

Ministry of Energy & Mines  
Energy & Minerals Division  
Geological Survey Branch

**ASSESSMENT REPORT  
TITLE PAGE AND SUMMARY**

TITLE OF REPORT [type of survey(s)] GEOPHYSICAL REPORT TOTAL COST \$5,691

AUTHOR(S) W. Gruenwald, R. Shives SIGNATURE(S) W. Gruenwald

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S) N/A YEAR OF WORK 2008

STATEMENT OF WORK - CASH PAYMENT EVENT NUMBER(S)/DATE(S) 4200126

PROPERTY NAME Antoine

CLAIM NAME(S) (on which work was done) 506371

COMMODITIES SOUGHT Cu, Au

MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN 093A-115, 093A-117

MINING DIVISION \_\_\_\_\_ NTS \_\_\_\_\_

LATITUDE \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ " LONGITUDE \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ " (at centre of work)

OWNER(S)

1) Warner Gruenwald 2) Roger MacInnis

MAILING ADDRESS

8055 Aspen Road Suite 690 - 800 W. Pender St  
Vernon, B.C. V1B 3M9 Vancouver, B.C. V6C 1L9

OPERATOR(S) [who paid for the work]

1) As above 2) As above

MAILING ADDRESS

PROPERTY GEOLOGY KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralization, size and attitude):

Triassic Takla Group volcanics, volcanoclastic & sedimentary trending NNW. Cut by  
NE & N to NNW faults. Dikes & small bodies of granitic (alkalic) rock in outcrop & drill  
core. Disseminated pyrite, chalcopigite and malachite in Takla volcanics over 5m x 7m

REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS # 14250, 27708

14339

TYPE OF WORK IN THIS REPORT	EXTENT OF WORK (IN METRIC UNITS)	ON WHICH CLAIMS	PROJECT COSTS APPORTIONED (incl. support)
<b>GEOLOGICAL (scale, area)</b>			
Ground, mapping _____			
Photo interpretation _____			
<b>GEOPHYSICAL (line-kilometres)</b>			
Ground			
Magnetic _____			
Electromagnetic _____			
Induced Polarization _____			
Radiometric _____			
Seismic _____			
Other _____			
Airborne <i>Gam X Inc. Analysis and Interpretation</i>		<i>506371</i>	<i>\$ 5,691</i>
<b>GEOCHEMICAL</b> (number of samples analysed for ...)			
Soil _____			
Silt _____			
Rock _____			
Other _____			
<b>DRILLING</b> (total metres; number of holes, size)			
Core _____			
Non-core _____			
<b>RELATED TECHNICAL</b>			
Sampling/assaying _____			
Petrographic _____			
Mineralographic _____			
Metallurgic _____			
<b>PROSPECTING (scale, area)</b> _____			
<b>PREPARATORY/PHYSICAL</b>			
Line/grid (kilometres) _____			
Topographic/Photogrammetric (scale, area) _____			
Legal surveys (scale, area) _____			
Road, local access (kilometres)/trail _____			
Trench (metres) _____			
Underground dev. (metres) _____			
Other _____			
			<b>TOTAL COST</b> <i>5,691</i>

**GEOPHYSICAL ASSESSMENT REPORT**

**On The**

**ANTOINE PROPERTY**

**Horsefly Area, British Columbia**

**Tenure No: 506371**

**52°23' NORTH LATITUDE 121°32' WEST LONGITUDE**

**Map No. 093A/03**

**Prepared By:**

**GEOQUEST CONSULTING LTD.**

**Vernon, B.C.**

**W. Gruenwald, P. Geo.**

**GAMX INC.**

**Ottawa, ON**

**R. Shives, B.Sc.**

**June 12, 2008**

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## 1.0 SUMMARY

*The Antoine property is situated in south-central British Columbia near the community of Horsefly, BC. It, covers 1755 hectares (17.5 km<sup>2</sup>) and is readily accessible from Horsefly, located approximately 15 kilometres by road to the southeast. Clear-cut logging activity has provided road access to several areas of the Antoine property. This report describes the Antoine property in the context of the 2003 Horsefly airborne geophysical survey and previous exploration programs.*

