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ASSESSMENT REPORT

on the

MOOSE - CARIBOU PROPERTY

Birch-Uchi Subprovince

Red Lake Mining Division

RED LAKE, ONTARIO

NTS 52K 15 NAD 83 Zone 15N E472000 N5643800

Lat. 50º 56’ 42.51” Long. -93º 23’ 54.83”

for

TRILLIUM GOLD MINES INC.

16.11.21

T.N.J. Hughes, P. Geo

Contents

APPENDIX

Moose-Caribou Airborne Geophysical Survey Logistics Report as a separate file

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SUMMARY

The Moose-Caribou, located west of the town of Ear Falls, Northern Ontario is the focus of a multi-disciplinary project targeting precious and base metals within the Confederation greenstone belt, part of the Uchi subprovince.

The property geology may be characterised as an approximately east-west trending volcano-sedimentary sequence of predominantly Confederation assemblage mafic to intermediate and felsic-intermediate volcanic rocks flanked to the north, by unsubdivided, Archæan, mainly mafic volcanic rocks, and in the south, intruded by a tonalite-trondhjemite gneissic suite. The Little Bear Lake pluton has intruded the sequence in the north, and massive to foliated monzonite to granodiorite in the south.

From the 8th to 11th June, 2021, Precision GeoSurveys Inc. of Langley, B.C. flew a high resolution helicopter-borne aeromagnetic survey for Trillium Gold Mines Inc over the 62 claim Moose-Caribou block which is located approximately 50 km east south-east of Red Lake, Ontario.

The survey was flown at 50 metre line spacing at a heading of 000^{o}/180^{o}; tie lines were flown at 500 metre spacing at a heading of 090^{o}/270^{o}. A total of 568 line km was flown, with a total area of 25.6 km^2. An additional one km was flown to retain data from flight lines flown outside the survey block margins for efficiency.

** For assessment reporting, the total area claimed is 2197.26 ha with a block excluded.*

Results indicate an roughly east-west (ESE-WNW) trending supracrustal sequence hosting several iron formations and ultramafic-mafic ?lavas intruded in the north-east by a gabbro. The sequence is tentatively Heyson sequence in age, and forms part of the Confederation assemblage. The effects of the Little Bear lake pluton and the monzonite-granodiorite complex respectively to the north and south, appear pronounced with supracrustal units partially preserved, effectively blurring major lithological contacts.

Recommended follow-up is accurate location of drill collars, a check on local geology, and running IP over selected areas on and near the postulated north margin of the supracrustal units where the sequence has been dextral-dislocated and folded. This method is recommended with the caveat that the surficial geology is both deep and conductive. Analysis of historic EM surveys should be undertaken to 'tighten' target areas for possible drilling.

The co-ordinate system used in the report is UTM, NAD 83 Zone 15N. All units in this report are metric unless otherwise stated.

1.0 INTRODUCTION

This report covers an examination of a June 2021 high resolution airborne magnetic survey over the Moose-Caribou property, Red Lake region, northwest Ontario, a review of the regional geology and geophysics, the exploration history, and property geology.

Based on these studies and assessments, a number of areas on the property were identified as favourable for ground follow-up.

Recommendations are made, with a budget provided.

2.0 PROPERTY DETAILS

2.1 Location & Access

The claims are located north north-east of the town of Ear Falls, within the Red Lake Mining Division, (Fig. 1), with property epicentre at UTM Zone 15N NAD83 co-ordinates E472000 N5643800

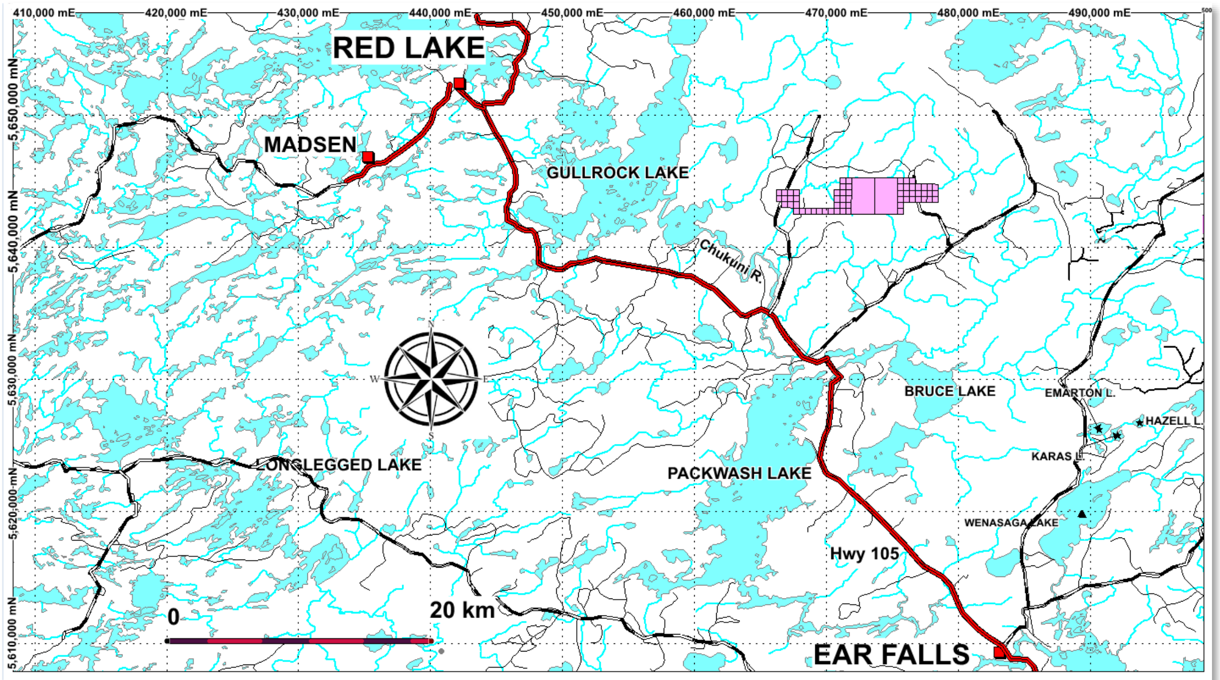


Figure 1 Regional Location map

Access

Just South of the Chukuni River crossing, Hwy 105, along the Chukuni River logging road leading to and past the NW corner of the property, a distance of approximately 9.7 km The centre-east portion of the property can be accessed via the Snake Falls main haul line for approximately 15 km, then a secondary logging road heading NW, for a distance of approximately five km. This road may be truck navigable as logging operations cleared parts of centre-east claims within the last ca. 10 years. Some old drill roads are still visible on Google Earth.

2.2 Topography & Vegetation

The property is located in boreal forest, with significant modification by clear-cutting, and today, largely covered by second growth poplar, alder, birch, pine and spruce. The physiography is flat, on an expansive outwash plain, at ca. 360 m asl., with only minor incision by small drainages.

2.3 Claim Status

The Moose-Caribou property consists of 62 contiguous single and multi-cell mining claims covering an area of 21.97 km^2. The claim numbers are shown in Figure 2 and listed in Table 1. All claims that were flown are highlighted in figure 3.

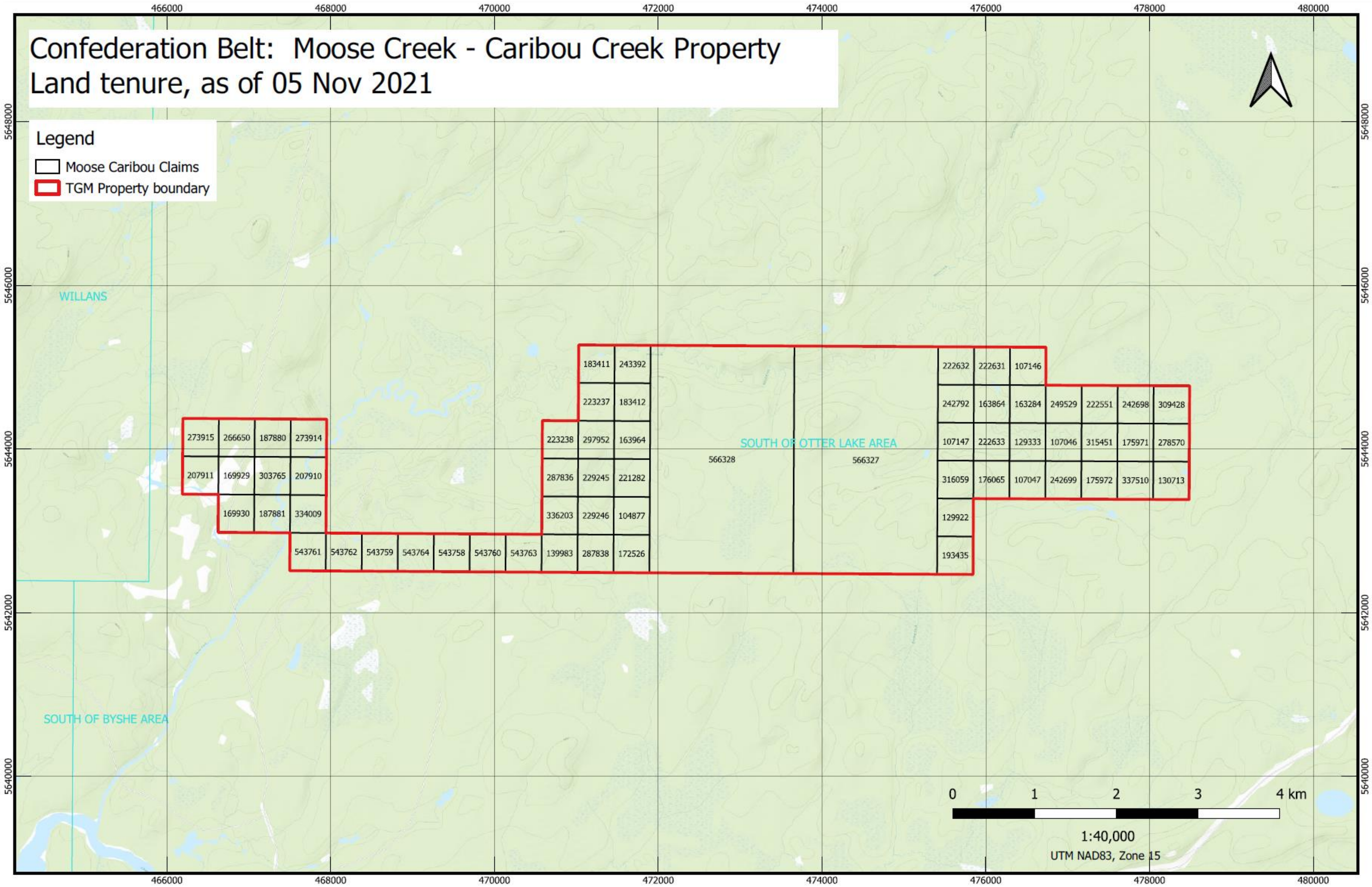


Figure 2 Land tenure

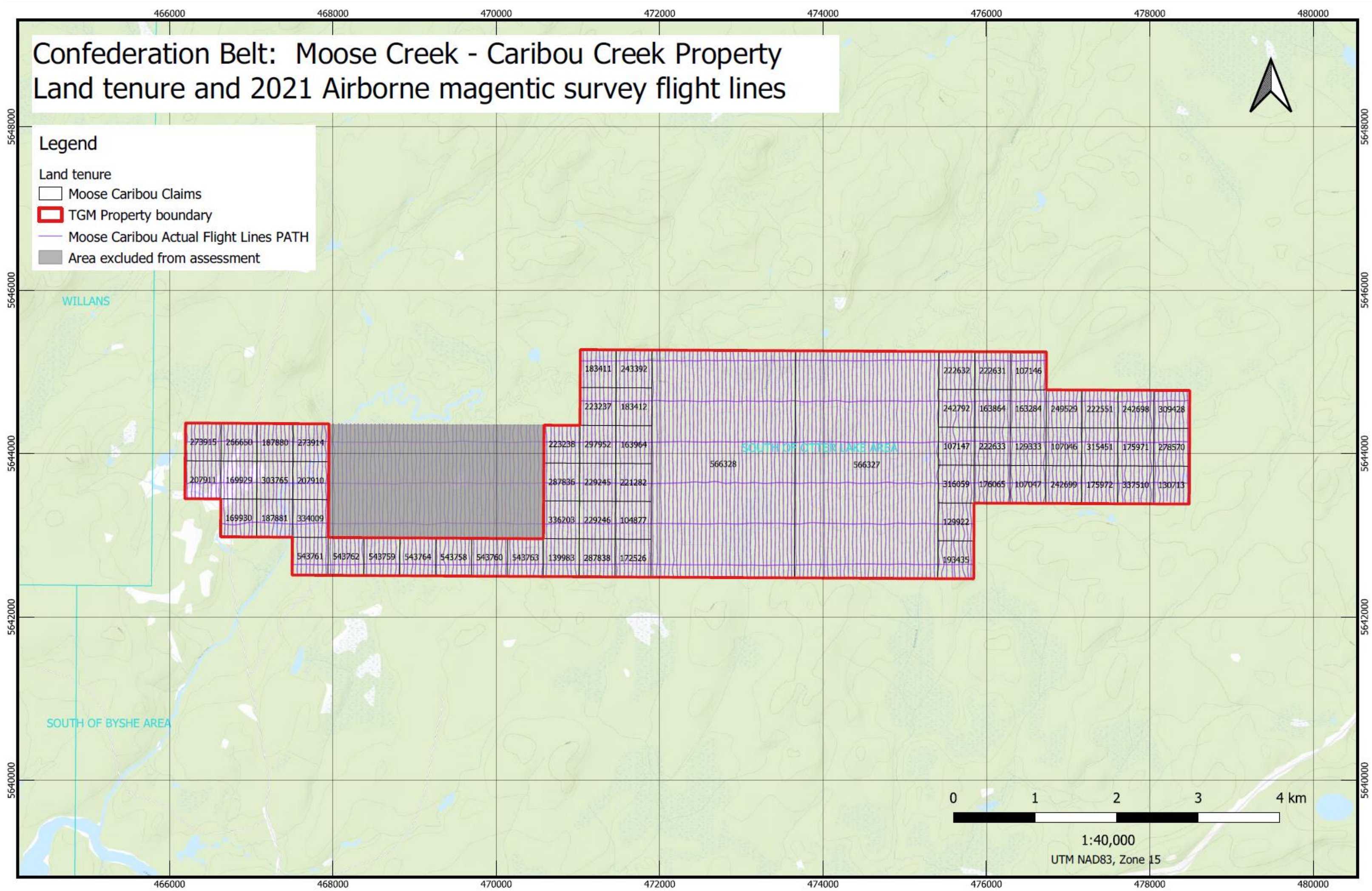


Figure 3 Moose-Caribou Claim map with flight lines

Table 1 Moose-Caribou claims

Tenure Number	Township / Area	Holder	No of cells	Area_Ha
104877	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
107046	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
107047	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
107146	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
107147	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
129333	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
129922	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
130713	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
139983	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
163284	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
163864	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
163964	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
169929	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
169930	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
172526	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
175971	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
175972	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
176065	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
183411	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
183412	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
187880	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34

187881	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
193435	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
207910	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
207911	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
221282	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
222551	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
222631	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
222632	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
222633	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
223237	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
223238	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
229245	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
229246	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
242698	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
242699	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
242792	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
243392	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
249529	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
266650	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
273914	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
273915	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
278570	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
287836	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35

287838	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
297952	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
303765	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
309428	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
315451	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.34
316059	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
334009	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
336203	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
337510	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
543758	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
543759	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
543760	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
543761	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
543762	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
543763	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
543764	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	1	20.35
566327	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	24	488.27
566328	South of Otter Lake Area	(100) TRILLIUM GOLD MINES INC	24	488.27
		Total:	**108**	**2197.26**

3.0 HISTORY

3.1 Government & Institutional

The earliest survey in the map area was performed by Robert Bell of the Geological Survey of Canada in his canoe journey on the English River and Albany River systems (Bell 1873). A second expedition by Bell (1886) traversed the English River Subprovince, between Lonely Lake (now Lac Seul) and Lake St. Joseph via the Root River. Fawcett (1885) conducted a line survey using transit and micrometre from Rat Portage (Kenora) to Osnaburgh House, returning via the Wenasaga River.

The first geological map of the subprovince was constructed by Dowling (1894) who carried out geological exploration in the vicinity of Red Lake including along the Trout Lake River. Wilson and Johnston (1904) made a reconnaissance traverse from Lac Seul to Cat Lake by way of the Wenasaga River in 1902. Burwash (1920) completed a report that included maps showing the geology of Whitemud Lake.

Seismic signatures have been studied by Hall and Hajnal (1969), Hall (1971) and Brown (1968).

Much of the body of earlier geological studies work was conducted by Breaks and Beakhouse as principal authors, with additional work by Harris, Corfu, Cruden, and Stott. See, Breaks et al., (1976, 1978), Breaks, (1991), Breaks and Bond, (1993).

Seismic reflection transects across the Western Superior Craton were completed in the 1990's and presented by Asudeh et al., 1996. From the mid-nineties to 2012, additional seismic work followed by Lithoprobe seismic reflection surveys and magnetotelluric surveys were completed.

Additional work, including Magnetotelluric (MT) soundings were also carried out by the GSC as a part of the Western Superior Lithoprobe transect. The seismic reflection line WS2B ran along Hwy 105 through Ear Falls.

Percival, J.A. et al., 2000 published an extensive study of the western Superior province, covering NW Ontario and eastern Manitoba. See also, Sanborn-Barrie et al., 2000, and Sanborn-Barrie et al., 2001 for additional information.

The GSC OF4256-2004 is a compilation of regional mapping for Red Lake and the Confederation greenstone belts, and provides references for work therein.

3.2 Industry Exploration

This covers work on or overlapping the Moose-Caribou property

1959-62 Canico flew regional AEM and magnetic surveys that partially covered the Moose-Caribou property.

1989 - Regional airborne magnetic and EM surveys were flown by Noranda Mining and Exploration Ltd.

1976-1983 - Selco completed an extensive base metal exploration programme throughout the area, performing airborne EM and Magnetometer and small ground geophysical surveys in the 1970's. The airborne data was not submitted for assessment. Follow-up drilling resulted in the discovery of the various Dixie base metal occurrences south-east of the Moose-Caribou property.

In 1976 Selco cut two grids in the southwest quadrant of the property. Horizontal Loop Electromagnetic and mag. surveys were completed and one weak out-of- phase anomaly was detected. No further work was recorded and no rock outcrop was noted in the vicinity of the grids.

Selco and Inco drilled the area including the west and centre of the Moose-Caribou property, returning a best intercept by Selco of 1.2 feet of 0.96% Cu, 3.22% Zn and 0.16 oz Ag per ton.

Selco drilled the following year with holes 150-9-1, -2 and -3 completed The holes tested a single east-west trending HLEM conductor over 250 m strike length. Tremolite schist, acid tuff, metasediments, mafic volcanic rocks, disseminated and semi-massive sulphides were intersected, plus thin IF and sections of granodiorite and granite. The easternmost hole drilled extensive gabbro, with two holes bottoming in granite.

In 1977, Selco completed magnetic and HLEM ground surveys as follow-up to a four-channel Airborne Electromagnetic (AEM) anomaly located during a previous airborne survey. One drill hole totalling 102.4 m was drilled, it intersecting two pyritic massive sulphide horizons which assayed 0.96% Cu, 3.22% Zn over 0.36 m and 0.69% Cu, 1.1% Zn over 0.67 m, respectively. *The location is shown in the property geology map, below*, in the far west of the property near the Chukuni River road. Co-ordinates are calculated from a paper map, with accuracy of ± 25 metres.

1978 Red Lake and 1991 Birch-Uchi-Confederation Lakes regional airborne magnetic and EM surveys were flown for the Ontario Geological Survey. No anomalies were noted over the area now covered by Moose-Caribou.

In 1979, OGS map P2214 was completed was published by Pirie and Kita, who mapped Willans Township. Very few outcrops were located on the Tri Origin RLX property to the west and overlapping onto Moose-Caribou, with mafic volcanic rocks noted to the north and intermediate and felsic volcanic and intrusive rocks noted to the south. Note the RLX property is largely covered by the current Moose-Caribou claims.

1990 work by Lightval Mines included MaxMin and magnetic surveys on their Moose Creek property, followed up with drilling ('MC –' series). Four holes were drilled for a total of 633.3 m. The geological survey by the eminently affable Peter Dadson revealed no outcrops, with report's recommendations to extend EM grids east and conduct additional surveys on the property including over the Inco-Selco drilled area in the far west.

Lightval's four holes intersected laminated sediments, with interbedded py-po, mafic metavolcanic rocks, crystal tuff, intercalated with granite and diorite dykes. Very limited sampling (15 samples) was published which is surprising given the amount of sulphidation intersected. Drill hole locations were measured off maps with good accuracy obtained, as drill roads are still preserved. Maximum gold assay was 160 ppb.

1992 A small southern portion of the Moose-Caribou ground was surveyed by Hawke Campbell using MaxMin, this after an interest in the property held by Lightval was transferred to Campbell. A weak conductor near the southern boundary was detected with unknown follow-up.

1993 Noranda optioned property largely covered by the current Moose-Caribou claims, and conducted a four-line time domain electromagnetic (TDEM) survey.

Inco, in 1995, "One hole (Borehole 79837. -55, az. 360) totalling 218.0 m was drilled to test a TDEM anomaly outlined by a prior EM survey. The strongest portion of the anomaly was interpreted to be located approximately 250.0 m down-plunge to the west from a massive sulphide intersection which was drilled by Selco in 1977. Borehole 79837 intersected 1.57 m of massive to semi-massive pyrite with minor chalcopyrite and sphalerite. This interval graded 0.351% Cu and 1.17%. Zn over 1.12 m from 163.21 to 164.33 m. Petrographic and geochemical data suggests that the Moose Creek mineralization is distal from a sea floor discharge vent. The sulphide intersection adequately explains the TDEM anomaly. No additional work is planned at the present time." From Inco assessment report. The location is shown in the property geology map.

2002 saw Goldcorp enter into a JV with Tri Origin, completing a mobile metal ion, 'MMI' sampling programme over the south-east of Moose-Caribou, extending east over to and partially across the Dixie-17, -18 and -19 deposits trend. Coupled with this was a 'thorough re-evaluation of the previous geophysical surveys…'. Two 'high quality gold anomalies and two anomalous Zn anomalies' (sic) were identified. These are off property anomalies, located to the south-east.

2004-2009 Tri Origin Expln. Ltd., Red Lake Extension (RLX) Property. The project was based on testing for a far south-eastern extension of the historic Red Lake Mine Extension. Tri Origin Exploration completed a programme comprising geophysical and remote sensing data compilation, geological investigations, line cutting, walking magnetic survey, humus soil geochemistry survey, induced polarization (IP) surveys, a limited overburden drilling geochemistry survey, and diamond drilling on the Red Lake Extension Property from August 2003 to April 2004.

Results showed the presence of elevated Au values in humus and in overburden drill samples coincident with areas highlighted by ground IP chargeability anomalies. Diamond drilling of these IP anomalies returned only very low gold and arsenic values; however, altered mafic volcanic rocks similar in appearance to those found in the Red Lake Gold Camp (Parker 2000) were identified in three of the four holes.

From July 2004 to October 2005 Tri Origin performed exploration work on the property consisting of geological and prospecting work, lithogeochemistry, percussion drilling, and soil sampling by pH and mobile metal ion analysis. In late August to early September 2005, the company completed three diamond drill holes totalling 520 metres.

The results from drilling are discussed in the report 'Results of the 2005 Diamond Drilling Program Red Lake Extension Property' by Chris Pegg for Tri Origin. In the winter of 2005-06 some additional line cutting and IP geophysical surveying were completed. 2004-2005 work was carried out mainly north of Moose-Caribou.

In 2006 (March-May) six drill holes totalling 927.7 metres of NQ core were completed by Tri Origin on the RLX property to test IP anomalies of interest and gold in humus geochemical targets. RLX holes 1-3 tested a broad chargeability feature. Interlayered metavolcanic and metasediments, including thin IF were intersected, plus laminated often ferruginous sediments, and a number of py-po occasionally semi-massive sections distributed intermittently throughout the holes. Some intercepts were partially syenitic or hybrids of such, and these may represent apophyses of the adjacent monzonite-granodiorite south, east and west of Gullrock Lake. Gold values were 0-90 ppb. Despite intersecting disseminated sulphides and locally, silicic sections, Tri Origin considered the drilling did not adequately explain the IP feature.

Results yielded no significant gold-bearing mineralization. This is described in the Report on the 2006 Diamond Drilling Program, Red Lake Extension (RLX) Property by Zenon Mandziuk. The drilling is located north and west of Moose-Caribou and deemed unrepresentative of underlying geology and mineral potential.

2007 From June to July, a rotasonic drilling programme was conducted on the property. 23 holes totalling 267.8 metres were drilled. Overall the sampling by Tri Origin failed to locate any significant anomalies (precious or base metal) on Moose-Caribou. The character and depth of the overburden suggest that chemical cycles/halos did not fully develop due to deep fluviolacustrine and fluvioglacial sediments.

The results obtained from drilling are reported in Report on June – July, 2007 Rotasonic Drilling Program, Targeting Gold and VMS Mineralization by ODM Ltd for Tri Origin. (Historic information from Tri Origin assessment report, 2009).

The 2007 Rotosonic drilling by Tri Origin (RLX holes 07-01 to -23) failed to obtain any significant mineralisation. Holes one and two were drilled just off property in the west end of Moose-Caribou. These tested either IP responses and/or anomalous humus sample results. The programme was beset by logistical, mechanical and manpower problems, and very little till was drilled, with the report concluding:

“Due to poor rig mobility and low productivity, the rotasonic drilling on the Red Lake Extension property was restricted to the most accessible sites east of Willans Lake. The bedrock here is overlain by a continuous till layer, the composition of which appears to mirror that of the bedrock.

Although the drilling pattern was spotty and some geophysical targets remain untested, the uniformly low gold grain, gold-in-pyrite, arsenopyrite, chalcopyrite and sphalerite content of the till, in concert with the unexpectedly high ratio of unprospective granitic to potentially prospective supracrustal bedrock, indicates that the entire eastern part of the property is infertile for both gold and base metals. Therefore processing the upper till samples is unnecessary and no further work is recommended on this part of the property.”

In 2009, Precambrian Ventures under the direct supervision of M. Fedikow, carried out an MMI survey over the six claim block covering successful drilling by Selco and Inco in the west end of the Moose-Caribou grid. “The recommendations that flow from this survey are as follows:

“The MMI-M survey has failed to detect significant geochemical responses on the property. No further MMI surveys are recommended for the Moose Creek West property.”

2012 geological surveys (prospecting) by Tri Origin were conducted along main haul lines, logging roads and with short, tangential forays into the scrub, retrieving a modicum of botanical information and discovering a dearth of outcrop.

GRID MAPPING

None known except for the Lightval work.

4.0 REGIONAL GEOLOGY

The property lies within the south-west (Confederation)-Birch-Uchi greenstone belt, or, depending on one's geological bias, the south-eastern portion of the Red Lake greenstone belt.

