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Technical Report

High-Resolution Heliborne Magnetic Survey

Swain Property, Birch-Uchi Greenstone Belt Area, Red Lake Mining Division, Ontario, 2022

Pacton Gold Inc.
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Vancouver, BC, Canada
V6C 3L6

Prospectair Geosurveys

Dynamic Discovery Geoscience

Prepared by:
Joël Dubé, P.Eng.

August 2022

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Survey flown by :
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I. INTRODUCTION

Prospectair Geosurveys conducted a heliborne high-resolution magnetic (MAG) survey for the mineral exploration company Pacton Gold Inc. on its Swain Property located in the Birch-Uchi Greenstone Belt area, Red Lake Mining Division, Province of Ontario (Figure 1). The survey was flown from May 4 to July 1, 2022.

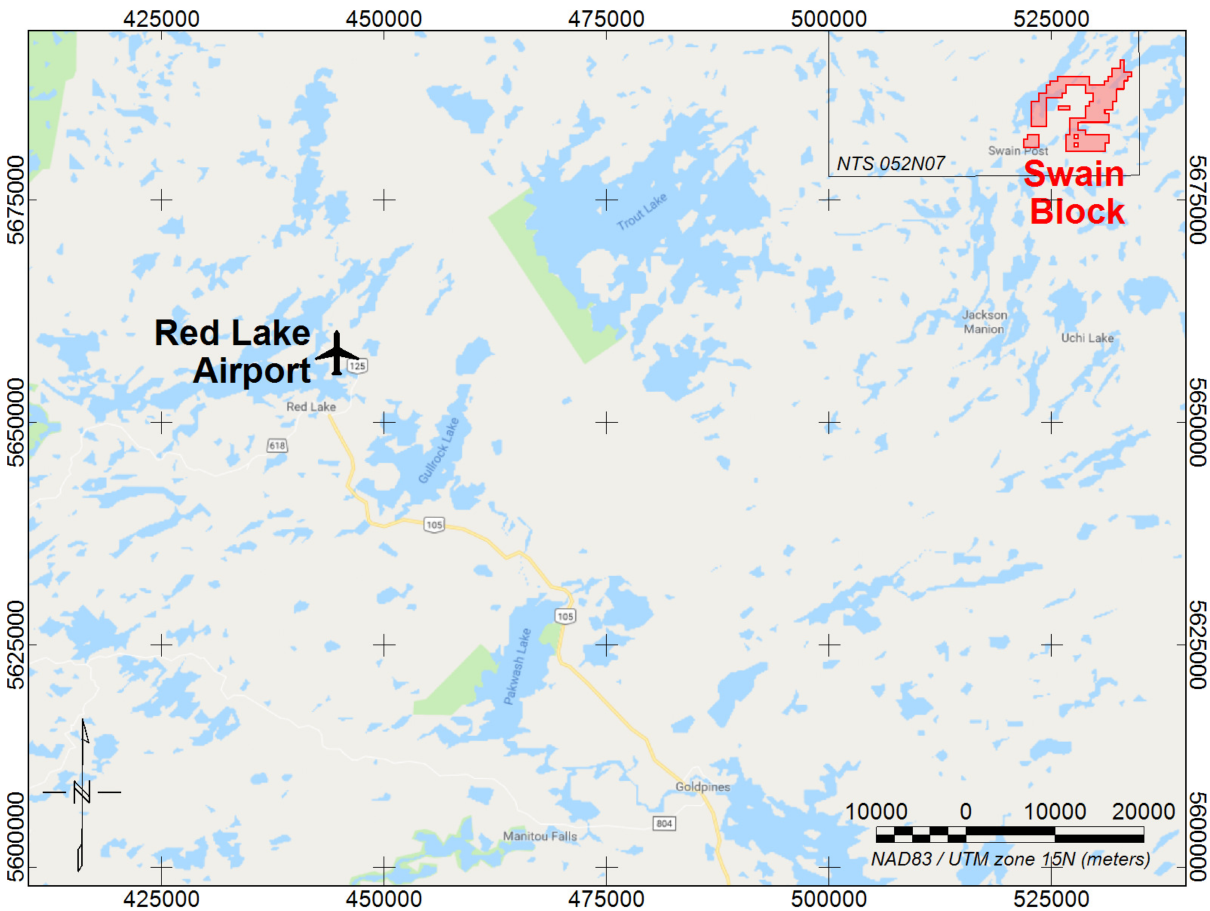
Figure 1: **General Survey Location**

One survey block was flown for a total of 920 l-km. Note that the block is subdivided into three areas. A total of 16 production flights were performed using Prospectair's Eurocopter EC120B, registration C-GEDI. The helicopter and survey crew operated out of the Red Lake Airport located 85 km to the southwest of the block (Figure 2).