*Regional historic work dates back to the late 1800s during the search for placer gold spurred by the discovery of the Barkerville goldfields and smaller but significant gold placers along the Quesnel, Horsefly and Cottonwood Rivers. During the 1920s to 1930s placer gold was mined from Antoine Creek near the north boundary of the property. The late 1900s was marked by several exploration periods beginning in 1964 with the discovery of porphyry copper-gold deposits at Mt. Polley and followed in the 1980s by other porphyry type deposits along with the QR gold mine. Mt. Polley commenced production in the 1990s but shut down for a short time due to depressed metal prices. Newly discovered and higher-grade discoveries along with much improved metal prices allowed Imperial Metals to reopen the mine in 2005.*

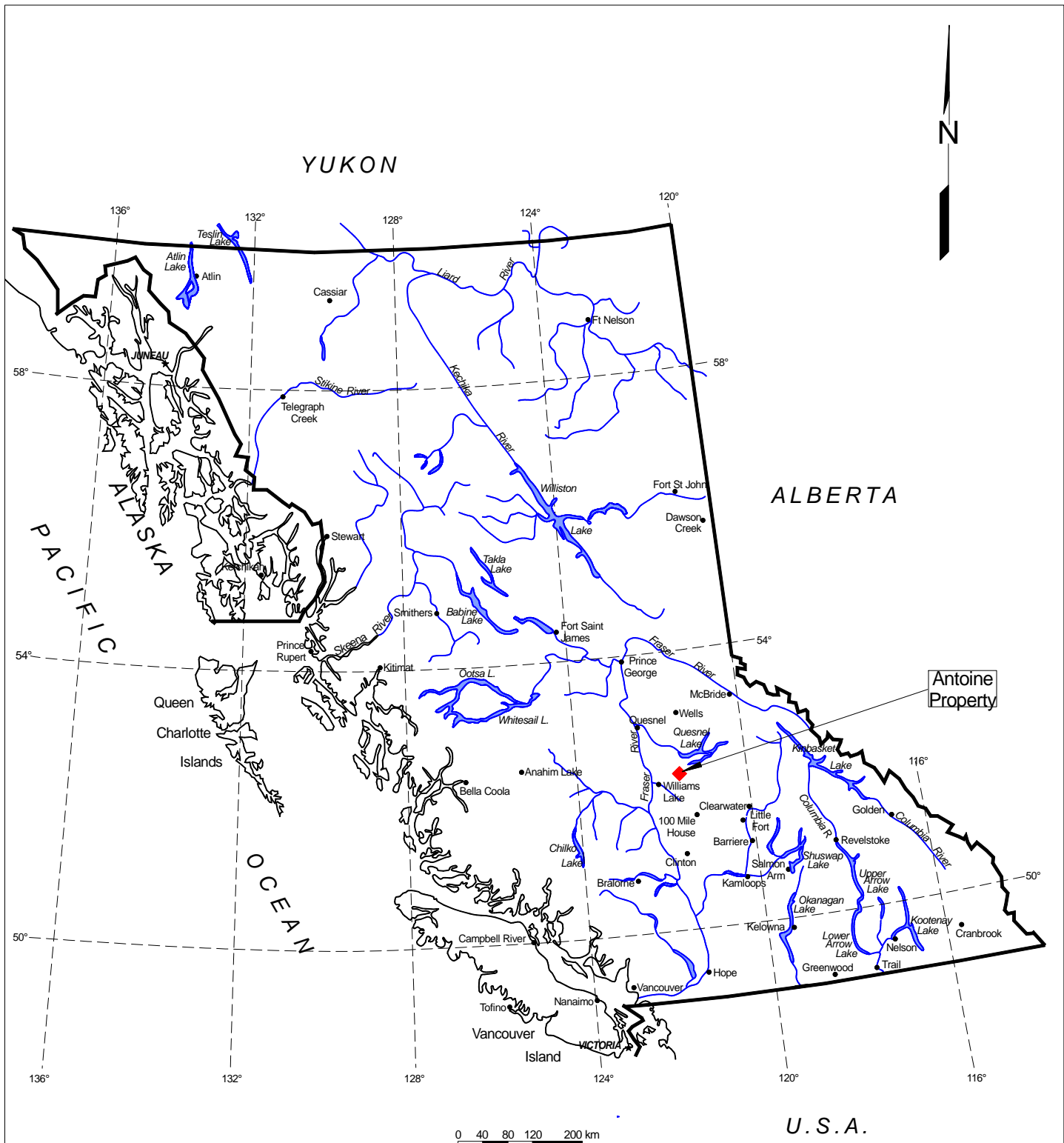
*In 1984-85 Asamera Inc. carried out geochemical and geophysical surveys (IP) and drilled five short diamond drill holes on the Antoine property. In 2004 Wave Exploration Corp. conducted a small program of grid based geochemical sampling. This work resulted in the delineation of three copper-in-soil anomalies and the discovery of copper mineralization in volcanic rocks.*

