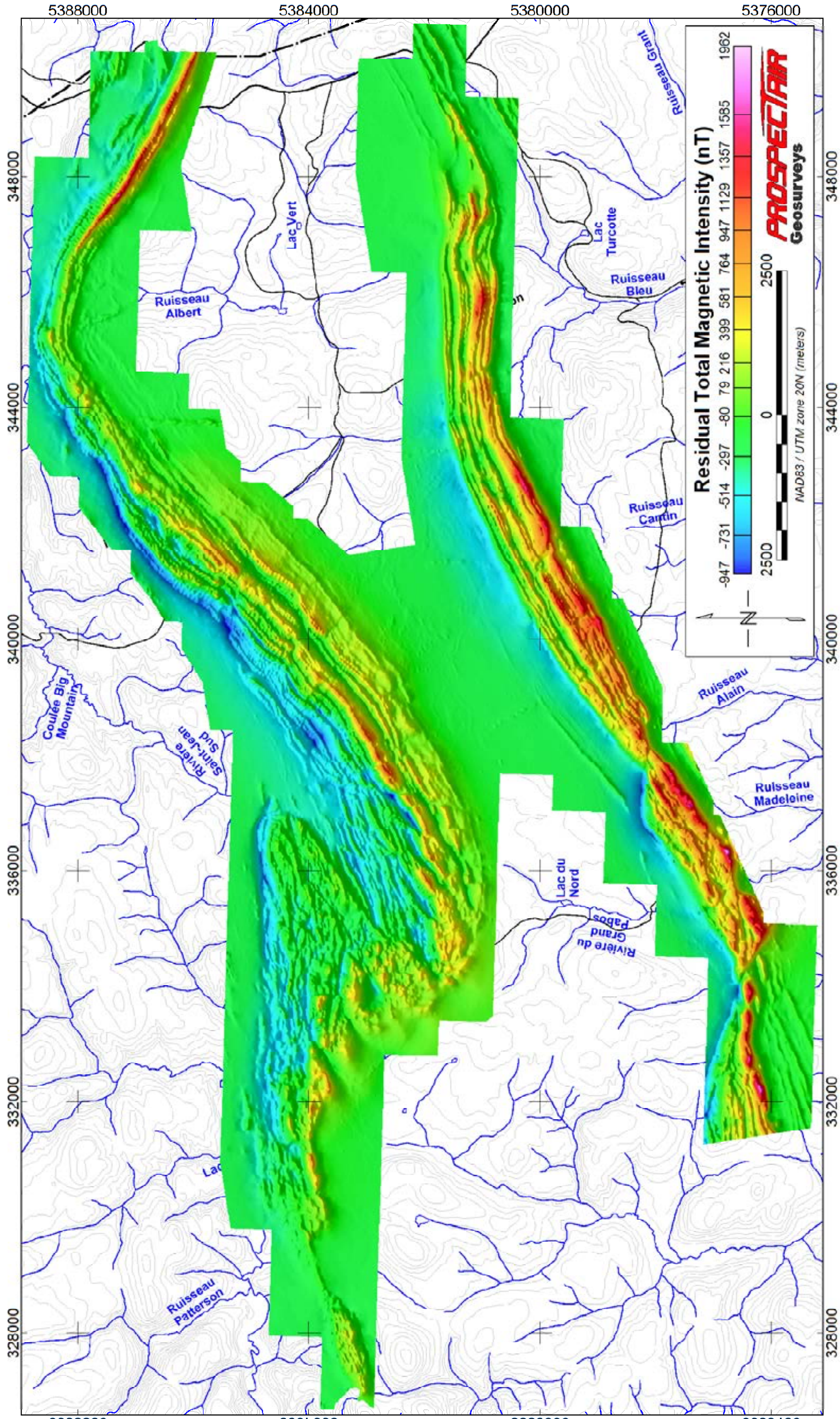


Figure 8: **First Vertical Derivative of the TMI**