Table 1: **Survey block particulars**

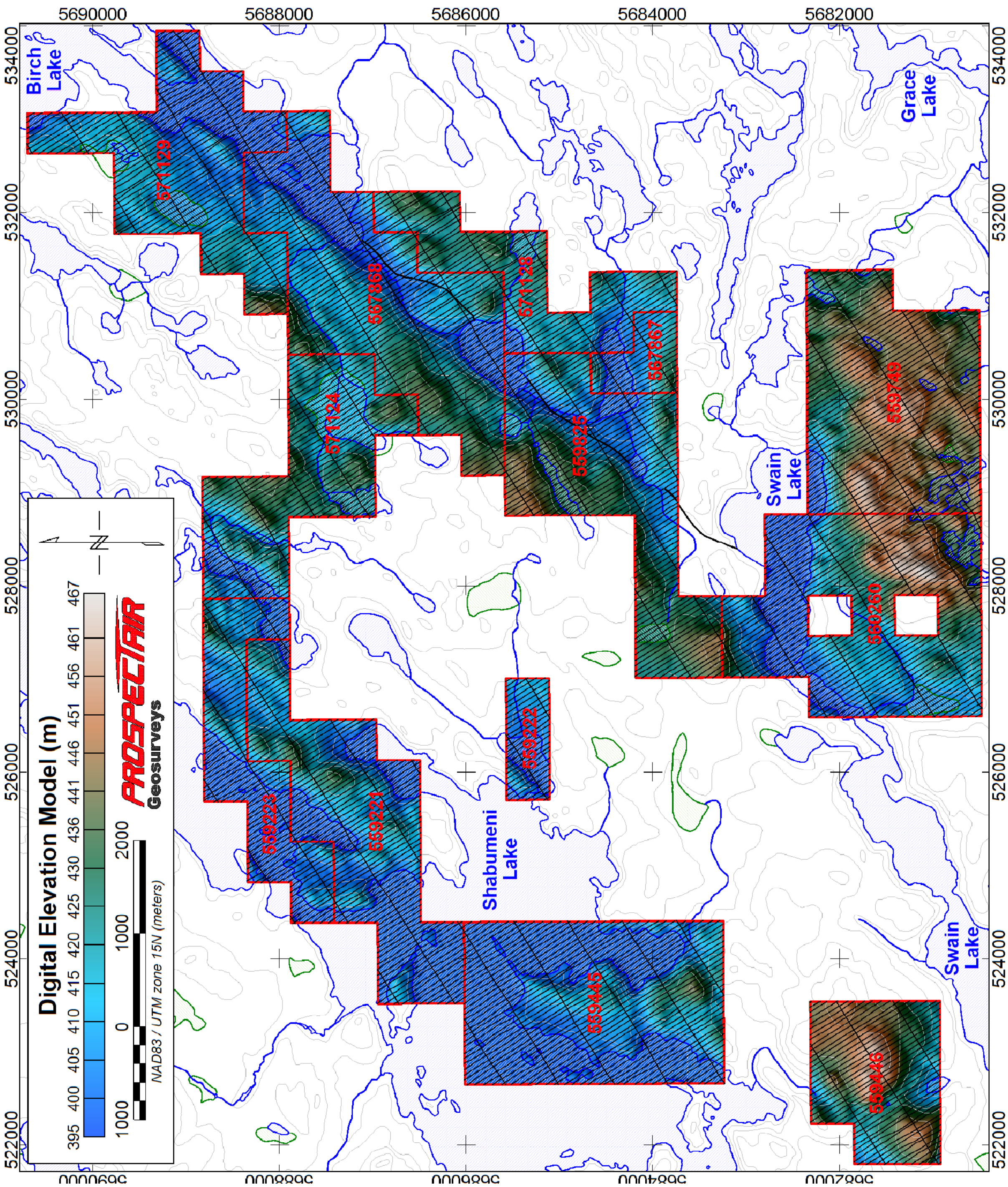
Block	NTS Mapsheet	Line-km flown	Flight numbers	Dates Flown
Swain	052N07	920 l-km	Flt 1 to 16	May 4 to July 1