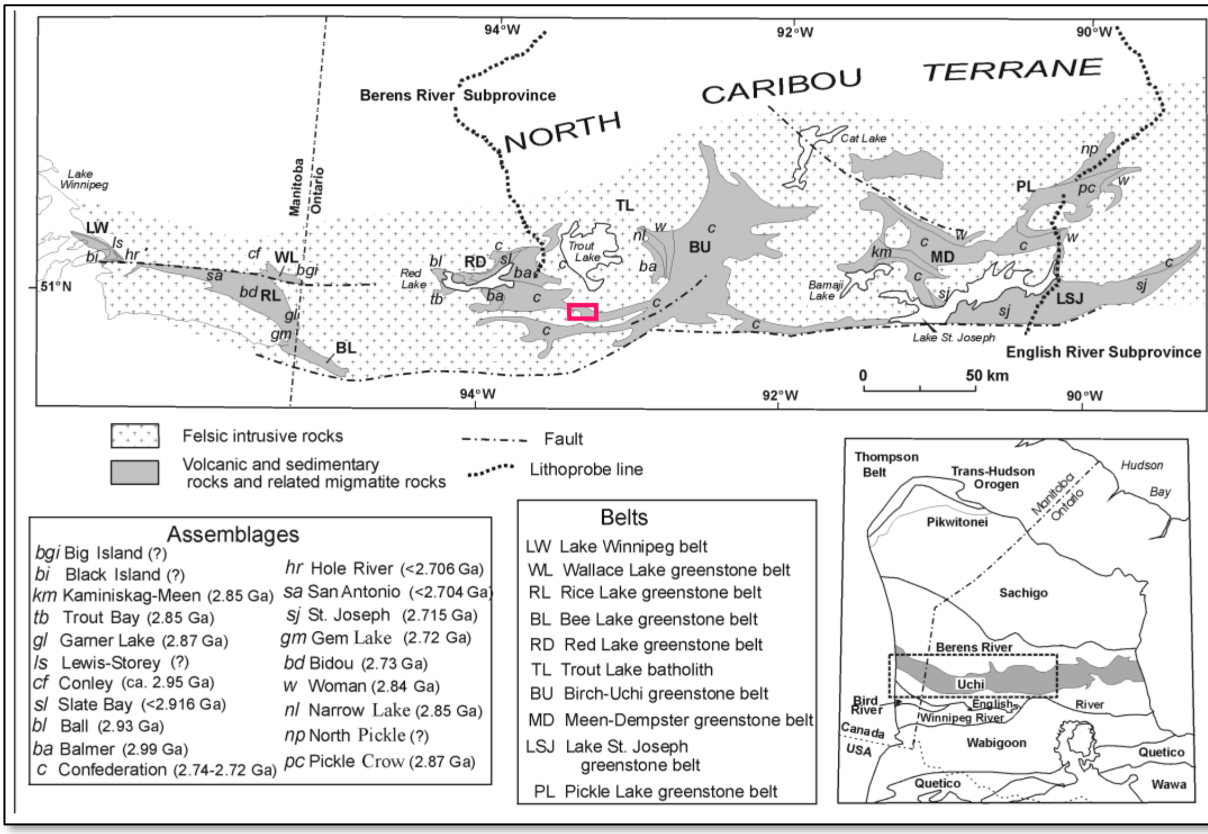
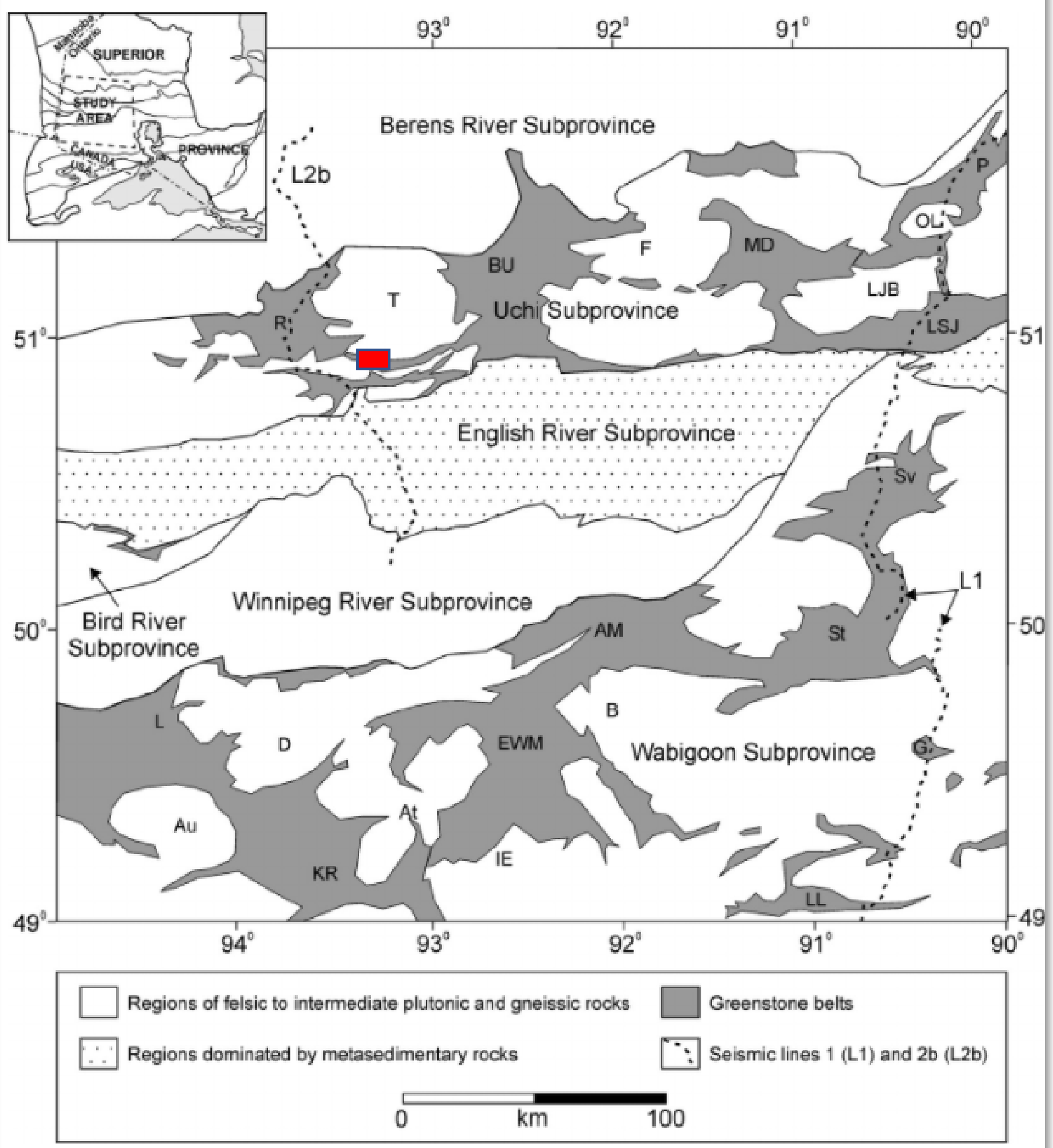


Figure 4 Generalized tectonic map of the western Uchi Subprovince

From Percival et al., 2000. Red rectangle covers property location



Schematic map of the Western Superior Province in the area of study. AM, Abram-Minnitaki greenstone belt; At, Atikwa batholith; Au, Aulneau batholith; B, Basket Lake batholith; BU, Birch-Uchi greenstone belt; D, Dryberry batholith; EWM, Eagle-Wabigoon-Manitou greenstone belt; F, Fawcett Lake batholith; G, Garden Lake greenstone belt; IE, Irene-Eltrut batholith; KR, Kakagi-Rowan greenstone belt; L, Lake of the Woods greenstone belt; LJB, Lake St. Joseph batholith; LL, Lumby Lake greenstone belt; LSJ, Lake St. Joseph greenstone belt; MD, Meen-Dempster greenstone belt; OL, Ochig Lake pluton; P, Pickle Lake greenstone belt; R, Red Lake greenstone belt; St, Sturgeon Lake greenstone belt; Sv, Savant Lake greenstone belt; T, Trout Lake batholith.

Figure 5 Schematic map, Western Superior Province

From Hrabi & Cruden, 2006

The following is taken directly from the 2004 Rupert Resources 43-101 by C.S. Wallis of Roscoe Postle Associates Inc.

“The Red Lake greenstone belt is located in the western part of the Uchi subprovince, a typical Archean granite-greenstone terrain containing east-trending belts of basic to felsic volcanic rocks, sedimentary rocks and synvolcanic intrusives (sic). The volcanic complex comprises mainly mafic flows with minor amounts of intermediate to felsic volcanic rocks with interbedded chemical and clastic units. The greenstone belt is bounded on all sides by granitoid batholithic masses. The Red Lake belt has been dated at 2.99 to 2.9 Ga while the Birch-Uchi belt adjoining to the east has been dated at 2.75 to 2.73 Ga.”

For the Birch-Uchi greenstone belt, from Percival et al., 2000:

“…, the likely volcanic stratigraphy for the Birch–Uchi greenstone belt is as follows: 1) Balmer assemblage: andesitic to rhyolitic volcanism (2989–2975 Ma), separated by an early (D0) deformation event from 2) Narrow Lake assemblage: tholeiitic pillow basalt that unconformably overlies the Balmer assemblage (bracketed between 2975 and 2832 Ma; most likely ca. 2855 Ma from comparison to the Red Lake greenstone belt) 3) Woman assemblage: pillow basalt overlain by ignimbritic rhyolite that disconformably overlies the Narrow Lake assemblage (bracketed between 2.88 and 2.81 Ga) 4) Confederation assemblage: three petrographically, chemically and spatially distinct belts of mafic to felsic volcanism (ca. 2.74 Ga).”

The stratigraphy and lithologies presented below taken from GSC 4256, 2004 (see overleaf). On a local scale, the divisions have to the best of this author’s knowledge not been verified by geochronology.

Overall, there is an approximately east-west trending volcano-sedimentary sequence of predominantly Confederation felsic-intermediate volcanic rocks, flanked to the north, by unsubdivided, mainly mafic volcanic rocks. The Little Bear Lake pluton has intruded the sequence in the north, and a not insignificant percentage of the supracrustal sequence in the south was affected by intrusion of the Neoarchean monzonite-granodiorite.

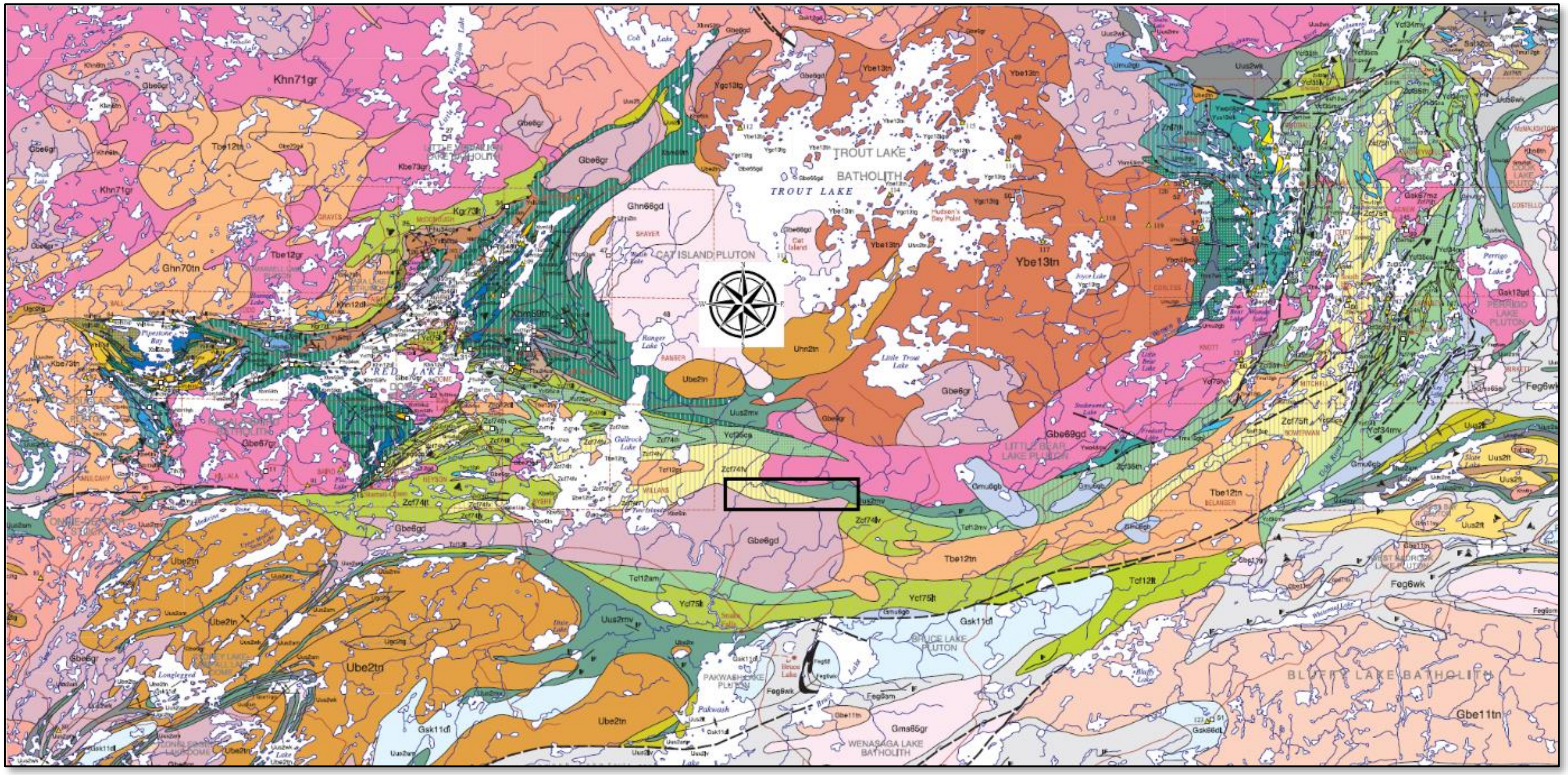


Figure 6 Geology of the East Uchi Subprovince

Black rectangle covers the property claims

Below, Legend, taken from GSC OF 4256 2004. *This only covers the area on and adjacent to the Moose-Caribou property.*

Gmu6gb	Gmu6gb Gabbroic rocks: generally undated gabbroic rocks intrusive into Confederation assemblage, including fine-grained tholeiitic dykes and sills intrusive into the Sundown Lake metasedimentary assemblage and coarse-grained magnetite-bearing gabbro dates at ca. 2699 Ma at locality #57; includes Leg Lake mafic complex.
Gbe69gd	Gbe69gd Granodiorite-quartz monzonite: weakly foliated, equigranular to porphyritic granodiorite-quartz monzonite, intrusive into deformed and locally mineralised strata; includes the ca. 2722 Ma Little Bear Lake granodiorite (U-Pb #62) and Shabumeni Lake stock (U-Pb #73) in the Birch-Uchi belt 2714 ± 4 Ma QFP (U-Pb #44).
Ycf74lv	Ycf74iv Heyson sequence (Red Lake) ca. 2739 Ma Intermediate volcanic rocks: andesitic to dacitic calc-alkaline flows, commonly plagioclase-phyric, possibly correlative with the Earngey sequence of the Birch-Uchi belt.
Zcf35th	Zcf35th Agnew Sequence ca 2744 Ma: mafic volcanic rocks: pillowed and pillow breccia of dominantly tholeiitic affinity.
Tcf12mv	Tcf12mv Mafic volcanic rocks: basaltic rocks considered part of the Confederation assemblage formed at the transitional continental margin setting.
Uus2mv	Uus2mv Mafic volcanic rocks: foliated, massive to pillowed basalt, amphibolite, and associated gabbroic rocks, locally plagioclase-phyric near Springpole and Pakwash lakes; lesser associated intermediate to felsic flows, tuff and wacke near Dixie Lake
Tbe12tn	Tbe12tn Tonalite: massive to weakly foliated biotite-tonalite to trondhjemite±diorite typically associated with, or intrusive into, <2.47 Ga Confederation assemblage.
Ywo48mv	Ywo48mv **Woman assemblage** (ca. 2870 Ma) Mafic volcanic rocks: massive to pillowed tholeiitic and calc-alkalic basaltic flows, capped locally by two metre thick marble (off property).

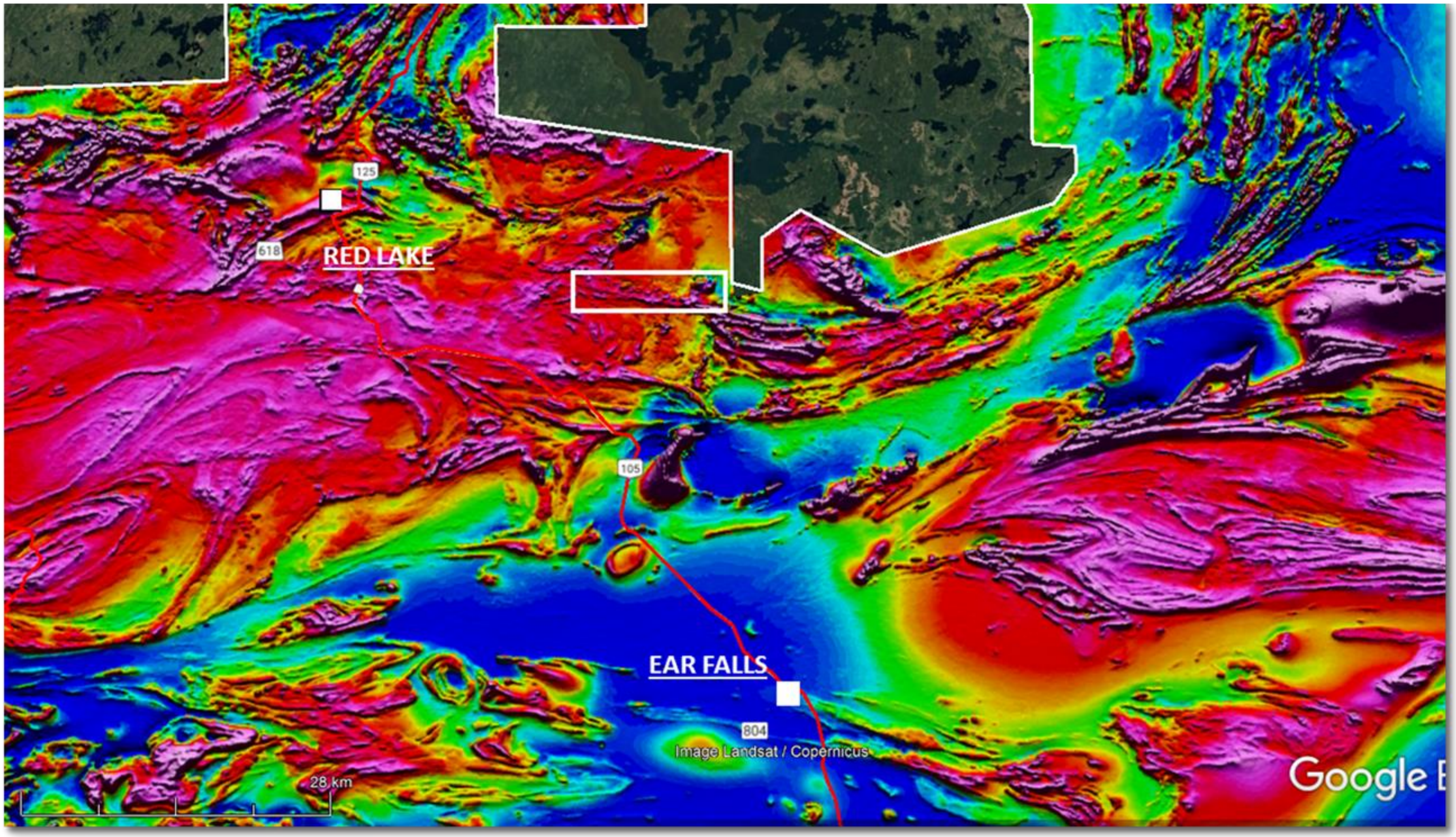


Figure 7 Regional residual magnetic data

Property outlined by white rectangle

“The Confederation Lake greenstone belt lies within the Superior Province, the largest of the structural provinces of the Canadian Shield. The Superior Province can be divided into “terranes” and “domains” and the currently favoured subdivision (Stott et al., 2010) has the Confederation Lake belt in the Uchi Domain within the North Caribou Terrane (figure 7-1). The Uchi Domain is characterized by numerous greenstone belts composed of generally submarine calc- alkaline, island-arc volcanic rocks and associated sedimentary rocks, separated by “granitoid” rocks that form generally oval masses. The term granitoid encompasses pre-volcanic gneissic basement complexes, often migmatized and remobilized as domes, as well as post-volcanic felsic plutons, usually of granodiorite to trondhjemite composition.

“The northeastern part of the Confederation Lake belt has been well mapped and its volcanology has been well studied by Thurston (1985), and the southern limit of mapping lies just north of the Garnet property (ENE of Moose-Caribou – ed.). The remainder of the belt has only been mapped at a reconnaissance level; the overburden thickness increases westwards as the terminal moraine is approached, making detailed mapping impossible.

“Thurston’s (1985) mapping has divided the volcanic rocks of the northern Confederation Lake belt into three cycles. The youngest, cycle 3, occupies the core of a complex synclinorium. The oldest, cycle 1, occupies the outer parts of the synclinorium. Cycle 2 is host to a number of gold occurrences and deposits, while all the base metal massive sulphide occurrences and deposits are in cycle 3. Figure 7-2 shows the regional geology (“Geology of Ontario”, available on the MNDM website, with everything except the cycle 3 volcanics and their internal mafic and felsic intrusions “greyed out” as being unrelated to the Garnet property and its mineralization. To the north and east of the Garnet property, Thurston’s (1985) map was used to delineate cycle 3, while to the west of Garnet Lake, the limits of cycle 3 have simply been extrapolated along strike. It will be noted that in this southwestern part of the belt, cycle 2 is thin and discontinuous, and cycle 1 is absent.

“On the basis of limited field mapping carried out in the late fall of 2016, the core of the greenstone belt…” (in the area near Moose-Caribou) “…forms an asymmetric graben that has been folded into a tight syncline. The asymmetry comes from the fact that the volcanics filling the northwest side of the graben are dominantly mafic, while those on the southeast side are dominantly felsic tuffs, agglomerates and lavas.” (Bowdidge, 2019)

Geological mapping by Confederation/Tribute/Noranda and Pistol Bay was assessed. Bowdidge (2019) suggested “…… that there is a matching anticline on the southeast flank of the belt.

Western Birch-Uchi belt, with below, stratigraphy and lithologies from GSC 4256, 2004. On a property scale, the divisions have to the best of our knowledge not been verified by geochronology.

An approximately east-west trending volcano-sedimentary sequence of predominantly Confederation felsic-intermediate volcanic rocks, flanked to the north, by unsubdivided, mainly mafic volcanic rocks. The Little Bear Lake pluton has intruded the sequence in the north, and in the south, a Neoarchæan pluton of similar composition.

Legend and map from GSC of 4256 2004

Ybe13tn Tonalite gneiss: heterogeneous, variably floated, layered & commonly folded gneiss of tonalitic, granodioritic & qz. dioritic composition, occurring as enclaves within the central & south-eastern Trout Lake batholith; variably cut by concordant to discordant dykes of tonalite±granodiorite

Zcf74fv Heyson Sequence ca 2739 Ma felsic volcanic rocks: rhyolitic rocks of tholeiitic (type FIII) affinity (flat to LREE-enriched): consisting of rhyolitic flows that may be quartz-phyric and locally exhibit primary lobate structure; lesser crystal tuff (U-Pb #37); associated gabbroic sills

Zcf74th Heyson sequence mafic volcanic rocks: massive to pillowed tholeiitic basalt, locally plagioclase phyric.

Zcf74iv Intermediate volcanic rocks: andesitic to dacitic calc-alkaline flows, commonly plagioclase-phyric, possibly correlative with the Earngey sequence of the Birch-Uchi belt

Ycf35ca Agnew sequence, (Birch-Uchi belt) ca. 2744 Ma Mafic volcanic rocks: calc-alkaline pillowed basalt flows, pillow breccia, and tuff of dominantly calc-alkaline affinity.

Ycf75it McNeely sequence (Red Lake0 ca. 2748-2742 Ma Mafic volcanic rocks: plagioclase-phyric, massive to pillowed, calc-alkaline basalt±andesite; locally amygdaloidal.

Tcf12mv Confederation assemblage ca. 2745-2735 Ma. Mafic volcanic rocks: basaltic rocks considered part of the Confederation assemblage formed at the transitional continental margin setting.

Tcf12am Confederation assemblage Amphibolite: amphibolite-facies mafic volcanic rocks, locally pillowed east of Dixie Lake, considered part of the Confederation assemblage

Uus2mv Mafic volcanic rocks: foliated, massive to pillowed basalt, amphibolite, and associated gabbroic rocks, locally plagioclase-phyric near Springpole and Pakwash lakes; lesser associated intermediate to felsic flows, tuff and wacke near Dixie Lake.

Tcf12pr	Tcp12pr Confederation plutonic suite Porphyritic rocks: light-weathering, feldspar- and qz-(± blue qz) porphyritic, intrusive/hypabyssal rocks with 20-30% phenocrysts, interpreted to be subvolcanic to the Confederation assemblage
Gbe69gd	Gbe69gd Granodiorite-quartz monzonite; weakly foliated, equigranular to porphyritic biotite granodiorite-quartz monzonite, intrusive into deformed and locally mineralised strata; includes the ca. 2712 Ma Little Bear Lake granodiorite (U-Pb #62) and Shabumeni Lake stock (U=Pb #73) in the Birch-Uchi belt 2714 ± 4 Ma quartz-feldspar porphyry (U-Pb #44) that cuts gold mineralisation at the Red Lake mine.
Gbe6gd	Gbe6gd Neoarchæan (2800 – 2500 Ma) unsubdivided Quartz monzonite to granodiorite; variably foliated biotite quartz monzonite, granodiorite and granite; locally leucocratic and quartz and/or K-feldspar porphyritic; xenolithic south of Gullrock Lake
Gbe6gr	Gbr6gr Neoarchæan (2800 – 2500 Ma) unsubdivided Granite, granodiorite: massive to weakly foliated, lineated, fine- to coarse-grained, monzogranite±quartz monzodiorite±tonalite and associated pegmatitic rocks, locally K-feldspar porphyritic.
Tbe12tn	Tbe12tn Neoarchean Tonalite: massive to weakly foliated biotite-tonalite to trondhjemite±diorite typically associated with, or intrusive into, <2,745 Ga Confederation assemblage
Xbm59th	Xbm59th Balmer Assemblage, ca. 2992-2954 Ma Mafic volcanic rocks: tholeiitic basalt, commonly variolitic and pillowed: typically aphyric, sparsely vesicular; consisting of a lower sequence with TiO_2 >1.5% and flat to enriched LREE profiles, and middle to upper sequences with TiO_2 <1.5% and flat to depleted LREE profiles
Ube2tn	Ube2tn Archæan (4000-2500 Ma) Unsubdivided Tonalite to granodiorite: medium-grained, variably foliated biotite-hornblende-biotite tonalite and associated rocks; cataclastic adjacent to Longlegged Lake - Pakwash Lake fault Zone.

4.1 Regional Quaternary Geology

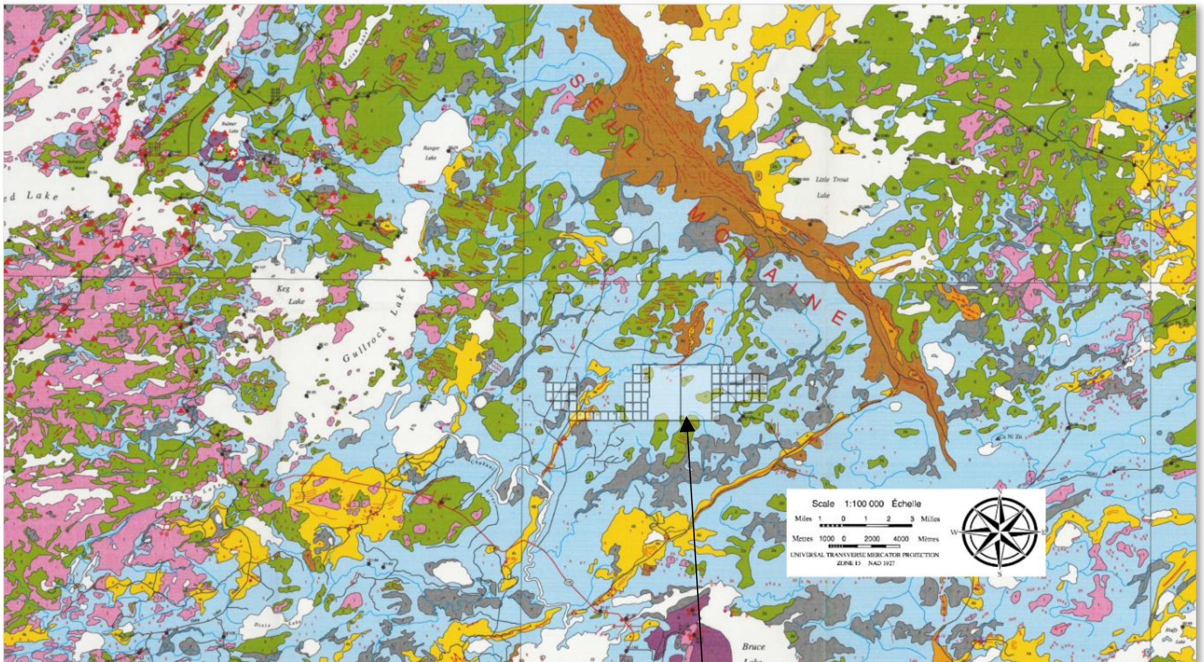


Figure 8 Quaternary Geology

From OF_2876 GSC Regional Surficial Geology. Property as transparency

Much of the property is underlain by fluviolacustrine and fluvial sediments (blue), with extensive, locally deep (>20 m) laminated to varved clay, silt and sand.

Scattered till (green) forms hummocky exposures, and may be gravelly to boulder, sand to sandy-silt, 1-6 m thick, covering bedrock.

Yellow areas denote fluvioglacial ‘outwash’ deposits of sand and gravel may represent old sub-glacial water courses and be esker or kame like in morphology.

Grey organic deposits occur across the property.

To the east of the property, the north-south trending Lac Seul moraine (brown) is flanked by shoreline, ice-edge deposits.

Pink areas denote concentrations of outcrops.

The extent of the ‘deep water’ deposits, flat plain topography and orientation of fluvioglacial deposits suggests significant west south-west fluvial transport and episodic breaching of glacial dammed lake(s). Overburden type and depth are not conducive to obtaining relevant, meaningful results from ‘regular’ soil sampling of the substrate. Conditions improve eastwards, with increasing preservation of till (green), but geochemical sampling of the unconsolidated surface material is not recommended unless orientation surveys are carried out.