*Geologically the Antoine property is situated within a north-westerly trending, highly prospective belt of rocks known as the "Quesnel Trough" that hosts many of British Columbia's largest and most economically important alkalic and calc-alkalic copper ± gold porphyry deposits. These include among others the Afton-Ajax, Copper Mountain and Mount Polley mines. Major undeveloped copper-gold porphyry deposits include Mt Milligan (Terrane Metals), Kwanika (Serengeti) and Kemess North (Northgate Exploration).*

*The Antoine property is situated in a region containing numerous mineral occurrences including Fjordland's Woodjam copper-gold property located 20 kilometres to the southeast and Imperial Metal's Mt. Polley copper- gold mine located 18 kilometres to the north-northwest. Another notable exploration highlight in the region is the alkalic copper-gold discoveries at GWR Resources property northeast of Lac La Hache.*

*Mapping by the BC Geological Survey indicates the Antoine property is underlain by Triassic (Takla Group) volcanic and sedimentary rocks. No intrusive rocks are mapped however small bodies of granitic rocks were reported by Wave Exploration and several granitic dikes were reported in the Asamera drilling.*

*Mr. Rob Shives of GamX Inc. carried out a detailed review and interpretation of the Horsefly airborne geophysical patterns and historical exploration data within and around the Antoine property. This work resulted in the definition of prospective target areas that correlate well with the known copper soil anomalies and that are virtually unexplored. These target areas definitely warrant further exploration including geochemical and geophysical surveys along with prospecting, trenching and possibly drilling.*



W. GRUENWALD & R. MACINNIS

Location Map  
**ANTOINE PROPERTY**

Tech Work By: GEOQUEST  
 Drawn By: EG

Date: June, 2008  
 Figure: 1

To accompany a report by W. Gruenwald, P. Geo.

## 2.0 INTRODUCTION

### 2.1 General Statement

The dramatic rise in copper and gold prices, new airborne geophysical surveys and new discoveries has spurred exploration activity in British Columbia. The Antoine property is situated in the “Quesnel Trough”, a geologic belt that hosts numerous copper ± gold ± molybdenum porphyry and copper ± gold skarn occurrences. The property is strategically located within these favourable rocks between Imperial Metal’s Mt. Polley copper-gold mine and the porphyry copper-gold discoveries at Fjordland’s Woodjam property and GWR Resources Lac La Hache property.

### 2.2 Location and Access

The Antoine property is situated in the Cariboo region of south-central British Columbia approximately 12 km northwest of the community of Horsefly and 50 kilometers northeast of Williams Lake. The latter is situated along Highway 97, the main transportation route through the region (Figure 1).

Geographic co-ordinates for the centre of the property are 52°23' N latitude and 121°32' W longitude on NTS Map No. 93A/03. UTM co-ordinates (Nad 83) are 10U - 595900E and 5806000N on TRIM Map Nos. 093A/033, 043.

Access to the Antoine property from Horsefly is along the all-season gravel road following the Beaver River Valley a distance of 12 kilometers. Several well-maintained, seasonal 4X4 trails leave this road to the north 2 – 3 kilometres into various portions of the property.

