

GM 72846

Report of a heliborne magnetic and VLF-EM survey on the Cachée Creek property

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**Report of a Heliborne Magnetic and VLF-EM Survey
on the Cachée Creek Property,
Abitibi, Quebec
32D/10**

For
Cachee Gold Mines Corp.
Toronto, Ontario

by
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September 2021



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Introduction

Cachee Gold Mines Corp. mandated MB Geosolutions to process the data of a heliborne magnetic and electromagnetic VLF survey executed at their request by K8aranda Geophysics Ltd.

This survey was performed using the K8aranda's "Quadrimag White Eagle Gradiometer" system, on the Cachee Creek property, located to the west of Amos in Abitibi. Figure 1 shows the location of the property.



Figure 1. Location of Cachee Creek Property

The survey was carried out between the dates of May 20 and 23, 2021 and covered a total of 829 line-kilometres on two blocks.

The Property

The claims covered by the survey are registered under Launay Gold Corp. This company holds the mining rights of 424 claims in the NTSC 32D/10 map sheet area.

The survey covers wholly or partially on 148 of these claims, 39 on block 1 located in the municipality of Taschereau, MRC Abitibi-Ouest, and 108 on block 2 located in the municipalities of Launay and Ste Gertrude-Manneville, MRC Abitibi. These claims and the survey flight lines are shown in Figure 2 and listed in table 1.

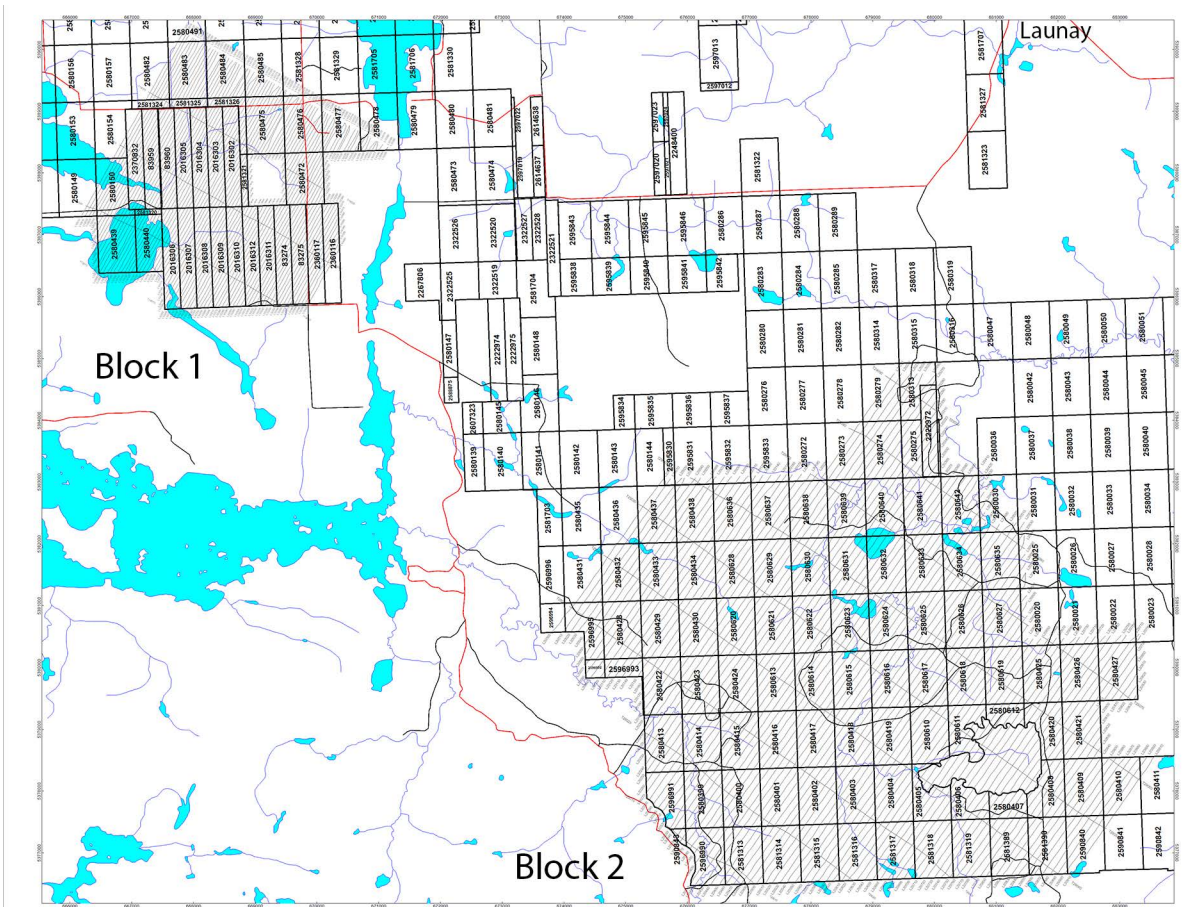


Figure 2. Claims covered by the survey and survey flight path.

Bloc1						
2580491	2580482	2580483	2580484	2580485	2581328	2580154
2581324	2581325	2581326	2580475	2580476	2580477	2580478
2580149	2580150p	2370832	83959	83960	2016305	2016304
2016303	2016302	2581321	2580472	2581320	2580439	2580440
2016306	2016307	2016308	2016309	2016310	2016311	2016312
83274	83275	2360117	2360116			
Bloc2						
2580279	2580313	2222972	2580144	2595830	2595831	2595832
2595833	2580272	2580273	2580274	2580275	2580036	2580436
2580437	2580438	2580636	2580637	2580638	2580639	2580640
2580641	2580642	2580030	2580031	2580431	2580432	2580433
2580434	2580628	2580629	2580630	2580631	2580632	2580633
2580634	2580635	2580025	2596994	2596995	2580428	2580429
2580430	2580620	2580621	2580622	2580623	2580624	2580625
2580626	2580627	2580020	2580021	2580022	2580023	2596992
2596993	2580422	2580423	2580424	2580613	2580614	2580615
2580616	2580617	2580618	2580619	2580425	2580426	2580427
2580413	2580414	2580415	2580416	2580417	2580418	2580419
2580610	2580611	2580612	2580420	2580421	2596991	2580399
2580400	2580401	2580402	2580403	2580404	2580405	2580406
2580407	2580408	2580409	2580410	2580411	2590843	2596990
2581313	2581314	2581315	2581316	2581317	2581318	2581319
2581389	2581390	2590840	2590841			

Tableau 1. Cachee Creek claims covered by the survey.