5.0 PROPERTY GEOLOGY

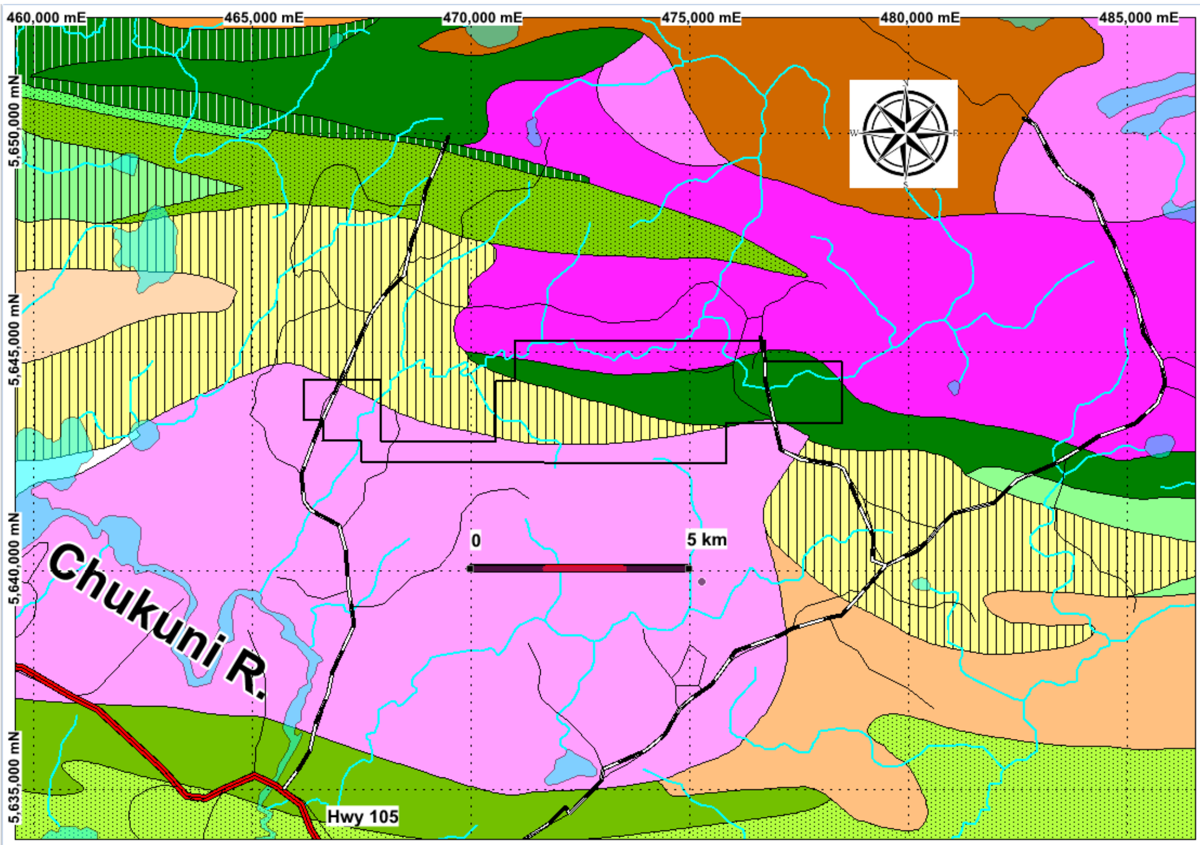


Figure 9 Property Geology

From GSC P3460, with legend above. Claim block outlined.

The geology is based almost exclusively on correlation with exposures off property, geophysical correlation on and off-property, and very limited drilling.

MINERAL OCCURRENCES

None known – negligible outcrop. The Zn-Cu intercepts from Inco and Selco drilling in the west of the property are reported in the government mineral database as a 'showing'.

Based almost exclusively on information culled from assessment reports, it's underlain by:

1. Deformed Heyson volcano-sediments, broadly characterised by intermediate-felsic pyroclastic, minor mafic and possibly ultramafic equivalents and related effusive rocks, interbedded, thin iron formations, ferruginous sediments. Especially in the south and centre-

south, these amphibolite metamorphic-grade lithologies which have undergone retrograde metamorphism, are interlayered by massive to finely gneissic or lineated, medium-grained granite, granodiorite, granite pegmatite and muscovite gneiss which represent outlier intrusions of a large felsic pluton extending to the west and south. Gneissic equivalents of metasediments and felsic-intermediate volcanic rocks have been reported.

2. Unsubdivided mafic volcanic rocks with pillow lavas, amphibolite, gabbro, possibly of Neoarchean age.

3. In the north, Little Bear Lake granodiorite

4. In the south, Neoarchean unsubdivided quartz monzodiorite to granodiorite

Some drilling intercepted gabbroic, and mafic-ultramafic rocks that intrude the supracrustal sequence.

Mineral assemblages are mainly qz-plag-bte±muscovite, plag-bte-amphibole and plag-qz-bte. Alteration includes chlorite, aluminosilicate and garnet, but overall, logs and descriptions suggest this is related to metamorphism of minerals rather economic mineralising episodes.

Several parallel stratigraphic parallel magnetic high features tend across the property, with most representing ferruginous sediments, talc or actinolite schist or IF. In the north-east is a feature interpreted to be a gabbroic intrusion.

Sulphide mineralisation may be disseminated, stringer, fabric parallel (S_0 or S_2, and semi-massive, with varying percentages of py and or po, and lesser Cp. Zinc was reported in some Selco and Inco holes. Magnetite may be disseminated, or finely layered.

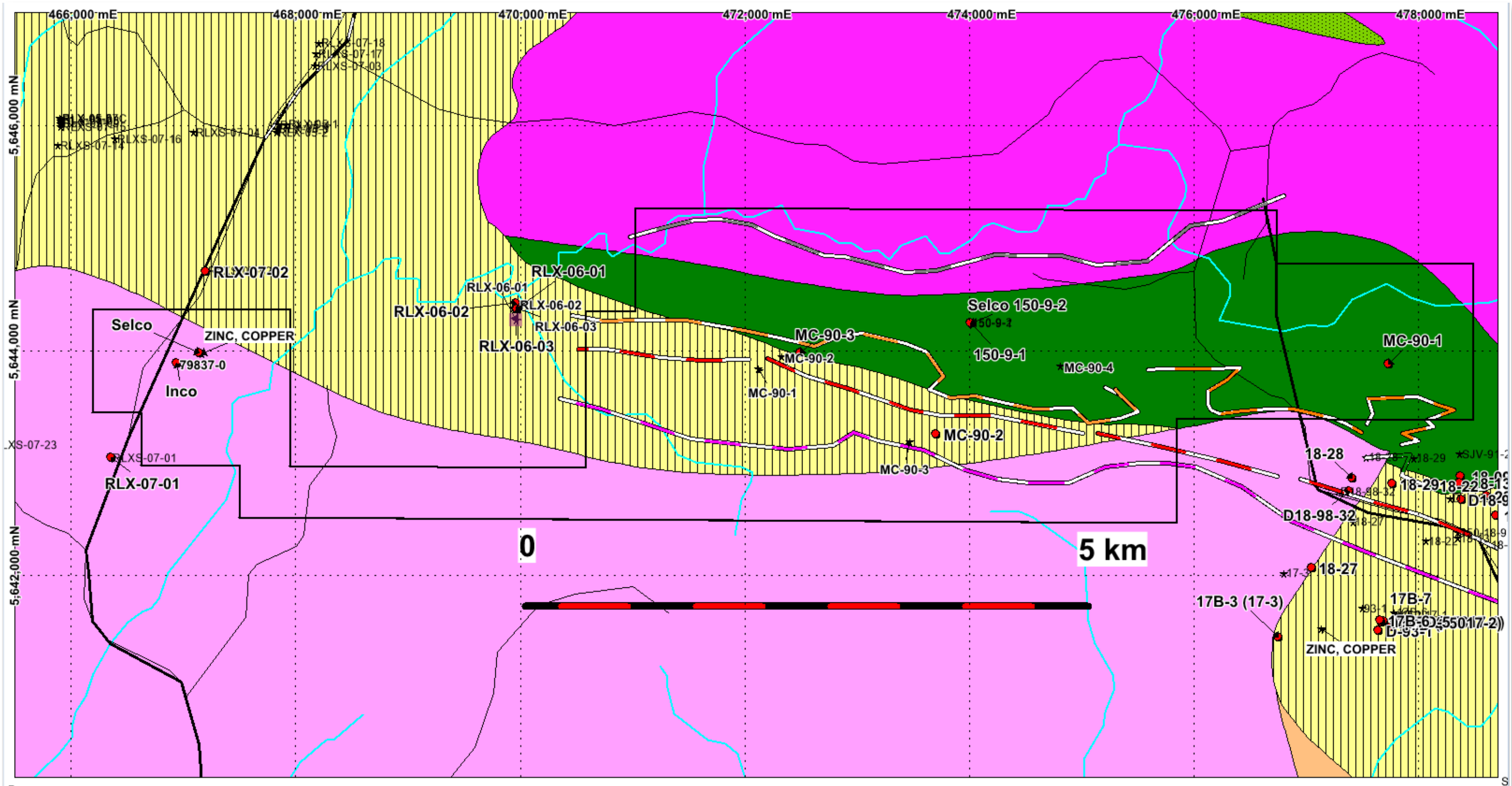


Figure 10 Moose-Caribou Geology

Geology as above is from published government data, with interpreted iron formation trends and major lithological breaks. *Off property interpretation based on government dataset(s)* Two sets of drill databases are displayed, the government (*) and internal (red dots). The gabbro intrusion in the north-east is not shown.

6.0 DEPOSIT TYPES

Targets within this portion of the Confederation Belt are orogenic gold systems with Archæan greenstone.

"Orogenic lode gold deposits of Middle Archæan to Tertiary age are arguably the predominant gold deposit type in metamorphic belts, and include several giant (>250 t Au) and numerous world-class (>100 t Au) examples. Their defining characteristics and spatial and temporal distributions are now relatively well documented, such that other gold deposit types can be compared and contrasted against them. They form as an integral part of the evolution of subduction-related accretionary or collisional terranes in which the host-rock sequences were formed in arcs, back arcs, or accretionary prisms. Current unknowns for orogenic gold deposits include the following: (1) the precise tectonic setting and age of mineralization in many provinces, particularly in Palaeozoic and older metamorphic belts; (2) the source of ore fluids and metals;(3) the precise architecture of the hydrothermal systems, particularly the relationship between first- and lower-order structures; and (4) the specific depositional mechanisms for gold, particularly for high-grade deposits." Groves et al., 2003

7.0 RESULTS

From 8th -11th June, 2021, on behalf of Trillium Gold Mines Inc., Precision GeoSurveys Inc. of Langley B.C. flew a high resolution helicopter-borne magnetic gradiometer survey over the Moose-Caribou property, Red Lake region, north-west Ontario.

The survey was flown at 50 metre line spacing at a heading of 000°/180°; tie lines were flown at 500 metre spacing at a heading of 090°/270°. A total of 568 line km was flown over one survey block with a total area on the claims of 21.97 km^2. An additional one km was flown to retain data from flight lines flown outside the survey block margins for efficiency.

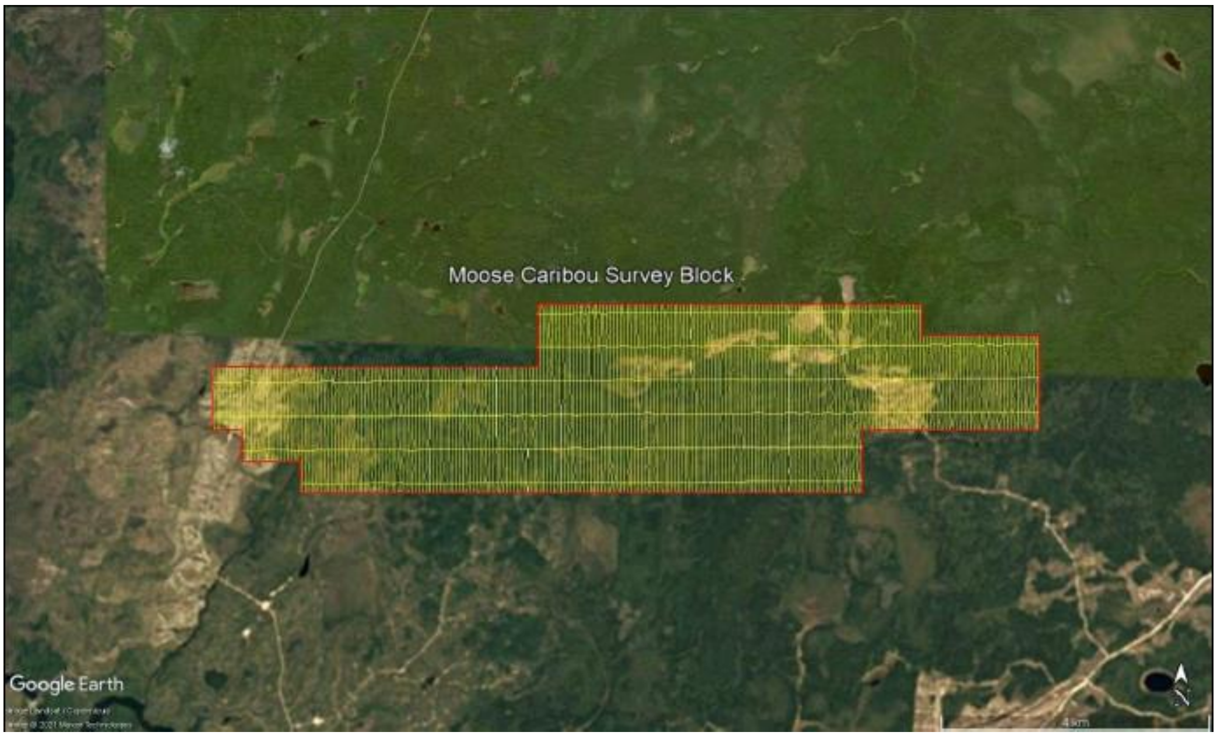


Figure 11 Plan View – Moose-Caribou survey block

Flight lines are shown in yellow. Summary is provided, below.

Survey Block	Area (km^2)	Line Type	No. of Lines Planned	No. of Lines Completed	Line Spacing (m)	Line Orientation (UTM grid)	Total Planned Line km	Total Actual km Flown
Moose Caribou	25.6	Survey	246	246	50	000°/180°	512	513
		Tie	6	6	500	090°/270°	55	55
		Total:	**252**	**252**			**567**	**568**

Specifics of the geophysical equipment and processing are provided in the accompanying report by Precision GeoSurveys Inc., author, S. Walker, M.Sc., P. Geo. This includes polygon co-ordinates for the survey block (in Appendix A, separate

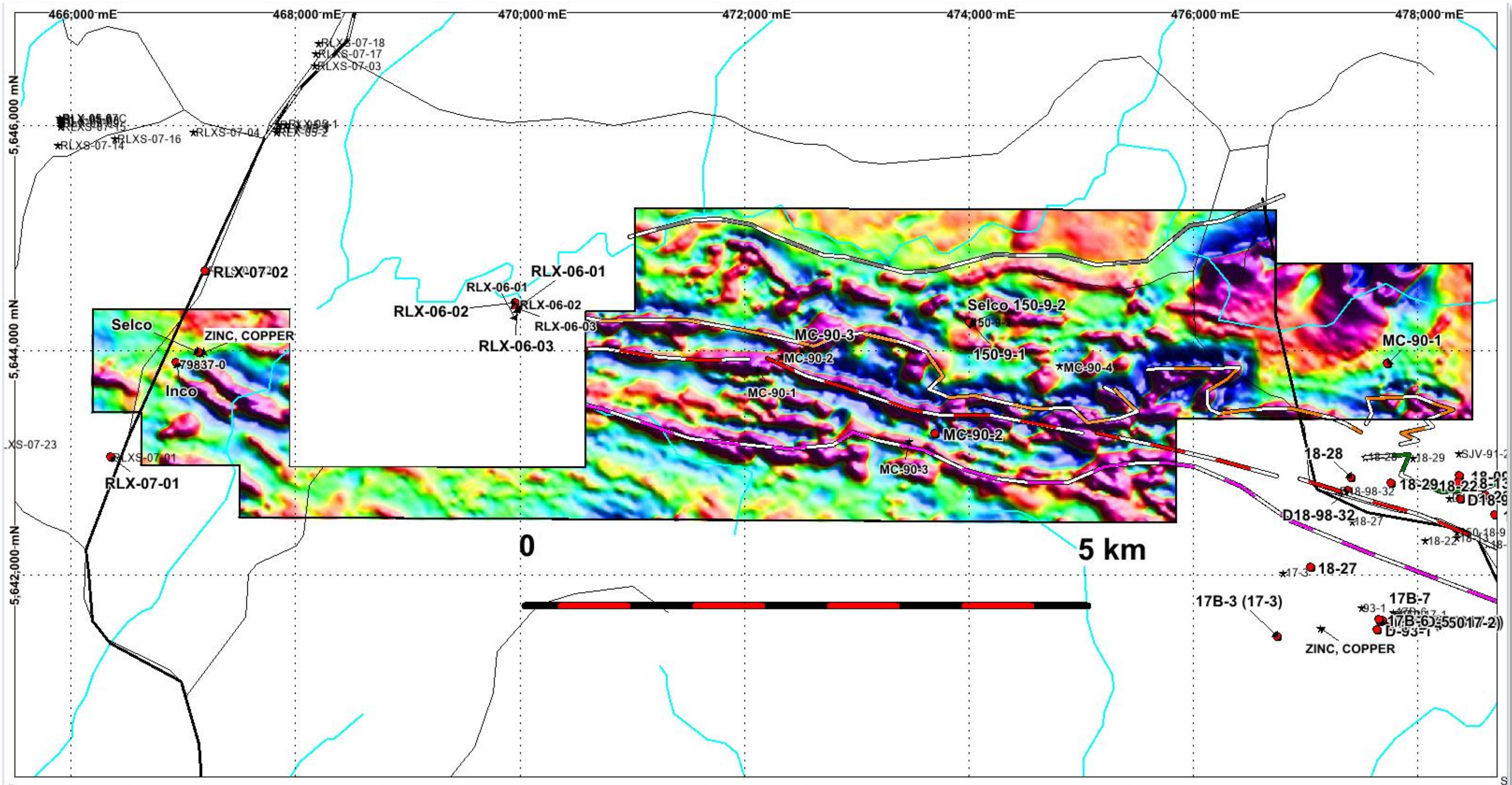


Figure 12 First derivative vertical gradient magnetic data

Historic drill holes are shown as asterisks or red dots. Dashed lines are main supracrustal trends and possible crustal breaks.

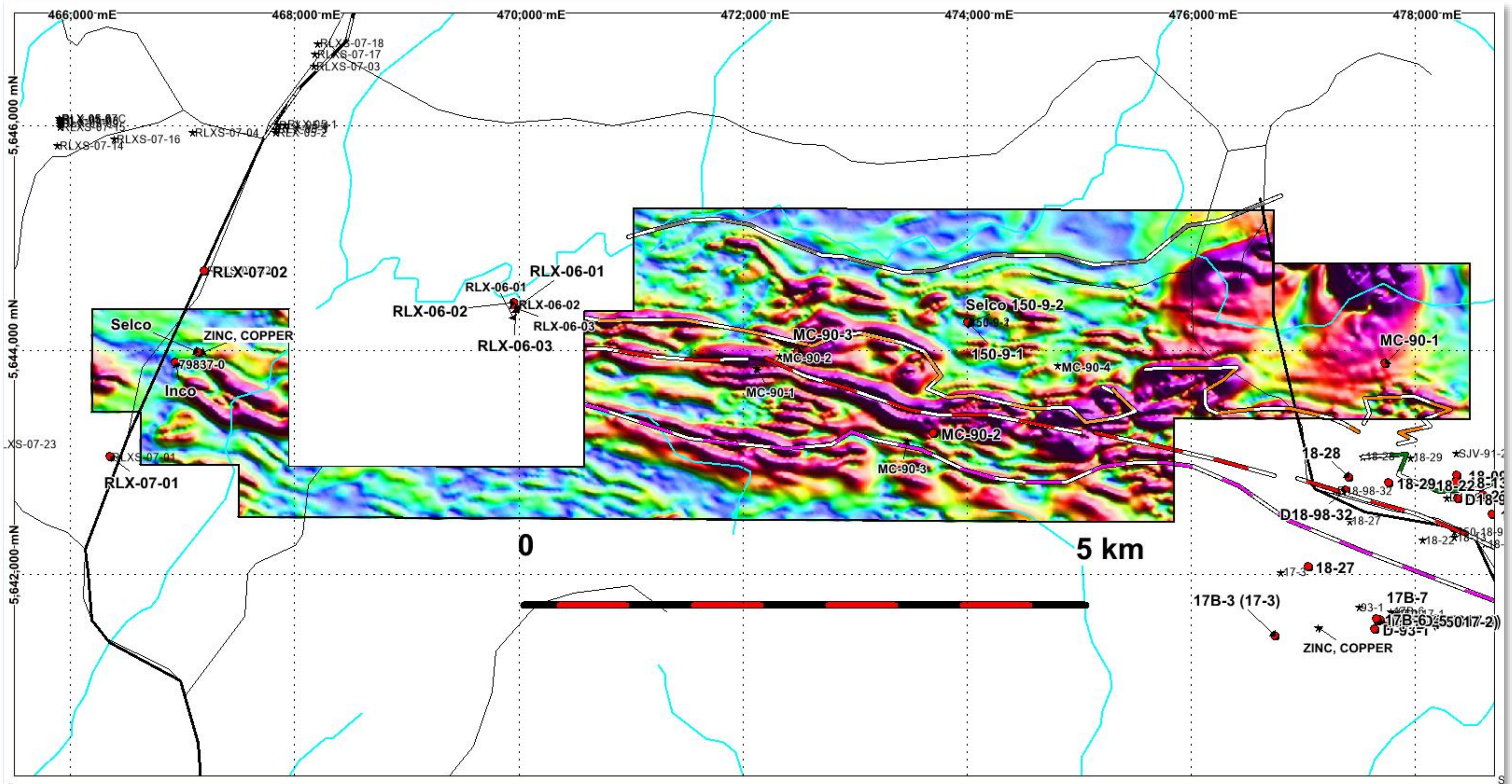


Figure 13 Horizontal gradient magnetic data

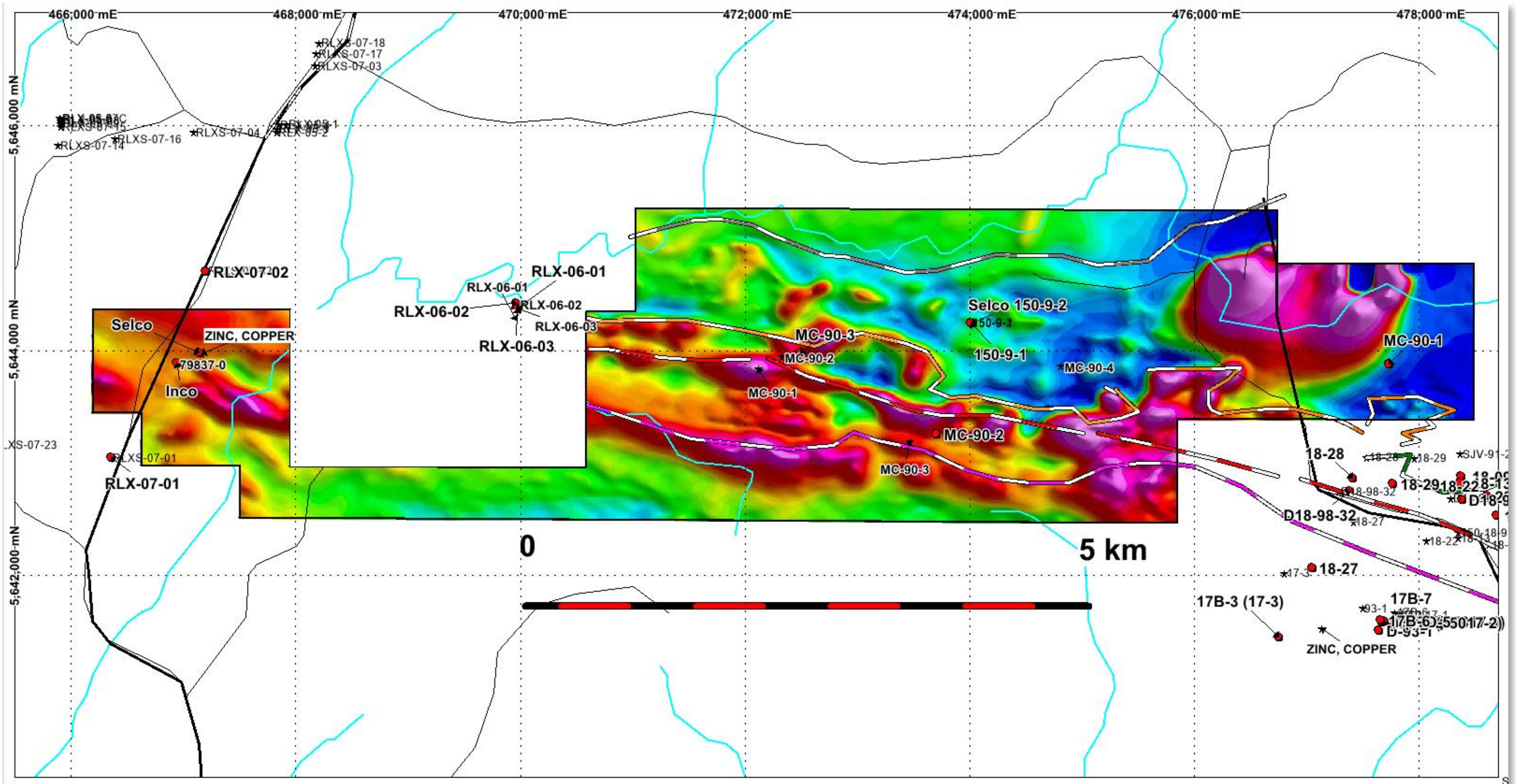


Figure 14 TMI magnetic data

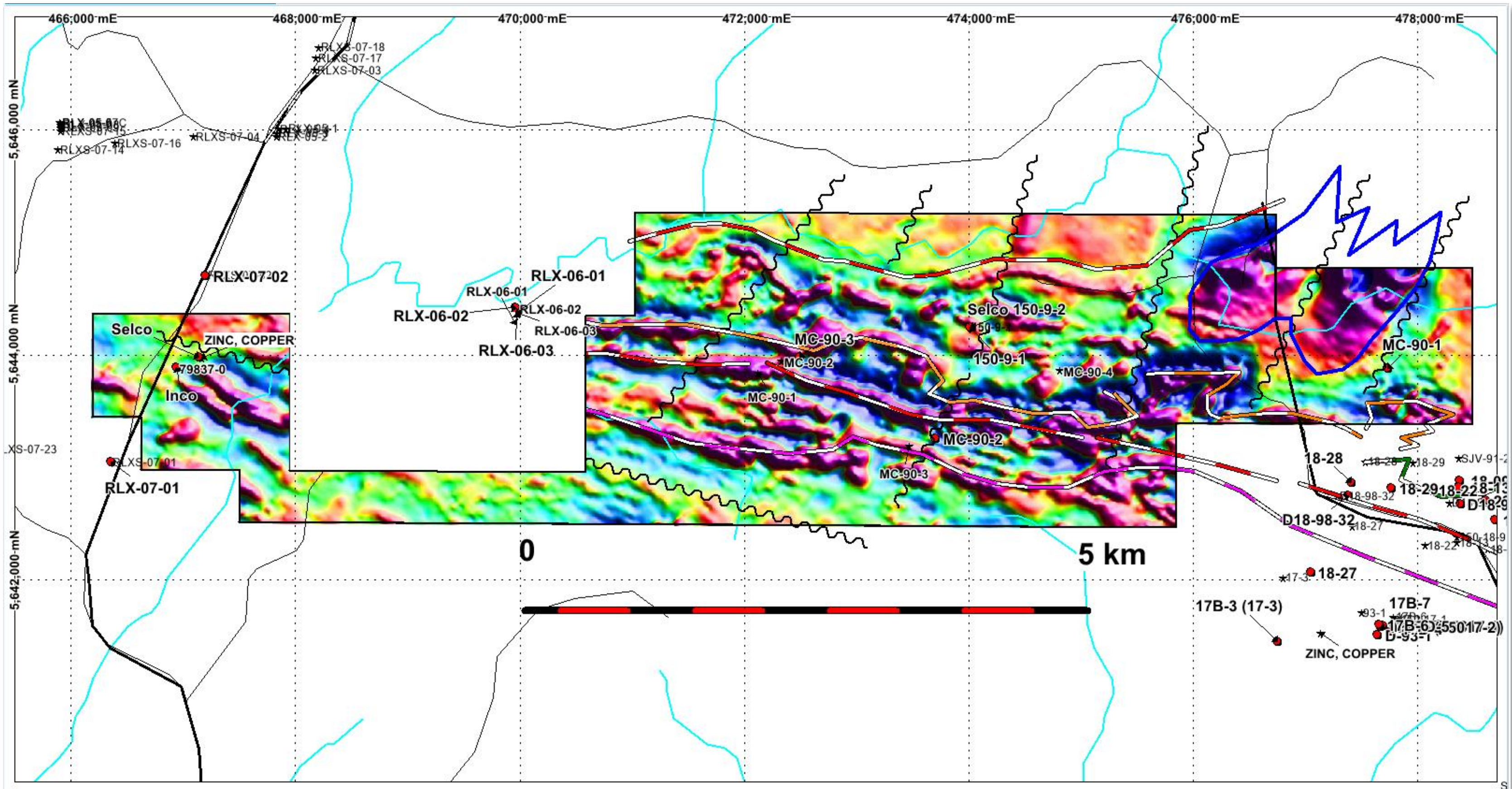


Figure 15 Interpretation with 1VD magnetic data

8.0 CONCLUSIONS

- The airborne survey outlined an approximately east-west trending supracrustal sequence flanked to the north by the relatively lower magnetic intensity Little Bear pluton, and to the south by a massive to foliated monzonite-granodiorite body.
- In the north-east of the property, there is outlined a (probable) gabbroic intrusion bisected by a north-east trending fault.
- Far western and southern stratigraphy has probably been modified with partial to near complete assimilation by the monzonite-granodiorite body.
- Linear high magnetic intensity features are probably representative of iron formations, though thin gabbroic bodies cannot be excluded (due to lack of drill testing). Also, historic drilling indicates possible ultramafic units parallel to and defining stratigraphy.
- The Little Bear Lake pluton (magenta colour, north) has a gradational boundary with the mafic volcanic sequence which is partially mafic-ultramafic, this based on very limited drill data and to some extent, correlation with results off-property, along strike.
- The main structural trends are a) roughly east-west, parallel to stratigraphy, and b) a later set of fractures, trending NE-SW.
- The folded and fragmented nature of northern and central stratigraphy may reflect dextral strike-slip related to folding, and/or partial assimilation and modification by the Little Bear pluton. Fold axial traces are generally NE trending, and east verging.
- Central and southern stratigraphy is officially Heyson sequence volcanic rocks, but it appears much of this is more mafic in nature and/or hosting iron formation sequences, delineated as red-white dashed lines in the property geology map. The northernmost grey-white dashed line represents a tentative boundary between the pluton and mainly mafic volcanic rocks, which if correct, would indicate considerable supracrustal material within the pluton.
- In many instances, drill hole locations are mislocated by as much as 200 metres, and caution is advised. Drill hole locations from the Trillium 'database' and the government drill hole database downloaded from Google Earth can also have differing locations.
- If the gabbroic bodies are as the GSC OF reports younger than 2.7 Ga, they may post-date what is believed to be the main gold mineralising event, ca. 2730-2710 Ma. Intrusion into the Confederation sequence would re-distribute or remove mineralisation.

