

# Report on a Helicopter-Borne Gamma Ray Spectrometer and Magnetic Gradiometer Survey



**Aeroquest Job # 05036**  
**Target Property**  
Telegraph Creek Area, British Columbia

for  
**Newcastle Minerals Limited**  
3632 Park Drive,  
Victoria, BC, V9C 3W3

by

** AEROQUEST LIMITED**

4-845 Main Street East  
Milton, Ontario, L9T 3Z3  
Tel: (905) 693-9129 Fax: (905) 693-9128  
[www.aeroquestsurveys.com](http://www.aeroquestsurveys.com)  
October, 2005

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- Left Panel: Coloured Total Magnetic Intensity (TMI) with line contours.
- Right Panel: Coloured 3-D Analytic Signal (3-D AS) with line contours.

### PLATE 2: Radiometric Data Products 1

- Left Panel: Coloured Potassium ground concentration (K) with line contours.
- Right Panel: Coloured equivalent Thorium to Potassium ratio (eTh/K).

### PLATE 3: Radiometric Data Products 2

- Left Panel: Coloured Total Count (TC) integrated with grey-scale Landsat-7 scene.
- Right Panel: Coloured equivalent Uranium (eU) integrated with grey-scale Landsat-7 scene.



## 2. INTRODUCTION

This report describes a helicopter-borne geophysical survey carried out on behalf of Newcastle Minerals, Ltd. on the Target Property, located in the Telegraph Creek area, northwestern British Columbia. The first principal geophysical sensor is Aeroquest's new TRI-DIRECTIONAL magnetic gradiometer system which employs four (4) optically pumped Potassium sensors. The second principal sensor was the Aeroquest's Airborne Gamma Ray Spectrometer (AGRS) system, which utilizes as 4 downward looking NaI crystals used as the main gamma-ray sensors and 1 upward looking crystal for monitoring non-geologic sources. Ancillary equipment includes a real-time differential GPS navigation system, radar altimeter, digital video acquisition system, and a base station magnetometer.

The airborne survey was flown at 200 m line spacing with a total survey coverage of 169 line-km. The survey flying described in this report took place on October 19<sup>th</sup>, 20<sup>th</sup> and 23<sup>rd</sup>, 2005.

This report describes the survey logistics, the data processing, presentation, and provides a brief interpretation of the results.

## 3. SURVEY AREA

The Target Property is situated in mountainous terrain 45 kilometres southwest of Telegraph Creek in northwestern British Columbia (Figure 1). Survey conditions were challenging due to the rugged terrain, and poor weather conditions which often made the survey area impassable due to clouded in peaks or fogged-in valleys. The airborne survey completed consisted of sixteen 10km long lines, spaced at 200m forming a single rectangular block elongated north-south. The a total survey coverage was 169 line-km included tie-lines (Figure 2). Originally the survey was planned to be much larger and extended to the west and southwest, however due to time constraints only a portion of the survey was completed as outlined in the survey contract. The flown survey block boundary coordinates are tabulated in Appendix 1.

The helicopter and survey crew were based at the Iskut Motor Inn, approximately 130 km east of the survey block. Primary installation of the geophysical equipment in the helicopter was carried out at the Pacific Western Helicopter base in Prince George, B.C. The gradiometer bird was transported by truck from Milton, ON, and installation was completed at the Iskut Motor Inn base.

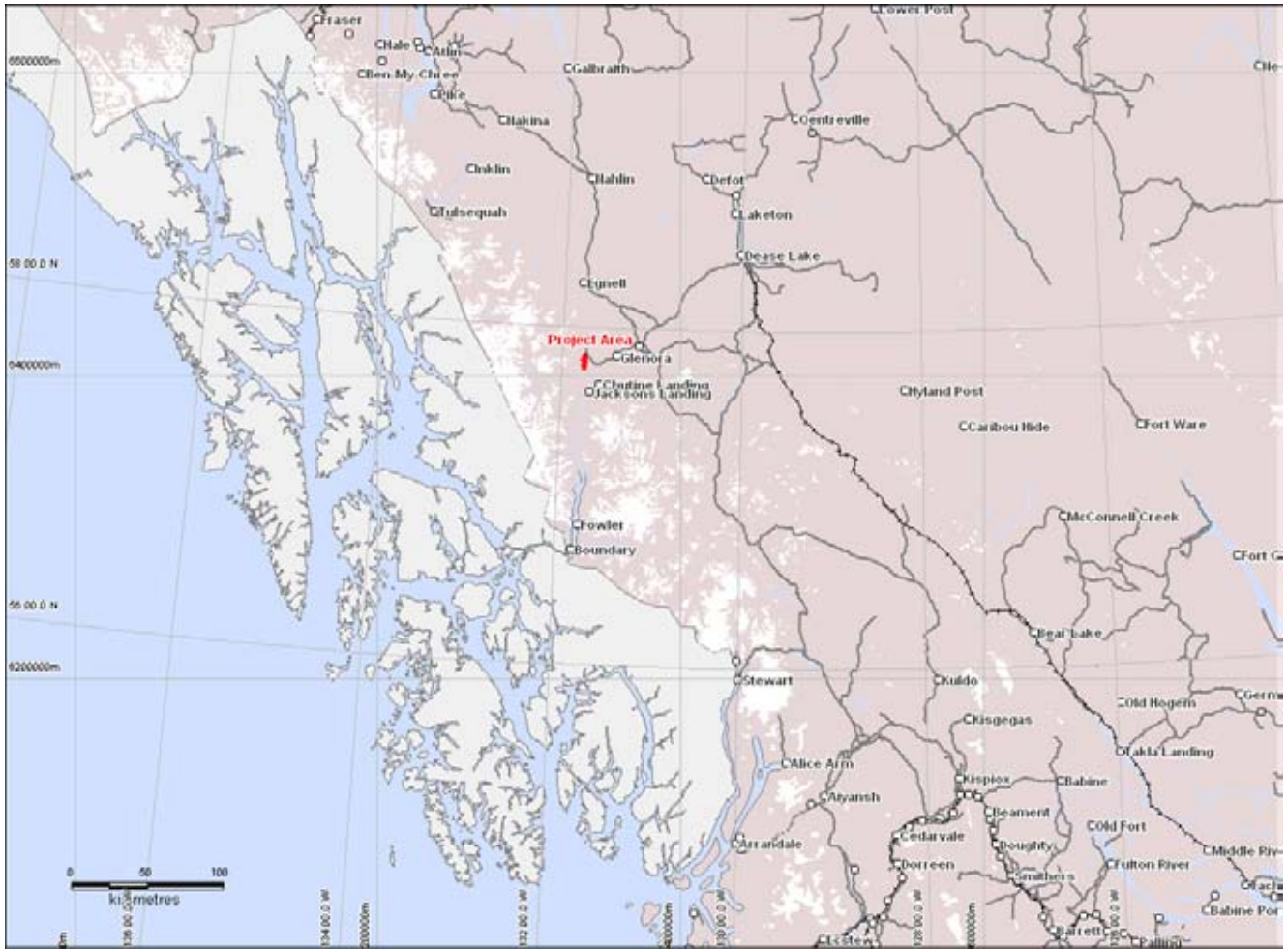











Figure 1. Regional location map of the project area

# Target Claim Map



**Mineral Titles Layers**

-  Target Tenure
-  All Mineral Tenures


**Topographic Layers**

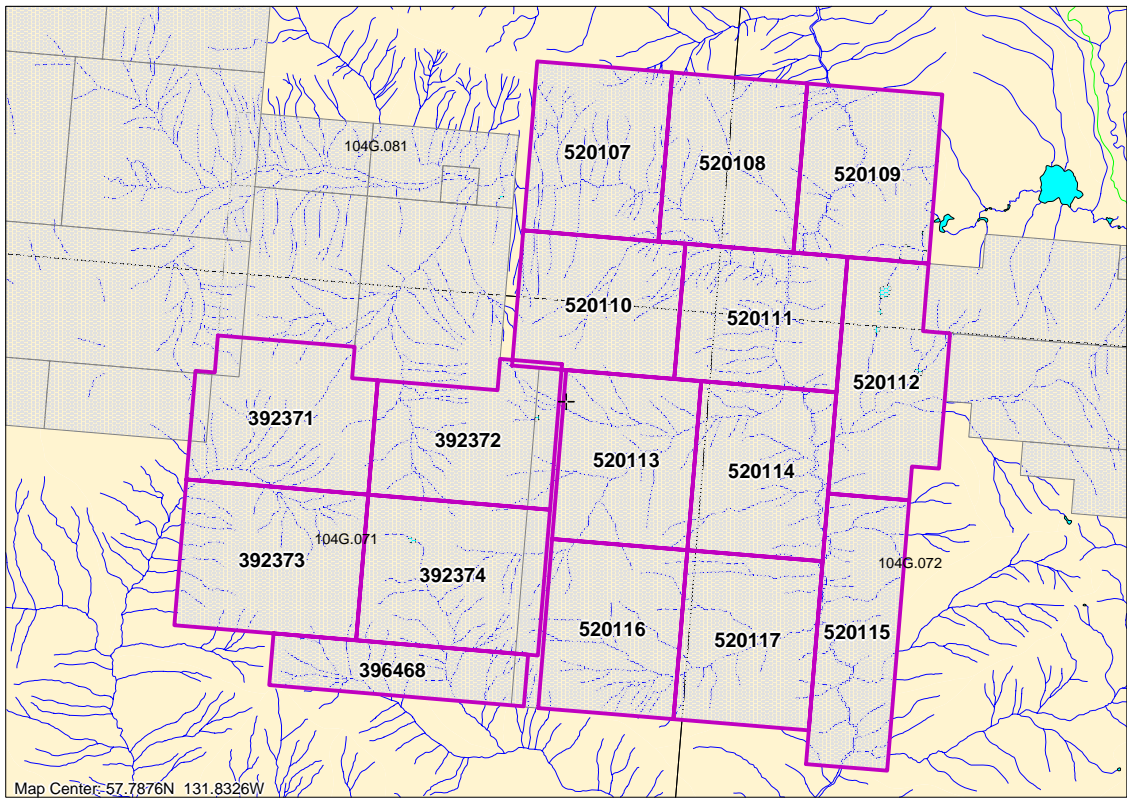
-  Railways 1:20K
-  Roads 1:20K
  -  Gravel Road
  -  Paved Road
  -  Rough Road
-  Lakes 1:20K
-  Rivers 1:20K