The Survey

A helicopter-borne magnetic and electromagnetic VLF survey, totalling 829 line-km, was carried out from May 20 to 23, 2021 on two sectors of the Cachee Creek property by K8aranda Geophysics Ltd.

The Block 1 was flown along survey lines oriented N29°E using a 50m line spacing and Block 2 was flown along survey lines oriented N35°E using a 100m line spacing. Both blocks were completed by perpendicular tie lines spaced 1000m apart.

Area	Survey Lines		Tie Line		Total length
	Azimuth	Spacing	Azimuth	Spacing	
Block 1	29°	50m	119°	1000m	282.2 km
Block 2	35°	100m	125°	1000m	546.8 km
Total					829.0 km

Tableau 2. Survey specifications

Equipment

- The Helicopter

The helicopter was a Eurocopter AStar 350 B2 registered C-GVDE and owned by Wendake Helicopter Inc. The AStar 350 helicopter allows the execution of a geophysical survey at low altitude even in rugged terrain and over a large range of temperature. A differential GPD and high precision altimeter help navigation. The helicopter has the autonomy of more than 3 hours of flight.

- The Gradiometer

The magnetic system used is a magnetic gradiometer designed by K8aranda Geophysics Ltd and called Quadrimag White Eagle whose fibreglass frame measures 3m in height, 10m in width and 7m in length and weighs approximately 180 kg. The Eagle is attached to the helicopter by a 100-foot (30.5 m) cable.

The magnetic gradiometer uses four GEM potassium vapour sensors mounted crosswise in a vertical plane at the front of the frame. Sensor specifications are given in 3.

The intensity of the total magnetic field is measured by the lower central sensor and the difference with the measurement of the upper central sensor 3m away provides the measured vertical gradient. The two lateral or cross line sensors, 10 metres apart, measure the transverse gradient. The longitudinal or inline gradient is obtained by the difference of two successive readings along the flight line whose spacing deduced from the GPS data is of the order of 2.5 to 3 metres.

Model	GEM System GSMP-35A
Sensitivity	+/- 0.0025 nT @ 1 Hz
Absolute Accuracy	+/- 0.1 nT over operating range maximum
Resolution	0.0001 nT
Sample rate	10 Hz (0.1 sec)
Dynamic Range	20,000 to 120,000 nT
Gradient tolerance	35,000 nT/m
Heading error	< 0.05 nT between 10° – 80°
Operating temperature	-32° C to +40° C normally
Tuning method	Dynamic re-starting at 30,000 nT
Volume of sensor	35 mm ³

Tableau 3 . Magnetometer Specifications

- *The VLF-EM system*

A **GEM systems** very low frequency electromagnetic sensor (VLF-EM) is added to the system. It can simultaneously measure the amplitude and the in-phase and out-of-phase components of signals emitted by two VLF transmitters.

The VLF waveband is used primarily for radio navigation services and for secure military communications. Considering that VLF waves can penetrate up to about 50 metres in salt water, they are used for military communication with submarines. However, since the advent of GPS, the technique is less used, and the quality of the signals is lower.

In Canada, three stations provide a good signal: Cutler, Maine (24.0 kHz), La Moure, North Dakota (25.2 kHz) and Jim Creek, Seattle (24.8 kHz). For this survey, the frequencies 24.0 kHz and 24.8 kHz were used.

- *The Altimeters*

Two altimeters are mounted on the Eagle for precise measurements. The main altimeter, a laser altimeter with multi-wave sensors mounted in the tail of the Eagle, is used for navigation and gives distance to the ground or to the foliage of vegetation. It gives the exact height of the magnetometer above the ground, from which a digital terrain model (DEM is determined). The second altimeter, a Free Flight TRA 3500 radar altimeter, monitors topographic details, confirms data from the laser altimeter and compensates for any failures.

- *The Global Positioning System (GPS)*

The GPS used is a Novatel V4.0 (WAAS compatible). It not only uses satellite signals but also signals from earth stations for more precise location.

All the data are sampled at a rate of 10 Hz and are collected by Geometrics' Maglog navigation software which also offers a plan view of the previously imported survey grid to facilitate navigation.

- *The Magnetic Base Station*

Two base stations, each consisting of a GEM potassium vapour sensors connected to a laptop computer powered by a 12V battery, are installed daily in a fixed location to record the variations of the magnetic field without external interference. The second station prevents the loss of survey in the event of failure of one of them during a survey day. Magnetic data readings are recorded by communications software and synchronized to UTC time for direct correlation with survey data. Base station data are collected at a frequency of 10 Hz.

Personnel

The K8aranda's field team is composed of four (4) peoples, including the pilot, the equipment operator, technical support and a geophysicist.

The pilot is responsible for following the pre-planned flight path and always maintaining an appropriate altitude of the geophysical system, while respecting the security rules.

The operator accompanies the pilot to ensure that all geophysical sensors are functioning as expected to ensure the quality of the data in real time.

The geophysicist collects the data at the end of each day, processes and analyzes them to ensure a final quality control. If necessary, he recommends to re-flight faulty sectors the following day. After the completion of the survey on each area, he generates a preliminary database.

The technical support helps the team as needed, in logistics, supplies.

Survey procedures

Prior to survey execution, flight lines are planned in each area in accordance with prescribed specifications. Navigation files, created with proprietary planning software according to provided boundaries of each survey area, are imported into the on-board navigation system used by the pilot and the operator during the survey. Tie lines are flown first or last, and survey lines are flown in sequential order. All re-flights determined by the quality control geophysicist are re-flown immediately and integrated into the master database.

After each flight, the data is processed and checked for quality control issues. This procedure is performed at the end of each survey.

All accepted data is then imported into a Geosoft database for further processing.

During survey, the average altitude of the gradiometer is around 40 metres. The height of the towed system is closely monitored using a laser altimeter. Best effort is made to ensure a close draping to the regional topography; however, security rules prevail. Based on an average survey speed of approximately 110 km / h and a sampling rate of 10 Hz, data samples are recorded at intervals of approximately 3 metres.

All auxiliary equipment used to guide navigation (laser altimeter, radar altimeter and GPS) were all been mounted directly to the gradiometer in order to calculate the precise location and position with minimal geometric error.

Quality Control

The data quality control is carried out on a daily basis by the operator and a geophysicist of K8aranda Geophysics using the criteria specified in table 4.