9.0 RECOMMENDATIONS

The TGM airborne data could be used to define targets for an IP survey over second and third order faults within the supracrustal sequence, with focus on the north margin, where folding and ?-shearing may have been more pronounced. The caveat is that albeit very minor drilling along this trend returned negative results.

At this stage, one could drill several of the previously tested EM anomalies to establish gold on the property or run IP lines over a couple of sections, bearing in mind the deep and conductive nature of the overburden. There is as yet no established stratigraphy across Moose-Caribou and There is very limited geochemical data on the property that could be utilised to define alteration anomalies.

Correlation with the geology and geochemistry associated with the south-east adjacent Dixie-17 and -18 zones drill results could be used, though the drilling thereon returned negligible gold.

Geological surveys should focus on the central and north margin of the supracrustal sequence Based on historic mapping, there are few exposures on the property, but a check is advisable.

Alternatives to a large scale geological survey would be geochemical sampling of the substrate, That stated, soil, humus, enzyme leach and MMI sampling have been employed in the search for precious and base metals in this area, with poor results due in large part to the deep and conductive overburden. An option could be soil gas hydrocarbon (SGH) survey which, based on such surveys completed in the region, may provide meaningful results.

Additional ground work is also required to accurately locate drill holes and determine the condition of old logging roads and trails. Much of the property is accessible only during winter using the Chukuni River road in the west and an old logging road off the Snake Falls road in the east.

Respectfully Submitted,

T.N.J. Hughes, P. Geo.

Proposed Budget

Item	Days/Unit	Base Cost	Total
Mapping, Prospecting and Sampling			
Project Geologist	4	700	2800
Junior geologist	4	350	1400
Room and board	4	300	1200
Transportation			
Truck, gas	4	150	6000
ATV	4	350	1400
Line Cutting 10 km	10	900	9000
Induced Polarization Survey 10 km	10	2000	20000
Reports and Maps	6	700	4200
Contingencies	15%		4600
Total Proposed Budget			**Can$ 52,900**

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52K14NW2005 Magrum West Goldcorp Geochem 2002

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52K14NW0031 Lightval Moose Creek MaxMin Magrum West 1991

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52K14NW0005 Noranda Dixie 18 DDH East of Magrum West 1988

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52K13NE9136 Lightval EM 1990

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12.0 STATEMENT OF QUALIFICATIONS

I, Toby Hughes of Vancouver, B.C. declare that:

- I graduated with an Hons. B.Sc. Geology, from Dundee University, Scotland in 1980

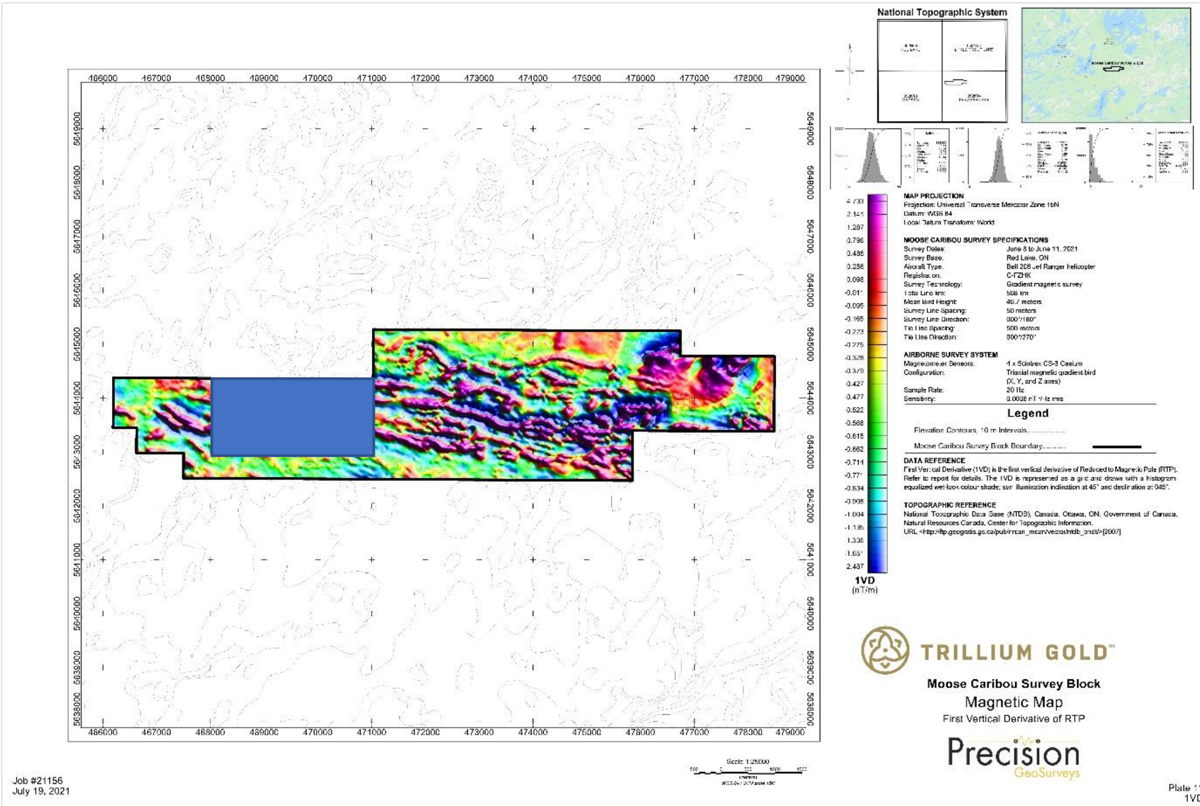
- I have worked as an exploration geologist for 41 years since graduation.

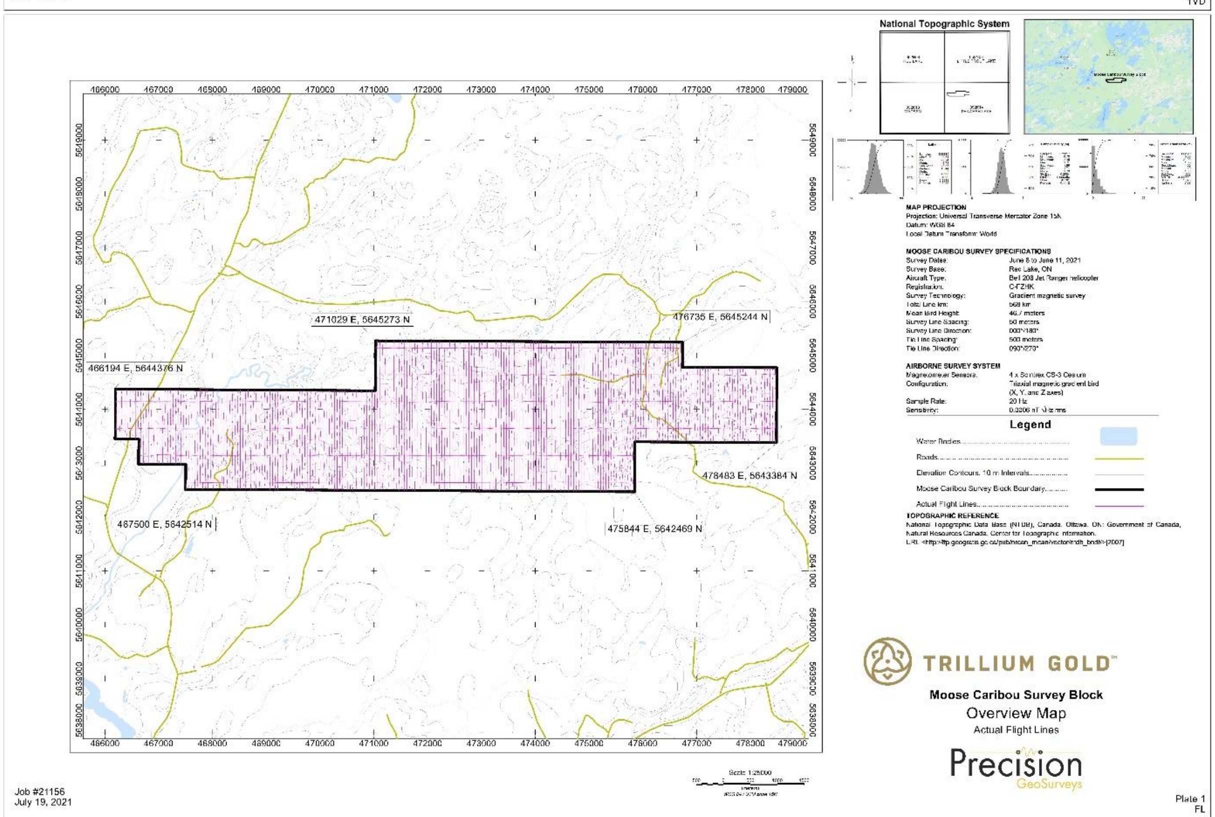
- I am a Practicing Geologist in good standing with Professional Geoscientists Ontario, No. 1318

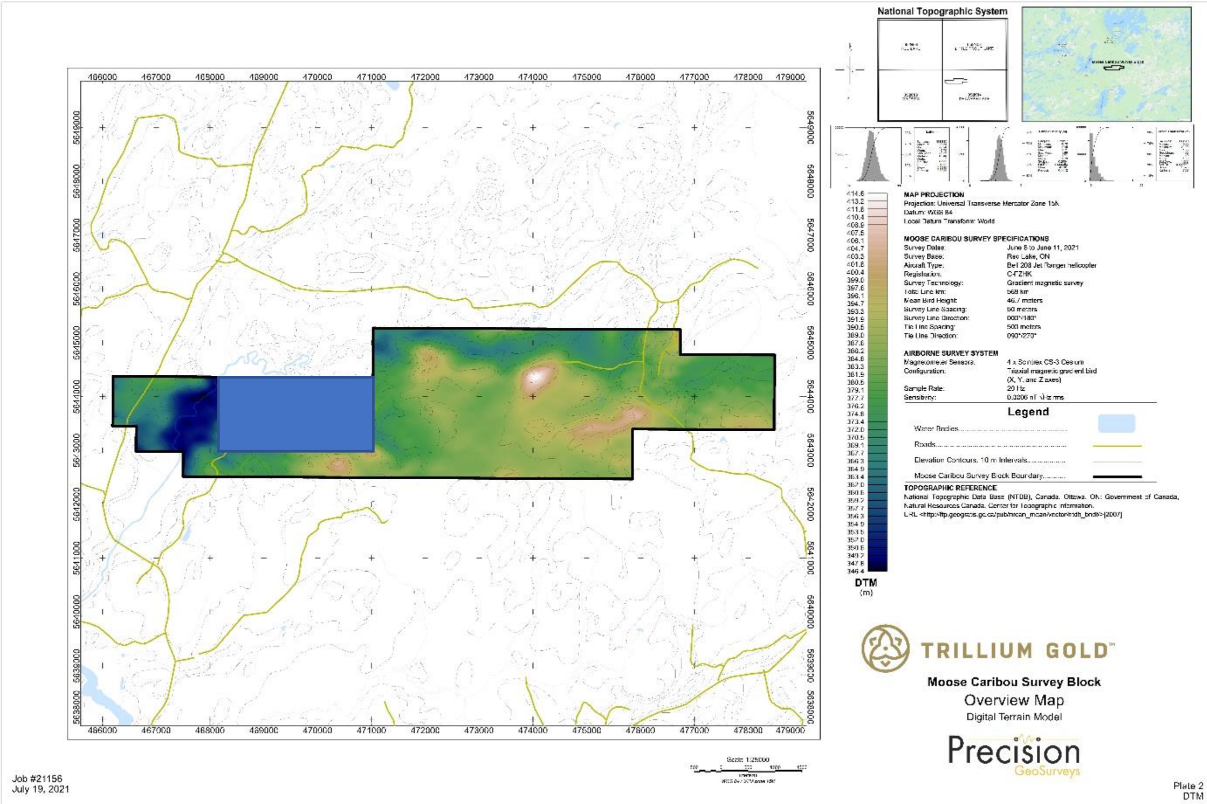
T. Hughes, P. Geo.

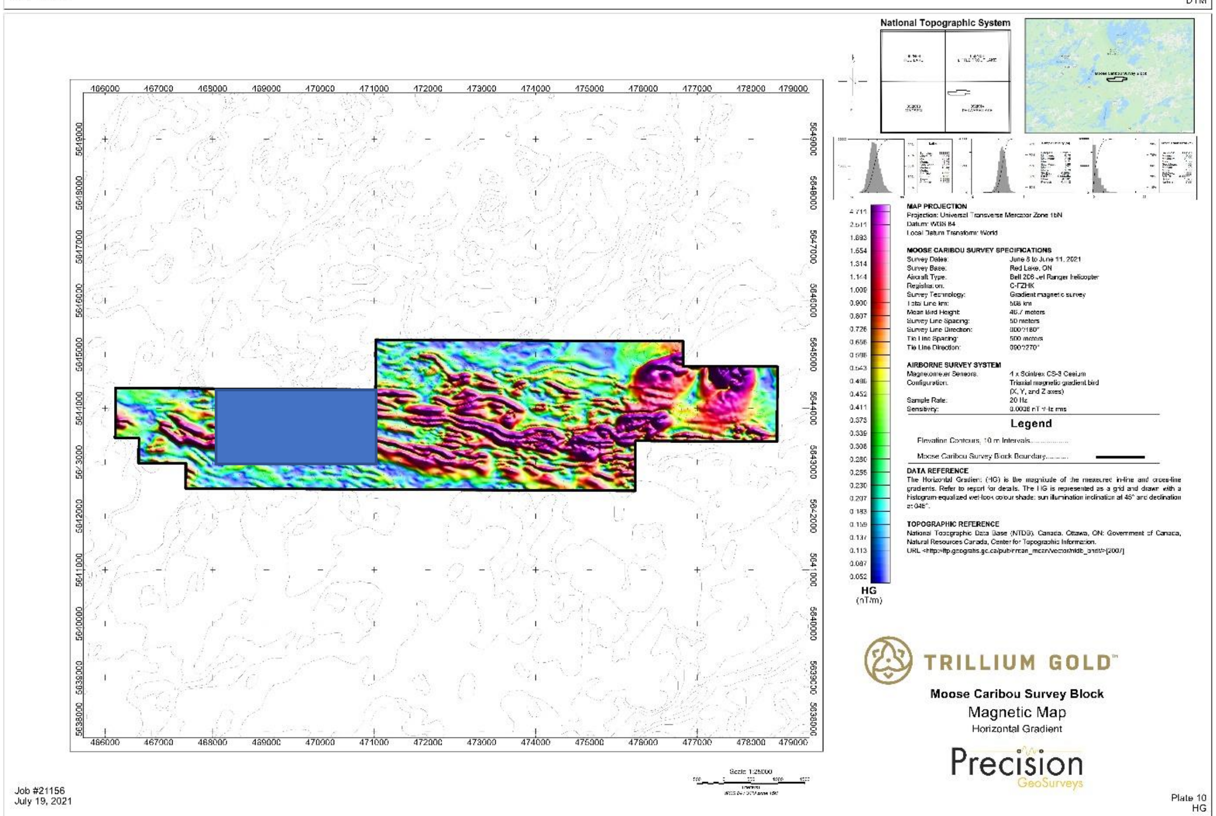
Dated this day, 16.11.21

APPENDIX I **Airborne Survey jpegs**






National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
AIRBORNE SURVEY SYSTEM
Legend
TOPOGRAPHIC REFERENCE
DTM
(m)
TRILLIUM GOLD
Moose Caribou Survey Block
Overview Map
Digital Terrain Model
Precision
GeoSurveys
Job #21156
July 19, 2021
Plate 2
DTM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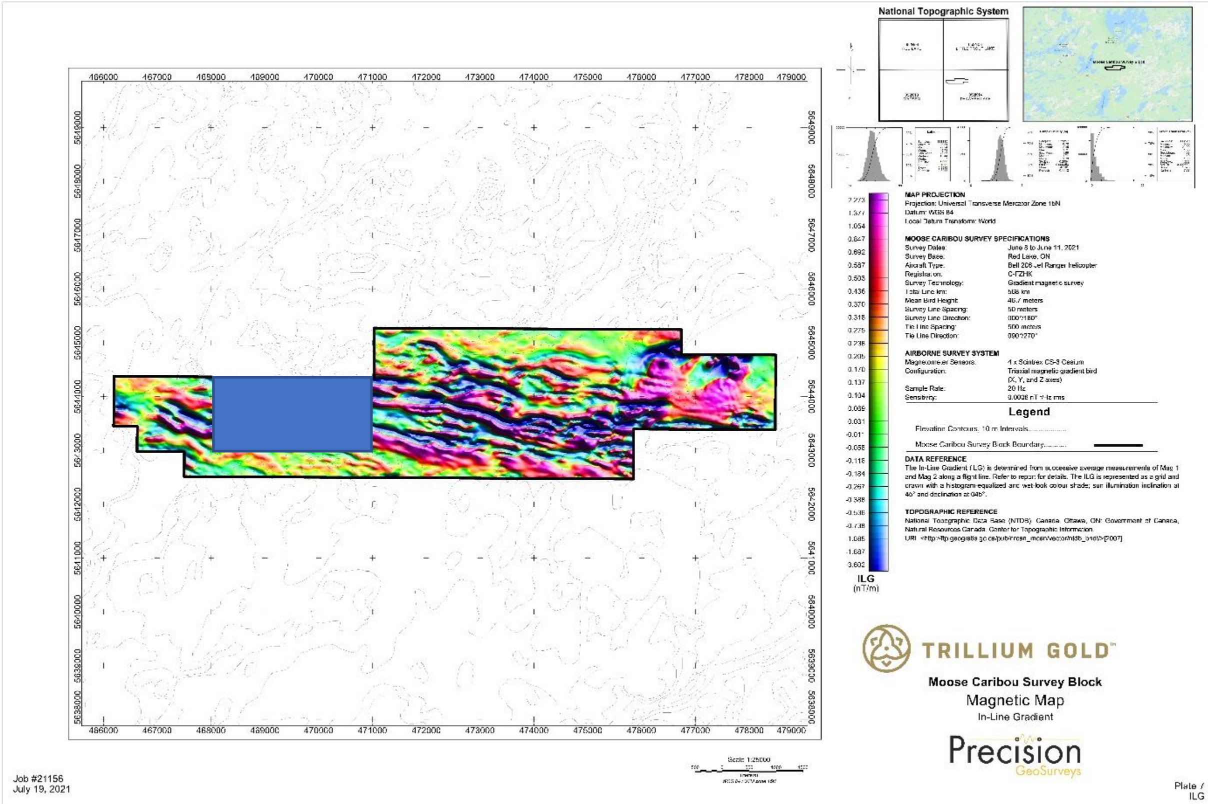
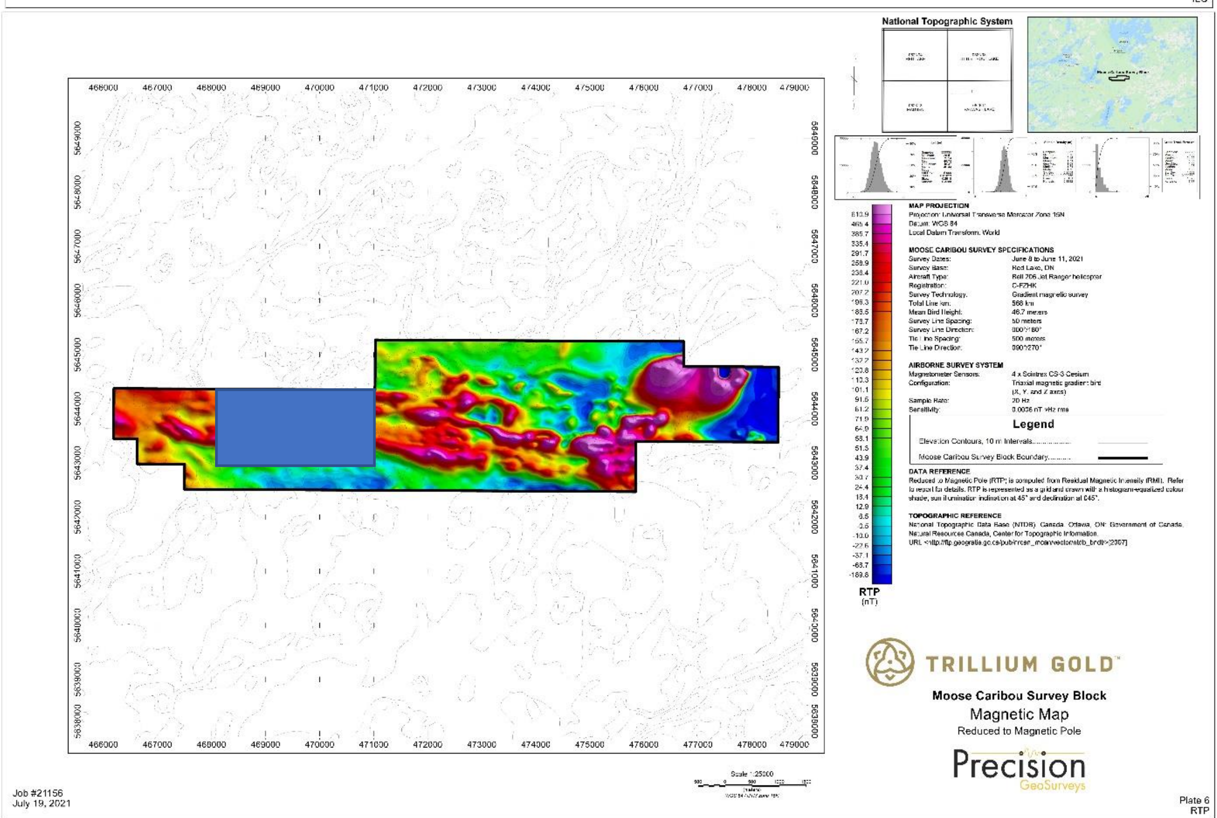
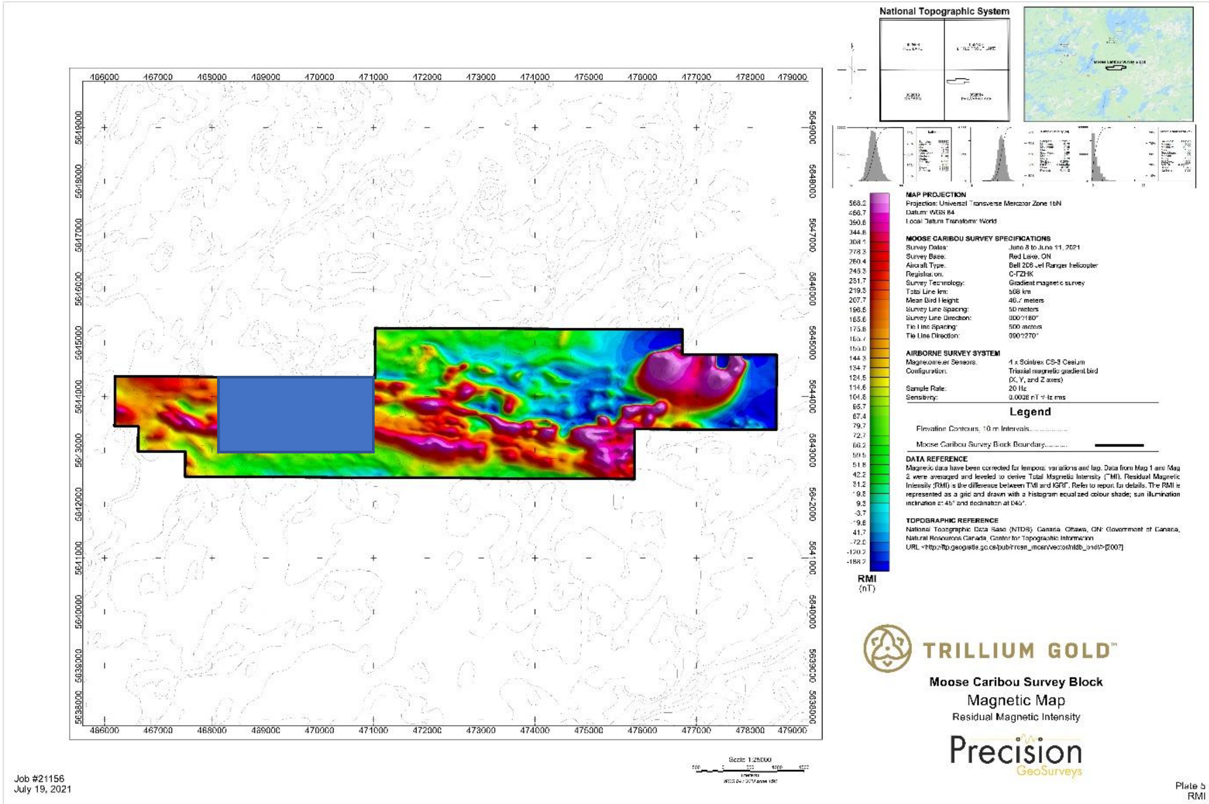
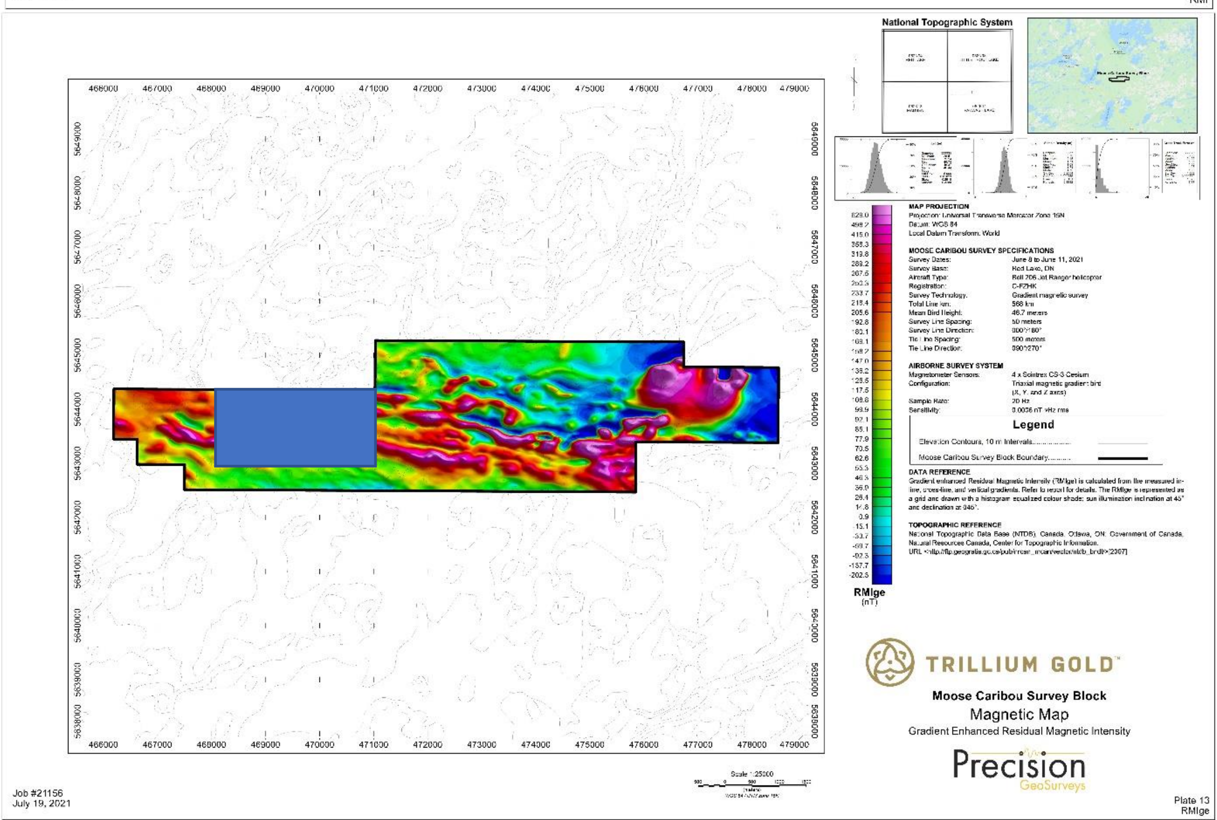
MAP PROJECTION
MOOSE CARIBOU SURVEY SPECIFICATIONS
AIRBORNE SURVEY SYSTEM
Legend
DATA REFERENCE
TOPOGRAPHIC REFERENCE
HG
(nT/m)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Horizontal Gradient
Precision
GeoSurveys
Job #21156
July 19, 2021
Plate 10
HG