Figure 2: **Survey Location and base of operation**



The Swain block was flown with traverse lines at 50 m spacing and control lines spaced every 500 m. The survey lines were oriented N148 and control lines were flown at an azimuth of N058. The average height above ground of the helicopter was 43 m and the magnetic sensor was at 24 m. The average survey flying speed was 31.5 m/s. The survey area is covered by forest, lakes and some wetlands. The topography is mostly gently undulating, with a few low-level hills. The elevation is ranging from 395 to 467 m above mean sea level (MSL). The block is approximately located between Swain Lake to the south, Shabumeni Lake to the west, Birch Lake to the north and Grace Lake to the east. With respect to the closest communities, the block is located about 70 km to the west of the Slate Falls village, 85 km to the northeast of Ear Falls, and 90 km to the ENE of the main town of Red Lake. Coordinates outlining the survey block are given in Appendix A, with respect to NAD-83 datum, UTM projection zone 15N. The location of the Swain Property claims (in red) and of the survey lines is shown on Figure 3. The Property claims numbers, as well as the approximate amount of line-km flown over each claim, are also listed in Appendix B.

Figure 3: **Survey lines and Swain 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-GEDI)

The survey was flown using Prospectair's EC120B helicopter that handles efficiently the equipment load and the required survey range. Table 3 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-GEDI 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 1 s 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 Swain Block:

  Traverse lines: Azimuth N148, 50 m spacing.

  Control Lines: Azimuth N058, 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 1.07 s for this survey.

V. FIELD OPERATIONS

The survey operations were conducted out of the Red Lake Airport from May 4 to July 1, 2022. Note that the survey was paused from May 25 to June 27 due to engine issues experienced on the helicopter. The data acquisition required 16 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 in a magnetically quiet area close to the block, at latitude 51.2797912°N, longitude 92.7750000°W. The survey pilots were Mario Asselin and Christophe Chiffre 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 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 1.07 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 24 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 are supplied with a 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 15 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 Swain block, presented in Figure 6, is relatively active and varies over a range of 6,730 nT, with an average of -44 nT and a standard deviation of 448 nT.

Most of the surveyed area is affected by linear magnetic features characteristic of alternating sequences of mafic volcanics with sedimentary or intermediate to felsic volcanic rocks, with possibly some intrusive stocks or dykes locally. Stronger anomalies are mostly found in the western and northwestern parts of the block, as well as in its southeast part, to the east of Swain Lake. They could be related to layers of mafic volcanic rocks, to meta-sedimentary horizons enriched in magnetic minerals or to intermediate/mafic intrusions. Stronger anomalies are best seen on Figure 7 which shows the residual TMI data with a linear color distribution. Other areas with lower background values and decreased signal variability are likely to be dominated by sedimentary or felsic intrusive/volcanic rocks.

Magnetic lineaments are mostly generally trending NE-SW in the area, varying from N-S, mainly in the west and central parts of the block, to E-W in some areas close to the eastern edge. The only exception is in the southeastern part of the block where lineaments are a lot more variable in strike, with some families of lineaments rather oriented WNW-ESE or NW-SE. A majority of lineaments appear curved, either by shearing or folding structures, or possibly also at the contact zone with some possible intrusions in the area. These evidences are 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 some 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 Swain 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.