Tableau 4. Quality Control Criteria

Item	Rules
Lines Spacing:	Not to exceed 1.4 times the planned line spacing for an average of more than 1 kilometre along a flight line.
Magnetic Storms:	Departure from a 1-minutes chord should not exceed 30 nT.
Bird Height:	Not to exceed 70m over 1 km.
Magnetic Noise:	Not to Exceed ± 1.0 nT over 1 km. < 5 seconds in duration and outside of high gradient areas.
Magnetic Dropouts:	< 5 seconds in duration.

According to the K8aranda criteria, no re-flight was necessary for this survey.

Data Processing

A series of processing were completed to provide the final results. These are:

Flight path

A low pass filter was applied to the GPS data, which were collected and merged in the database at the same sampling rate of other data, to remove the high-frequency noise.

Digital Terrain Model (DTM)

The digital terrain model (DTM) was calculated by removing the laser altimeter values from the GPS elevation. The DTM grid is microlevelled and resampled in the database.

Magnetic Data Processing

The data is corrected, if necessary, for any lag and bird swings. A swing of the bird results in false readings for a few seconds. These data and occasional spikes are removed.

Total Magnetic Intensity (TMI) and Orthogonal Gradients

The Total Magnetic Field Intensity (TMI) is calculated by removing the diurnal variation, evaluated from the Magnetic Base Station record from the central lower magnetometer data. This correction is not required for the gradients.

The vertical and cross line gradients are determined by the difference between the appropriate sensors divided by the distance between these sensors.

The inline gradient is the difference between two successive TMI values divided by the spacing determined by GPS. Horizontal, cross line and inline gradients are corrected for the direction of flight. The values for southbound and westbound flights are multiplied by -1 to conform to the northbound or eastbound values.

If required, the calculated gradients are filtered lightly to remove high-frequency noise present in certain conditions. When used, horizontal gradients on tie lines must be interchanged to conform those of the survey lines.

The magnetic data grids are then levelled by tie lines and the resulting grids, micro-levelled.

First and second vertical derivatives (FVD, SVD).

The first vertical derivative (FVD) and the second vertical derivative (SVD) were calculated using a 1D Fourier transform of the TMI along the measured data. The equation for these two derivatives are:

$$FVD = \frac{dT}{dZ}$$

$$SVD = \frac{d^2T}{dz^2}$$

Magnetic Total Gradient or Analytic Signal (ASIG)

The magnetic analytic signal (ASIG), also known as the Total Gradient, is calculated by taking the square root of the sum of the squares of each of the 3 axis derivatives. The equation for the analytic signal is:

$$ASIG = \sqrt{\left[\left(\frac{dT}{dx}\right)^2 + \left(\frac{dT}{dy}\right)^2 + \left(\frac{dT}{dz}\right)^2\right]}$$

where dT/dx is the calculated in-line gradient, dT/dy is the measured cross line gradient and dT/dz is the measured vertical gradient of the total magnetic field.

In general, the analytic signal is a gradient product that ignores the effects of target orientation. This turns all responses, regardless of how they interact with the earth's magnetic field, into the positive direction. Therefore, both negative anomalies and dipole effects will appear positive, centred on the target source.

The analytic signal can be used to map the edge of large magnetic bodies as well as to enhance anomalous trends that can appear insignificant in a TMI grid. The nature of the algorithm also strips out effects of deep regional responses and focuses more on the near surface ones.

Magnetic Tilt Derivative (TDR)

The magnetic tilt derivative (TDR) combines all three gradients (X, Y and Z) to produce what is called a tilt angle. This product highlights very subtle, near surface structures in the dataset where the zero-contour line of the grid is said to represent geology contacts or edges of bodies. The distance between the zero contour at the 45° contour can give an approximation of the depth of the host body.

The magnetic tilt derivative is calculated by the following equation:

$$TDR = \tan^{-1} \left[\frac{dT/dz}{\sqrt{\left(\frac{dT}{dx}\right)^2 + \left(\frac{dT}{dy}\right)^2}} \right]$$

where dT/dx is the calculated in-line gradient, dT/dy is the calculated cross line gradient and dT/dz is the calculated vertical gradient of the total magnetic field.

VLF-EM data processing

The processing of VLF data included:

- Polarity inversion of the measurements alternating in phase quadrature according to the direction of the line.
- Deletion of erroneous data points; and
- Grid Microleveling to filter the variations line by line.

Unfortunately, no monitoring total VLF field using a base station was made for this survey. To our understanding, K8aranda Geophysics has proceeded to level adjustments of the total field, but we can still see some total VLF field strength in the data.

MB Geosolutions Data Processing

The final survey database was transferred by Cachee Gold Mines Corp. to Marc Boivin of MB Geosolutions for verification, processing and reporting.

After verifying that the data has been collected according to the rules of the art, MB Geosolutions has reprocessed some data and generated Geosoft grid files of the following products:

- Digital elevation model (DEM)
- Total magnetic field (TMI)
- Measured vertical gradient (VG)
- First Vertical Derivative of the total Magnetic field (FVD)
- Second Vertical derivative of the total magnetic field (SVD)
- Analytical Signal of the total magnetic field (ASIG)
- Total VLF field transmitted by the NAA station (VLF1-total)
- Total VLF field transmitted by the NLK station (VLF2-total)

Presentation of the results

Final maps at a scale of 1:20,000 are provided with this report.

Figures 3 to 11 show the results of the final products generated by this report.