**Grid Layers**

-  Grid 1:20K - labels
-  Grid 1:20K - outline

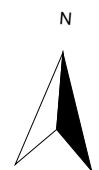
**BC Border Layers**

-  BC Border 1:50K



Map Center: -57.7876N 131.8326W

SCALE 1 : 103,516



# Mineral Titles Online Report

*Click on Tenure Numbers for more information.*

*Click column headings to sort results.*

[Download to Excel](#)

Tenure Number	Type	Claim Name	Good Until	Area (ha)
<a href="#">392371</a>	Mineral	TARGET 1	20070308	500
<a href="#">392372</a>	Mineral	TARGET 2	20080308	500
<a href="#">392373</a>	Mineral	TARGET 3	20070308	500
<a href="#">392374</a>	Mineral	TARGET 4	20080308	500
<a href="#">396468</a>	Mineral	TARGET 5	20070906	350
<a href="#">520107</a>	Mineral	TARGET6	20070917	430.925
<a href="#">520108</a>	Mineral		20070917	430.922
<a href="#">520109</a>	Mineral	TARGET 7	20070917	430.922
<a href="#">520110</a>	Mineral	TARGET 8	20070917	413.905
<a href="#">520111</a>	Mineral	TARGET 9	20070917	413.903
<a href="#">520112</a>	Mineral	TARGET 10	20070917	431.233
<a href="#">520113</a>	Mineral	TARGET 11	20070917	431.377
<a href="#">520114</a>	Mineral	TARGET 12	20080917	431.377
<a href="#">520115</a>	Mineral	TARGET 13	20070917	414.34
<a href="#">520116</a>	Mineral	TARGET 14	20070917	431.63
<a href="#">520117</a>	Mineral	TARGET 14	20070917	431.629

Total Area: 7042.163 ha

[LIBC Metadata](#)

[Mineral Title Online](#)

[BC Geological Survey](#)

[British Columbia Ministry of Energy, Mines and Petroleum Resources](#)



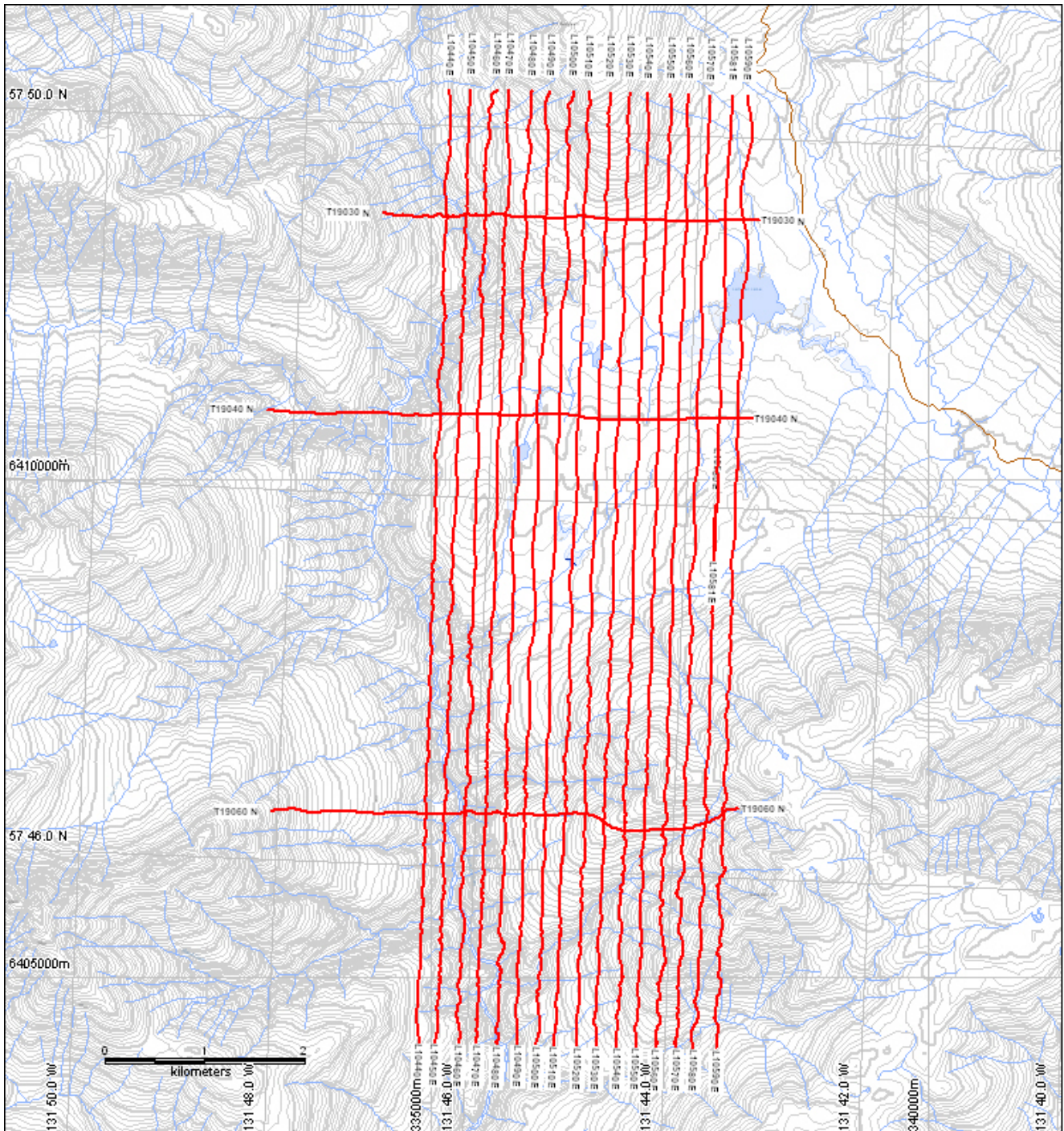


Figure 2. Target Area survey blocks showing planned flight path.

Figure 3. Target Area survey blocks showing surveyed flight path

#### 4. GEOLOGICAL SETTING (From Newcastle Minerals Press release, Sept 22, 2005)

The Target property “comprises 4,700 hectares underlain by sedimentary rocks and minor volcanic rocks belonging to the Upper Triassic Stuhini Group, which have been intruded by several monzonitic, monzodioritic and syenitic stocks, or dykes. Two types of exploration targets are present on the property – high-grade shear/vein gold deposits of the SNIP Mine-type, and large alkaline porphyry copper-gold deposits.

Previous exploration programs have identified numerous gold-silver showings, auriferous boulders and copper/gold soil geochemical anomalies throughout the property. Six main showings and a large, high-order gold-in-soil anomaly have been identified on the property. Regional geochemical surveys done by the British Columbia Geological Survey showed anomalous values for copper and gold in streams draining the property. Placer gold has been recovered from the main stream, which drains the eastern part of the property. The Late Triassic Limpoke Pluton underlays the northern part of the property and is its most important geological feature. The geological setting of the property is similar to that which hosts numerous porphyry copper-gold prospects within or adjacent to alkalic or sub-alkalic sub-volcanic intrusive complexes intruded into coeval volcanic and sedimentary rocks of late Triassic and early Jurassic age. This is the setting for several major copper-gold deposits and prospects in the Quesnel and Stikine Terranes throughout the length of British Columbia. Examples include Red Chris, Copper Canyon, Galore Creek, GJ and Kemess. The Red-Chris prospect has a resource in excess of 500 million tonnes at 0.35% copper and 0.47 grams per tonne gold, including a higher-grade core containing 120 million tonnes at 0.58% copper and 0.47 grams per tonne gold. The Galore Creek deposit – 70 kilometres to the southeast – hosts a resource of 284 million tonnes at 0.67% copper.”

### 5. SURVEY SPECIFICATIONS AND PROCEDURES

#### 5.1. Flight Path and Survey Coverage Specifications

The general survey flying specifications are summarised in the following table:

Survey / Map Area Name	Survey Block Name	Line Spacing (m)	Line/Tie Direction (azimuth)	Survey Coverage (line-km)	Date(s) Flown (2005)
Target Property	Target 2	200	0/90	169	October 19, 20, 23

The total survey coverage (169 km) was calculated by adding up the survey and control (tie) line lengths as presented in the final Geosoft database, after windowing the datasets to the survey block outlines. Three control (tie) lines were flown perpendicular to the survey lines at a spacing of 200 m and 400

The nominal gradiometer bird terrain clearance was 40 m but was periodically higher or lower over due to mountainous terrain and the capability of the aircraft. Nominal survey speed over relatively flat terrain is 75 km/hr and is generally lower in rougher terrain. Scan rates for ancillary data acquisition is 0.05 second for the gradiometer. The 20 samples per second translates to a gradiometer reading about every 75 centimeters to 1.5 metres along the flight path. The gamma-ray spectrometer, radar altimeter, and GPS determined position were recorded at a 1 second sampling interval.

## **5.2. Navigation**

Navigation is carried out using a GPS receiver, an AGNAV2 system for navigation control. The Pico Envirotec acquisition system is used for GPS data recording. The x-y-z position of the aircraft, as reported by the GPS, is recorded at 0.2 second intervals. The system has a published accuracy of under 3 metres. A recent static ground test of the Mid-Tech WAAS GPS yielded a standard deviation in x and y of under 0.6 metres and for z under 1.5 metres over a two-hour period.

# **6. AIRCRAFT AND EQUIPMENT**

## **6.1. Aircraft**

A Eurocopter (Aerospatiale) AS350B2 "A-Star" helicopter - registration C-GBKV was used as survey platform. The helicopter was owned and operated by Pacific Western Helicopters, Prince George, BC. Installation of the gamma ray spectrometer and ancillary equipment was carried out by AeroQuest Limited at the Pacific Western helicopter base in Prince George. The aircraft was then ferried to the survey base (Iskut Motor Inn, Iskut BC). The gradiometer bird was transported to the survey base by truck and assembled. The survey aircraft was flown at a nominal terrain clearance of 55 m.





Figure 4. Survey helicopter C-GBKV (Pacific Western).