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

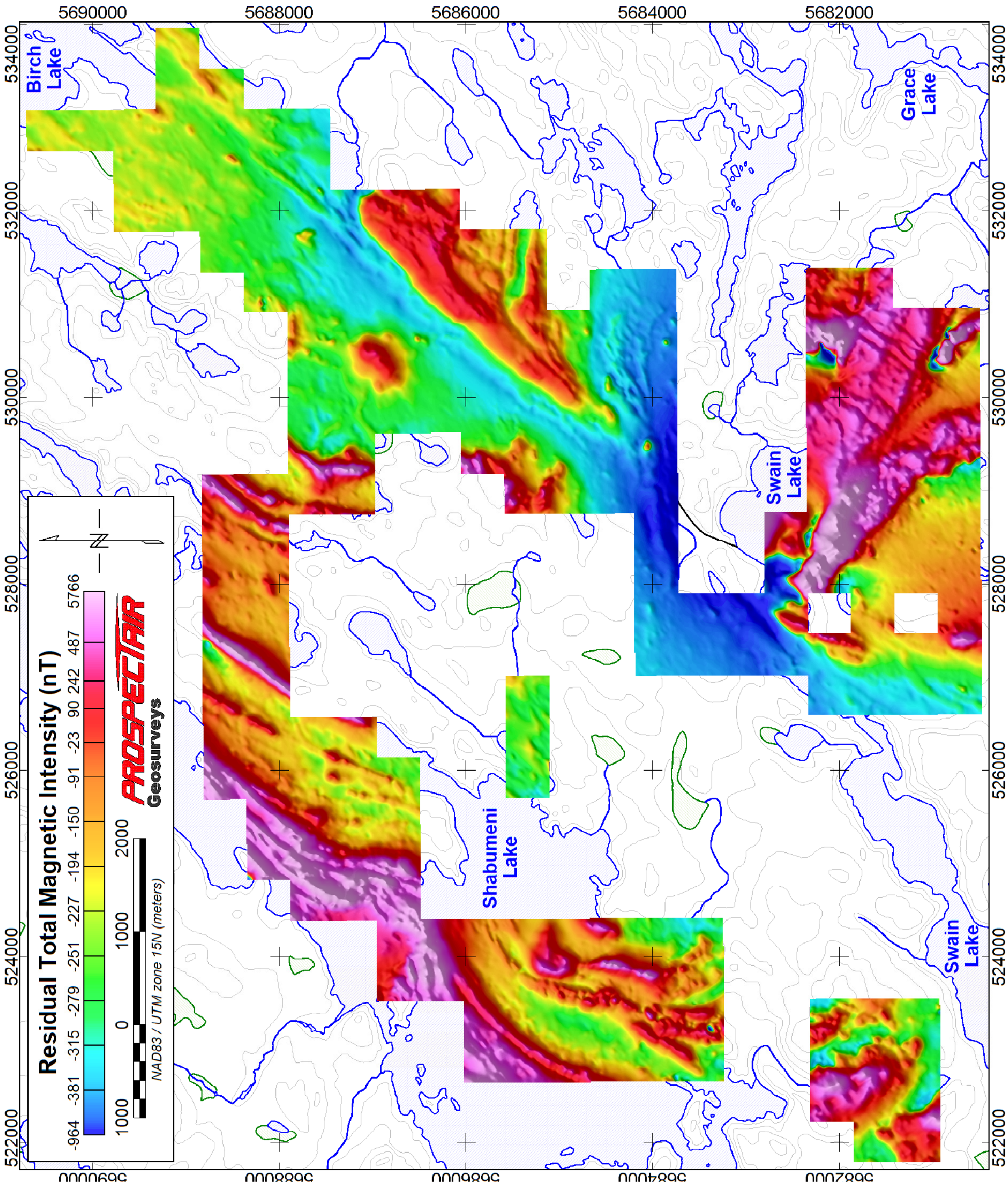


Figure 7: **Residual