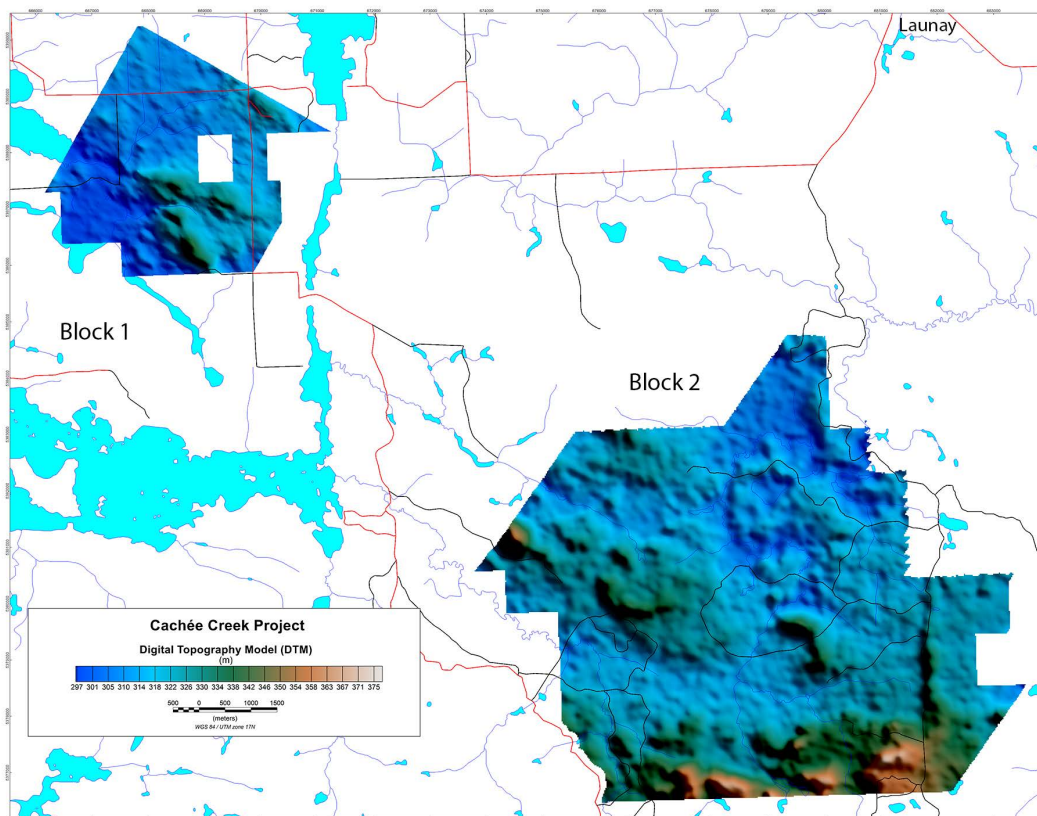


Figure 3. Digital Topography Model

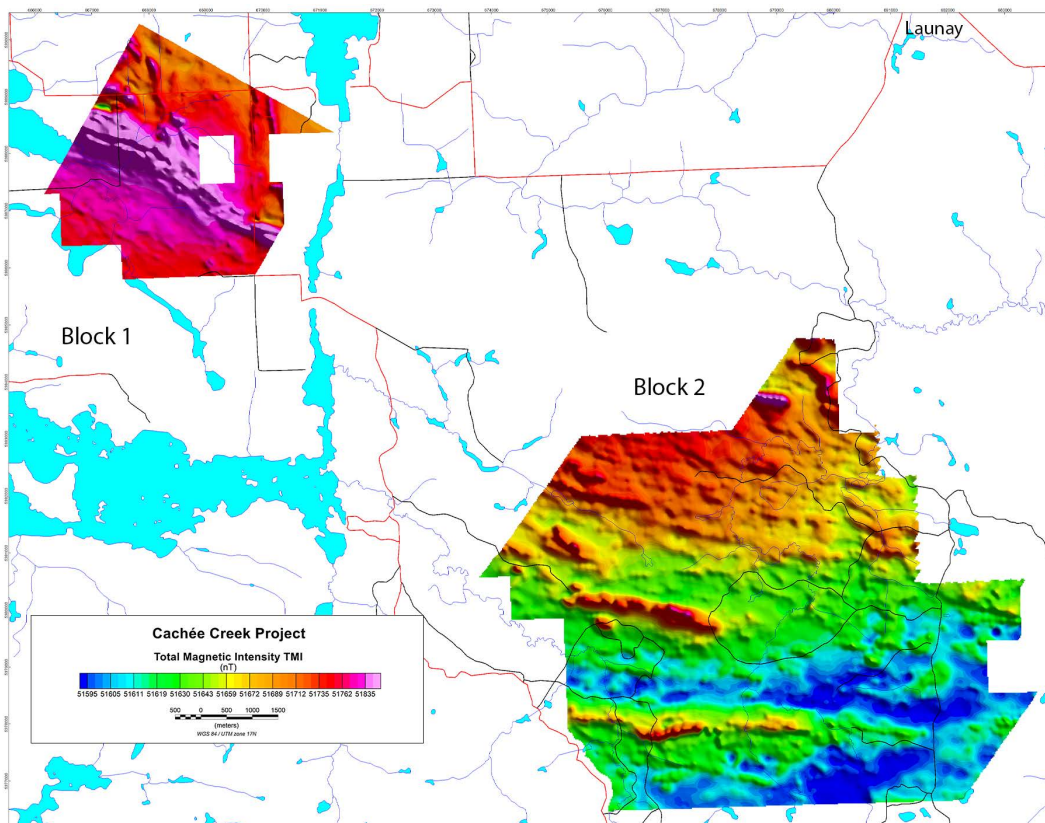


Figure 4. Total Magnetic Field.