National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
Survey Dates: June 8 to June 11, 2021
Survey Base: Red Lake, ON
Aircraft Type: Bell 206 Jet Ranger helicopter
Registration: C-FZHK
Survey Technology: Gradient magnetic survey
Total Line km: 568 km
Mean Bird Height: 46.7 meters
Survey Line Spacing: 50 meters
Survey Line Direction: 000°/180°
Tie Line Spacing: 500 meters
Tie Line Direction: 090°/270°
AIRBORNE SURVEY SYSTEM
Magnetometer Sensors: 4 x Scintrex CS-3 Cesium
Configuration: Triaxial magnetic gradient bird (X, Y, and Z axes)
Sample Rate: 20 Hz
Sensitivity: 0.0036 nT √Hz rms
Legend
Elevation Contours, 10 m Intervals
Moose Caribou Survey Block Boundary
DATA REFERENCE
The In-Line Gradient (ILG) is determined from successive average measurements of Mag 1 and Mag 2 along a flight line. Refer to report for details. The ILG is represented as a grid and drawn with a histogram-equalized and wet-look colour shade; sun illumination inclination at 45° and declination at 045°.
TOPOGRAPHIC REFERENCE
National Topographic Data Base (NTDB). Canada. Ottawa, ON: Government of Canada, Natural Resources Canada, Center for Topographic Information.
URL <http://ftp.geogratis.gc.ca/pub/nrcan_rncan/vector/ntdb_bndt>[2007]
ILG (nT/m)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
In-Line Gradient
Precision GeoSurveys
Scale 1:25000
Job #21156
July 19, 2021
Plate 7
ILG


National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
Survey Dates: June 8 to June 11, 2021
Survey Base: Red Lake, ON
Aircraft Type: Bell 206 Jet Ranger helicopter
Registration: C-FZHK
Survey Technology: Gradient magnetic survey
Total Line km: 568 km
Mean Bird Height: 46.7 meters
Survey Line Spacing: 50 meters
Survey Line Direction: 000°/180°
Tie Line Spacing: 500 meters
Tie Line Direction: 090°/270°
AIRBORNE SURVEY SYSTEM
Magnetometer Sensors: 4 x Scintrex CS-3 Cesium
Configuration: Triaxial magnetic gradient bird (X, Y, and Z axes)
Sample Rate: 20 Hz
Sensitivity: 0.0036 nT √Hz rms
Legend
Elevation Contours, 10 m Intervals
Moose Caribou Survey Block Boundary
DATA REFERENCE
Reduced to Magnetic Pole (RTP) is computed from Residual Magnetic Intensity (RMI). Refer to report for details. RTP is represented as a grid and drawn with a histogram-equalized colour shade, sun illumination inclination at 45° and declination at 045°.
TOPOGRAPHIC REFERENCE
National Topographic Data Base (NTDB). Canada. Ottawa, ON: Government of Canada, Natural Resources Canada, Center for Topographic Information.
URL <http://ftp.geogratis.gc.ca/pub/nrcan_rncan/vector/ntdb_bndt>[2007]
RTP (nT)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Reduced to Magnetic Pole
Precision GeoSurveys
Scale 1:25000
Job #21156
July 19, 2021
Plate 6
RTP


National Topographic System
MAP PROJECTION
MOOSE CARIBOU SURVEY SPECIFICATIONS
AIRBORNE SURVEY SYSTEM
Legend
DATA REFERENCE
TOPOGRAPHIC REFERENCE
RMI
(nT)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Residual Magnetic Intensity
Precision
GeoSurveys
Job #21156
July 19, 2021
Plate 5
RMI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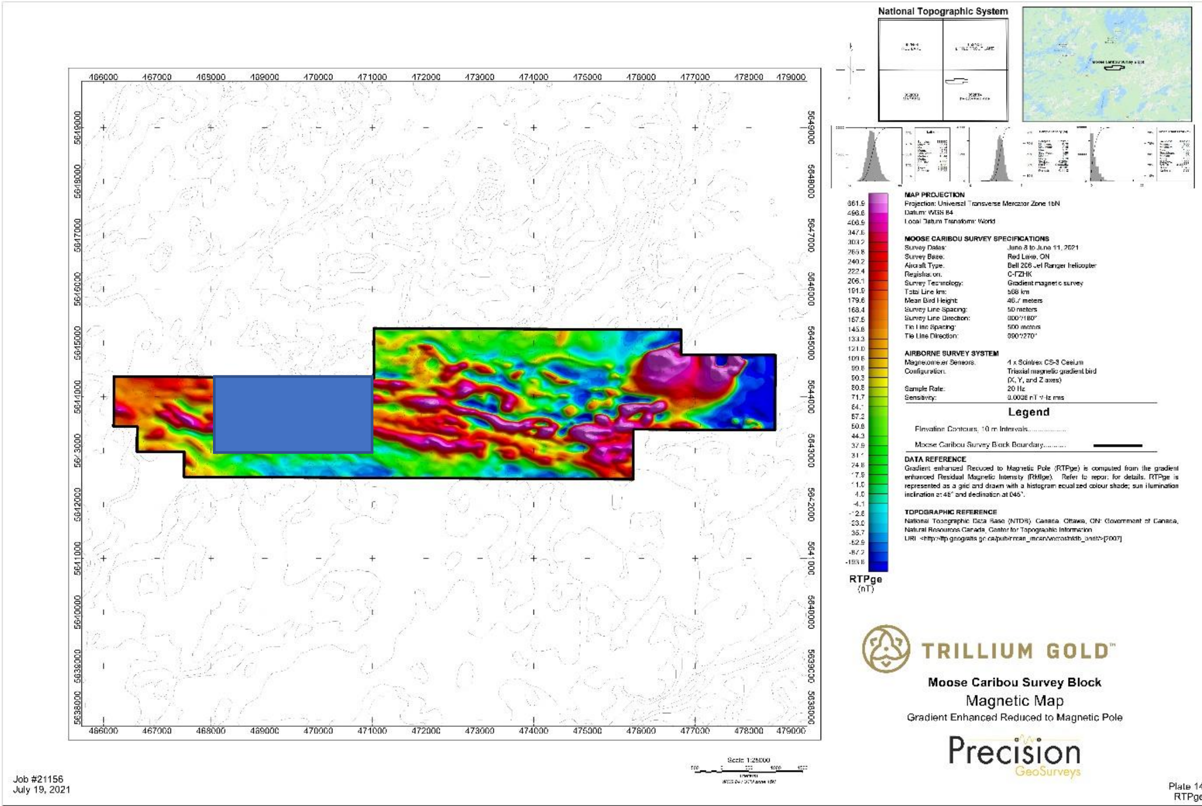
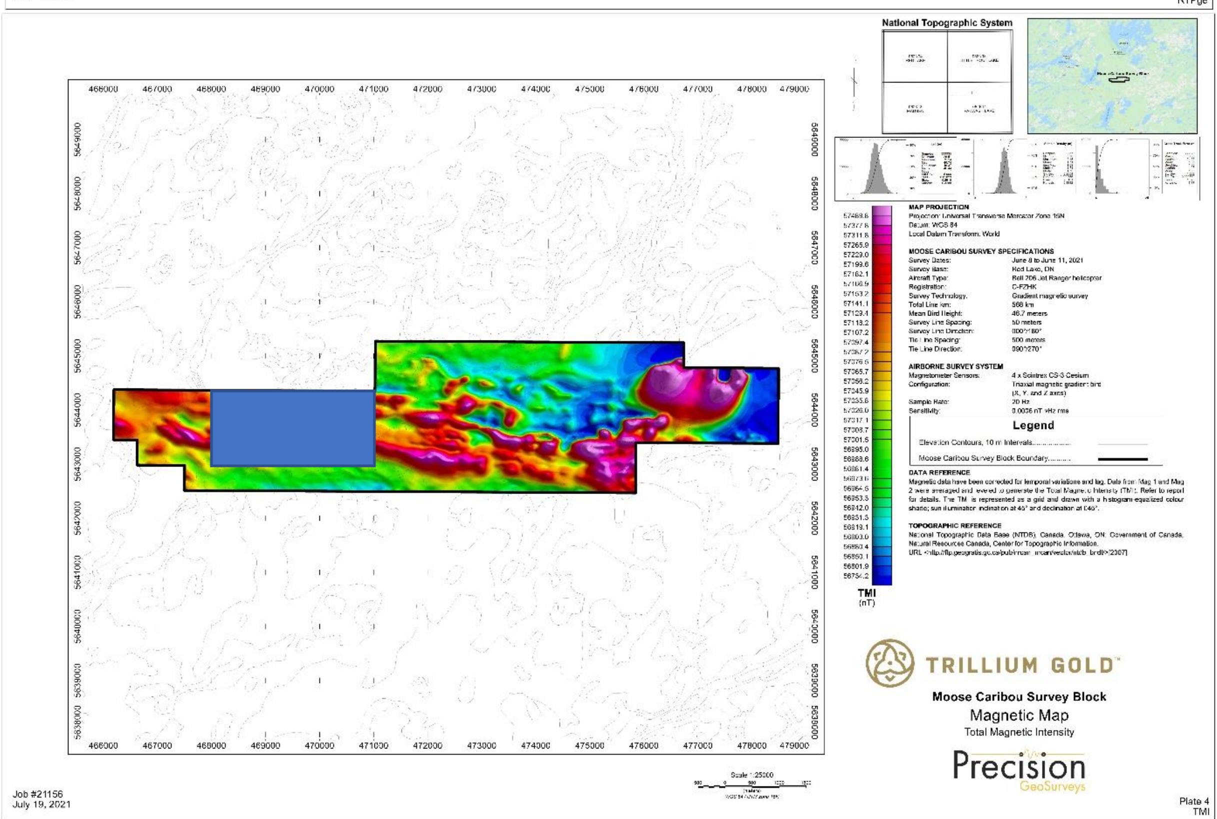
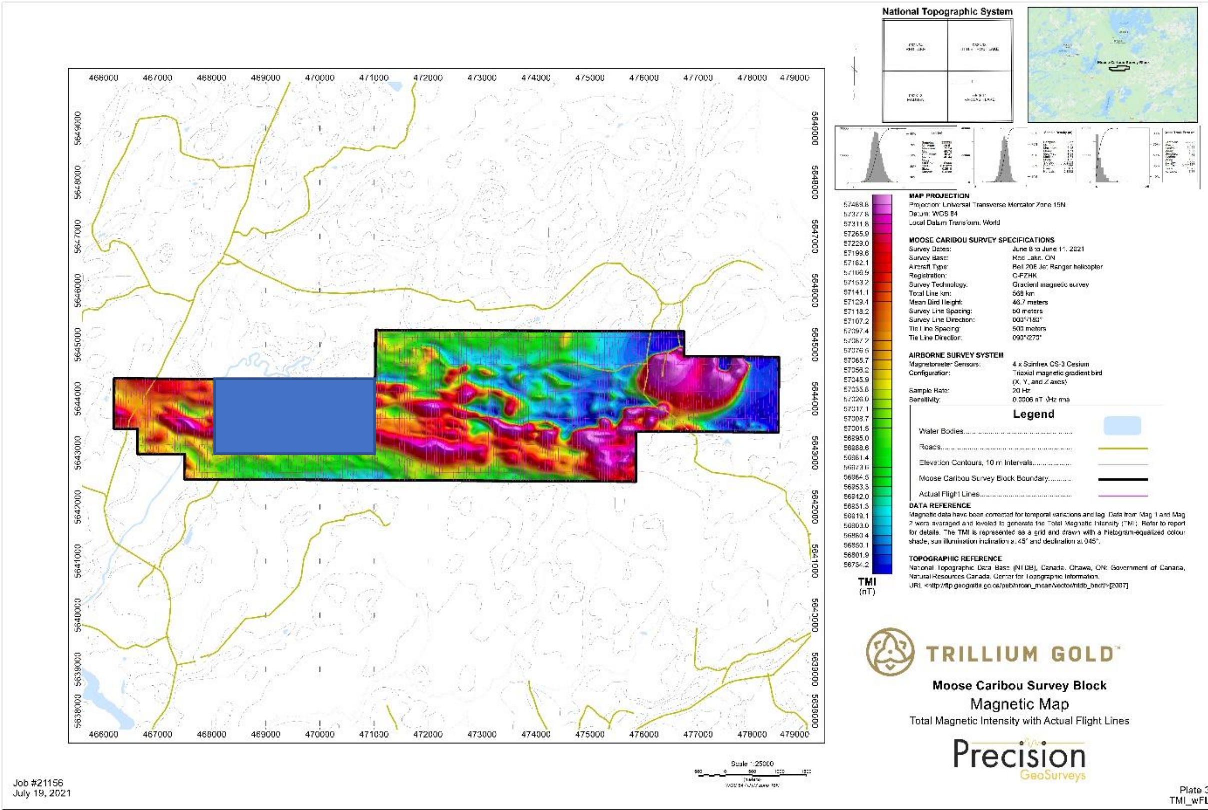
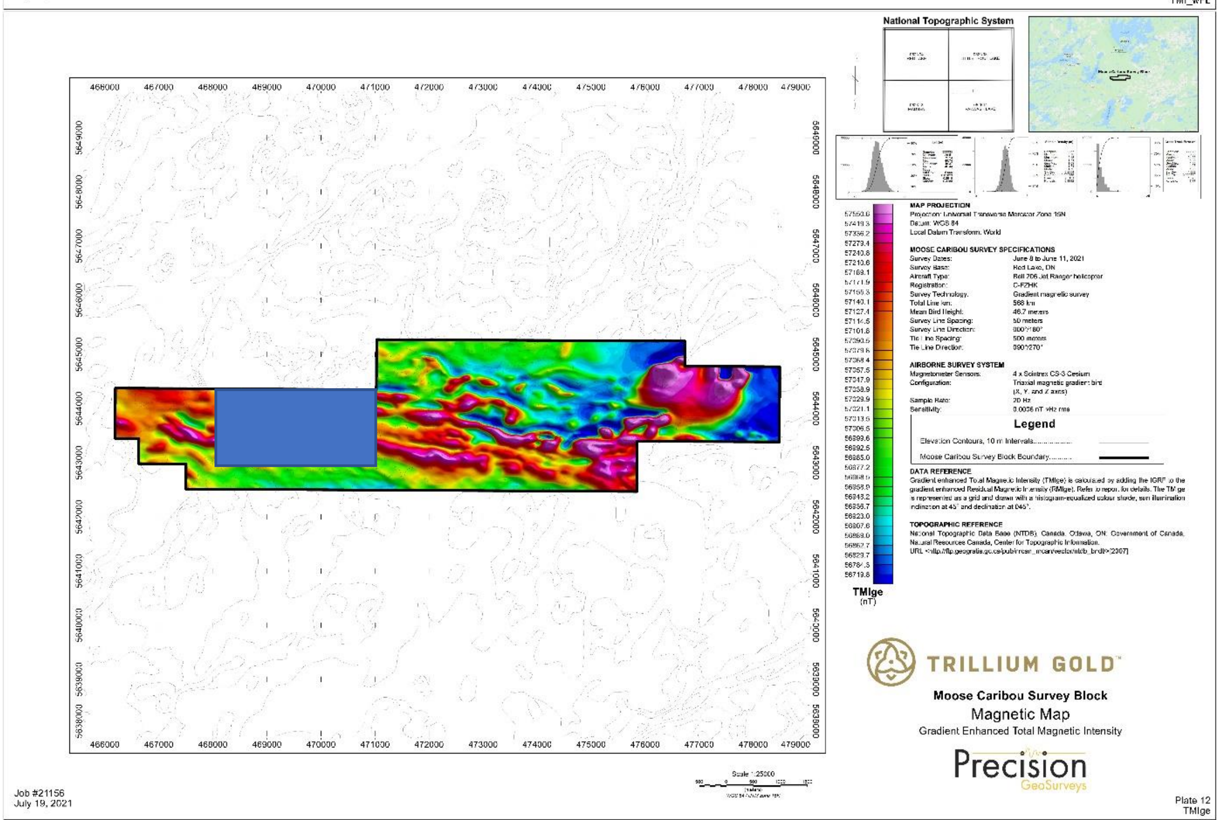
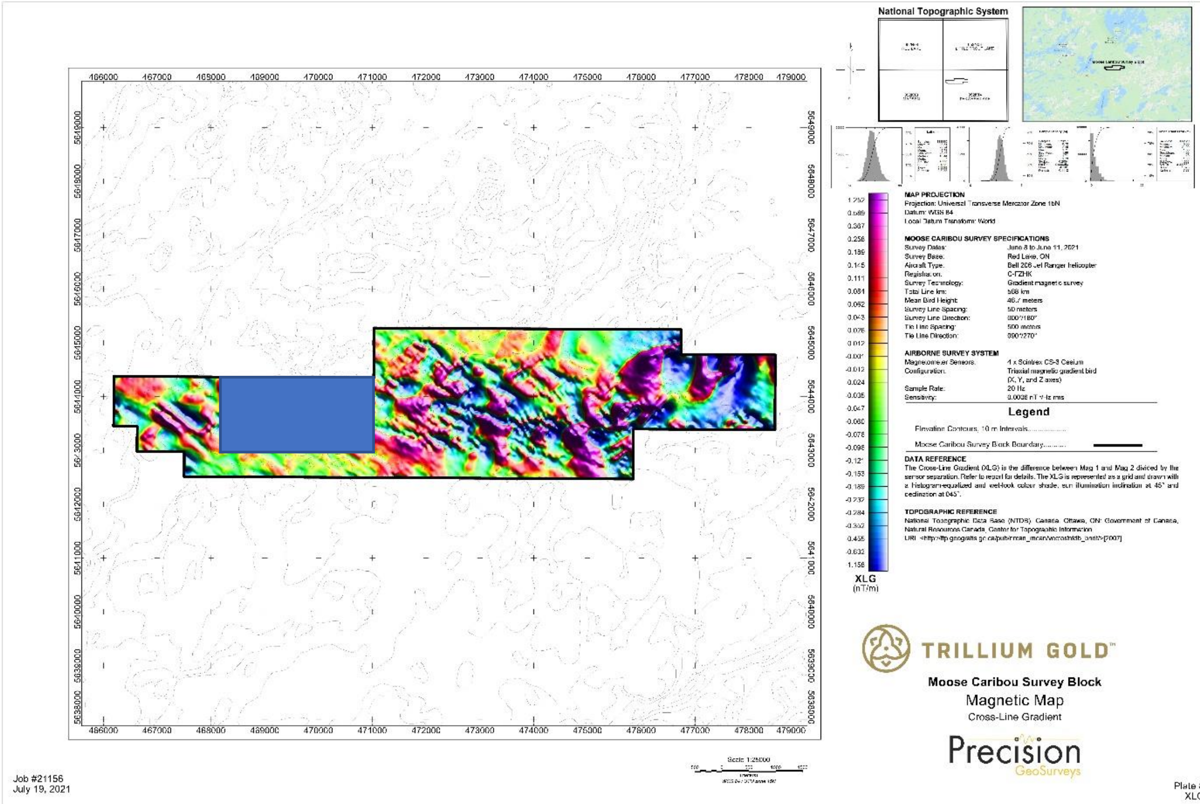
MAP PROJECTION
MOOSE CARIBOU SURVEY SPECIFICATIONS
AIRBORNE SURVEY SYSTEM
Legend
DATA REFERENCE
TOPOGRAPHIC REFERENCE
RMIge
(nT)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Gradient Enhanced Residual Magnetic Intensity
Precision
GeoSurveys
Job #21156
July 19, 2021
Plate 13
RMIge

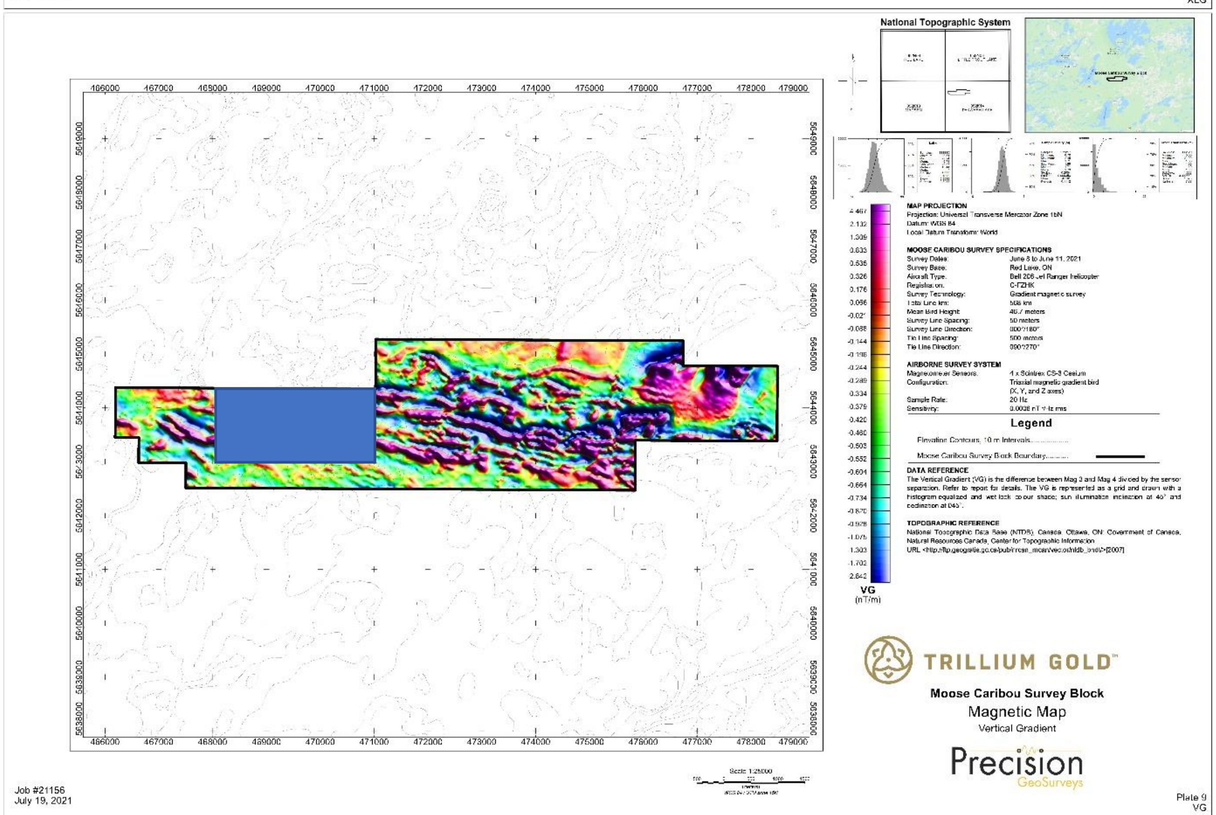

National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
Survey Dates: June 8 to June 11, 2021
Survey Base: Red Lake, ON
Aircraft Type: Bell 206 Jet Ranger helicopter
Registration: C-FZHK
Survey Technology: Gradient magnetic survey
Total Line km: 508 km
Mean Bird Height: 46.7 meters
Survey Line Spacing: 50 meters
Survey Line Direction: 000°/180°
Tie Line Spacing: 500 meters
Tie Line Direction: 090°/270°
AIRBORNE SURVEY SYSTEM
Magnetometer Sensors: 4 x Scintrex CS-3 Cesium
Configuration: Triaxial magnetic gradient bird (X, Y, and Z axes)
Sample Rate: 20 Hz
Sensitivity: 0.0036 nT √Hz rms
Legend
Elevation Contours, 10 m Intervals
Moose Caribou Survey Block Boundary
DATA REFERENCE
Gradient enhanced Reduced to Magnetic Pole (RTPge) is computed from the gradient enhanced Residual Magnetic Intensity (RMIge). Refer to report for details. RTPge is represented as a grid and drawn with a histogram equalized colour shade; sun illumination inclination at 45° and declination at 045°.
TOPOGRAPHIC REFERENCE
National Topographic Data Base (NTDB). Canada. Ottawa, ON: Government of Canada, Natural Resources Canada, Center for Topographic Information.
RTPge
(nT)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Gradient Enhanced Reduced to Magnetic Pole
Precision GeoSurveys
Scale 1:25000
Job #21156
July 19, 2021
Plate 14
RTPge


National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
Survey Dates: June 8 to June 11, 2021
Survey Base: Red Lake, ON
Aircraft Type: Bell 206 Jet Ranger helicopter
Registration: C-FZHK
Survey Technology: Gradient magnetic survey
Total Line km: 508 km
Mean Bird Height: 46.7 meters
Survey Line Spacing: 50 meters
Survey Line Direction: 000°/180°
Tie Line Spacing: 500 meters
Tie Line Direction: 090°/270°
AIRBORNE SURVEY SYSTEM
Magnetometer Sensors: 4 x Scintrex CS-3 Cesium
Configuration: Triaxial magnetic gradient bird (X, Y, and Z axes)
Sample Rate: 20 Hz
Sensitivity: 0.0036 nT √Hz rms
Legend
Elevation Contours, 10 m Intervals
Moose Caribou Survey Block Boundary
DATA REFERENCE
Magnetic data have been corrected for temporal variations and lag. Data from Mag 1 and Mag 2 were averaged and leveled to generate the Total Magnetic Intensity (TMI). Refer to report for details. The TMI is represented as a grid and drawn with a histogram-equalized colour shade; sun illumination inclination at 45° and declination at 045°.
TOPOGRAPHIC REFERENCE
National Topographic Data Base (NTDB). Canada. Ottawa, ON: Government of Canada, Natural Resources Canada, Center for Topographic Information.
TMI
(nT)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Total Magnetic Intensity
Precision GeoSurveys
Scale 1:25000
Job #21156
July 19, 2021
Plate 4
TMI


National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
Survey Dates: June 8 to June 11, 2021
Survey Base: Red Lake, ON
Aircraft Type: Bell 206 Jet Ranger helicopter
Registration: C-FZHK
Survey Technology: Gradient magnetic survey
Total Line km: 568 km
Mean Bird Height: 46.7 meters
Survey Line Spacing: 50 meters
Survey Line Direction: 000°/180°
Tie Line Spacing: 500 meters
Tie Line Direction: 090°/270°
AIRBORNE SURVEY SYSTEM
Magnetometer Sensors: 4 x Scintrex CS-3 Cesium
Configuration: Triaxial magnetic gradient bird (X, Y, and Z axes)
Sample Rate: 20 Hz
Sensitivity: 0.0006 nT √Hz rms
Legend
Water Bodies
Roads
Elevation Contours, 10 m Intervals
Moose Caribou Survey Block Boundary
Actual Flight Lines
DATA REFERENCE
Magnetic data have been corrected for temporal variations and lag. Data from Mag 1 and Mag 2 were averaged and leveled to generate the Total Magnetic Intensity (TMI). Refer to report for details. The TMI is represented as a grid and drawn with a histogram-equalized colour shade, sun illumination inclination at 45° and declination at 045°.
TOPOGRAPHIC REFERENCE
National Topographic Data Base (NTDB), Canada. Ottawa, ON: Government of Canada, Natural Resources Canada, Center for Topographic Information.
TMI (nT)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Total Magnetic Intensity with Actual Flight Lines
Precision GeoSurveys
Scale 1:25000
Job #21156
July 19, 2021
Plate 3
TMI_wFL