Total Magnetic Intensity with linear color distribution**

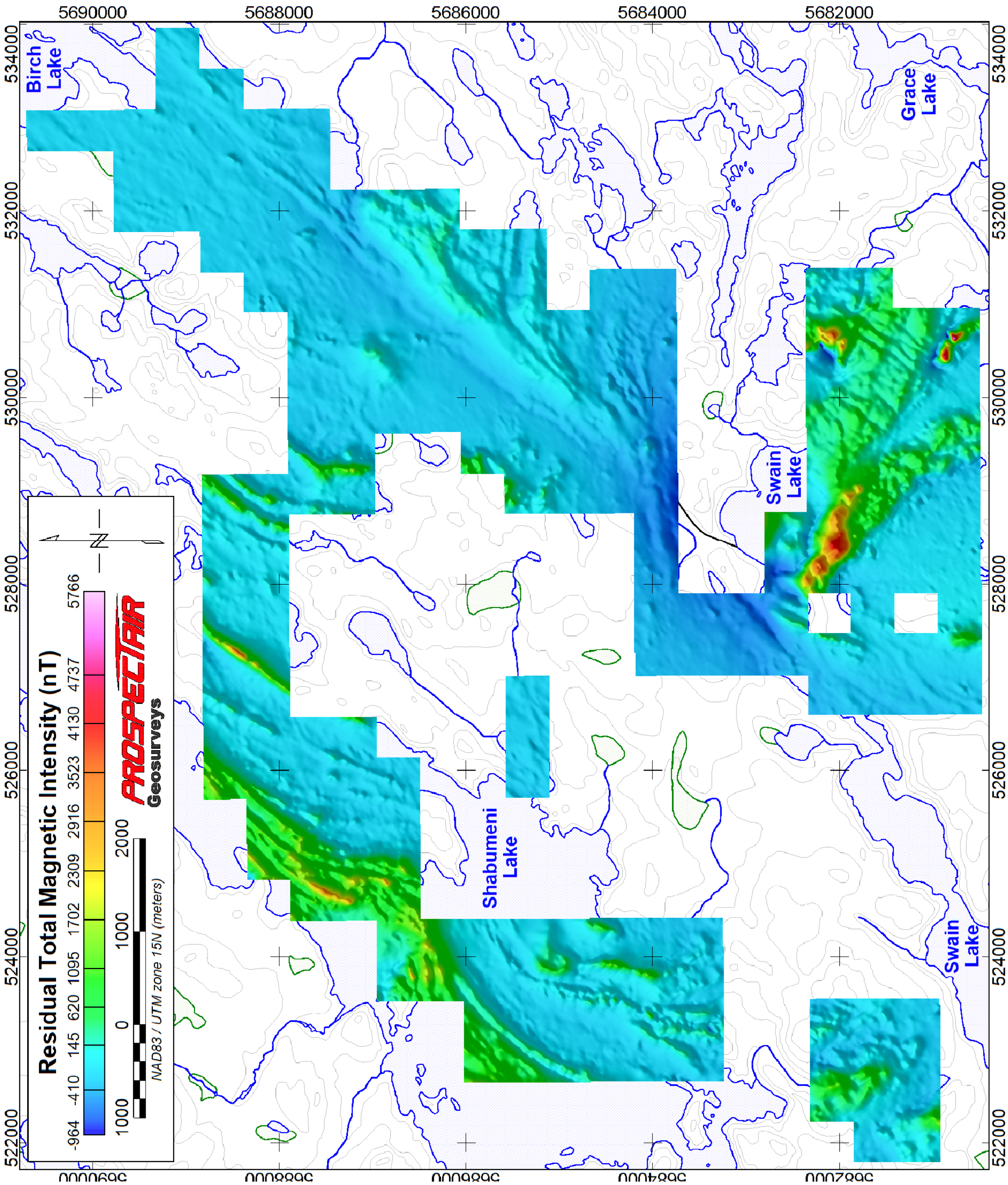