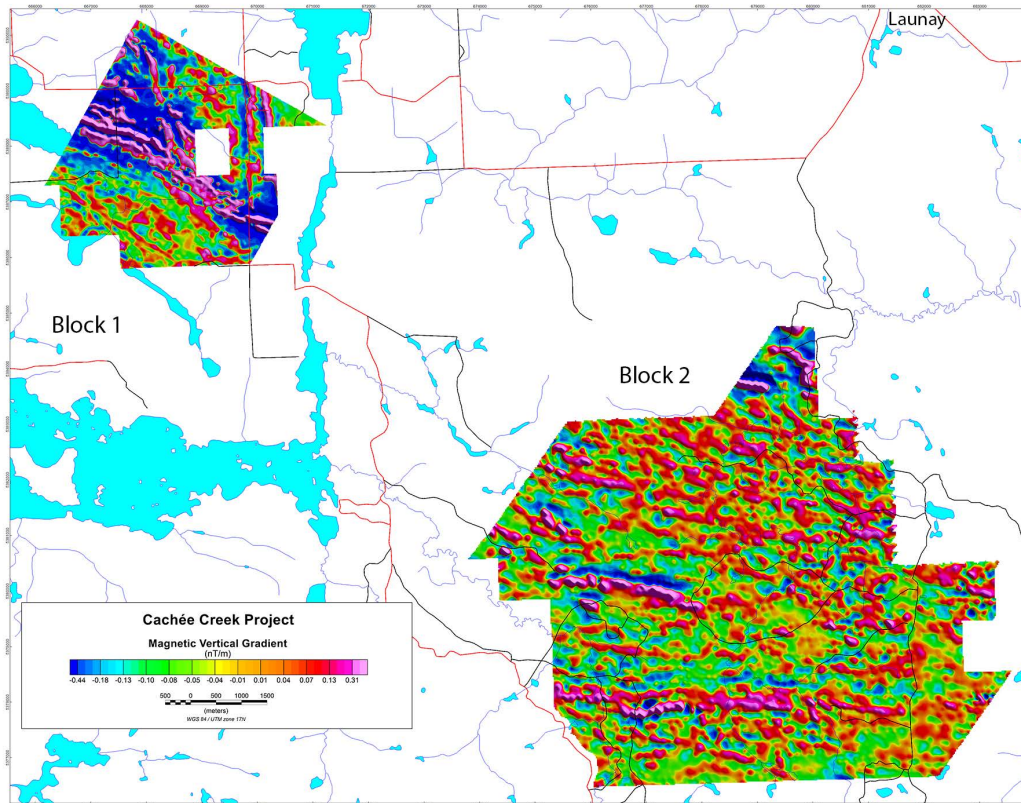


Figure 5. Measured Vertical Gradient.

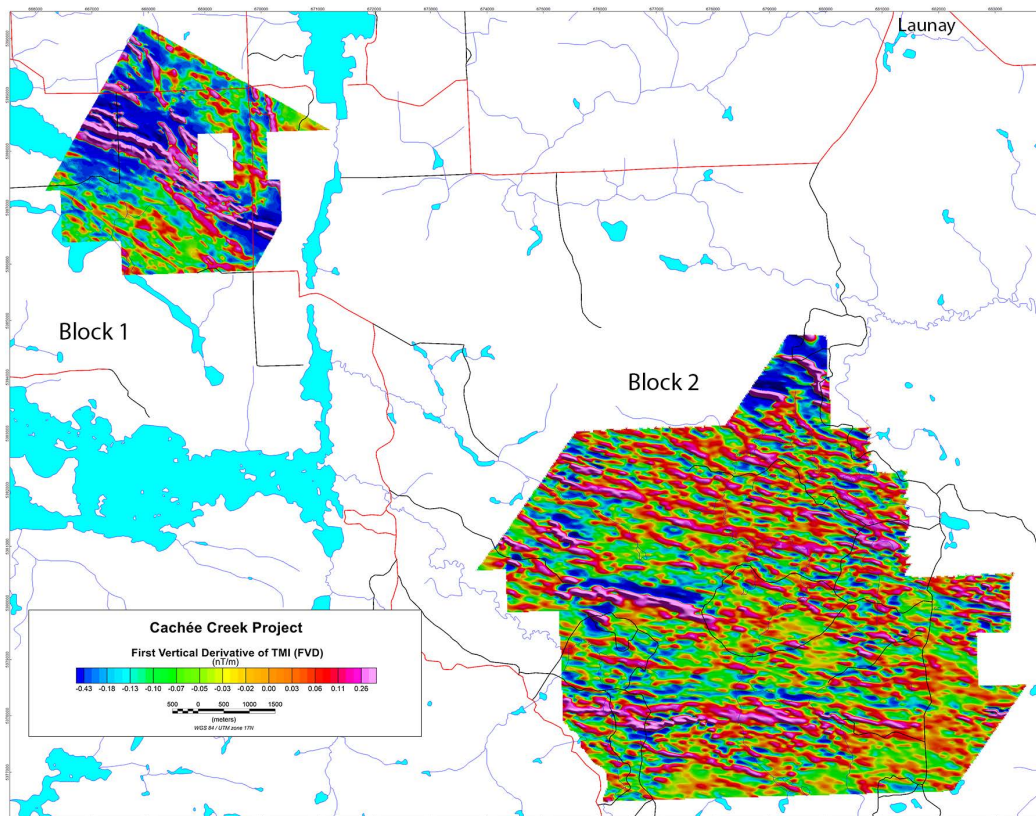


Figure 6. First Vertical Derivative of TMI.

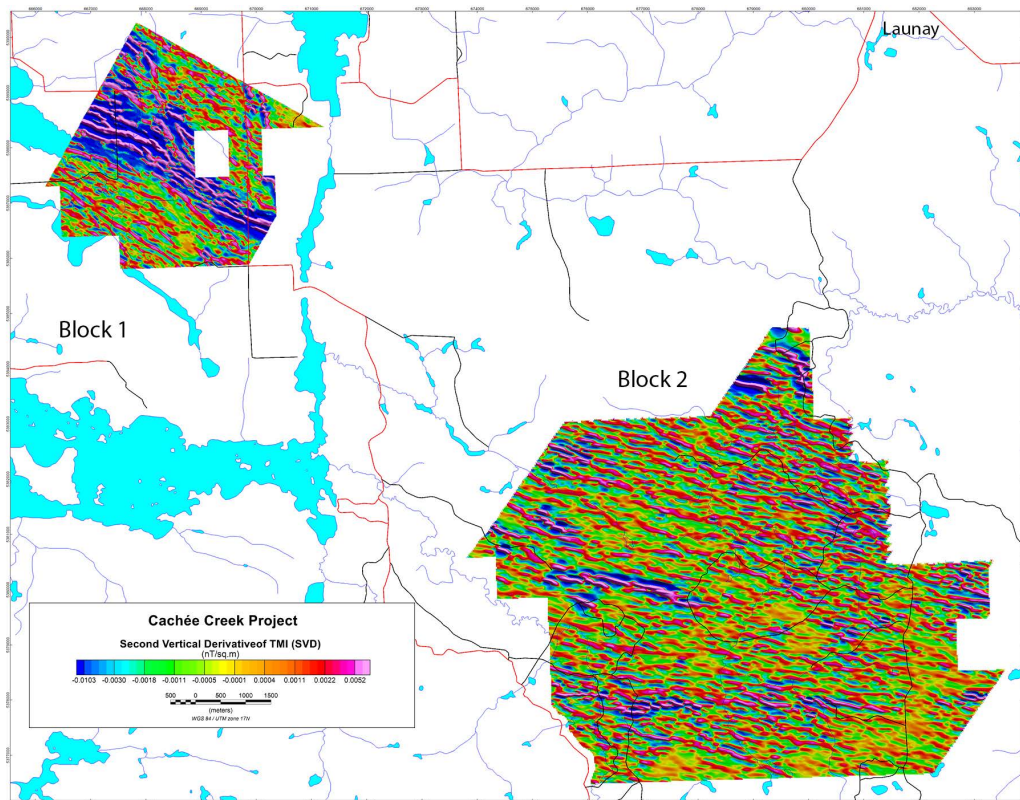


Figure 7. Second Vertical Derivative of TMI (SVD).