## 6.2. Magnetic Gradiometer System

The Aeroquest TRI-DIRECTIONAL magnetic gradiometer system employs four (4) GSMP-30<sup>a</sup> (optically pumped Potassium) sensors in a 3D sensor geometry (Figure 5). This allows for measurements of the total field, vertical gradient and horizontal gradients both along and cross lines. The magnetic data is collected at a rate of 20Hz, and recorded by a dedicated Windows-based computer. The specifications of this system are as follows:

- 0.001 nT/ $\sqrt{\text{Hz}}$  sensitivity
- +/- 0.1 nT absolute accuracy
- 5,000 nT/m gradient tolerance
- 10,000 - 125,000 nT dynamic range
- 10° to 80° and 100° to 170° orientation range
- Heading error less than 0.1 nT combined for sensor spins on all
- All orientations from 10° to 80° and 360° full rotation about axis
- 2 metre standoffs between axis and sensors





Figure 5. Magnetic Gradiometer Bird.



Figure 6. The gradiometer bird (A), and GPS antenna (B)

### 6.3. Airborne Gamma Ray Spectrometer (AGRS) System

The Aeroquest AGRS system consists of a GRS410 sensor pack (Figure 7), which is installed on the floor of the helicopter cabin and a acquisition system designed and manufactured by Pico Envirotec.

The system has 4 downward looking NaI crystals used as the main sensors and 1 upward looking crystal for monitoring non-geologic sources. The system features automatic peak detection and real-time calibration to ensure spectrum stability and a high quality final product. The full spectrum is recorded (256 or 512 channels) to allow for subsequent noise reduction processing such as NASVD. The data are processed to produce the standard IAGA ROI channels – Total Count, Potassium, Uranium and Thorium. The potassium, and equivalent uranium and thorium concentrations are also derived and ratios of these concentrations are computed to enhance the interpretation of the survey results.



Figure 7. Aeroquest AGRS system. A. AGRS Sensor (Crystal Pack), B. Data acquisition computer.

#### **6.4. Magnetometer Base Station**

An integrated GPS and magnetometer base station is set up to monitor and record the diurnal variations of the Earth's magnetic field. The sensor, GPS and magnetic, receiver/signal processor is a dedicated unit for purposes of instrument control and/or data display and recording. The unit uses a common recording reference using the GPS clock.

The base station was a Geometrics G858 optically pumped Caesium gas magnetometer coupled with a Garmin GPS18 GPS sensor. Data logging and magnetometer control was provided by the unit's internal software. The logging was configured to measure at 1.0 second intervals. Digital recording resolution was 0.01 nT. The sensor was placed on a tripod away from potential noise sources near the camp. A continuously updated profile plot of the magnetometer value is available for viewing on the unit's display.

#### **6.5. Radar Altimeter**

A Terra TRA 3500/TRI-30 radar altimeter is used to record terrain clearance. The antenna was mounted on the outside of the helicopter beneath the cockpit. Therefore, the recorded data reflect the height of the helicopter above the ground. The Terra altimeter has an altitude accuracy of +/- 1.5 metres.

#### **6.6. Video Tracking and Recording System**

A high resolution digital colour video camera is used to record the helicopter ground flight path along the survey lines. The video is recorded digitally and annotated with GPS position and time and can be used to verify ground positioning information and cultural causes of anomalous geophysical responses.

#### **6.7. GPS Navigation System**

The navigation system consists of an Ag-Nav Incorporated AG-NAV2 GPS navigation system comprising a PC-based acquisition system, navigation software, a deviation indicator in front of the aircraft pilot to direct the flight, a full screen display with controls in front of the operator, a Mid-Tech RX400p WAAS-enabled GPS receiver mounted on the instrument rack and an antenna mounted on the magnetometer bird. WAAS (Wide Area Augmentation System) consists of approximately 25 ground reference stations positioned across the United States that monitor GPS satellite data. Two master stations, located on the east and west coasts, collect data from the reference stations and create a GPS correction message. This correction accounts for GPS satellite orbit and clock drift plus signal delays caused by the atmosphere and ionosphere. The corrected differential message is then broadcast through one of two geostationary satellites, or satellites with a fixed position over the equator. The corrected position has a published accuracy of under 3 metres. A recent static ground test of the Mid-Tech WAAS GPS yielded a standard deviation in x and y of under 0.6 metres and for z under 1.5 metres over a two-hour period.

Survey co-ordinates are set up prior to the survey and the information is fed into the airborne navigation system. The co-ordinate system employed in the survey design was WGS84 [World] using the UTM zone 9N projection. The real-time differentially corrected GPS positional data was recorded by the RMS DGR-33 in geodetic coordinates (latitude and longitude using WGS84) at 0.2 s intervals.

## 7. PERSONNEL

The following AeroQuest personnel were involved in the project:

- Manager of Operations: Bert Simon
- Field Data Processor: Sean Scrivens
- Field Operator: Troy Will
- Data Interpretation and Reporting: Jonathan Rudd, Matthew Pozza, Marion Bishop

The survey pilot, Rick Clawson and AME, Bruce Gaines were employed directly by the helicopter operator – Pacific Western Helicopters Ltd.

## 8. DELIVERABLES

The report includes a set of three (3) 1:20,000 map plates. Each map plate contains two geophysical data products for a total of six (6) data products listed below:

### PLATE 1: Magnetic Data Products

- Left Panel: Coloured Total Magnetic Intensity (TMI) with line contours.
- Right Panel: Coloured 3-D Analytic Signal (3-D AS) with line contours.

### PLATE 2: Radiometric Data Products 1

- Left Panel: Coloured Potassium ground concentration (K) with line contours.
- Right Panel: Coloured equivalent Thorium to Potassium ratio (eTh/K).

### PLATE 3: Radiometric Data Products 2

- Left Panel: Coloured Total Count (TC) integrated with greyscale Landsat-7 scene.
- Right Panel: Coloured equivalent Uranium (eU) integrated with greyscale Landsat-7 scene.

All the maps show flight path trace and survey line numbers. Topographic line contours with a shaded background and lake/ river outlines are overlain for reference on all maps except the TC map. The TC data was mathematically integrated with a Landsat-7 scene and provides a detailed view of land features and the corresponding radiometric response. The magnetic-gradient data is presented as colour-shaded maps with superimposed line contours with a minimum contour interval of 0.05 nT/m.

The geophysical profile data is archived digitally in Geosoft GDB binary format databases. A description of the contents of the individual channels in the database can be found in Appendix 3. A copy of this digital data is archived at the Aeroquest head office in Milton.

## 9. DATA PROCESSING AND PRESENTATION

All in-field and post-field data processing was carried out using Aeroquest proprietary data processing software, and Geosoft Oasis montaj software. Maps were generated using a 48-inch wide Hewlett Packard 4000ps plotter.

### 9.1. Base Map

The geophysical maps accompanying this report are based on positioning in the NAD83 datum. The survey geodetic GPS positions have been projected using the Universal Transverse Mercator projection in Zone 9 north. A summary of the map datum and projection specifications is as follows:

- Datum: NAD83
- Ellipse major axis: 6378137m eccentricity: 0.08181919084
- Datum Shifts (x,y,z) : 0, 0, 0 metres
- Map Projection: Universal Transverse Mercator Zone 9 N
- Central Scale Factor: 0.9996
- False Easting, Northing: 500,000m, 0m

The base map contains topographic and land feature data derived from 1:20,000 For reference, the latitude and longitude in NAD83 are also noted on the maps. The skeletal topography that is overlain was supplied by the client. The shaded topographic background was produced from NASA SRTM data.

### 9.2. Flight Path & Terrain Clearance

The position of the survey helicopter was directed by use of the Global Positioning System (GPS). Positions were updated five times per second (5Hz) and expressed as WGS84 latitude and longitude calculated from the raw pseudo range derived from the C/A code signal. The instantaneous GPS flight path, after conversion to UTM co-ordinates, is drawn using linear interpolation between the x/y positions. The terrain clearance was maintained with reference to the radar altimeter.

### 9.3. Magnetic Gradient Data

Merging of the recorded magnetic data with the various recorded ancillary data was done post flight using the GPS time stamp as a reference. Prior to any leveling the magnetic data was subjected to a lag correction of -0.05 seconds and a spike removal filter. Then the magnetic gradients profile channels were produced (Vertical, Horizontal, and Total gradient) from the total-field sensor readings. The corrected profile data were interpolated on to a grid using a random grid technique (Minimum Curvature Gridding with tension) with a grid cell size of ¼ of the line spacing. The production of the total-field grid was carried out by first applying a correction for diurnal variations using the magnetic base station. and the intersections of the tie lines. No corrections for the regional reference field (IGRF) were applied.

## 9.4. Radiometric Data

### Equipment and General Adherence to IAEA Standards

Aeroquest Limited generally adopts the standards for airborne gamma-ray spectrometry (the radiometric method) as laid out in the IAEA Technical Report 323 – Airborne Gamma-Ray Spectrometry Surveying.

### Spectral Calibration

When calibrated (with thorium source about once a year) linearity of the each detector is measured and linearity correction coefficients are calculated. When operating in real time (collecting data), the linearity of each detector is mathematically corrected for each measurement. Individual detector tracking (tuning) and linearity correction provide better fit of the individual spectra that are being summed and therefore a sharper (better resolution) spectrum is obtained.

Calibration of the 5 detectors was carried out on April 27, 2005 as follows:

Crystal	S/N	Cs resolution (%)
1	SAM359	7.9
2	SAM358	8.4
3	SAM355	8.4
4	SAM357	8.4
5	SAM356	9.1

### Data Quality Assurance and Control

The spectrometer data are referenced to the other ancillary data sets using the Pico Envirotec data acquisition system (Figure 7). After each flight, preliminary ROI channels are generated and profiles are then plotted from the digital data to check for any missing data, spikes or data corrupted by other noise sources. Where necessary, the data are corrected or flagged for re-flight depending on the severity or duration of the noise.

### Dead-time Correction

Generally, the first data reduction step for radiometric data is dead-time correction. Because the GRS-10 dead time is virtually nil, this correction is only applied where the total count rates are extremely high. Dead-time correction is made to each window using the expression  $N=n/(1-T)$  where N is the corrected count; n is the raw recorded count; and T is the dead-time.