National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
Survey Dates: June 8 to June 11, 2021
Survey Base: Red Lake, ON
Aircraft Type: Bell 206 Jet Ranger helicopter
Registration: C-FZHK
Survey Technology: Gradient magnetic survey
Total Line km: 568 km
Mean Bird Height: 46.7 meters
Survey Line Spacing: 50 meters
Survey Line Direction: 000°/180°
Tie Line Spacing: 500 meters
Tie Line Direction: 090°/270°
AIRBORNE SURVEY SYSTEM
Magnetometer Sensors: 4 x Scintrex CS-3 Cesium
Configuration: Triaxial magnetic gradient bird (X, Y, and Z axes)
Sample Rate: 20 Hz
Sensitivity: 0.0006 nT √Hz rms
Legend
Elevation Contours, 10 m Intervals
Moose Caribou Survey Block Boundary
DATA REFERENCE
Gradient enhanced Total Magnetic Intensity (TMIge) is calculated by adding the IGRF to the gradient enhanced Residual Magnetic Intensity (RMIge). Refer to report for details. The TMIge is represented as a grid and drawn with a histogram-equalized colour shade, sun illumination inclination at 45° and declination at 045°.
TOPOGRAPHIC REFERENCE
National Topographic Data Base (NTDB), Canada. Ottawa, ON: Government of Canada, Natural Resources Canada, Center for Topographic Information.
TMIge (nT)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Gradient Enhanced Total Magnetic Intensity
Precision GeoSurveys
Scale 1:25000
Job #21156
July 19, 2021
Plate 12
TMIge


National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
Survey Dates: June 8 to June 11, 2021
Survey Base: Red Lake, ON
Aircraft Type: Bell 206 Jet Ranger helicopter
Registration: C-FZHK
Survey Technology: Gradient magnetic survey
Total Line km: 508 km
Mean Bird Height: 46.7 meters
Survey Line Spacing: 50 meters
Survey Line Direction: 000°/180°
Tie Line Spacing: 500 meters
Tie Line Direction: 090°/270°
AIRBORNE SURVEY SYSTEM
Magnetometer Sensors: 4 x Scintrex CS-3 Cesium
Configuration: Triaxial magnetic gradient bird (X, Y, and Z axes)
Sample Rate: 20 Hz
Sensitivity: 0.0006 nT √Hz rms
Legend
Elevation Contours, 10 m Intervals
Moose Caribou Survey Block Boundary
DATA REFERENCE
The Cross-Line Gradient (XLG) is the difference between Mag 1 and Mag 2 divided by the sensor separation. Refer to report for details. The XLG is represented as a grid and drawn with a histogram-equalized and wet-look colour shade, sun illumination inclination at 45° and declination at 045°.
TOPOGRAPHIC REFERENCE
National Topographic Data Base (NTDB). Canada. Ottawa, ON: Government of Canada, Natural Resources Canada, Center for Topographic Information.
XLG
(nT/m)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Cross-Line Gradient
Precision
GeoSurveys
Scale 1:25000
Job #21156
July 19, 2021
Plate 8
XLG


National Topographic System
MAP PROJECTION
Projection: Universal Transverse Mercator Zone 15N
Datum: WGS 84
Local Datum Transform: World
MOOSE CARIBOU SURVEY SPECIFICATIONS
Survey Dates: June 8 to June 11, 2021
Survey Base: Red Lake, ON
Aircraft Type: Bell 206 Jet Ranger helicopter
Registration: C-FZHK
Survey Technology: Gradient magnetic survey
Total Line km: 508 km
Mean Bird Height: 46.7 meters
Survey Line Spacing: 50 meters
Survey Line Direction: 000°/180°
Tie Line Spacing: 500 meters
Tie Line Direction: 090°/270°
AIRBORNE SURVEY SYSTEM
Magnetometer Sensors: 4 x Scintrex CS-3 Cesium
Configuration: Triaxial magnetic gradient bird (X, Y, and Z axes)
Sample Rate: 20 Hz
Sensitivity: 0.0006 nT √Hz rms
Legend
Elevation Contours, 10 m Intervals
Moose Caribou Survey Block Boundary
DATA REFERENCE
The Vertical Gradient (VG) is the difference between Mag 3 and Mag 4 divided by the sensor separation. Refer to report for details. The VG is represented as a grid and drawn with a histogram equalized and wet look colour shade; sun illumination inclination at 45° and declination at 045°.
TOPOGRAPHIC REFERENCE
National Topographic Data Base (NTDB). Canada. Ottawa, ON: Government of Canada, Natural Resources Canada, Center for Topographic Information.
VG
(nT/m)
TRILLIUM GOLD
Moose Caribou Survey Block
Magnetic Map
Vertical Gradient
Precision
GeoSurveys
Scale 1:25000
Job #21156
July 19, 2021
Plate 9
VG

APPENDIX 2

Moose-Caribou Airborne Geophysical Survey Logistics Report

Precision GeoSurveys

AIRBORNE GEOPHYSICAL SURVEY REPORT

Moose Caribou Survey Block

Red Lake, Ontario

Trillium Gold Mines Inc.

Precision GeoSurveys Inc.
www.precisiongeosurveys.com
Hangar 42 Langley Airport
21330 - 56th Ave., Langley, BC
Canada V2Y 0E5
604-484-9402

Shawn Walker, M.Sc., P.Geo.

August 2021
Job# 21156

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List of Moose Caribou Survey Block Plates

1.0 Introduction

This report outlines the geophysical survey operations and data processing procedures taken during the high resolution helicopter-borne magnetic gradiometer survey flown over the Moose Caribou survey block for Trillium Gold Mines Inc. The survey block is located in western Ontario (Figure 1) and it was flown from June 8 to June 11, 2021.

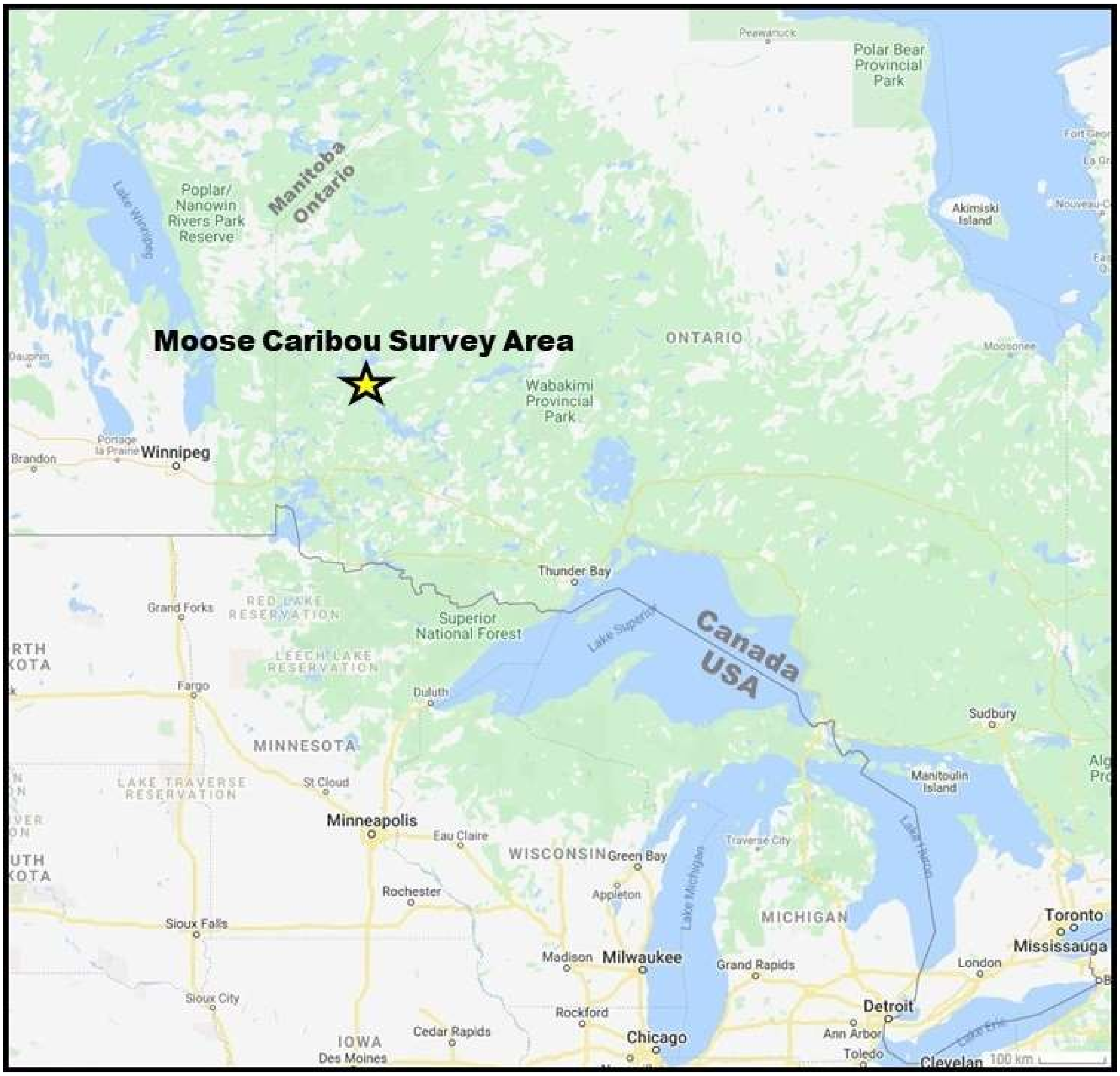

Figure 1: Moose Caribou survey located in Western Ontario.

1.1 Survey Area

The Moose Caribou survey block is centered approximately 30 km east of Red Lake, Ontario (Figure 2).

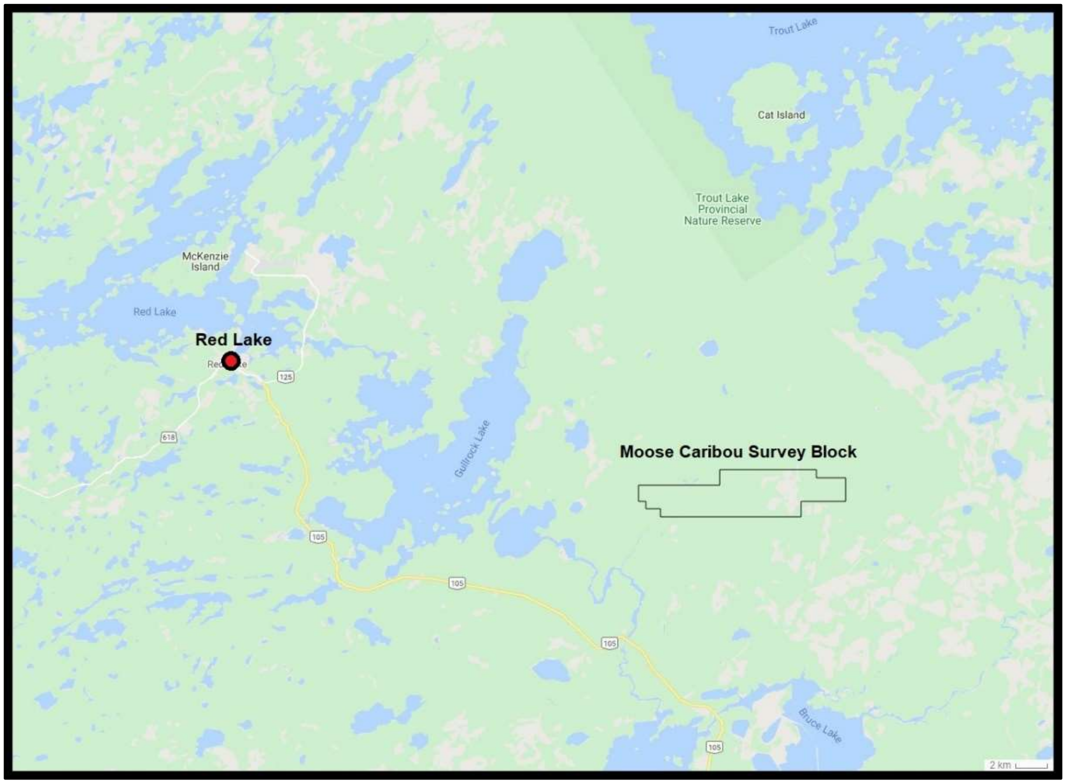

Figure 2: Moose Caribou survey block east of Red Lake, Ontario.

Moose Caribou was flown at 50 m line spacing at a heading of 000°/180°; tie lines were flown at 500 m spacing at a heading of 090°/270° (Figure 3).

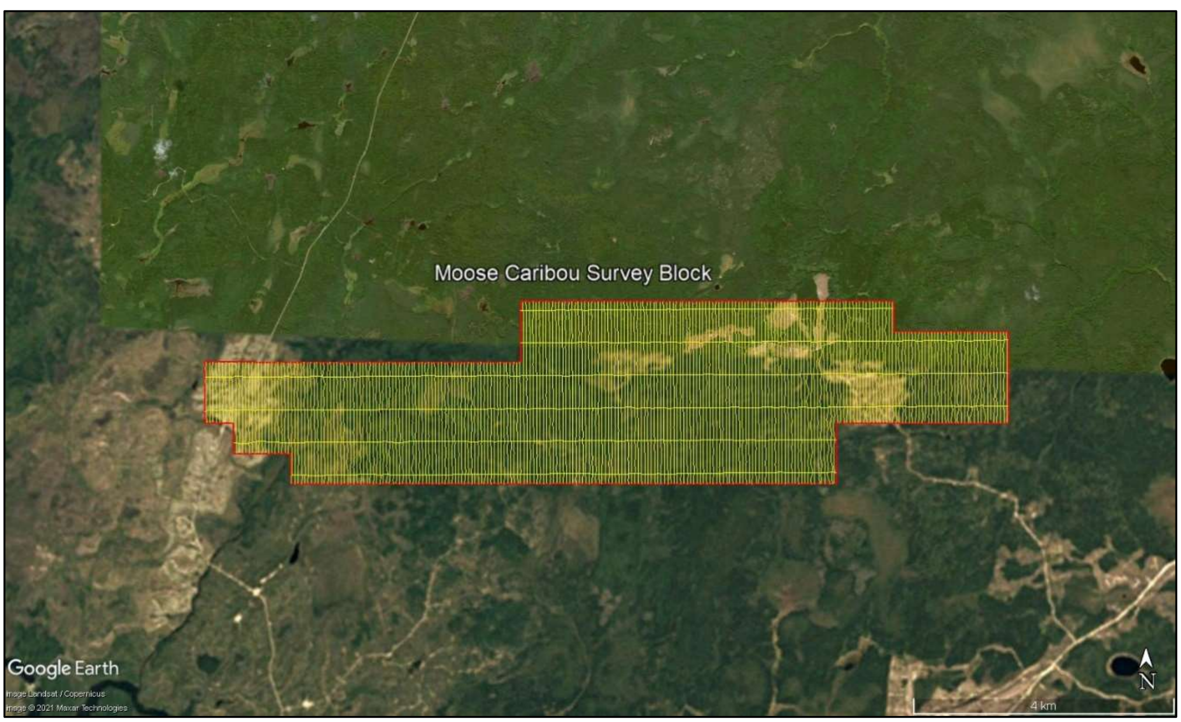

Figure 3: Plan View – Moose Caribou survey block with actual flight lines in yellow and survey block boundary in red.

1.2 Survey Specifications

The geodetic system used for the geophysical survey was WGS 84 in UTM Zone 15N. A total of 568 line km was flown over one survey block with a total area of 25.6 km^2 (Table 1). An additional 1 km was flown to retain data from flight lines flown outside the survey block margins for efficiency. Polygon coordinates for the Moose Caribou survey block are specified in Appendix A.

Survey Block	Area (km^2)	Line Type	No. of Lines Planned	No. of Lines Completed	Line Spacing (m)	Line Orientation (UTM grid)	Total Planned Line km	Total Actual km Flown
Moose Caribou	25.6	Survey	246	246	50	000°/180°	512	513
		Tie	6	6	500	090°/270°	55	55
		Total:	**252**	**252**			**567**	**568**

Table 1: Survey flight line specifications for Moose Caribou.

2.0 Geophysical Data

Geophysical data are collected in a variety of ways and are used for many purposes including aiding in the determination of geology, mineral deposits, oil and gas deposits, geotechnical investigations, contaminated land sites, and UXO (unexploded ordnance) detection.

For the purposes of this survey, airborne gradient magnetic data were collected to serve in geological mapping and exploration for mineral deposits.

2.1 Magnetic Data

Magnetic surveying is the most common airborne geophysical technology used for both mineral and hydrocarbon exploration. Aeromagnetic surveys measure and record the total intensity of the magnetic field at the magnetometer sensor, which is a combination of the desired geomagnetic field as well as influences from the constantly varying solar wind and the aircraft's magnetic field. By subtracting temporal and aircraft magnetic effects, the resulting aeromagnetic maps show the spatial distribution and relative abundance of magnetic minerals - most commonly the iron oxide mineral magnetite - in the upper levels of Earth's crust, which in turn are related to lithology, structure, and alteration of bedrock. Survey specifications, instrumentation, and interpretation procedures depend on the objectives of the survey. Magnetic surveys are typically performed for:

- Geological Mapping - to aid in mapping lithology, structure, and alteration.
- Depth to Basement Mapping - for exploration in sedimentary basins or mineralization associated with the basement surface.

2.1.1 Gradient Magnetic Data

In addition to high resolution total magnetic field data, horizontal and vertical magnetic gradient data were collected by using a triaxial magnetic gradient bird-type system. Direct measurement of the magnetic gradient has the following benefits:

- Enhanced definition of near-surface anomalies.
- Emphasis on short wavelength spatial components of magnetic anomalies from horizontal variations of the gradients.
- Attenuation of long wavelength spatial components associated with regional trends and large scale anomalies.
- Reduction of high frequency temporal variations in the Earth's magnetic field due to micro-pulsations.
- Immunity to diurnal fluctuations.
- Reduction of aircraft/sensor movement errors.

3.0 Aircraft and Equipment

All geophysical and subsidiary equipment were carefully installed on an aircraft by Precision GeoSurveys to collect gradient magnetic data.

3.1 Aircraft

Precision GeoSurveys flew the survey using a Bell 206 Jet Ranger helicopter, registration C-FZHK.

3.2 Geophysical Equipment

The survey aircraft (Figure 4) was equipped with a slung bird-type triaxial magnetic gradient system, data acquisition system, GPS navigation systems, pilot guidance unit (PGU), laser altimeter, barometer, and fluxgate magnetometer. In addition, two magnetic base stations were used to record temporal magnetic variations. Technical specifications for the geophysical equipment are provided in Appendix B.

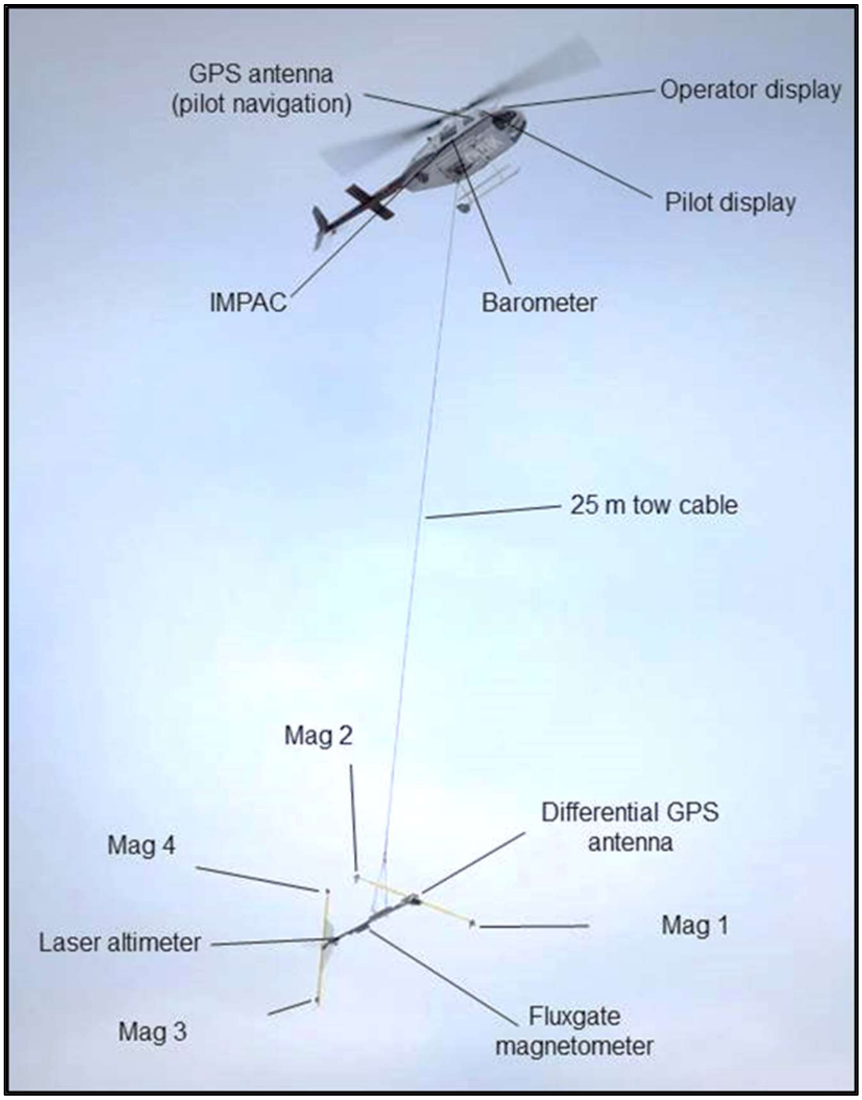

Figure 4: Survey helicopter equipped with geophysical equipment and the triaxial magnetic gradient bird-type configuration slung 25 m below the helicopter.

3.2.1 Triaxial Gradiometer

The primary geophysical technology used on this survey was a slung magnetic gradiometer, custom designed and manufactured by Precision GeoSurveys. The gradiometer bird is constructed completely from non-magnetic and non-conductive materials and provides the required sensor separation for triaxial gradient measurements in stable flight, while incorporating a laser altimeter, fluxgate magnetometer, and a GPS antenna. It is attached to the helicopter by a 25 m long tow cable that eliminates magnetic interference from the aircraft and holds the weight of the system. A shear pin is used as a safety weak link. Magnetic, laser altimeter, attitude, and GPS data are transmitted to the helicopter by wires routed along the tow cable. By design, this gradiometer separates the electronic equipment from the magnetic sensors to allow for cleaner data collection unaffected by electronic noise and the aircraft's magnetic fields. The bird weighs approximately 80 kg and can be disassembled into multiple components for ease of transport.

In total, the gradiometer (Figure 5) contains four Scintrex CS-3 cesium vapor magnetic sensors individually measuring the total magnetic intensity at their respective positions (Table 2). The unique arrangement of the sensors allows direct measurement of the geomagnetic field in the X (cross-line) gradient axis with the two forward sensors (Mag 1 and Mag 2) and the Z (vertical) gradient axis with the two aft sensors (Mag 3 and Mag 4).

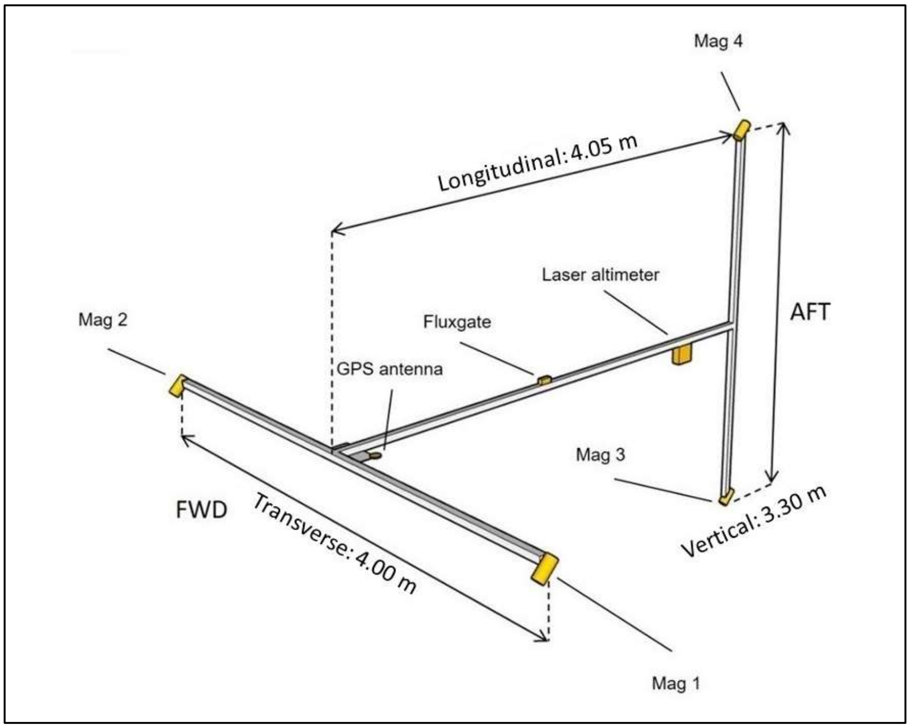

Figure 5: Schematic diagram of magnetic gradiometer system showing triaxial sensor separations. Not to scale.

Position	Location	Model	Serial Number
Mag 1	Forward left	Scintrex CS-3	0706248
Mag 2	Forward right	Scintrex CS-3	2010625
Mag 3	Aft lower	Scintrex CS-3	2105647
Mag 4	Aft upper	Scintrex CS-3	0712302

Table 2: Magnetometer details.

3.2.2 IMPAC

The Integrated Multi-Parameter Acquisition Console (IMPAC) (Figure 6), manufactured by Nuvia Dynamics Inc. (previously Pico Envirotec Inc.), is the main computer used in integrated data recording, data synchronizing, providing real-time quality control data for the geophysical operator display, and the generation of navigation information for the pilot and operator display systems.

Figure 6: IMPAC data acquisition system.

IMPAC uses the Microsoft Windows operating system and geophysical parameters are based on Nuvia's Airborne Geophysical Information System (AGIS) software. Depending on survey specifications, information such as magnetic field, electromagnetic response, total gamma count, counts of various radioelements (K, U, Th, etc.), cosmic radiation, barometric pressure, atmospheric humidity, temperature, aircraft attitude, navigation parameters, and GPS status can all be monitored on the AGIS on-board display (Figure 7).

While in flight, raw magnetic response, magnetic fourth difference, compensated and uncompensated magnetic data, radiometric spectra, EM response, aircraft position, survey altitude, cross track error, and other parameters in accordance with survey specifications are recorded and can be viewed by the geophysical operator for immediate QC (quality control). Additional software allows for post or real time magnetic compensation and radiometric calibration.

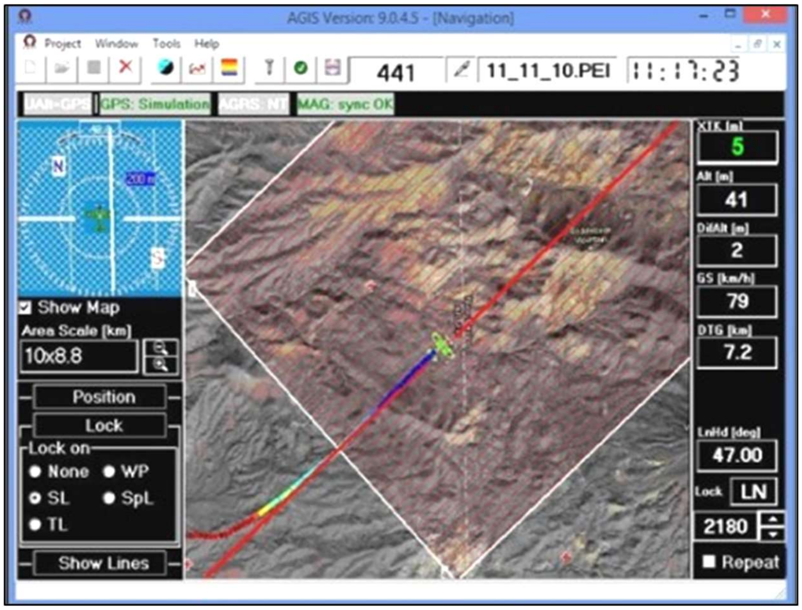

Figure 7: AGIS operator display showing real time flight line recording and navigation parameters. Additional windows display real-time geophysical data to operator.

3.2.3 GPS Navigation System

A Hemisphere R120 GPS receiver and a Novatel GPS antenna on the aircraft integrated with the AGIS navigation system and pilot display (PGU) provide accurate navigational information and control. A Hemisphere R330 GPS receiver (Figure 8) located in the helicopter connected to a Novatel GPS antenna located on the triaxial magnetic gradient bird airframe provides accurate position data for the bird independent of pilot navigation. The R120 and R330 GPS receivers support fast updates and output messages at a rate of up to 20 Hz (20 times per second); delivering sub-meter positioning accuracy in three dimensions for each of the two GPS antenna locations. They support GNSS (GPS/GLONASS) L1 and L2 signals.