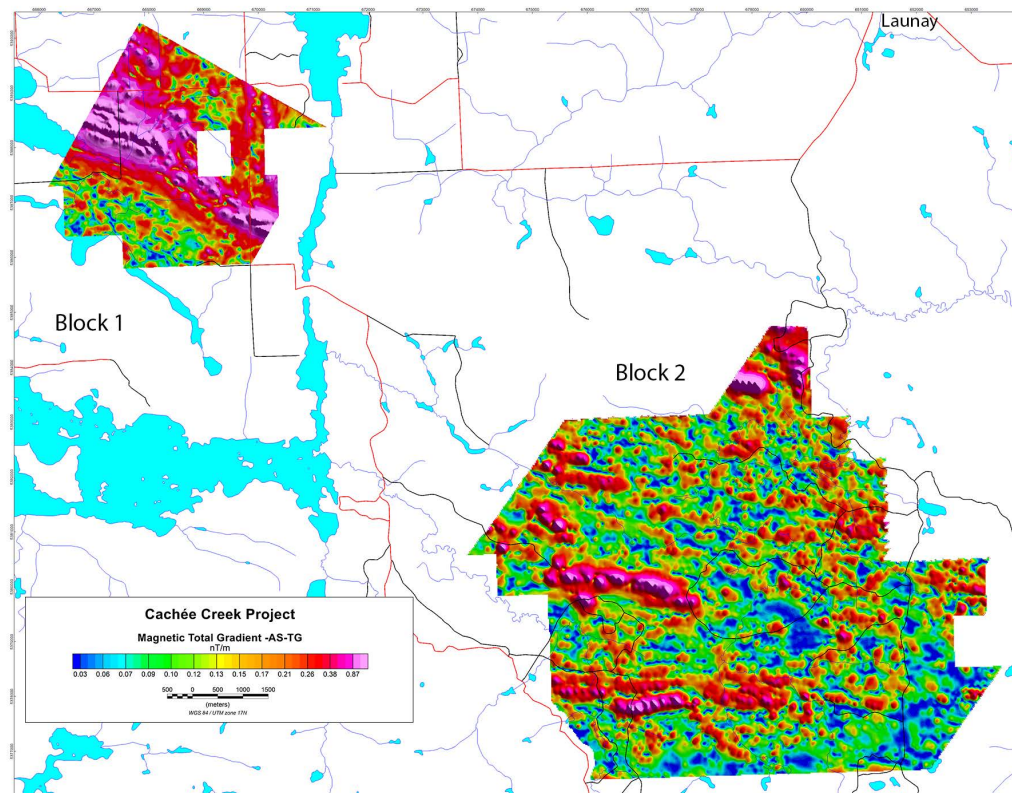


Figure 8. Analytic Signal of TMI (AS).

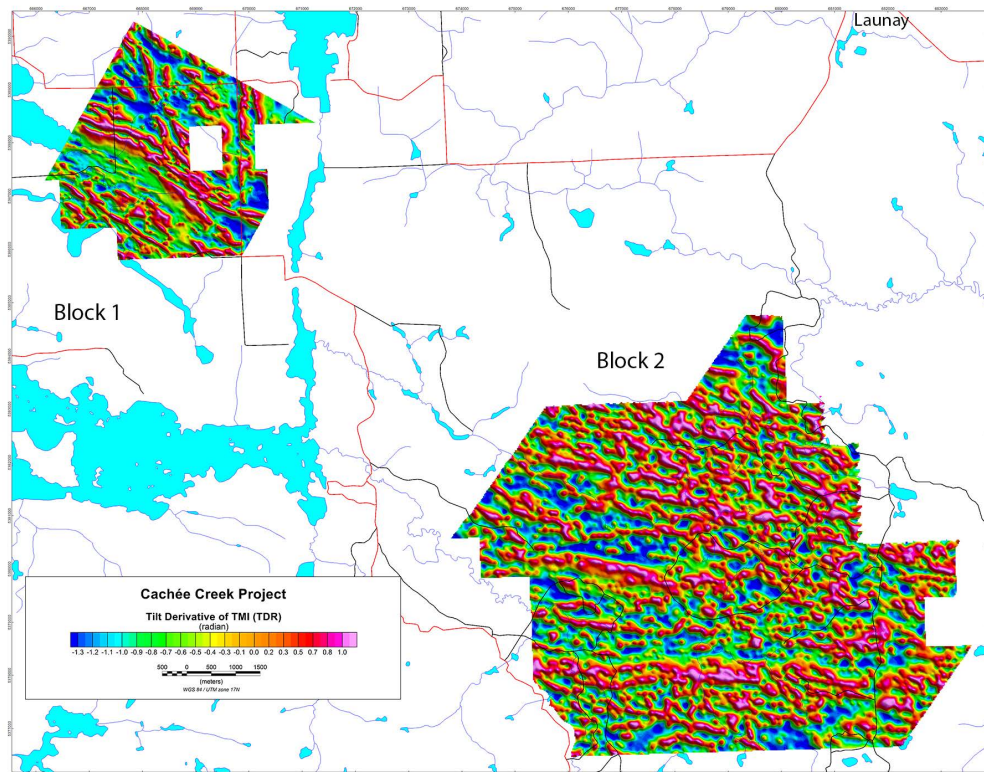


Figure 9. Tilt Derivative of TMI.