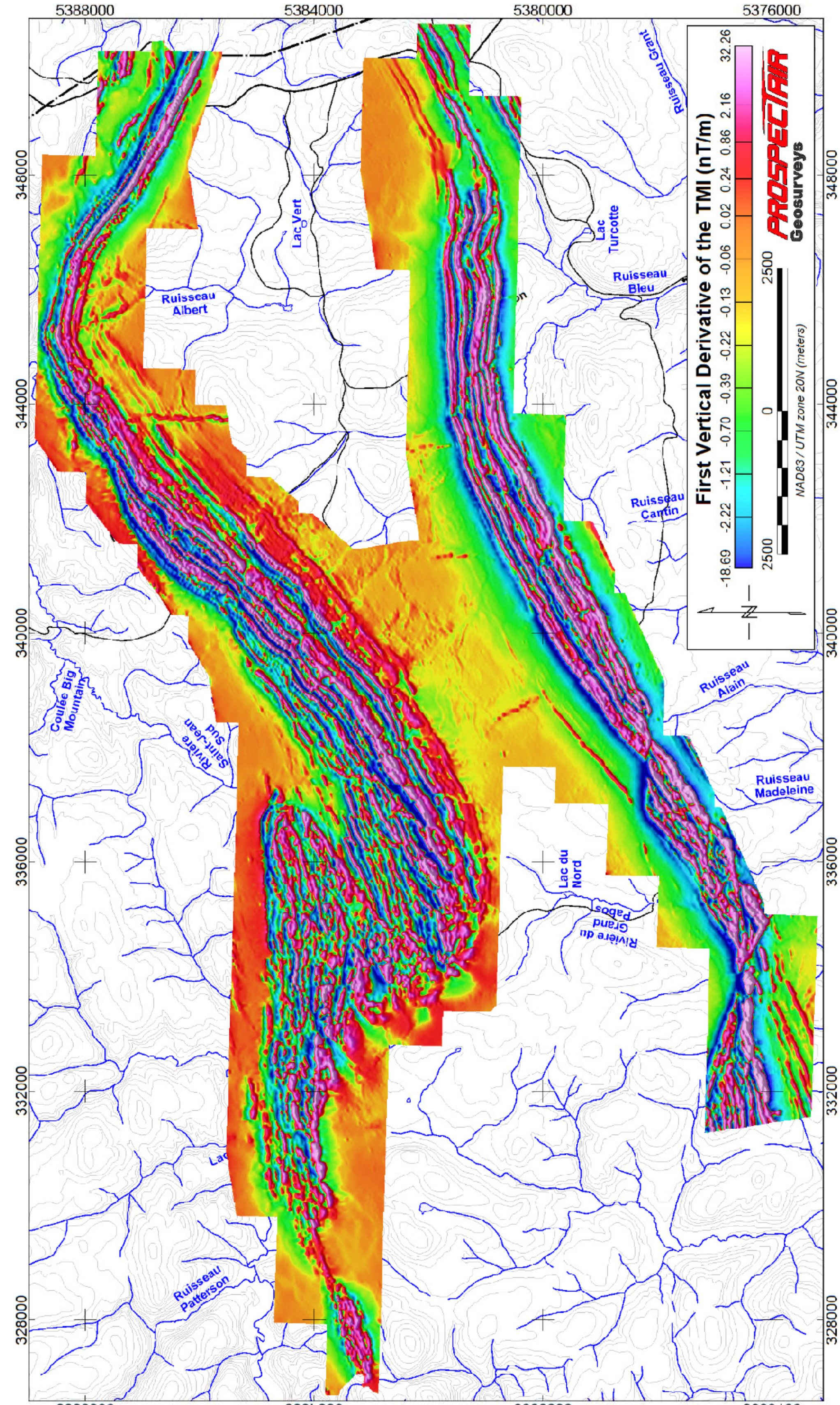
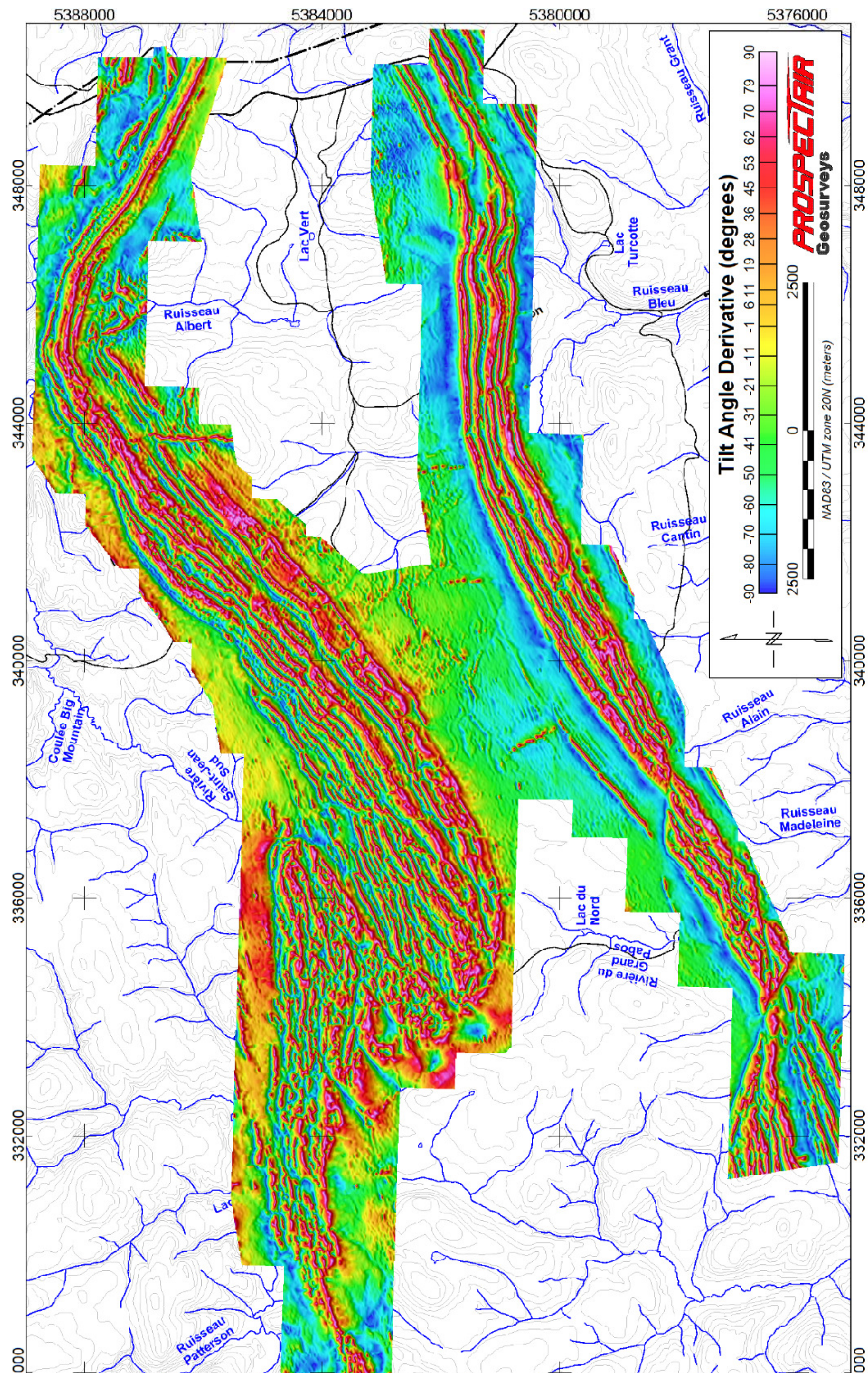