### Filtering to Prepare for Background Corrections

The radar altimeter data are filtered in order to ensure that no noise sources from the altimeter data are introduced to the radiometric data processing. The upward looking data are also filtered to improve the count statistics. A typical filter width ranges from 10 to 20s. In order to establish radon background levels from the upward-looking detector data, temporary heavily filtered upward and downward looking uranium and downward looking thorium data are utilized. The original unfiltered data are, of



course, retained. All filtering will be carried out in consultation with the Client Representative if requested by the Client.

### **Cosmic and Aircraft Background**

Cosmic and aircraft background expressions are determined for each spectral window as described in chapter 4 of the IAEA Technical Report 323. The general form of these expressions is  $N = a + bC$ , where  $N$  is the combined cosmic and aircraft background for each window;  $a$  is the aircraft background in the window;  $C$  is the cosmic channel count; and  $b$  is the cosmic stripping factor for the window.

The expressions are evaluated for each ROI window for each sample and used as a subtractive correction for the data.

### **Radon Background**

Correction of the data for variations in background due to radon is a multi-step process. First, test flights at various elevations over water are carried out in the field to establish the contribution of atmospheric radon to the ROI windows. A least squares analysis of the data from these test flights yields the constants for equations 4.9 to 4.12 (IAEA Report 323). Second, the response of the upward looking detector to radiation from the ground is established. Here a departure from the IAEA Report has been recommended by Grasty and Hovgaard (1996). The expression for the radon component in the downward looking uranium window is given by  $U_r = (u - a_1U - a_2T + a_2b_T - b_u)/(a_u - a_1 - a_2a_T)$  (see Eq. 4.3 – IAEA 323) where,  $U_r$  is the radon background detected in the downward  $U$  window;  $u$  is the measured count in the upward uranium window;  $U$  is the measured count in the downward uranium window;  $T$  is the measured count in the downward thorium window;  $a_1$ ,  $a_2$ ,  $a_u$  and  $a_T$  are proportionality factors; and  $b_u$  and  $b_T$  are constants determined experimentally. Using  $a_1$  or  $a_2$  (see above) in this equation will result in a good estimate of  $U_r$  permitting correction of the other ROI windows.

Survey altitude test data will be collected and used to establish atmospheric background and calibrate the upward and downward looking detector systems. Variations in count rates due to soil moisture content and altimeter variations can largely be overcome by a normalization procedure using the thorium count. The procedure correlates the thorium count to the uranium count assuming the contribution to each ROI from the ground is proportional.

### **Computation of Effective Height Above Ground Level**

Radar altimeter data are used in adjusting the stripping ratios for altitude and to carry out the height attenuation corrections. They are then converted to effective height ( $h_e$ ) at STP by the expression  $h_e = (h * 273.15)/(T + 273.15) * (P/1013)$ , where  $h$  is the observed radar altitude;  $T$  is the temperature in degrees C; and  $P$  is the barometric pressure in mbars

### **Compton Stripping Correction**

The stripping ratios  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $a$ ,  $b$  and  $g$  are determined during tests over calibration pads. The principal ratios  $a$ ,  $\beta$  and  $g$  should be adjusted for temperature, pressure and altitude (above ground) before stripping is carried out. These stripping ratios are used to remove the contribution in each of the three ROI windows from higher energy sources, leaving only the contribution from potassium, uranium and thorium.

### **Altitude Attenuation Correction**

The altitude attenuation correction corrects the data in each of the ROI windows for the effects of altitude. The count rates decrease exponentially with altitude and therefore the counts are corrected to a constant altimeter datum at the nominal survey height of 30m.

### **Apparent Radioelement Concentrations**

The corrected count rate data can be converted to estimate the ground concentrations of each of the three radioelements, potassium, uranium and thorium. The procedure assumes an infinite horizontal slab source geometry with a uniform radioelement concentration. The calculation assumes radioactive equilibrium in the U and Th decay series. Therefore the U and Th concentrations are assigned as equivalent concentrations using the nomenclature eU and eTh.

An estimate of the air absorbed dose rate can be made from the apparent concentrations, K%, eU ppm and eTh ppm.

### **Computation of Radioelement Ratios**

Standard ratioing of the three radioelements (eU/eTh, eU/K and eTh/K) can be carried out and presented in profile or plan map form. In order to ensure statistical confidence in generating these ratios, we generally take the following precautions:

- Reject all data point where the apparent potassium concentration is less than 0.25% as these measurements are likely taken over water.
- Carry out cumulative summing along the survey line of each radioelement, rejecting areas where the summation does not exceed a certain threshold value (usually 100 counts for both numerator and denominator).
- Compute the ratios using the cumulative sums.



## 10. RESULTS AND INTERPRETATION

The survey was successful in mapping the magnetic and radioelement response of the geology throughout the survey area. The following is a brief summary and interpretation of the results. For a detailed interpretation of the survey data please contact Aeroquest Limited.

### 10.1. Magnetic Response

The magnetic gradient data provide a high resolution map of the distribution of the magnetic mineral content of the survey area. The sources for anomalous magnetic responses are thought to be predominantly magnetite because of the relative abundance and strength of response (high magnetic susceptibility) of magnetite over other magnetic minerals such as pyrrhotite. The presented data can be used to interpret the location of geological contacts and other structural features such as faults and zones of magnetic alteration. The total magnetic intensity data (Map Sheet “Target MAG” – left panel) (Figure 8A) shows the magnetic response ranges from lows of approximately 56450 nT to highs of 59440 nT, which is a sizable dynamic range considering the size of the survey block. The total field map also shows several broad oblate magnetic highs in the central portion of the survey block which are interpreted as intrusive bodies. One of these anomalies is appears elongated east-west and curiously has a magnetic lineament paralleling the northern margin of the response. This lineament feature is interpreted as a remanently magnetized dyke, and may have a structural relation to the intrusion. Examination of the horizontal gradient map (not presented) shows that the dyke continues eastward to the boundary of the survey block, possibly plunging to depth.

The available magnetic gradient data was used in order to further investigate the magnetic responses in the area. The 3-D analytic signal (or *total magnetic gradient*) is presented in the right map panel on Plate 1 and in Figure 8B below. This form of magnetic gradient data provides an enhanced view of subtle magnetic variation in the near surface bedrock and also has the added advantage of placing magnetic highs directly over the sources (unlike total field data). The 3-D analytic signal map can be thought of as a map of magnetization in the ground and the result is independent of the inclination of the Earth’s magnetic field as well as remnant magnetized source- effects. The presented map also better defines discriminates magnetic targets and better defines the edges of the intrusive body centered at 336113E 6408095N. The feature appears more rounded than interpreted in the total-intensity map, but is still elongated East-West and has a strike length of just over 1 km. The analytic signal map also reveals a subtle magnetic fabric that trends northwest-southeast in the northern half of the survey block. This magnetic trend may identify the most recent faulting direction in the area. Several other smaller discrete magnetic sources are also clearly visible in the analytic signal map which were not as apparent in the total-field data.

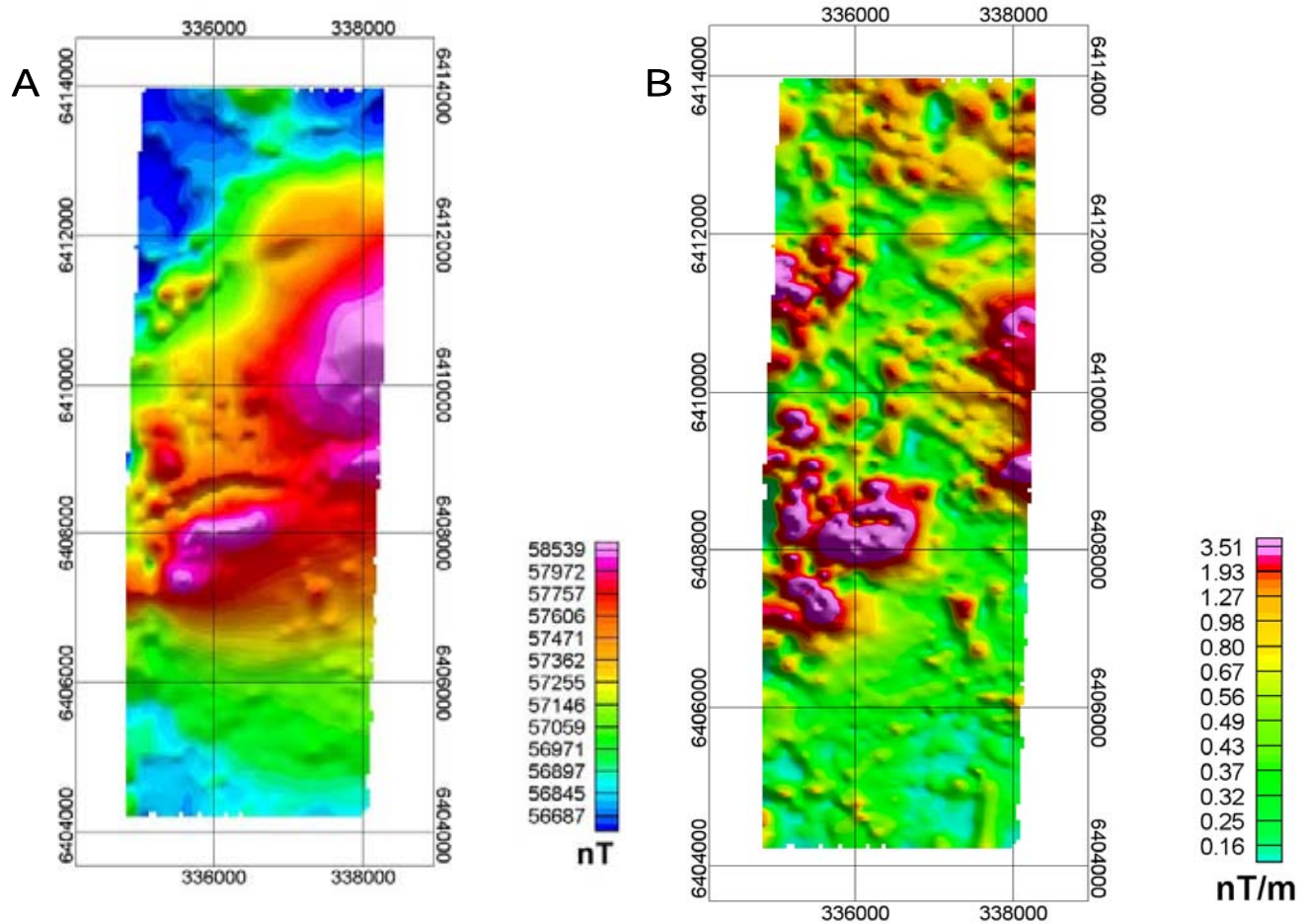


Figure 8. A. Total magnetic intensity map. B. 3-D analytic signal map (Total magnetic Gradient) showing enhancement of near-surface ground magnetization and subtle NW-SE trends.