The Hemisphere receivers support differential correction methods including L-Band, RTK, SBAS, and Beacon. They employ innovative Hemisphere GPS Eclipse SureTrack technology, which allows phase modeling on satellites that the airborne unit is currently tracking. With SureTrack technology, dropouts are reduced and speed of the signal reacquisitions is increased, enhancing accurate positioning when base corrections are not available.

Figure 8: Hemisphere R330 GPS receiver.

3.2.4 Pilot Guidance Unit

Steering and elevation (ground clearance) information is continuously provided to the pilot by the Pilot Guidance Unit (PGU). The graphical display is mounted on top of the aircraft's instrument panel, remotely from the data acquisition system. The PGU is the primary navigation aid (Figure 9) to assist the pilot in keeping the aircraft on the planned flight path, heading, speed, and at the desired ground clearance.

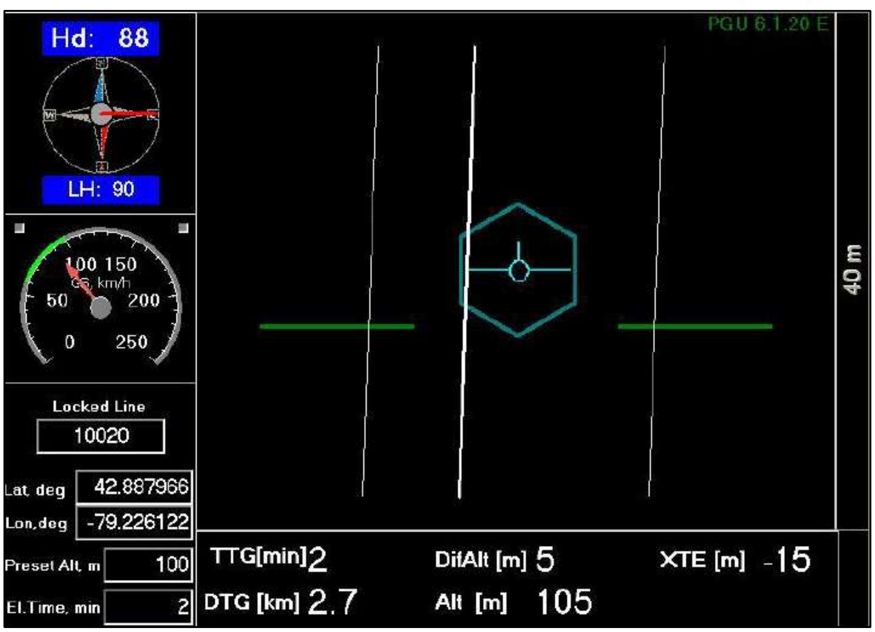

Figure 9: PGU screen displaying navigation information.

PGU information is displayed on a full VGA 600 x 800 pixel 7 inch (17.8 cm) LCD display. The CPU for the PGU is contained in a PC-104 console and uses Microsoft Windows operating system control, with input from the GPS antenna on the aircraft, laser altimeter, and AGIS.

3.2.5 Laser Altimeter

Terrain clearance is measured by an Opti-Logic RS800 Rangefinder laser altimeter (Figure 10) attached to the belly of the forward magnetometer boom. The RS800 laser is a time-of-flight sensor that measures distance by a rapidly modulated and collimated laser beam that creates a dot on the target surface. The maximum range of the laser altimeter is 700 m off natural surfaces with accuracy of ±1 m on 1 x 1 m diffuse target with 50% (±20%) reflectivity. Within the sensor unit, reflected signal light is collected by the lens and focused onto a photodiode. Through serial communications and digital outputs, ground clearance data are transmitted to an RS-232 compatible port and recorded and displayed by the AGIS and PGU at 10 Hz in meters.

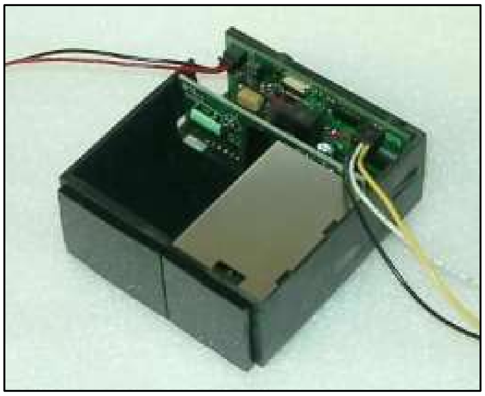

Figure 10: Opti-Logic RS800 Rangefinder laser altimeter.

3.2.6 Magnetometer

The survey was flown with four Scintrex CS-3 split-beam cesium vapor magnetometers (Figure 11) mounted in a non-magnetic and non-conductive slung bird-type configuration. The magnetometers were oriented at 45 degrees with respect to the horizontal to couple with local magnetic field at the Moose Caribou survey area.

Figure 11: View of CS-3 cesium vapor magnetometers.

3.2.7 Fluxgate Magnetometer

As the gradient survey bird travels along a survey line, small attitude changes (pitch, roll, and yaw) are recorded by a triaxial fluxgate magnetometer (Figure 12). The fluxgate consists of three magnetic sensors, X, Y, and Z, operating independently and simultaneously. Each sensor has an analog output corresponding to the directional component of the ambient magnetic field along its axis. Response of the sensors is proportional to the cosine of the angle between the applied field and the sensor's sensitive axis.

Figure 12: Billingsley TFM100G2 triaxial fluxgate magnetometer.

3.2.8 Magnetic Base Station

Temporal variations of Earth's magnetic field, particularly diurnal, were monitored and recorded by two GEM GSM-19T base station magnetometers. They were operated at all times while airborne data were being collected. The base stations were located in an area with low magnetic gradient, away from electric power transmission lines and moving ferrous objects, such as motor vehicles, that could affect the survey data integrity.

The GEM GSM-19T magnetometer (Figure 13) with integrated GPS time synchronization uses proton precession technology with absolute accuracy of ±0.20 nT and sensitivity of 0.15 nT at 1 Hz. Base station magnetic data were recorded on internal solid-state memory and downloaded onto a field laptop computer using a serial cable and GEMLink 5.4 software. Profile plots of the base station readings were generated, updated, and reviewed at the end of each survey day.

Figure 13: GEM GSM-19T proton precession magnetometer.

4.0 Survey Operations

The survey was flown from June 8 to June 11, 2021, in cloudy conditions. The experience of the pilots ensured that data quality objectives were met, and that safety of the flight crew was never compromised given the potential risks involved in airborne geophysical surveying. Field processing and quality control checks were performed daily.

4.1 Operations Base and Crew

The base of operation for the Moose Caribou survey was at the Red Lake Airport (CYRL), Ontario, west of the survey block.

Precision's geophysical crew consisted of three members (Table 3):

Crew Member	Position
Colin Pelton	Helicopter survey pilot and AME
Wendell Huttema, Ph.D.	Geophysical operator and electronics technician
Shawn Walker, M.Sc., P.Geo.	Geophysicist – data processor, mapping, and reporting (off-site)

Table 3: List of survey crew members.

4.2 Magnetic Base Station Specifications

Changes in the Earth's magnetic field over time, such as diurnal variations, magnetic pulsations, and geomagnetic storms, were measured and recorded by two stationary GEM GSM-19T proton precession magnetometers. The magnetic base stations were installed at the Red Lake Airport (Table 4; Figures 14 and 15) in an area of low magnetic interference away from metallic items such as ferromagnetic objects, vehicles, and power lines that could affect the base stations and ultimately the survey data.

Station Name	Easting/Northing	Latitude/Longitude	Datum/Projection
GEM 3 S/N 5081669	444235 m E 5657849 m N	51° 4' 11.081" N 93° 47' 45.28" W	WGS 84, Zone 15N
GEM 4 S/N 2065370	444248 m E 5657882 m N	51° 4' 11.08" N 93° 47' 44.63" W	WGS 84, Zone 15N

Table 4: Magnetic base station locations.

Magnetic readings were reviewed at regular intervals to ensure that no airborne data were collected during periods of high magnetic activity (greater than 10 nT change per minute).

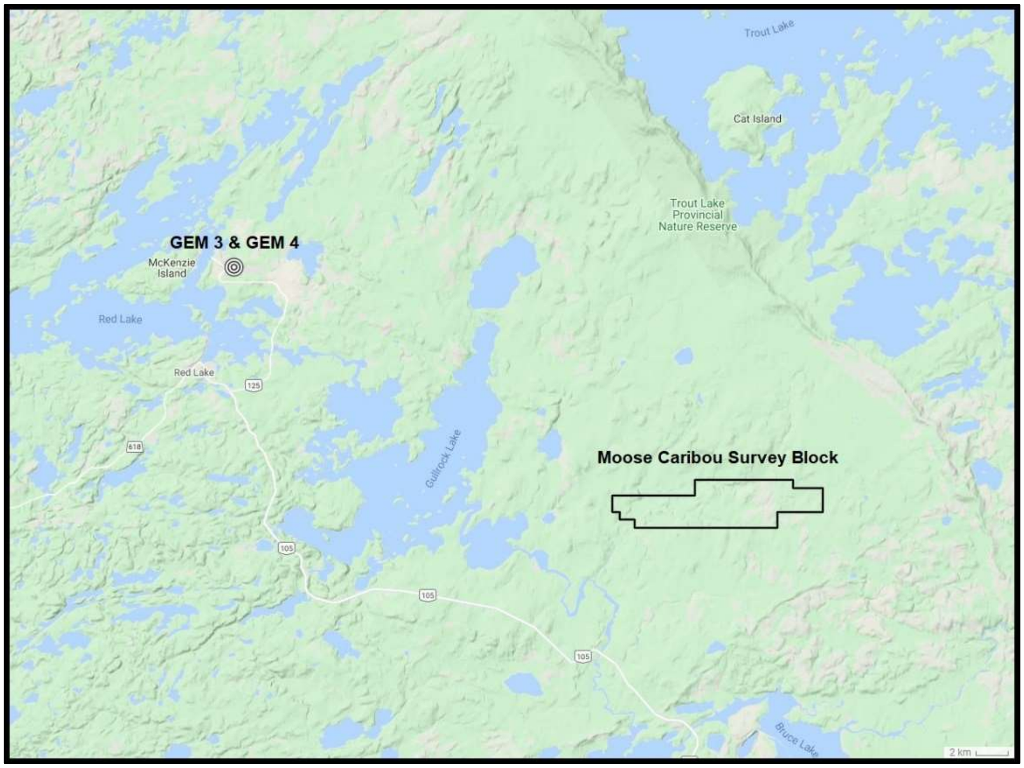

Figure 14: GEM 3 and GEM 4 magnetic base stations located west of the survey block.

Figure 15: GEM 3 (left) and GEM 4 (right) magnetic base stations at the Red Lake Airport, Ontario.

4.3 Field Processing and Quality Control

Survey data were transferred from the aircraft's data acquisition system to a USB memory stick and copied onto a field data processing laptop on a flight by flight basis. The raw data files in PEI binary data format were converted into Geosoft GDB database format. Using Geosoft Oasis Montaj 9.9.1, the data were inspected to ensure compliance with contract specifications (Table 5; Figures 16 to 18).

Parameter	Specification	Tolerance
Position	Line Spacing	Flight line deviation within 8 m L/R from ideal flight path. No exceedance for more than 1 km.
	Height	Nominal flight height of 40 m above ground level (AGL) with tolerance of ±10 m. No exceedance for more than 1 km, provided deviation is not due to tall trees, topography, mitigation of wildlife/livestock harassment, cultural features, or other obstacles beyond the pilot's control.
	GPS	GPS signals from four or more satellites must be received at all times, except where signal loss is due to topography. No exceedance for more than 1 km.
Magnetics	Temporal/Diurnal Variations	Non-linear temporal magnetic variations within 10 nT of a linear chord of length 5 minutes.
	Normalized 4th Difference	Magnetic data within 0.01 nT peak to peak. No exceedance for distances greater than 1 km or more, provided noise is not due to geological or cultural features.

Table 5: Contract survey specifications.

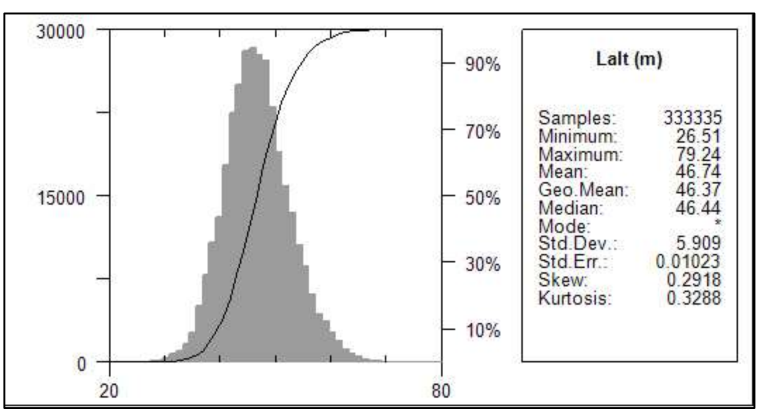

Figure 16: Histogram showing survey bird elevation vertically above ground.

Precision GeoSurveys

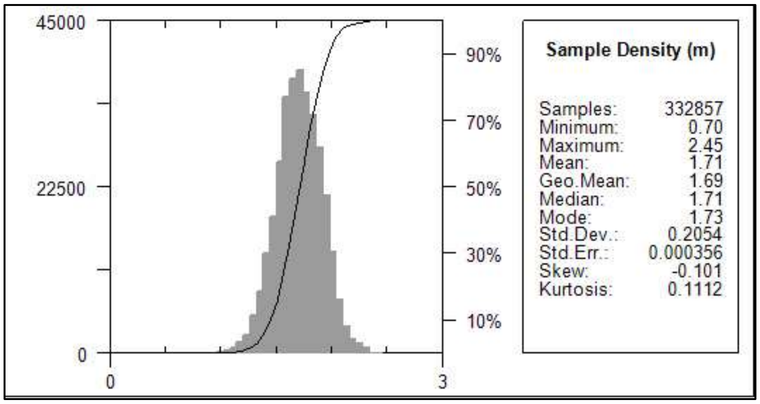

Figure 17: Histogram showing magnetic sample density. Horizontal distance in meters between adjacent in-line measurement locations; magnetic sample frequency 20 Hz.

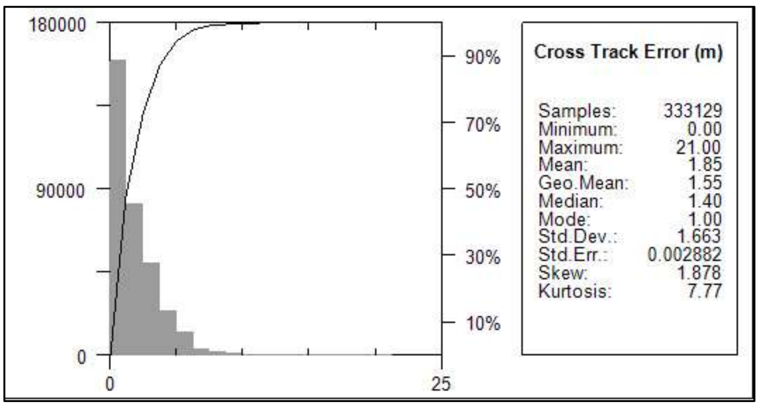

Figure 18: Histogram showing cross track error of survey bird.

5.0 Data Acquisition Equipment Checks

Equipment tests and calibrations were conducted for the laser altimeter and magnetometers at the start of the survey to ensure compliance with contract specifications and to deliver high quality airborne geophysical data. A lag test was conducted for both the laser altimeter and magnetometers. For the airborne magnetometers, a heading error test was flown.

5.1 Laser Altimeter Calibration

The Opti-Logic RS800 laser altimeter used on the survey helicopter was tested and calibrated in accordance with manufacturer's instructions prior to starting the survey. This ensured that heights reported by the laser were accurate within the normal survey operating range.

5.2 Lag Test

A lag test was performed to determine the difference in time the digital reading was recorded for the magnetometers and laser altimeter with the position fix time that the fiducial of the reading was obtained by the GPS system resulting from a combination of system lag and different locations of the various sensors and the GPS antenna. The test was flown in reciprocal headings over identifiable features at survey speed and height to isolate position changes. The resulting data (Table 6) were used to correct for time and position.

Instrument	Source	Lag Fiducial	Correction (sec)
Mag 1	Logging equipment	40	2.0
Mag 2	Logging equipment	40	2.0
Mag 3	Logging equipment	40	2.0
Mag 4	Logging equipment	40	2.0
Laser	Sharp gully	6	0.3

Table 6: Survey lag correction values. Laser altimeter resampled to 20 Hz.

5.3 Heading Correction Test

Optically pumped magnetometers are subject to small errors in the reported total magnetic intensity depending on the direction of flight. For a gradient survey, this heading error is determined for each of the four survey flight directions by comparing the average total magnetic intensity for all four sensors with the average total magnetic intensity reported by the individual sensors. These four differences are then averaged, and the same heading correction is applied to all four sensors in the four flight directions, so that the gradient measurements are not affected. Results of the heading correction analysis are summarized in Table 7.

Heading	Heading Correction (nT)
000°	0.70
090°	-2.00
180°	0.22
270°	1.08
Total:	**0.00**

Table 7: Heading correction data.

6.0 Data Processing

After all data were collected, several procedures were undertaken to ensure that the data met a high standard of quality. All magnetic data recorded by the AGIS were converted into Geosoft or ASCII file formats using Nuvia Dynamics software. Further processing (Figure 19) was carried out using Geosoft Oasis Montaj 9.9.1 geophysical processing software along with proprietary processing algorithms.

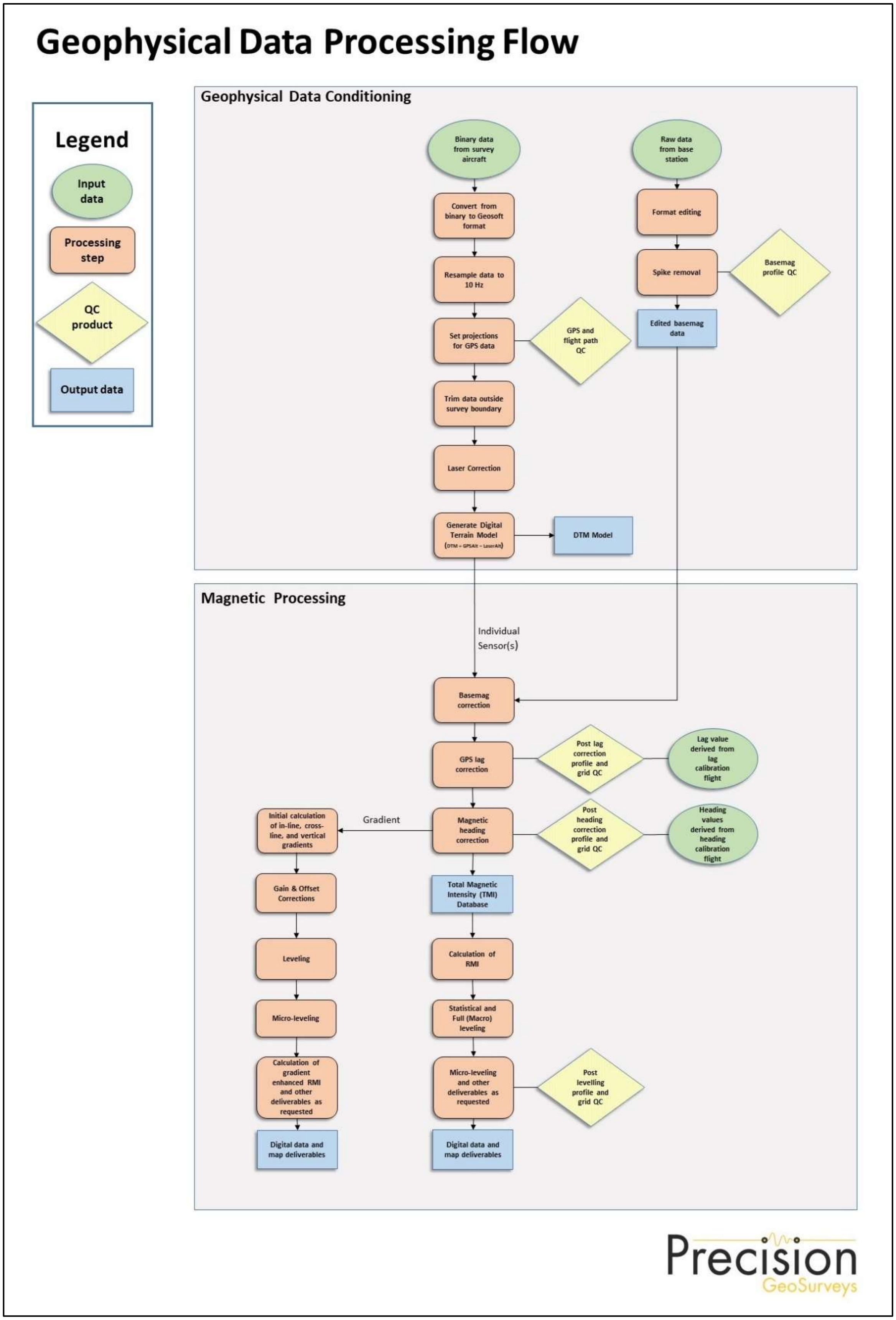

Figure 19: Magnetic data processing flow.

6.1 Position Corrections

In order to collect high resolution geophysical data, the location at which the data were collected and recorded must be accurate.

6.1.1 Lag Correction

A correction for lag error was applied to the geophysical data recorded at each individual sensor to compensate for the combination of lag in the recording system and the sensing instrument flying in a different location from the GPS antenna, as determined during the lag test. Validity of the lag corrections was confirmed by the absence of grid corrugations in adjoining reciprocal lines.

6.2 Flight Height and Digital Terrain Model

Laser altimeters are unable to provide valid data over glassy water or fog which dissipate the laser so that a "zero" reading is obtained. In these cases, estimates of correct height are inserted manually. Dense vegetation generates high frequency variations from leaf and branch reflections. A Rolling Statistics filter is applied to the lag corrected (0.3 seconds lag) laser altimeter data to remove vegetation clutter followed by a Low Pass filter to smooth out the laser altimeter profile to eliminate isolated high frequency noise and generate a surface closely corresponding to the actual ground profile.

A Digital Terrain Model (DTM) channel was calculated by subtracting the processed laser altimeter data from the filtered GPS altimeter data defined by the WGS 84 ellipsoidal height. DTM accuracy is affected by the geometric relationship between the GPS antenna and the laser altimeter as well as flight attitude of the aircraft, slope of the ground, sample density, and satellite geometry.

6.3 Magnetic Processing

Magnetic data from each individual sensor were corrected for temporal variations (including diurnal) and lag. The data were examined for magnetic noise and spikes, which were removed as required. The background magnetic field, International Geomagnetic Reference Field (IGRF) of the Earth was removed. Survey and tie line data of the resulting residual magnetic field were leveled. Magnetic gradients in the X, Y, and Z axes were determined to provide in-line, cross-line, and vertical gradients, respectively.

6.3.1 Temporal Variation Correction

The intensity of Earth's magnetic field varies with location and time. The time variable, known as diurnal or more correctly temporal variation, is removed from the recorded airborne data to provide the desired magnetic field at a specified location. Magnetic data from base station GEM

3 were used for correcting the airborne magnetic survey data, and GEM 4 data were retained for backup. The data were edited, plotted, and merged into a Geosoft database (.GDB) on a daily basis.

Base station measurements were averaged to establish a magnetic reference datum of 56948.25 nT. Magnetic deviations relative to the reference datum were used to calculate the observed variations of the Earth's magnetic field over time. The airborne magnetic data were then corrected for temporal variations by subtracting the base station deviations from the data collected on the aircraft, effectively removing the effects of diurnal and other temporal variations.

6.3.2 Heading Correction

For each survey heading, changes in the apparent magnetic field due to instrumental heading error are measured and recorded. These values are used to construct a heading table (.TBL) file. For the entire dataset, the overall average magnetic field value was calculated. For each of the four headings, the averages were calculated and then compared to the overall average to determine four values which were used to correct heading and offset errors in each flight direction for each magnetometer.

6.3.3 IGRF Removal

The International Geomagnetic Reference Field (IGRF) model is the empirical representation of Earth's dynamic magnetic field (main core field without external sources) collected and disseminated from satellite data and from magnetic observatories around the world. The IGRF has historically been revised and updated every five years by a group of modellers associated with the International Association of Geomagnetism and Aeronomy (IAGA).

The initial unleveled Residual Magnetic Intensity (RMI) was calculated by taking the difference between the 13^{th} generation IGRF (IGRF-13, released in December 2019) and the non-leveled Total Magnetic Intensity (TMI) to create a more valid model of individual near-surface magnetic anomalies. This model is independent of time to allow for other magnetic data (previous or future) to be more easily incorporated into each survey database.

6.3.4 Leveling and Micro-leveling

Small inconsistencies in flight height and line orientation result in small spatial variabilities in magnetic intensity measured at the intersection points of survey lines and tie lines. Using the initial Residual Magnetic Intensity (RMI) data from the average of Mag 1 and Mag 2 (TMI with the IGRF removed), RMI data from survey and tie lines were leveled to each other. Two types of leveling were applied to the corrected data: conventional leveling and micro-leveling. There were two components to conventional leveling: statistical leveling to level tie lines and full leveling to level survey lines. The statistical leveling method corrected the SL/TL intersection errors that follow a specific pattern or trend. Through the error channel, an algorithm calculated a least-squares trend line and derived a trend error curve, which was then added to the channel to be leveled. The second component was full leveling. This adjusted the magnetic value of the survey lines so that all lines matched the trended tie lines at each intersection point.

Following statistical leveling, micro-leveling was applied to the corrected conventional leveled data. This iterative grid-based process removed low amplitude components of flight line noise that still remained in the data after tie line and survey line leveling and resulted in fully leveled RMI data.

6.4 Magnetic Gradient

When magnetic values are obtained simultaneously from two or more sensors at a fixed separation, gradient of the magnetic field can be measured. Dividing the difference in magnetic values between the sensors by the distance between the sensors yields the magnetic gradient. The units are commonly reported as nT/m and, by convention, positive magnetic polarity is defined as to the north and east, and negative to the south and west. For vertical gradient, positive is defined as downwards. The sensors and the separations that were used to determine the various gradients are listed in Table 8.

Direction	Sensors	Separation (m)
Lateral (X)	Mag 1 and Mag 2	4.00
Longitudinal (Y)	Sequential TMI values (Average of Mag 1 and Mag 2)	1.71*
Vertical (Z)	Mag 3 and Mag 4	3.30

Table 8: Magnetic sensor relationship used to calculate magnetic gradients. Total magnetic intensity (TMI) was determined as the average of Mag 1 and Mag 2, and successive values of the TMI were used to determine the longitudinal (Y axis) gradient.
*average separation between sequential TMI values shown; actual value varied according to aircraft speed.

Because the magnetic field gradient varies more rapidly than total field strength, magnetic gradient provides higher spatial resolution, especially for shallow sources that are smaller than the survey line spacing or linear sources that are parallel to flight lines. Magnetic gradients, as compared to total magnetic intensities, have the additional benefits of being less sensitive to temporal variations and aircraft/sensor movement errors.

6.4.1 Horizontal Gradients

Horizontal magnetic gradients were determined in the in-line (Y axis) and cross-line (X axis) directions. Mag 1 (left) and Mag 2 (right) were used for both directions so that elevations were consistent in both axes. Gradients were calculated with respect to the magnetometer array with units provided as nT/m.

In-line gradient (ILG) is determined from successive average magnetic values of Mag 1 and Mag 2 referenced to the distance between data points in accordance with the following formula:

$$ILG = \frac{a(i+1) - a(i-1)}{d(i+1) + d(i-1)}$$

where: a is the average total magnetic intensity of Mag 1 and Mag 2
d is the distance between measurements
i is the record number for the sample location

Cross-line gradient (XLG) was measured directly by dividing the difference between Mag 1 and Mag 2 by the sensor separation in accordance with the following formula:

$$XLG = \frac{\text{Mag 1} - \text{Mag 2}}{d_x}$$

where: d_x is the transverse sensor separation, 4.00 m

Gain corrections were applied to the initial cross-line gradient. Overall, Mag 1 and Mag 2 should produce the same total magnetic field. If the ratio of the TMI between the sensors does not equal one, a gain correction needs to be applied to account for instrument error and asymmetric magnetic fields. The mean of the ratio between the TMI values for Mag 1 and Mag 2 for each line was calculated and applied to each Mag 2 value along the line. The cross line gradient was then re-calculated from the gain-corrected Mag 2 values.

After correcting for gain in the cross-line gradient, offset corrections were applied. Offsets were determined by subtracting the first difference of the gain-corrected cross-line gradient from the gain-corrected gradient to reduce line-to-line errors (striping) in the gradient grid. The resulting data were then micro-leveled to remove any remaining striping.