Figure 9: **Tilt Angle Derivative**



VIII. FINAL PRODUCTS

Digital Line Data

The Geosoft database is provided with the channels detailed in Table 3.

Table 3: **MAG line data channels**

No.	Name	Description	Units
1	UTM_X	UTM Easting, NAD-83, Zone 20N	m
2	UTM_Y	UTM Northing, NAD-83, Zone 20N	m
3	Lat_deg	Latitude in decimal degrees	Deg
4	Long_deg	Longitude in decimal degrees	Deg
5	Gtm_sec	Second since midnight GMT	Sec
6	Radar	Ground clearance given by the radar altimeter	m
7	Terrain	Calculated Digital Elevation Model (w.r.t. MSL)	m
8	GPS_Z	Helicopter altitude (w.r.t. MSL)	m
9	Mag_Raw	Raw magnetic data	nT
10	Mag_Lag	Lagged magnetic data	nT
11	Gnd_mag	Base station magnetic data	nT
12	Mag_Cor	Magnetic data corrected for diurnal variation	nT
13	TMI	Fully levelled Total Magnetic Intensity	nT
14	TMIres	Residual TMI (IGRF removed)	nT

Maps

All maps are referred to NAD-83 datum in the UTM projection Zone 20 North, with coordinates in metres. Maps are at a 1:20,000 scale and are provided in PDF, PNG, Geotiff and Geosoft MAP formats for the products detailed in Table 4.

Table 4: **Maps delivered**

No.	Name	Description
1	DEM+FlightPath+Claims	Digital Elevation Model with flight path and property claims
2	TMI	Residual Total Magnetic Intensity
3	FVD	First Vertical Derivative of the TMI
4	TILT	Tilt Angle Derivative

Grids
All grids are referred to NAD-83 in the UTM projection Zone 20 North, with coordinates in metres. Grids are provided in Geosoft GRD format, with a 10m grid cell size, as well as in the Geotiff format for the products listed in Table 5.