## 10.2. Radiometric response

The radiometric data indicate the apparent concentrations of potassium, uranium, and thorium in the rocks and soils at the surface. Because these elements are concentrated in the Earth's silicate crust, their concentrations tend to vary for different lithologic materials. The radiometric data therefore provide information on the lithologic characteristics and distribution of the overlying geologic materials. The depth of measurement is on the order of 30 cm and the circular area measured by the spectrometer has a diameter equal to approximately four times the altitude of the helicopter above the ground.

The Total Count map (Plate 2- right panel) is presented as a composite image using a Landsat-7 satellite scene. This particular data product highlights the fact that higher radioactivity is generally observed near steep sloped drainage systems in the area. The anomalous highs may be reflecting concentrations of alluvial materials with relatively higher radioactivity than background. Another

possible interpretation is the steep slopes and incised valleys have thinner cover and have more exposed bedrock resulting in an elevated response.

The Potassium ground concentration (K) map, show elevated response along the western margin of the survey block. The K highs in this area seem to correlate with topographic highs, suggesting the response is sourced from the underlying or exposed bedrock in these areas. Unfortunately there is not any obvious spatial correlation of the anomalous K concentration to the magnetic responses discussed above.

The equivalent Uranium (eU) map (Plate 2, right panel) shows the area contains very little uranium near the surface. Small relative increases in the eU response is observed along steep sloping drainage systems in the western portion of the survey block. An anomalous eU response is observed on L10500 at approximately 6412000 northing. This response also occurs on a topographic high and is not particularly significant for gold exploration, however discrete nature of the response is worth noting.

Respectfully submitted,

Matt Pozza, M.Sc.  
Aeroquest Limited  
December, 2005

## APPENDIX 1 – SURVEY BLOCK CORNER COORDINATES

The approximate outline of the data collected for this project is defined in the following table. Positions are in NAD83 / UTM zone 9N.

Easting (m) Northing (m)

341379	6404150
344935	6404150
344935	6413973
341379	6413973

## APPENDIX 2 - Description of Database Fields

Due to the greatly different sample rates of the magnetic and radiometric data in the survey (20Hz vs. 1Hz) they are presented as separate databases for efficiency. In the database, the Survey lines and Tie Lines are prefixed with an "L" for "Line" and "T" for "Tie".

Database (05036\_Mag\_final.gdb):

Column	Units	Description
Fid		Geosoft fiducial
Line		Survey Line #
Flight		Helicopter Flight #
utctime	hh:mm:ss.s	UTC time
Distance	m	Distance from start of survey line
X	m	UTM Easting (NAD83)
Y	m	UTM Northing (NAD83)
ralt	m	radar altitude of aircraft
MagTf	nT	Top sensor magnetic field reading
MagAf	nT	Aft sensor magnetic field reading
MagLf	nT	Left sensor, magnetic field reading
MagRf	nT	Right sensor, magnetic field reading
Mag_AS	nT/m	3-D analytic signal (total magnetic gradient)
Mag_HG	nT/m	Horizontal magnetic gradient
Mag_VG	nT/m	Vertical magnetic gradient

Database (05036\_Spec\_final.gdb):

Column	Units	Description
Fid		Geosoft fiducial
Line		Survey Line #
Flight		Helicopter Flight #
utctime	hh:mm:ss.s	UTC time
Distance	m	Distance from start of survey line
X	m	UTM Easting (NAD83)
Y	m	UTM Northing (NAD83)
ralt	m	radar altitude of aircraft
Balt	m	Barometric altitude of the aircraft
Galt_m	m	GPS altitude of the aircraft
dtm	m	digital terrain model
BaroT_deg	°C	Barometric air temperature
TC	µR/hr	AGRS Total Count
eTh	ppm	equivalent Thorium
eU	ppm	equivalent Uranium
K	%	Potassium ground concentration
eTh_K_ratio		Ratio of eTh to K
eU_K_ratio		Ratio of eU to K
eU_eTh_ratio		Ratio of eU to eTh

# NEWCASTLE MINERALS LTD.

Suite 416, 108-800 Kelly Road  
Victoria, British Columbia  
Canada, V9B 6J9  
Tel. (250) 474-7999  
Fax (250) 474-7997

November 15, 2006

Ministry of Energy, Mines and Petroleum Resources  
Mineral Titles Branch

**Attention: Rick Conte, Director, Mineral Titles**

Room 300, 865 Hornby Street  
Vancouver, B.C. V6Z 2G3

Tel: 604 660-2672 Fax: 604 660-2653

Dear Sir:

**RE: YOUR LETTER DATED NOVEMBER 8, 2006, RECEIVED ON NOVEMBER 10, 2006 WITH RESPECT TO NEWCASTLE MINERALS LTD. SECTION 33 OF THE MINERAL TENURE ACT STATEMENT OF WORK NUMBERS 4068764 ASSESMENT REPORT NUMBER 28272**

In connection with the above noted, please find a detailed cost statement noted below, the report on cd and a copy of your letter.

## Costs

30% of minimum survey charges on signing of contract with Aeroquest Ltd.	\$8,400.00
Mobilization/Demobilization	\$12,000.00
100% of survey charges based on 1 day	\$28,000.00
Less Courtesy Discount	(\$1,682.24)
<b>Sub total</b>	<b>\$38,317.76</b>
<b>GST 7%</b>	<b>\$2682.24</b>
<b>Total</b>	<b>\$41,000.00</b>

We trust that you find all in order. If you have any questions, please feel free to contact the writer.

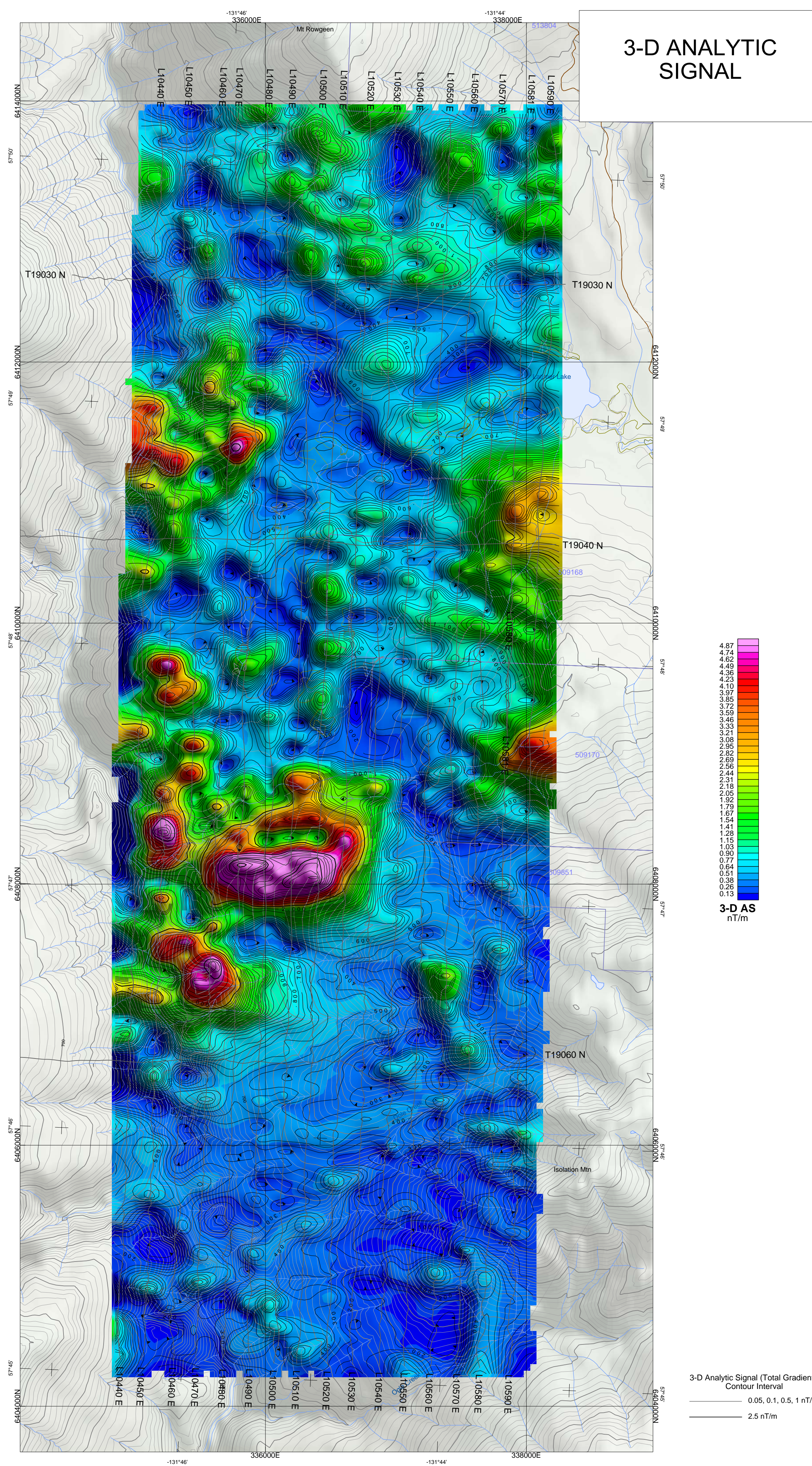
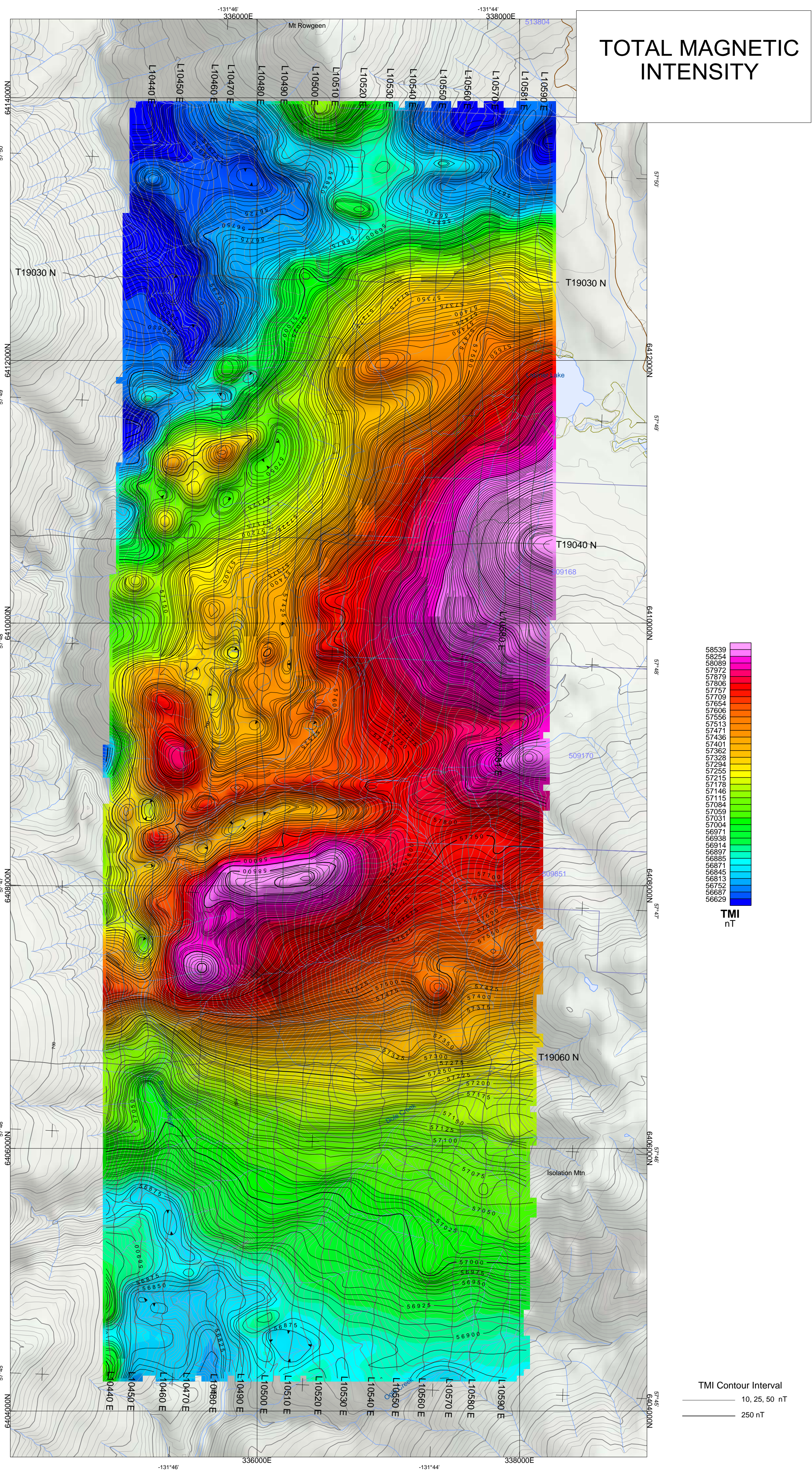
Yours very truly,  
NEWCASTLE MINERALS LTD.