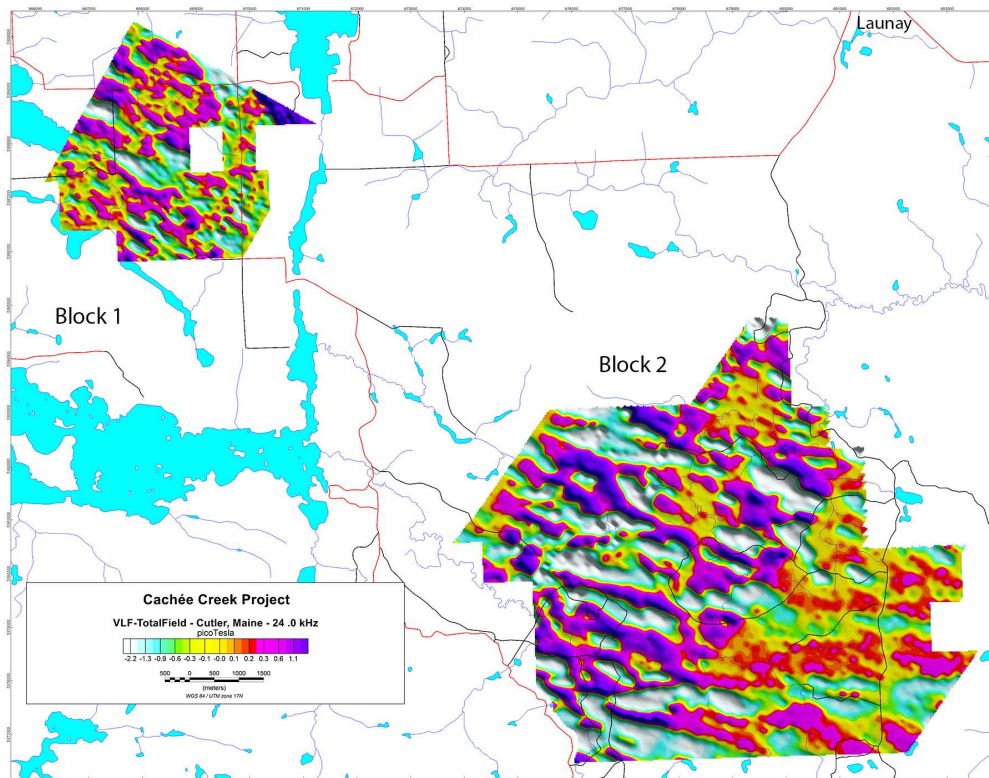


Figure 10. VLF-EM NAA Cutler - Total Field.

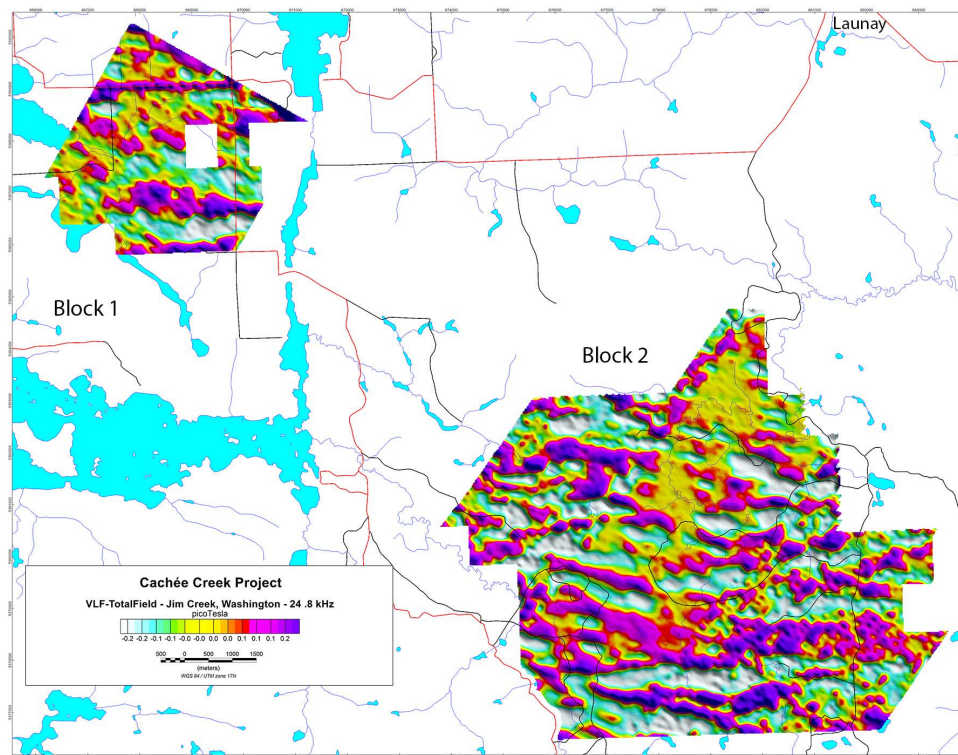


Figure 11. VLF-EM NLK Jim Creek - Total Field.

General interpretation

The figure 12 show a general interpretation of the survey. The two survey grids cover the geological contact between the Figury Group (to the north) and the Hunter Mines Group (to the south). The contact is marked by the Macamic fault.

The TMI data of the block 1 shows an ultramafic unit of the Figury Group located on contact with the Macamic fault. The data also reveal several other highly magnetic units, not clearly identified on public domain geological maps. Finally, two possible Proterozoic gabbro dykes oriented north-south are visible on the total magnetic intensity image.