Total Horizontal Gradient (HG) is the magnitude of the combined in-line and cross-line gradients. It is used to estimate contact locations of magnetic bodies at shallow depths, reveal anomaly textures, and highlight anomaly-pattern discontinuities. Horizontal Gradient (HG) is calculated as:

$$\text{HG}(x, y) = \sqrt{ILG^2 + XLG^2}$$

where: ILG is the in-line gradient
XLG is the cross-line gradient

6.4.2 Vertical Gradient

Vertical gradient (Z axis) is useful for enhancing shorter wavelength signals; therefore, edges of magnetic anomalies are highlighted, and deep geologic sources in the data are suppressed.

Vertical gradient is determined directly with respect to the magnetometer array of Mag 3 (lower) and Mag 4 (upper) with units provided as nT/m as follows:

$$Vertical\ Gradient = \frac{\text{Mag 3} - \text{Mag 4}}{d_z}$$

where: d_z is the vertical sensor separation, 3.30 m

6.4.3 Calculation of First Vertical Derivative

First Vertical Derivative (1VD) is the first order vertical derivative of the leveled Reduced to Magnetic Pole (RTP) data determined from RMI. It is the vertical rate of change in the magnetic field per unit distance (m). The vertical gradient is used to enhance shorter wavelength signals; therefore, edges of magnetic anomalies are highlighted, and deep geologic sources in the data are suppressed.

The filter, L, used to produce the n^{th} vertical derivative is described by:

$$L(r) = r^n$$

where: r is the radial component in the wavenumber domain

6.4.4 Gradient Enhanced Magnetic Intensity

Using the measured gradients (in-line and cross-line directions), the initial enhanced Total Magnetic Intensity (TMIge) was generated. A Butterworth high-pass filter was applied to this initial enhanced TMI to extract the short wavelength signals and a low-pass filter was applied to the measured TMI to extract the long wavelength signals. These wavelengths are then summed together to generate the final enhanced Total Magnetic Intensity. By subtracting the IGRF, the gradient enhanced Residual Magnetic Intensity (RMIge) was generated.

6.4.5 Gradient Enhanced Reduction to Magnetic Pole

Gradient enhanced Reduced to Magnetic Pole (RTPge) data were determined from the gradient enhanced Residual Magnetic Intensity (RMIge) data. The RTP filter was applied in the Fourier domain and rotates the observed magnetic inclination and declination field to what the field would look like at the north magnetic pole, to allow observation of magnetic trends and patterns independent of magnetic inclination and declination. Eliminating the dipolar nature of magnetic anomalies is useful for interpretation because peak RTP magnetic values can be related to the centre of magnetic rock bodies and asymmetries in the RTP imagery closely reflect true dips and plunges.

Inclination and declination were calculated by using the "Date" channel. The derived values were used in the following formula:

$$RTP\ (\theta) = \frac{[\sin(I) - I\ \cdot \cos(I) \cdot \cos(D - \theta)]^2}{[\sin^2(I_a) + \cos^2(I_a) \cdot \cos^2(D - \theta)] \cdot [\sin^2(I) + \cos^2(I) \cdot \cos^2(D - \theta)]}$$

where: I is geomagnetic inclination in ° from horizontal
D is geomagnetic declination in ° azimuth from magnetic north
I_a is the inclination for amplitude correction (never less than I). Default is ± 20°. If $|I_a|$is specified to be less than$|I|$, it is set to I

7.0 Deliverables

Moose Caribou survey block data are presented as digital databases, maps, and a logistics report.

7.1 Digital Data

Digital files have been provided in three formats:

- GDB file for use in Geosoft Oasis Montaj,
- XYZ file,
- CSV Excel comma separated file.

Full descriptions of the digital data and contents are included in Appendix C.

7.1.1 Grids

The digital data were represented as grids as listed below:

- Digital Terrain Model (DTM)
- Total Magnetic Intensity (TMI)
- Residual Magnetic Intensity (RMI) – removal of IGRF from TMI
- Reduced to Magnetic Pole (RTP) – reduced to magnetic pole of RMI
- In-Line Gradient (ILG)
- Cross-Line Gradient (XLG)
- Vertical Gradient (VG)

- Horizontal Gradient (HG) – total magnitude of the horizontal gradients (in-line and cross-line)
- First Vertical Derivative (1VD) of RTP
- Gradient enhanced Total Magnetic Intensity (TMIge)
- Gradient enhanced Residual Magnetic Intensity (RMIge)
- Gradient enhanced Reduced to Magnetic Pole (RTPge) – reduced to magnetic pole of RMIge

Magnetic data were gridded and displayed using the following Geosoft parameters:

- Gridding method: minimum curvature
- Grid cell size: 12.5 m
- Low-pass desampling factor: 2
- Tolerance: 0.001
- % pass tolerance: 99.99
- Maximum iterations: 100

The gradient and gradient enhanced magnetic grids were drawn with a wet-look colour shade and all other magnetic grids were drawn with a histogram-equalized colour shade. All maps were shaded with the sun illumination inclination at 45° and declination at 045°. DTM grid was drawn with a linear topographic colour scale.

7.2 KMZ

Gridded digital data were exported into .KMZ files which can be displayed using Google Earth. The grids can be draped onto topography and rendered to give a 3D view.

7.3 Maps

Digital maps were created for the Moose Caribou survey block. The following map products were prepared:

Overview Maps (colour images with elevation contour lines):

- Actual flight lines, with topographic features
- DTM

Magnetic Maps (colour images with elevation contour lines):

- TMI, with actual flight lines and topographic features
- TMI
- RMI
- RTP of RMI

- ILG
- XLG
- VG
- HG
- 1VD of RTP

Gradient Enhanced Magnetic Maps (colour images with elevation contour lines):

- TMIge
- RMIge
- RTPge of RMIge

All survey maps were prepared in WGS 84 and UTM Zone 15N.

7.4 Report

A pdf copy of the logistics report is included along with digital data and maps. The report provides information on the data acquisition procedures, data processing, and presentation of the Moose Caribou survey block data.

8.0 Conclusions and Recommendations

The Moose Caribou survey resulted in the collection of 568 line km of high resolution gradient magnetic data over one survey block. The data have been processed and plotted on maps as a representation of the magnetic features of the survey area.

Geophysical data processing, particularly leveling and data interpolation routines, may tend to smooth the original data so that resolution is reduced. In addition, gridding algorithms are not always able to properly calculate grids where flight height between adjacent flight lines varied due to cultural obstacles or steep terrain, where geological structures are acute to flight lines, where line spacing exceeds the size of the causative anomaly, or near grid margins as in "edge effects." Therefore, subtle geophysical features in gridded and derivative-enhanced products or near the survey margins may introduce artifacts and must be evaluated with discretion.

The airborne geophysical data were acquired to map the geophysical characteristics of the survey area, which are in turn related to the distribution of magnetic minerals in the Earth. Magnetic patterns correspond to the concentration and distribution of magnetite and other magnetic minerals in Earth's subsurface. Therefore, the geophysical data will be useful in mapping lithology, structure, and alteration, which will benefit mineral exploration initiatives and geological studies.

Geophysical data are rarely a direct indication of mineral deposits and therefore interpretation and careful integration with existing and new geological, geochemical, and other geophysical data are recommended to maximize value from the survey investment.

Respectfully submitted,
Precision GeoSurveys Inc.

Shawn Walker, P.Geo.
August 2021

Appendix A

Polygon Coordinates

Moose Caribou – WGS 84 Zone 15N

Latitude (deg N)	Longitude (deg W)	Easting (m)	Northing (m)
50.95001	93.48126	466194	5644376
50.95001	93.45626	467950	5644365
50.95001	93.41876	470584	5644349
50.95001	93.41251	471023	5644347
50.95834	93.41251	471029	5645273
50.95834	93.33126	476735	5645244
50.95418	93.33126	476733	5644781
50.95418	93.30626	478488	5644774
50.94168	93.30626	478483	5643384
50.94168	93.34376	475848	5643395
50.93334	93.34376	475844	5642469
50.93334	93.46251	467500	5642514
50.93751	93.46251	467502	5642978
50.93751	93.47501	466624	5642983
50.94168	93.47501	466627	5643446
50.94168	93.48126	466188	5643449

Appendix B

Equipment Specifications

- GEM GSM-19T Proton Precession Magnetometer (Magnetic Base Station)
- Hemisphere R120 GPS Receiver (for pilot navigation)
- Hemisphere R330 GPS Receiver (for data recovery)
- Opti-Logic RS800 Rangefinder Laser Altimeter
- Setra Model 276 Barometric Pressure Sensor
- Scintrex CS-3 Survey Magnetometer
- Billingsley TFM100G2 Ultra Miniature Triaxial Fluxgate Magnetometer
- Nuvia Dynamics IMPAC data recorder system (for navigation and geophysical data acquisition)

GEM GSM-19T Proton Precession Magnetometer (Magnetic Base Station)

Sensitivity	0.15 nT @ 1 Hz
Resolution	0.01 nT (gamma), magnetic field and gradient
Absolute Accuracy	±0.2 nT @ 1 Hz
Operating Range	20,000 nT to 120,000 nT
Gradient Tolerance	Over 7,000 nT/m
Operating Ranges	Temperature: -40°C to +50°C Battery Voltage: 10.0 V minimum to 15 V maximum Humidity: up to 90% relative, non-condensing
Storage Temperature	-50°C to +50°C
Dimensions	Console: 223 x 69 x 40 mm Sensor Staff: 4 x 450 mm sections Sensor: 170 x 71 mm dia. Weight: console 2.1 kg, sensor and staff assembly 2.2 kg
Integrated GPS	Yes

Hemisphere R120 GPS Receiver

GPS Sensor	Receiver Type	L1, C/A code, with carrier phase smoothing (Patented COAST technology during differential signal outage
	Channels	12-channel, parallel tracking (10-channel when tracking SBAS)
	Update Rate	Up to 20 Hz position
	Cold Start Time	<60 s
	SBAS Tracking	2-channel, parallel tracking
	Horizontal Accuracy	<0.02 m 95% confidence (RTK 1, 2) <0.28 m 95% confidence (L-Dif 1, 2) <0.6 m 95% confidence (DGPS 1,3) <2.5 m 95% confidence (autonomous, no SA1)
	Differential Options	SBAS, Autonomous, External RTCM, RTK, OmniSTAR (HP/XP)
Beacon Sensor Specifications	Channels	2-channel, parallel tracking
	Frequency Range	283.5 to 325 kHz
	MSK Bit Rates	50, 100, and 200 bps
L-Band Sensor	Channels	Single channel
	Frequency Range	1530 MHz to 1560 MHz
	Satellite Selection	Manual or Automatic (based on location)
	Startup and Satellite Reacquisition Time	15 seconds typical
Communications	Serial Ports	2 full duplex RS232C
	Baud Rates	4800 – 115200
	USB Ports	1 Communications
	Correction I/O Protocol	RTCM SC-104
	Data I/O Protocol	NMEA 0183
	Timing Output	1 PPS (HCMOS, active high, rising edge sync, 10 kΩ, 10 pF load)
	Raw Data	Proprietary binary (RINEX utility available)
Environmental	Operating Temperature	-30°C to +70°C
	Storage Temperature	-40°C to +85°C
	Humidity	95% non-condensing
Power GPS Sensor	Input Voltage Range	8 to 36 VDC
	Power Consumption	3 Watts
	Current Consumption	< 250 mA @ 12 VDC
	Antenna Voltage Output	5.0 VDC

[1]Depends on multipath environment, number of satellites in view, satellite geometry and ionospheric activity.
[2] Up to 5 km baseline length.
[3] Depends also on baseline length.

Hemisphere R330 GPS Receiver

GPS Sensor	Receiver Type	L1 and L2 RTK with carrier phase	
	Channels	12 L1CA GPS 12 L1P GPS 12 L2P GPS 12 L2C GPS 12 L1 GLONASS (with subscription code) 12 L2 GLONASS (with subscription code) 3 SBAS or 3 additional L1CA GPS	
	Update Rate	10 Hz standard, 20 Hz available	
	Cold Start Time	<60 s	
	Warm Start Time 1	30 s (valid ephemeris)	
	Warm Start Time 2	30 s (almanac and RTC)	
	Hot Start Time	10 s typical (valid ephemeris and RTC)	
	Reacquisition	<1 s	
	Differential Options	SBAS, Autonomous, External RTCM, RTK, OmniSTAR (HP/XP)	
Horizontal Accuracy		RMS (67%)	2DRMS (95%)
	RTK [1, 2]	10 mm + 1 ppm	20 mm + 2 ppm
	OmniSTAR HP [1, 3]	0.1 m	0.2 m
	SBAS (WAAS) [1]	0.3 m	0.6 m
	Autonomous, no SA [1]	1.2 m	2.5 m
L-Band Sensor	Channel	Single channel	
	Frequency Range	1530 MHz to 1560 MHz	
	Satellite Selection	Manual or Automatic (based on location)	
	Startup and Satellite Reacquisition Time	15 seconds typical	
Communications	Serial Ports	2 full duplex RS232	
	Baud Rates	4800 – 115200	
	USB Ports	1 Communications, 1 Flash Drive data storage	
	Correction I/O Protocol	Hemisphere GPS proprietary, RTCM v2.3 (DGPS), RTCM v3 (RTK), CMR, CMR+NMEA 0183, Hemisphere GPS binary	
	Timing Output	1 PPS (HCMOS, active high, rising edge sync, 10 kΩ, 10 pF load)	
	Event Marker Input	HCMOS, active low, falling edge sync, 10 kΩ	
Environmental	Operating Temperature	-40°C to +70°C	
	Storage Temperature	-40°C to +85°C	
	Humidity	95% non-condensing	
Power GPS Sensor	Input Voltage Range	8 to 36 VDC	
	Consumption, RTK	<3.5 W (0.30 A @ 12 VDC typical)	
	Consumption, OmniSTAR	<4.3 W (0.36 A @ 12 VDC typical)	

[1]Depends on multipath environment, number of satellites in view, satellite geometry and ionospheric activity.
[2] Depends also on baseline length.
[3] Requires a subscription from OmniSTAR.

Precision GeoSurveys

Opti-Logic RS800 Rangefinder Laser Altimeter

Accuracy	±1 m on 1x1 m^2 diffuse target with 50% reflectivity, up to 700 m
Resolution	0.2 m
Communication Protocol	RS232-8, N, 1 ASCII characters
Baud Rate	19200
Data Raw Counts	~200 Hz
Data Calibrated Range	~10 Hz
Data Rate	~200 Hz raw counts for un-calibrated operation; ~10 Hz for calibrated operation (averaging algorithm seeks 8 good readings)
Calibrated Range Units	Feet, Meters, Yards
Laser	Class I (eye-safe), 905 nm ± 10 nm
Power	7 - 9 VDC conditioned required, current draw at full power (~ 1.8 W)
Laser Wavelength	RS100 905 nm ± 10 nm
Laser Divergence	Vertical axis – 3.5 mrad half-angle divergence; Horizontal axis – 1 mrad half-angle divergence; (approximate beam “footprint” at 100 m is 35 cm x 5 cm)
Dimensions	32 x 78 x 84 mm (lens face cross section is 32 x 78 mm)
Weight	<227 g (8 oz)
Casing	RS100/RS400/RS800 units are supplied as OEM modules consisting of an open chassis containing optics and circuit boards. Custom housings can be designed and built on request.

Setra Model 276 Barometric Pressure Sensor

Performance	Accuracy RSS[1] (at constant temp)	±0.25% FS[2]
	Non-Linearity (BSFL)	±0.22% FS
	Hysteresis	0.05% FS
	Non-Repeatability	0.05% FS
	Thermal Effects[3]	Compensated range: 0°C to +55°C (+30°F to +130°F) Zero shift (over compensated range): 1% FS Span shift (over compensated range): 1% FS
	Resolution	Infinite, limited only by output noise level (0.0005% FS)
	Time Constant	10 msecs to reach 90% final output with step function pressure input
	Long Term Stability	0.25% FS / 6 months
Environmental	Temperature	Operating[4]: -18°C to +79°C (0°F to +175°F) Storage: -55°C to +121°C (-65°F to +250°F)
	Vibration	2 g from 5 Hz to 500 Hz
	Shock	50 g (Operating, 1/2 sine 10 ms)
	Acceleration	10 g
Electrical	Circuit	3-Wire[5] (Exc, Out, Com)
	Power Consumption	0.20 W (24 VDC)
	Output Impedance	5 Ω
	Output Noise	<200 μV RMS (0 to 100 Hz)

[1] RSS of non-linearity, hysteresis, and non-repeatability.
[2] FS = 300 mb for 800 – 1100 mb range; 500 for 600 – 1100 mb range; and 20 PSI for 0 to 20 PSIA.
[3] Units calibrated at nominal 70°F. Maximum thermal error computed from this datum.
[4] Operating temperature limits of the electronics only. Pressure media temperatures may be considerable higher or lower.
[5] The separate leads for +EXC, -EXC, +Out, -Out are commoned internally. The shield is connected to the case. For best performance, either the -Exc or -Out should be connected to the case. Unit is calibrated at the factory with -Exc connected to the case. The insulation resistance between all signal leads are tied together and case ground is 10

Scintrex CS-3 Magnetometer

Operating Principal	Self-oscillating split-beam Cesium Vapor (non-radioactive ^{133}Cs)
Operating Range	15,000 nT to 105,000 nT
Gradient Tolerance	40,000 nT/m
Operating Zones	15° to 75° and 105° to 165°
Hemisphere Switching	a) Automatic b) Electronic control actuated by the control voltage levels (TTL/CMOS) c) Manual
Sensitivity	0.0006 nT √Hz rms
Noise Envelope	Typically 0.002 nT peak to peak, 0.1 to 1 Hz bandwidth
Heading Error	±0.20 nT (inside the optical axis to the field direction angle range 15° to 75° and 105° to 165°)
Absolute Accuracy	<2.5 nT throughout range
Output	a) Continuous signal at the Larmor frequency which is proportional to the magnetic field (proportionality constant 3.49857 Hz/nT) sine wave signal amplitude modulated on the power supply voltage b) Square wave signal at the I/O connector, TTL/CMOS compatible
Information Bandwidth	Only limited by the magnetometer processor used
Sensor Head	Diameter: 63 mm (2.5") Length: 160 mm (6.3") Weight: 1.15 kg (2.6 lb)
Sensor Electronics	Diameter: 63 mm (2.5") Length: 350 mm (13.8") Weight: 1.5 kg (3.3 lb)
Cable, Sensor to Sensor Electronics	3 m (9' 8"), lengths up to 5 m (16' 4") available
Operating Temperature	-40°C to +50°C
Humidity	Up to 100%, splash proof
Supply Power	24 to 35 VDC
Supply Current	Approx. 1.5 A at start up, decreasing to 0.5 A at 20°C
Power Up Time	Less than 15 minutes at -30°C

Billingsley TFM100G2 Ultra Miniature Triaxial Fluxgate Magnetometer

Axial Alignment	Orthogonality better than ±1°
Input Voltage Options	15 to 34 VDC @ 30 mA
Field Measurement Range Options	±100 µT = ±10 V
Accuracy	±0.75% of full scale (0.5% typical)
Linearity	±0.015% of full scale
Sensitivity	100 µV/nT
Scale Factor Temperature Shift	0.007% full scale/°C
Noise	≤12 pT rms/√Hz @ 1 Hz
Output Ripple	3 mV peak to peak @ 2^{nd} harmonic
Analog Output at Zero Field	±0.025 V
Zero Shift with Temperature	±0.6 nT/°C
Susceptibility to Perming	±8 nT shift with ± 5 Gs applied
Output Impedance	332 Ω ± 5%
Frequency Response	3 dB @ >500 Hz (to >4 kHz wide band)
Over Load Recovery	±5 Gs slew <2 ms
Random Vibration	>20 G rms 20 Hz to 2 kHz
Temperature Range	-55°C to +85°C
Acceleration	>60 G
Weight	100 g
Size	3.51 cm x 3.23 cm x 8.26 cm
Connector	Chassis mounted 9 pin male "D" type

Nuvia Dynamics IMPAC data recorder system

(for navigation and geophysical data acquisition)

Functions	Integrated Multi-Parameter Airborne Console (IMPAC) with integrated dual Global Positioning System Receiver (GPS) and all necessary navigation guidance software. Inputs for geophysical sensors - portable gamma ray spectrometer GRS-10/AGRS, MMS4/MMS8 Magnetometer, Herz Totem-2A, A/D converter, temperature/humidity probe, barometric pressure probe, and laser/radar altimeter. Output for the multi-parameter PGU (Pilot Guidance Unit)
Display	Monitor display 600 x 800 pixels; customized keypad and operator keyboard. Multi-screen options for real-time viewing of all data inputs, fiducial points, flight line tracking, and GPS channels by operator
Navigation	Pilot/operator navigation guidance. Software supports preplanned survey flight plan, along survey lines, way-points, preplanned drape profile surfaces
Data Sampling	Sensor dependent
Data Synchronization	Synchronized to GPS position. Supports dual GPS
Data File	PEI Binary data format
Storage	80 GB
Software	DataView: Allows fast data verification and conversion of PEI binary data to Geosoft GBN or ASCII formats MAPConv: For survey preparation, calibration and conversion of maps, and survey plot after data acquisition MAGComp: For calculation of magnetic compensation coefficients AGRS/GRS10 Calibration: High voltage adjustment, linearity correction coefficients calculation, and communication test support AGIS: Real time data acquisition and navigation system. Displays chart/spectrum view in real-time for fast data Quality Control (QC)
Electrical	Multiple ethernet connections, RS232 serial ports, USB ports, and 16-bit differential analog input channels. It can support up to 4 magnetometer sensors
Power Requirement	24 VDC

Appendix C

Digital File Descriptions

- Magnetic Database
- Geosoft Grids
- Maps

Magnetic Database:

Abbreviations used in the GDB/XYZ files listed below:

CHANNEL	UNITS	DESCRIPTION
X_WGS84	m	UTM Easting – WGS84 Zone 15N
Y_WGS84	m	UTM Northing – WGS84 Zone 15N
Lat_deg	Decimal degree	Latitude – WGS84
Lon_deg	Decimal degree	Longitude – WGS84
Date	yyyy/mm/dd	Dates of the survey flight(s) – Local
FLT		Flight number(s)
LineNo		Line numbers
STL		Number of satellite(s)
GPSfix		1 = non-differential 2 = WAAS/SBAS differential
Heading	degree	Heading of the aircraft
GPStime	HH:MM:SS	GPS time (UTC)
Geos_m	m	Geoidal separation
XTE_m	m	Cross track error
Galt	m	GPS height – WGS84 Zone 15N (ASL)
Lalt	m	Laser altimeter readings (AGL)
DTM	m	Digital Terrain Model
Sample_Density	m	Horizontal distance in meters between adjacent measurement locations; sample frequency is 20 Hz
Speed_km_hr	km/hr	Ground speed of aircraft in km/hr
basemag	nT	Base station temporal variation data
IGRF	nT	International Geomagnetic Reference Field, IGRF-13
Declin	Decimal degree	Calculated declination of magnetic field
Inclin	Decimal degree	Calculated inclination of magnetic field
Mag1_Head	nT	Mag 1 – Diurnal, lag, and heading corrected
Mag2_Head	nT	Mag 2 – Diurnal, lag, and heading corrected
Mag3_Head	nT	Mag 3 – Diurnal, lag, and heading corrected
Mag4_Head	nT	Mag 4 - Diurnal, lag, and heading corrected
TMI	nT	Total Magnetic Intensity (average of Mag 1 and Mag 2)
RMI	nT	Residual Magnetic Intensity (average of Mag 1 and Mag 2)
ILG	nT/m	In-Line Gradient (Mag 1 and Mag 2)
XLG	nT/m	Cross-Line Gradient (Mag 1 and Mag 2)
VG	nT/m	Vertical Gradient (Mag 3 and Mag 4)
HG	nT/m	Total horizontal gradient (in-line and cross-line)
TMIge	nT	Gradient enhanced Total Magnetic Intensity
RMIge	nT	Gradient enhanced Residual Magnetic Intensity

Grids:

Moose Caribou, WGS 84 Datum, Zone 15N, cell size at 12.5 m

FILE NAME	DESCRIPTION
21156_MooseCaribou_DTM_12.5m.grd	Digital Terrain Model gridded at 12.5 m cell size
21156_MooseCaribou_TMI_12.5m.grd	Total Magnetic Intensity gridded at 12.5 m cell size
21156_MooseCaribou_RMI_12.5m.grd	Residual Magnetic Intensity gridded at 12.5 m cell size
21156_MooseCaribou_RTP_12.5m.grd	Reduced to Magnetic Pole of RMI gridded at 12.5 m cell size
21156_MooseCaribou_ILG_12.5m.grd	Measured In-Line Gradient (Mag 1 and Mag 2) gridded at 12.5 m cell size
21156_MooseCaribou_XLG_12.5m.grd	Measured Cross-Line Gradient (Mag 1 and Mag 2) gridded at 12.5 m cell size
21156_MooseCaribou_VG_12.5m.grd	Measured Vertical Gradient (Mag 3 and Mag 4) gridded at 12.5 m cell size
21156_MooseCaribou_HG_12.5m.grd	Total Horizontal Gradient (in-line and cross-line) gridded at 12.5 m cell size
21156_MooseCaribou_1VD_12.5m.grd	First Vertical Derivative of RTP gridded at 12.5 m cell size
21156_MooseCaribou_TMIge_12.5m.grd	Gradient enhanced Total Magnetic Intensity (in-line, cross-line, and vertical gradients) gridded at 12.5 m cell size
21156_MooseCaribou_RMIge_12.5m.grd	Gradient enhanced Residual Magnetic Intensity (in-line, cross-line, and vertical gradients) gridded at 12.5 m cell size
21156_MooseCaribou_RTPge_12.5m.grd	Gradient enhanced Reduced to Magnetic Pole of RMIge gridded at 12.5 m cell size

Maps:

Moose Caribou, WGS 84 Datum, Zone 15N (jpegs, pdfs, and georeferenced pdf)

Plate Number	Plate Name	FILE NAME	DESCRIPTION
1	FL	21156_MooseCaribou_ActualFlightLines	Plotted actual flown flight lines
2	DTM	21156_MooseCaribou_DTM_12.5m	Digital Terrain Model gridded at 12.5 m cell size
3	TMI_wFL	21156_MooseCaribou_TMI_wFL_12.5m	Total Magnetic Intensity gridded at 12.5 m cell size with actual flown flight lines
4	TMI	21156_MooseCaribou_TMI_12.5m	Total Magnetic Intensity gridded at 12.5 m cell size
5	RMI	21156_MooseCaribou_RMI_12.5m	Residual Magnetic Intensity gridded at 12.5 m cell size
6	RTP	21156_MooseCaribou_RTP_12.5m	Reduced to Magnetic Pole of RMI gridded at 12.5 m cell size
7	ILG	21156_MooseCaribou_ILG_12.5m	Measured In-Line Gradient gridded at 12.5 m cell size
8	XLG	21156_MooseCaribou_XLG_12.5m	Measured Cross-Line Gradient gridded at 12.5 m cell size
9	VG	21156_MooseCaribou_VG_12.5m	Measured Vertical Gradient gridded at 12.5 m cell size
10	HG	21156_MooseCaribou_HG_12.5m	Total Horizontal Gradient (in-line and cross-line) gridded at 12.5 m cell size
11	1VD	21156_MooseCaribou_1VD_12.5m	First Vertical Derivative of RTP gridded at 12.5 m cell size
12	TMIge	21156_MooseCaribou_TMIge_12.5m	Gradient enhanced Total Magnetic Intensity gridded at 12.5 m cell size
13	RMIge	21156_MooseCaribou_RMIge_12.5m	Gradient enhanced Residual Magnetic Intensity gridded at 12.5 m cell size
14	RTPge	21156_MooseCaribou_RTPge_12.5m	Gradient enhanced Reduced to Magnetic Pole of RMIge gridded at 12.5 m cell size

Plates

Moose Caribou Survey Block

- Plate 1: Moose Caribou – Actual Flight Lines (FL)
- Plate 2: Moose Caribou – Digital Terrain Model (DTM)
- Plate 3: Moose Caribou – Total Magnetic Intensity with Actual Flight Lines (TMI_wFL)
- Plate 4: Moose Caribou – Total Magnetic Intensity (TMI)
- Plate 5: Moose Caribou – Residual Magnetic Intensity (RMI)
- Plate 6: Moose Caribou – Reduced to Magnetic Pole (RTP)
- Plate 7: Moose Caribou – In-Line Gradient (ILG)
- Plate 8: Moose Caribou – Cross-Line Gradient (XLG)
- Plate 9: Moose Caribou – Vertical Gradient (VG)
- Plate 10: Moose Caribou – Horizontal Gradient (HG)
- Plate 11: Moose Caribou – First Vertical Derivative (1VD) of RTP
- Plate 12: Moose Caribou – Gradient Enhanced Total Magnetic Intensity (TMIge)
- Plate 13: Moose Caribou – Gradient Enhanced Residual Magnetic Intensity (RMIge)
- Plate 14: Moose Caribou – Gradient Enhanced Reduced to Magnetic Pole (RTPge) of RMIge