Figure 8: **First Vertical Derivative of TMI**

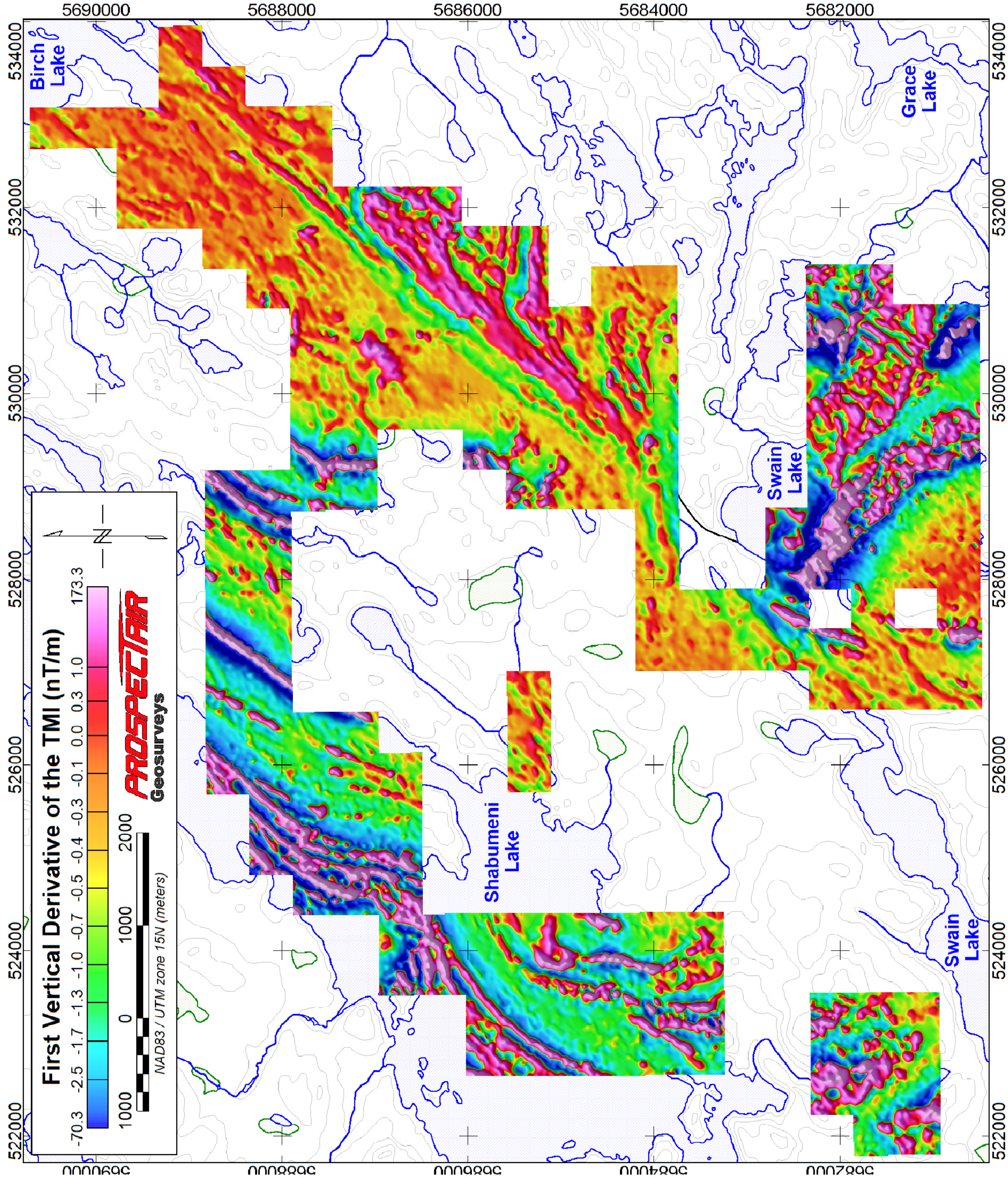
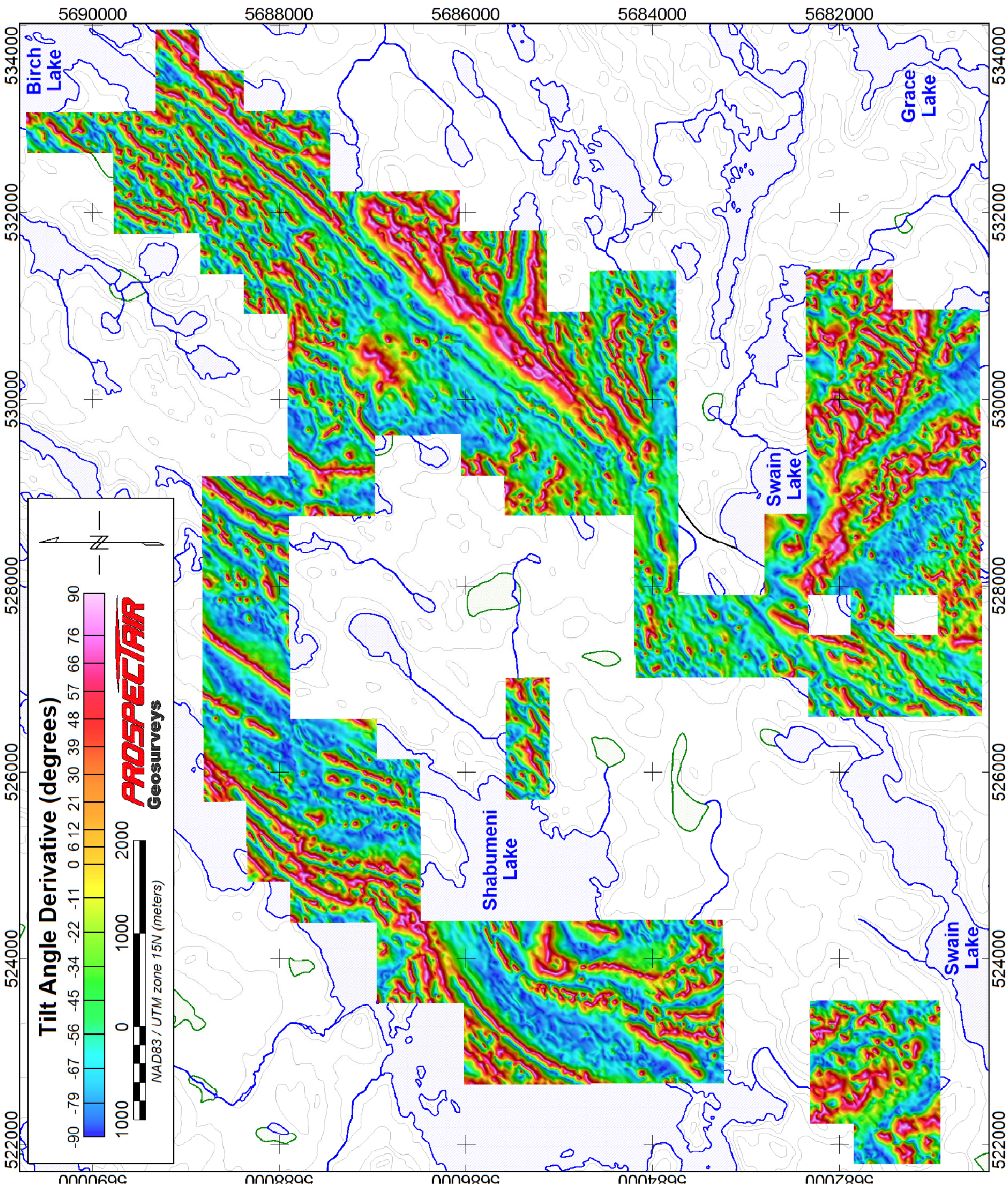