Per

Kevin C. Whelan, President

cc. Allan Wilcox, Geological Survey Branch, Victoria  
5<sup>th</sup> Floor, 1810 Blanshard Street, Victoria, B.C. V8W 9N3

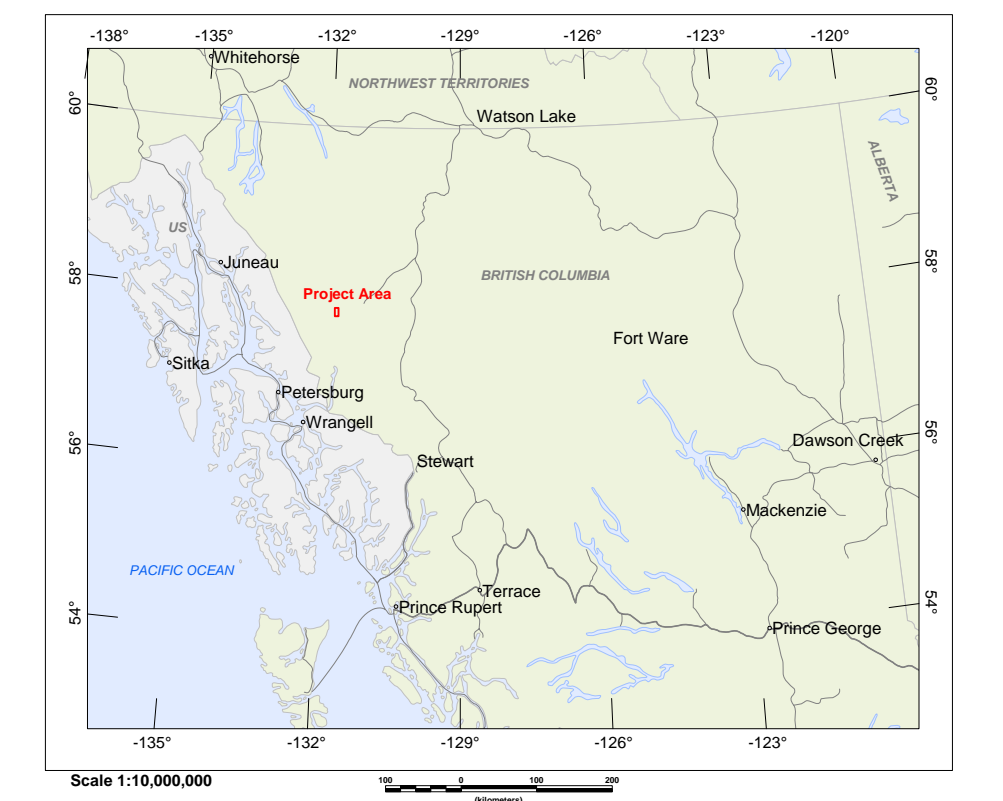




The topographic data base was supplied by the client  
Shaded background elevation from NASA SRTM data  
Inset data derived from Natural Resources Canada 'Atlas of Canada Base Maps'

This map accompanies the technical report entitled 'Report on a Helicopter-Borne Magnetic and Electromagnetic Survey, Target Property, Stewart Area, British Columbia, by Aeroquest Limited, December 2005'

Grid North  
NAD83-Zone9



**SURVEY SPECIFICATIONS:**  
Survey from: October 19, 20, 23, 2005  
Traverse line spacing: 200 metres  
Traverse line direction: N-S(2°)  
Nominal EM bird height: 30 metres  
Aircraft: Aerospatiale A-Star 350B2 (C-GBKV)

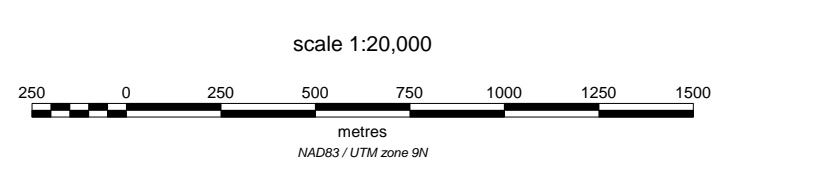
**INSTRUMENTATION:**  
Magnetic Gradiometer: 4 x GEM Systems GSMP-30 potassium vapour  
Sensor Configuration: Triaxial towed bird  
Sensitivity: 0.00 nT  
Gamma Ray Spectrometer: PicoEnvirotech AGIS GRS 10-S  
Downward looking crystals vol. -16.8L (1024ccu in)

**NAVIGATION:**  
Navigation: Differential Global Positioning System (DGPS)  
Navigation equipment: AGNAV with MID-TECH RX400p receiver  
Radar Altimeter: Terra TRA3000TRI-30

**DATA PROCESSING:**  
Magnetics: diurnal, teline and micro-leveling corrections

**POSITIONING**  
Datum: NAD83  
Major Axis: 6378137.000  
Eccentricity: 0.081819191

**MAP PROJECTION**  
Projection: Universal Transverse Mercator  
Central Meridian: 129°W (Zone 9)  
Central Scale Factor: 0.9996  
False Easting/Northing: 500,000m/0m