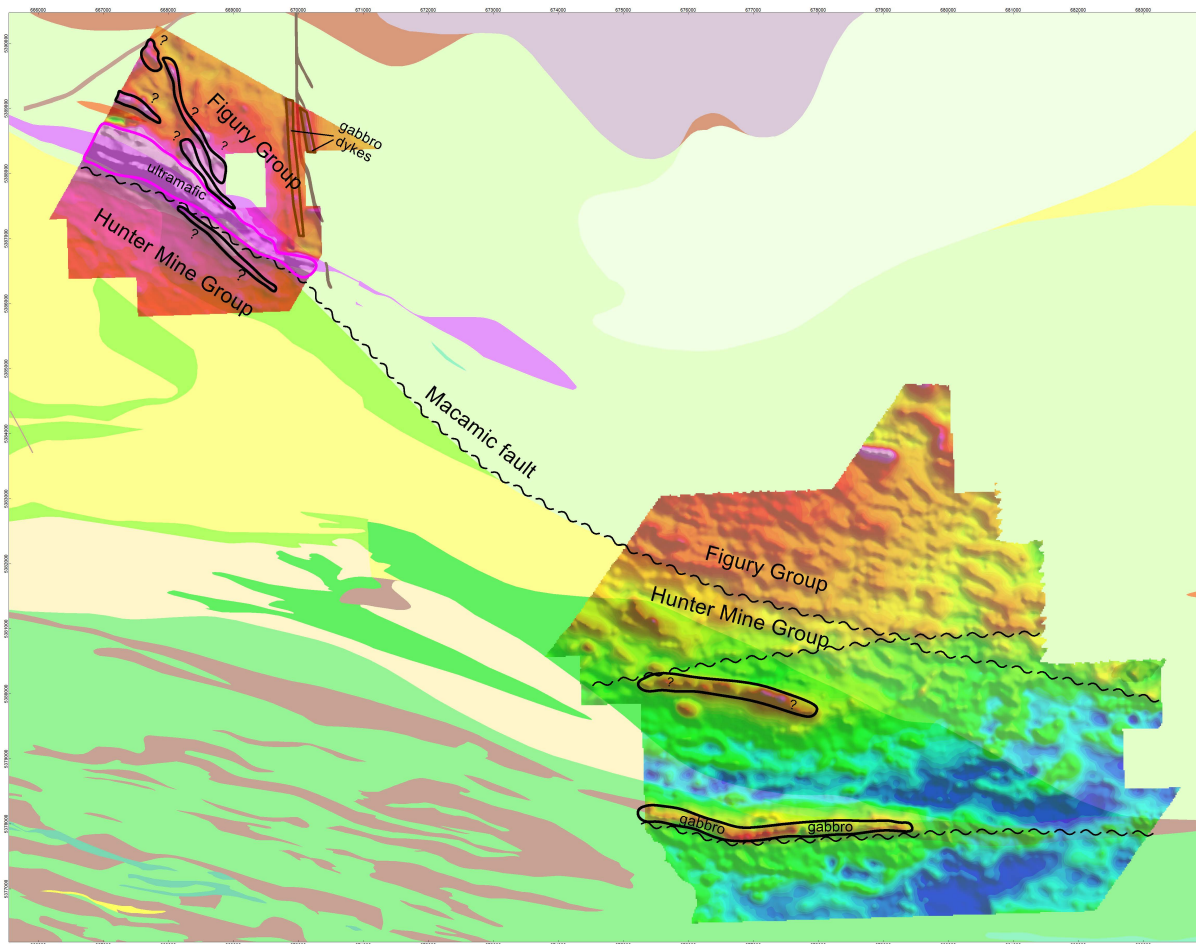


Figure 12. General interpretation.

The TMI data of the block 2 also show the contact between the Figury group, characterized by a moderate high magnetic background and the Hunter Mines Group, characterized by a lower magnetic background. The data also show a more complex structural setting compared to the known geological maps. A more advanced structural interpretation will be required. At least one high magnetic unit outlined by the survey cannot be explained by public domain geological maps.

The VLF-EM data of the two grids show complex images. Because the VLF-EM is strongly affected by geomorphology, cultural features and geology, a careful analysis of the results of the two VLF stations surveys will be required before making any interpretation of this EM survey.

Recommendations

The area covered by the survey has been the subject of several geophysical surveys, the reports of which are available from SIGEOM.

The compilation and analysis of these works is strongly recommended. It will provide a better understanding of the sector and the responses observed by this geophysical survey.

Based on the results of such a compilation, exploration works can be recommended, including detailed geophysical surveys like induced polarization and drone magnetic surveys.

Deliverables

Final maps were created for the survey grids at scale of 1:20,000 (UTM zone 17N, WGS84 datum), as follows:

- Cachee Creek flight path and claims
- Cachee Creek DTM (Digital Terrain Model)
- Cachee Creek TMI (Total Magnetic Intensity)
- Cachee Creek Vertical Gradient (Measured vertical gradient)
- Cachee Creek FVD (First vertical Derivative)
- Cachee Creek SVD (Second vertical Derivative)
- Cachee Creek TDR (Tilt Derivative)
- Cachee Creek AS (Analytical Signal)
- Cachee Creek VLF-TF Cutler 24kHz (VLF total field)
- Cachee Creek VLF-TF Jim Creek 24,8kHz (VLF total field)

The survey comes with digital archives, including maps (PDF format), database (Geosoft gdb format), Geosoft grid files and GIS files (vector and geotif).

Conclusions

Cachee Gold Mines Corp. mandated MBGeosolutions to verify and process the data from a heliborne magnetic and electromagnetic VLF survey performed by K8aranda Geophysics Ltd, in May 2021, over their Cachee Creek Property near Taschereau, Abitibi.

The magnetic data provided by K8aranda Geophysics meet the high standard of the industry in terms of quality. Unfortunately, the total field VLF variations were not monitored and fully corrected for diurnal variation (like the magnetic total field). Therefore, the interpretation of the VLF will be limited to a general characterization.

The high quality of the magnetic data offers significant potential for geological and structural interpretation. Advanced interpretation is highly recommended.

Respectfully submitted,


Jean M Hubert, eng
Geophysicist


Marc Boivin, P.Geo.
Geophysicist



CERTIFICATE of QUALIFICATIONS

Jean M. Hubert

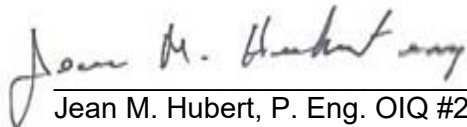
1912 Boulevard Laurier
Québec, QC, Canada, G1S 1M8

Phone: 418-688-9450

I, undersigned, Jean M. Hubert, do certify:

1. I am a consulting geophysicist, professional engineer and a collaborator of MBGeosolutions.
2. I am a graduate in Geological Sciences from Ecole Polytechnique de Montréal in 1972.
3. I have more than 40 years of practice in geophysics applied to mining exploration.
4. I am a member of l'Ordre de Ingénieurs du Québec and of the Society of Exploration Geophysicist.
5. I do not hold any interest in the company Cachee Gold Mines Corp., K8aranda Geophysics Ltd or in any mining properties discussed in this report.
6. I examined the K8aranda survey data and I wrote the document "Report of a Heliborne Magnetic and VLF Survey on the Cachee Creek Property, Abitibi, 32D/10"

Dated September 27, 2021


Jean M. Hubert, P. Eng. OIQ #22848

CERTIFICATE of QUALIFICATIONS

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E-mail: mbgeosolutions@gmail.com

I, Marc Boivin, P.Ge, do hereby certify that:

1. I am an independent consulting geophysicist, good-standing member of the Ordre des géologues du Québec (#351)

2. I earned a Bachelor of Science in Geology in 1983 at Université du Québec à Montréal.

3. I have practised my profession for 35 years in mining exploration geophysics.

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

5. I examined the K8aranda survey data and I wrote the document "Report of a Heliborne Magnetic and VLF Survey on the Cachee Creek Property, Abitibi, 32D/10"

Dated September 27, 2021

A handwritten signature in black ink, appearing to read 'Marc Boivin', written over a horizontal line.

Marc Boivin, P.Ge. (OGQ #351), Geophysicist