Figure 9: **Tilt Angle Derivative**



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 15N	m
2	UTM_Y	UTM Northing, NAD-83, Zone 15N	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 15 North, with coordinates in metres. Maps are at a 1:15,000 scale and are provided in PDF, PNG 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 15 North, with coordinates in metres. Grids are provided in Geosoft GRD format, with a 10 m 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.

August 1, 2022

IX. STATEMENT OF QUALIFICATIONS

Joël Dubé
7977 Décarie Drive
Ottawa, ON, Canada, K1C 3K3

Telephone: 819.598.8486
E-mail: jdube@ddgeoscience.ca

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

1. I am a Professional Engineer specialized 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 1st day of August, 2022

____
Joël Dubé, P.Eng. #100194954

X. Appendix A – Survey block outline

Swain Block, main part

Easting	Northing
530957	5680496
526590	5680472
526580	5682333
527016	5682335
527006	5684189
528749	5684198
528741	5685588
529177	5685591
529174	5686054
529609	5686057
529604	5686976
528733	5686971
528728	5687898
526559	5687886
526564	5686959
526128	5686957
526131	5686494
524389	5686485
524404	5683241
522654	5683233
522642	5686021
523513	5686025
523508	5686952
524379	5686956
524374	5687883
524810	5687885
524808	5688348
525678	5688352
525676	5688816
529166	5688835
529171	5687908
530905	5687918
530902	5688381
531337	5688384
531334	5688847
531769	5688850
531764	5689777
532634	5689782
532628	5690709
533071	5690712
533080	5689322
533948	5689324
533953	5688857
533518	5688854
533521	5688390

533086	5688387
533092	5687461
532221	5687455
532230	5686065
531794	5686062
531800	5685136
530929	5685130
530932	5684674
531367	5684677
531373	5683743
527888	5683722
527893	5682803
528761	5682804
528767	5682345
531382	5682360
531387	5681426
530951	5681423