Newcastle Minerals Ltd.  
Stewart Area, British Columbia

## MAGNETIC DATA PRODUCTS

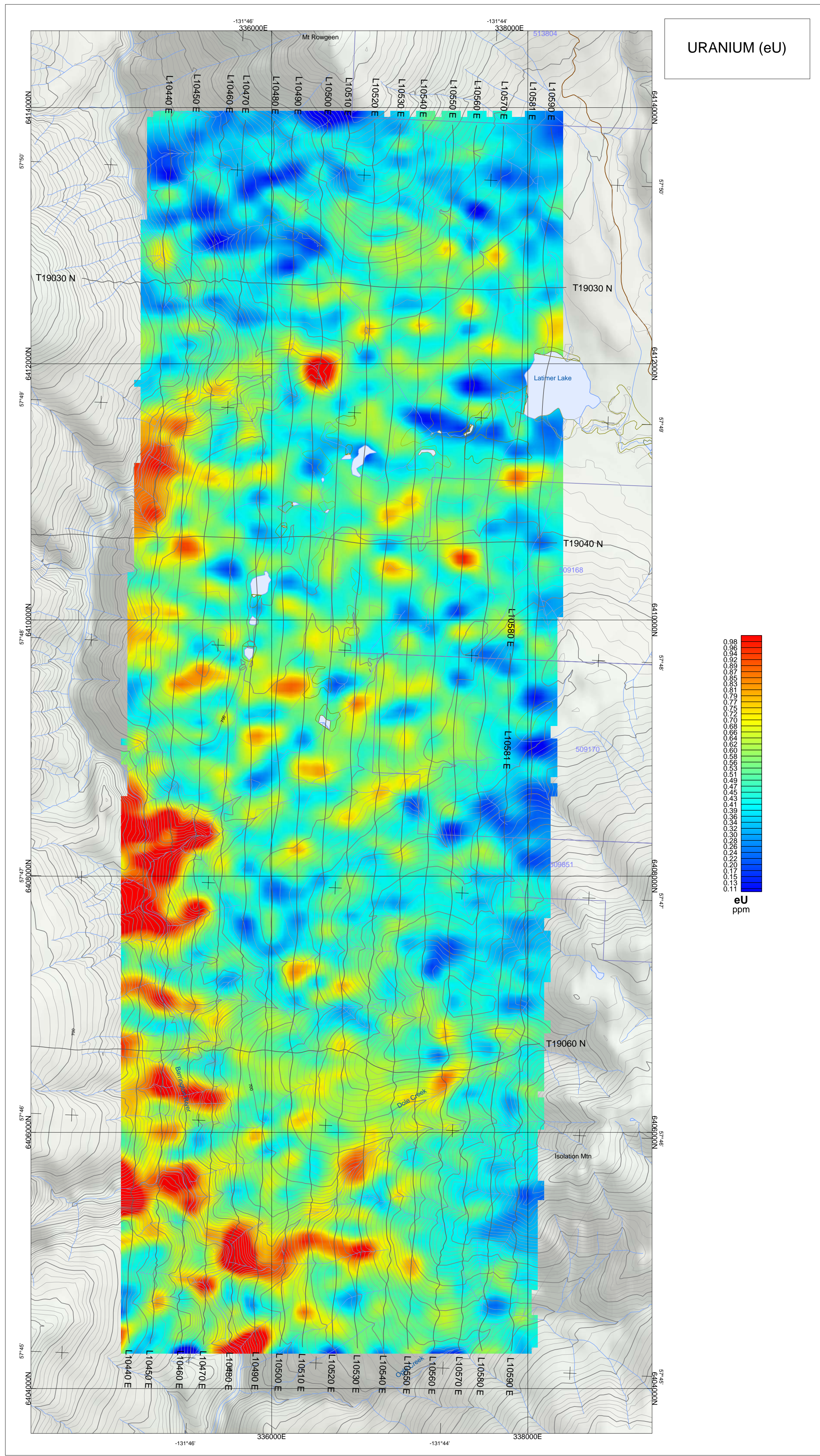
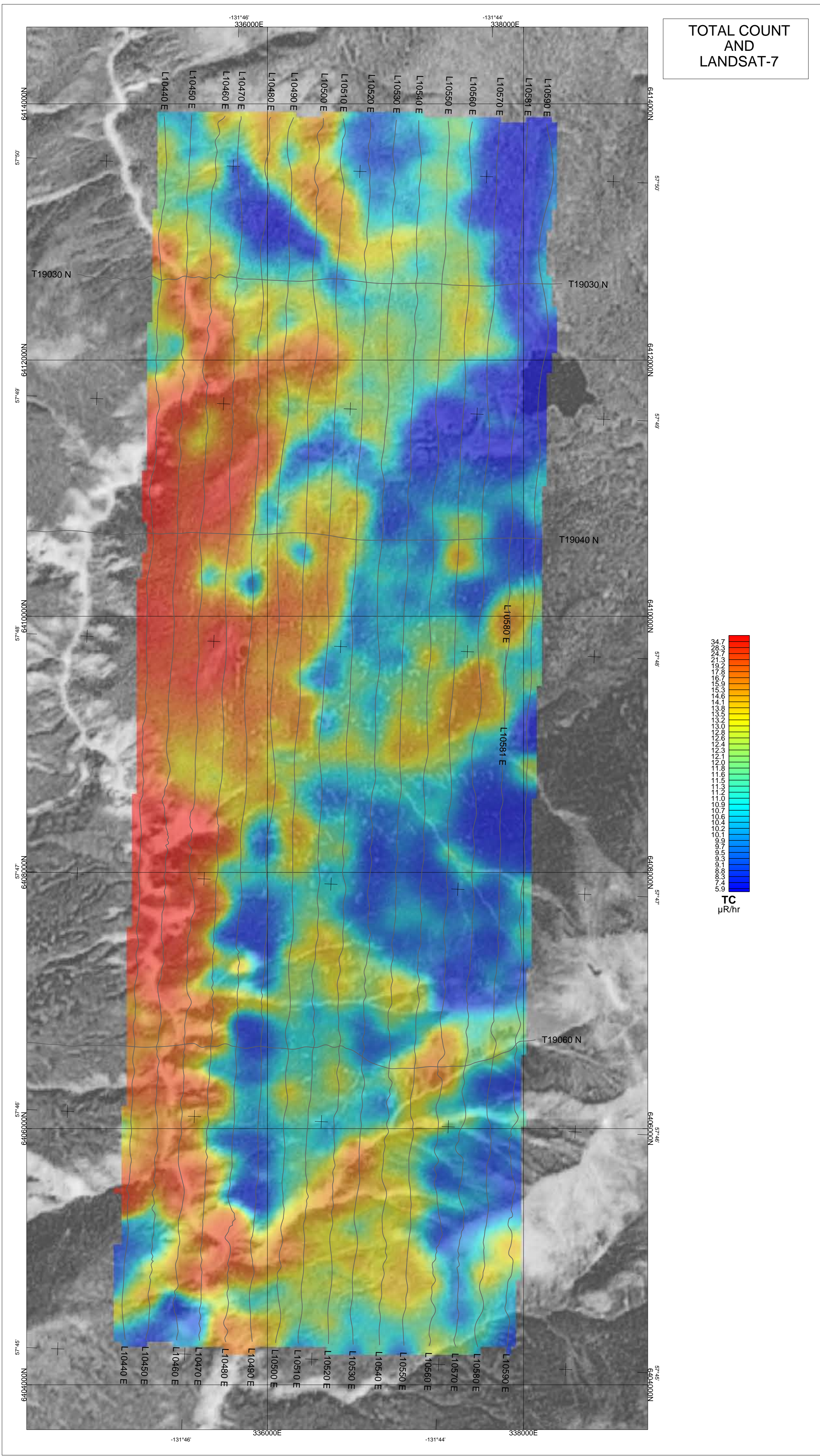
### Target Property

NTS 104G13

Survey flown by:  
**AEROQUEST LIMITED**  
4-845 Main St. East  
Mission, B.C., CANADA V2T 3Z3  
Tel: (604) 893-9128 Fax: (604) 893-9128  
www.aeroquestsurveys.com

December 2005

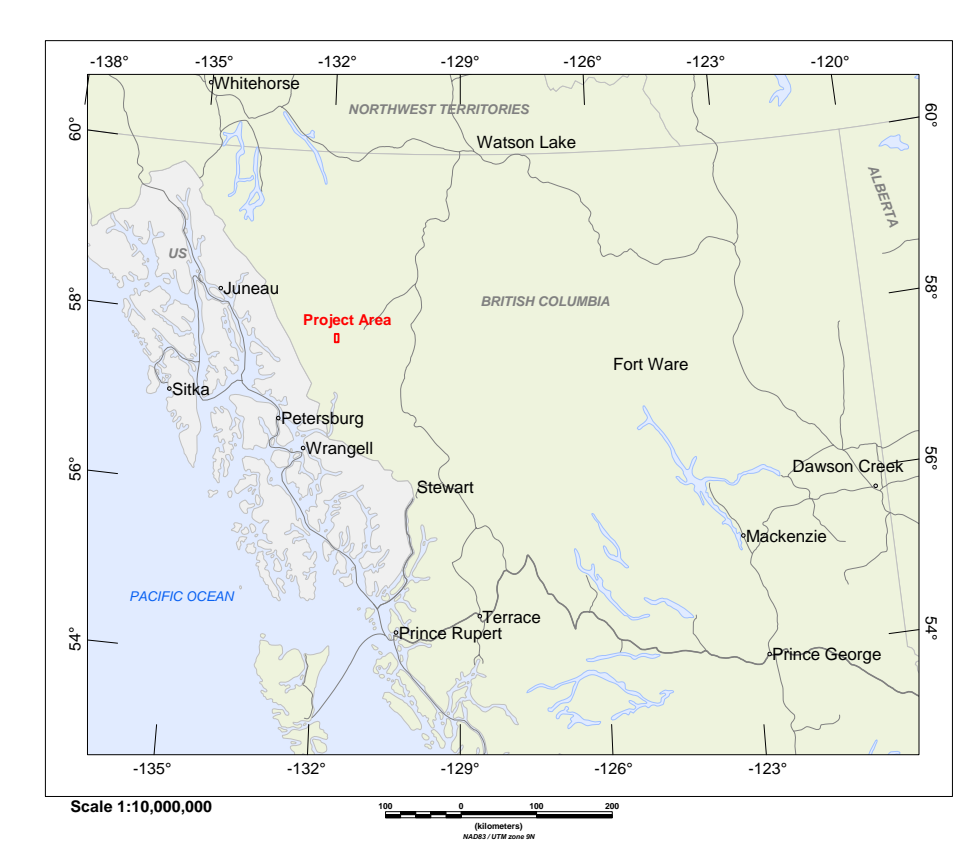




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Grid North  
NAD83-Zone9



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Traverse line spacing: 200 metres  
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Nominal EM bird height: 30 metres  
Aircraft: Aerospatiale A-Star 350B2 (C-GBKV)

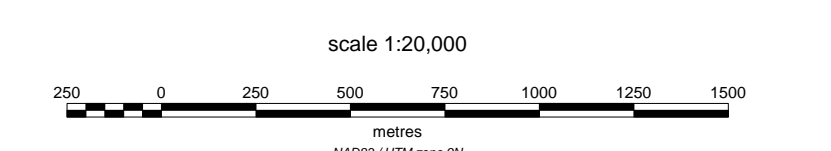
**INSTRUMENTATION:**  
Magnetic Gradiometer: 4 x GEM Systems GSMP-30 potassium vapour  
Sensor Configuration: Triaxial towed bird  
Sensitivity: 0.001nT  
Gamma Ray Spectrometer: PicoEnvirotech AGIS GRS 10-S  
Downward looking crystals vol. -16.8L (1024cu in)

**NAVIGATION:**  
Navigation: Differential Global Positioning System (DGPS)  
Navigation equipment: AGNAV with MID-TECH RX400p receiver  
Radar Altimeter: Terra TRA3000TRI-30