Table 5: **Grids delivered**

No.	Name	Description	Units
1	Terrain	Calculated Digital Elevation Model	m
2	TMI	Total Magnetic Intensity	nT
3	FVD	First Vertical Derivative of TMI	nT/m
4	SVD	Second Vertical Derivative of TMI	nT/m^2
5	TMIres	Residual TMI (IGRF removed)	nT
6	TILT	Tilt Angle Derivative	Degree

Project Report
The report is submitted in PDF format.

Respectfully submitted,

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Joël Dubé, P.Eng.
June 24, 2022

IX. STATEMENT OF QUALIFICATIONS

Joël Dubé
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I, Joël Dubé, P.Eng., do hereby certify that:

1. I am a consultant in geophysics, President of Dynamic Discovery Geoscience Ltd., registered in Canada.

2. I earned a Bachelor of Engineering in Geological Engineering in 1999 from the École Polytechnique de Montréal.

3. I am an Engineer registered with the Ordre des Ingénieurs du Québec, No. 122937, and a Professional Engineer with Professional Engineers Ontario, No. 100194954 (CofA No. 100219617), with the Association of Professional Engineers and Geoscientists of New Brunswick, No. L5202 (CofA No. F1853), with the Association of Professional Engineers of Nova Scotia, No. 11915 (CofC No. 51099), with Engineers Geoscientists Manitoba, No. 43414. (CofA No. 6897), with Professional Engineers & Geoscientists Newfoundland & Labrador, No. 10012 (PtoP No. N1134) and with the Northwest Territories Association of Professional Engineers & Geoscientists, No. L4447 (PtoP No. P1414)

4. I have practised my profession for 23 years in exploration geophysics.

5. I have not received and do not expect to receive a direct or indirect interest in the properties covered by this report.

Dated this 24th day of June, 2022

INGÉNIEUR - PROFESSIONAL ENGINEER
Joël Dubé
122937
QUÉBEC

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Joël Dubé, P.Eng. #122937

X. Appendix A – Survey block outline

Native Copper Block

Easting	Northing
335054	5375209
331546	5375313
331251	5377181
334488	5377085
334515	5378011
335746	5377975
335772	5378901
337003	5378865
337029	5379792
337644	5379774
337671	5380695
333490	5380817
333370	5380934
333394	5381747
332779	5381765
332807	5382691
326709	5382876
326706	5382893
326722	5382917
326733	5382942
326744	5382960
326775	5383001
326820	5383037
326837	5383057
326840	5383066
326839	5383087
326830	5383107
326810	5383131
326837	5383162
326849	5383168
326861	5383168
326871	5383166
326887	5383149
326899	5383130
326921	5383140
326934	5383141
326945	5383138
326974	5383122
326989	5383118
327001	5383123
327032	5383151
327044	5383170
327047	5383180
327047	5383189

327041	5383226
327038	5383272
326769	5383548
326740	5383552
326704	5383561
326682	5383571
326690	5383808
327919	5383771
327947	5384697
329790	5384641
329812	5385355
330935	5385533
338419	5385313
338430	5385709
339241	5385838
339829	5386200
340288	5386187
340296	5386489
340659	5386712
341139	5387090
341543	5387079
341552	5387416
342274	5387985
342797	5387971
342811	5388478
343407	5388880
348353	5388745
348328	5387819
350170	5387769
350145	5386843
350321	5386838
350358	5386603
350351	5386603
350308	5386605
350262	5386609
350244	5386582
350207	5386540
350165	5386502
350162	5386479
350170	5386392
350143	5385600
350079	5385607
348189	5386210
347045	5386024
347070	5386921
344618	5386988
344593	5386062
343978	5386079
343963	5385538

343295	5385432
343074	5385177
342724	5385187
342712	5384759
342290	5384272
342084	5384278
342077	5384025
341450	5383302
341632	5382161
343131	5382399
346329	5382311
346346	5382914
348064	5383191
350047	5383138
350022	5382212
350637	5382195
350612	5381264
349383	5381297
349358	5380371
343824	5380521
343799	5379595
341954	5379646
341939	5379132
341078	5378744
340698	5378755
340693	5378571
339138	5377872
338211	5377899
338198	5377450
337200	5377001
336954	5377008
336951	5376889
335262	5376130
335081	5376135