Swain Block, central part

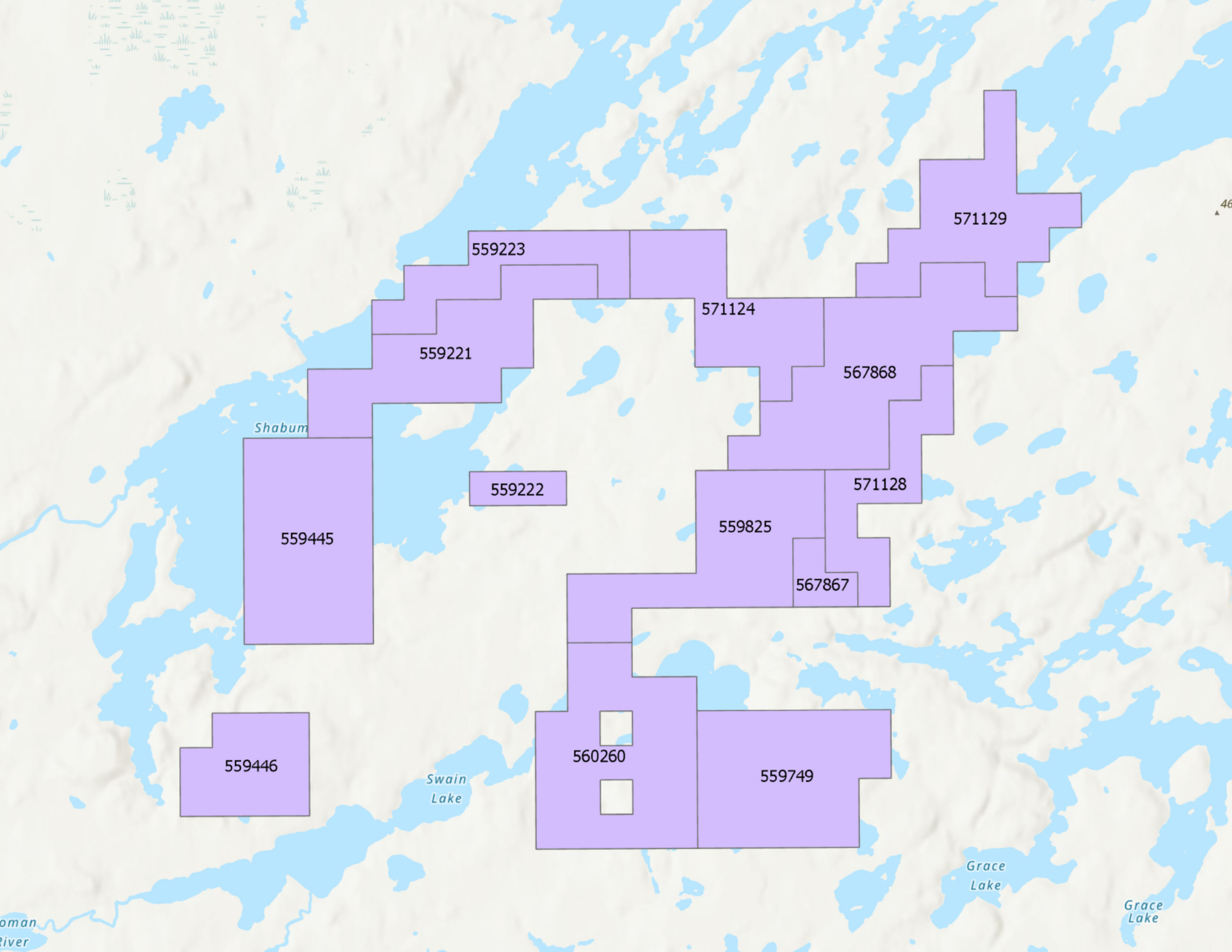
Easting	Northing
527009	5685108
525695	5685101
525692	5685572
527006	5685579

Swain Block, southwest part

Easting	Northing
523544	5680920
521792	5680913
521788	5681847
522224	5681849
522222	5682312
523537	5682318

XI. Appendix B – Property claims covered by the survey

Tenure number	Holder	l-km within claim
559223	(100) PACTON GOLD INC.	32.382
559749	(100) PACTON GOLD INC.	115.600
559825	(100) PACTON GOLD INC.	115.555
560260	(100) PACTON GOLD INC.	83.172
567867	(100) PACTON GOLD INC.	60.039
567868	(100) PACTON GOLD INC.	9.240
571124	(100) PACTON GOLD INC.	92.534
571128	(100) PACTON GOLD INC.	92.512
571129	(100) PACTON GOLD INC.	92.489
559221	(100) PACTON GOLD INC.	73.969
559222	(100) PACTON GOLD INC.	87.808
559445	(100) PACTON GOLD INC.	60.084
559446	(100) PACTON GOLD INC.	4.618



571129
559223
571124
559221
567868
Shabum
559222
571128
559825
559445
567867
560260
559749
559446
Swain
Lake
Grace
Lake
Grace
Lake
oman
River