**DATA PROCESSING:**  
Magnetics: diurnal, teline and micro-leveling corrections

**POSITIONING**  
Datum: NAD83  
Major Axis: 6378137.000  
Eccentricity: 0.081819191

**MAP PROJECTION**  
Projection: Universal Transverse Mercator  
Central Meridian: 129°W (Zone 9)  
Central Scale Factor: 0.9996  
False Easting/Northing: 500,000m/0m



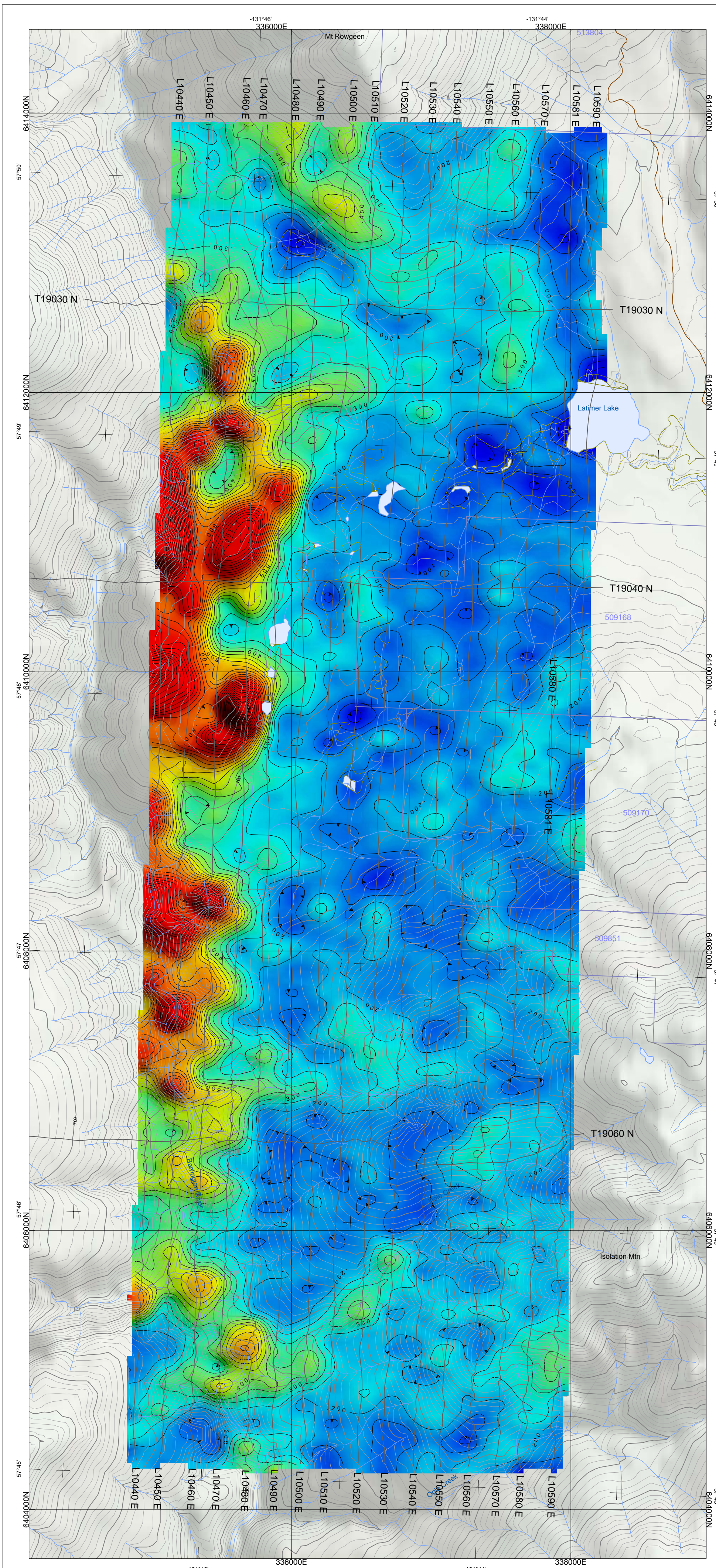
Newcastle Minerals Ltd.  
Stewart Area, British Columbia

**RADIOMETRICS DATA PRODUCTS 1**  
**Target Property**  
NTS 104G13

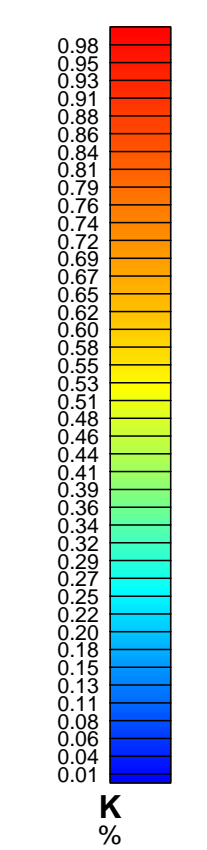
Survey flown by:  
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December 2005

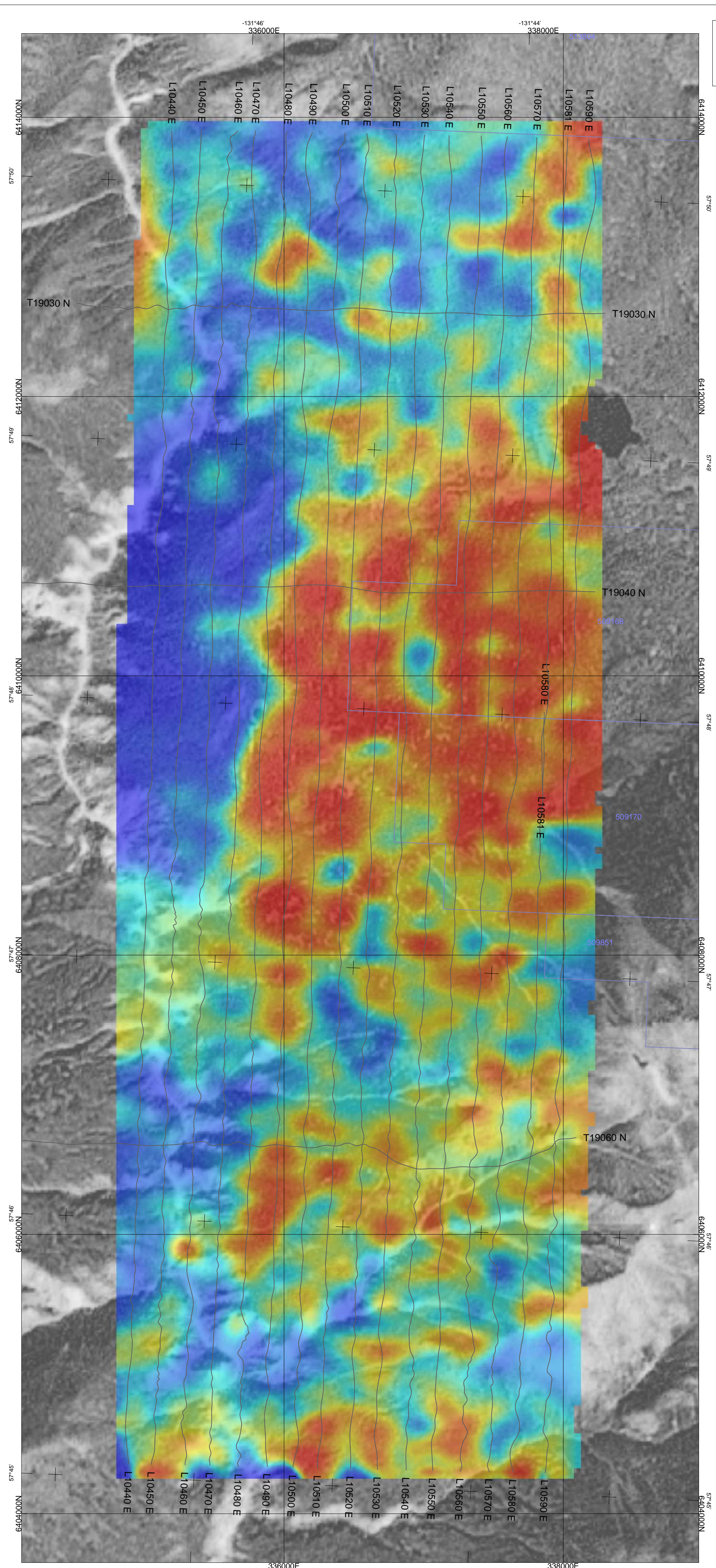




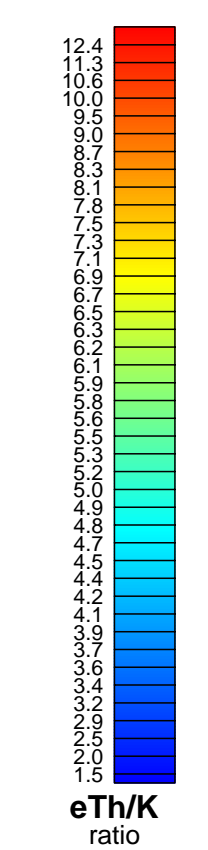
**POTASSIUM (K)  
GROUND  
CONCENTRATION**



K Contour Interval  
0.05, 0.1, 0.5 %



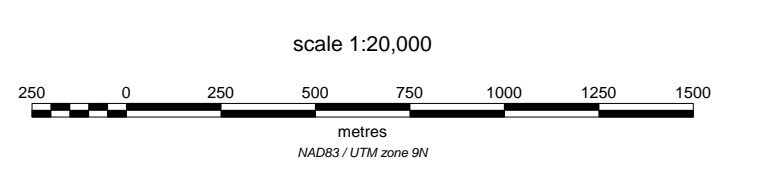
**THORIUM-  
POTASSIUM  
RATIO (eTh/K)**



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Shaded background elevation from NASA SRTM data  
Inset data derived from Natural Resources Canada 'Atlas of Canada Base Maps'  
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Central Scale Factor: 0.9996  
False Easting/Northing: 500,000m/0m



Newcastle Minerals Ltd.  
Stewart Area, British Columbia  
**RADIOMETRIC DATA  
PRODUCTS 2  
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NTS 104G13

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