### 2.3 Physiography, Vegetation and Climate

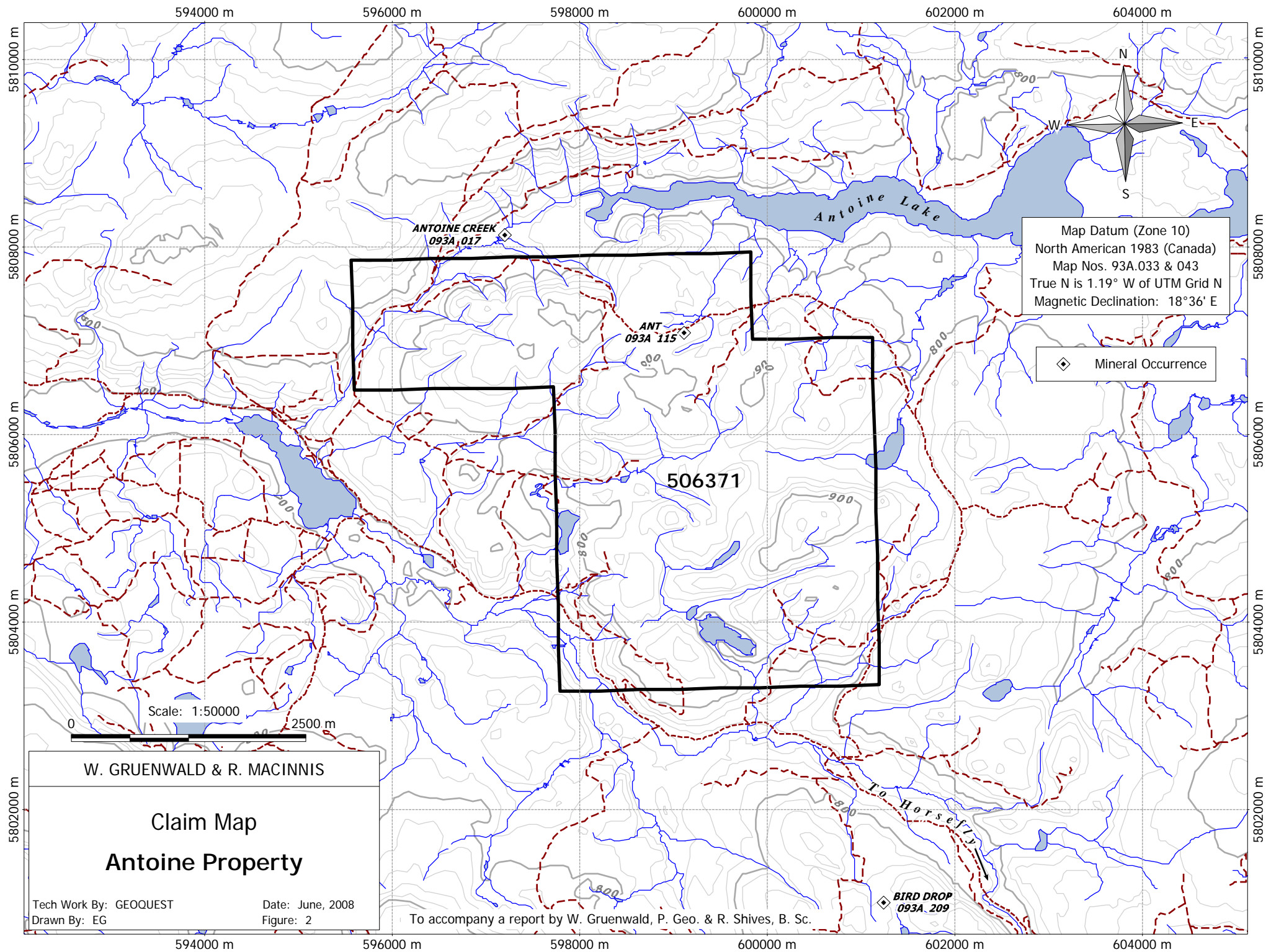
The property is characterized by broad, rolling glaciated terrain of the Interior Plateau. Surficial deposits of glaciofluvial till, sand and boulders cover most of the property. The thickness of these ranges from relatively thin on hills and ridge tops to several tens of metres in valley bottoms. Bedrock exposures are not common. Topographic relief is 150 metres ranging from 750 metres in the southwest corner of the property to 900 metres in the northwest corner (Figure 2). Locally steep knolls and bluffs ranging from 50 to 100 meters high are present.

Vegetation generally consists of pine and fir with eastern slopes sparsely covered with cedar and thick undergrowth. Clear-cut logging has taken place in many areas of the property over the past 20+ years. Thick secondary growth occurs in some of the older clear-cuts. In the region most of the mature and some of the replanted pine has died due to infestation by mountain pine beetle.

In British Columbia the Coast Mountains provide an effective barrier to the moist westerly air flow. East of this range on the Interior Plateau the climate is drier and more continental. Summers tend to be warm and dry with cooler and less moist winters.

### 2.4 Mineral Claims

The Antoine property consists of a single tenure (#506371) covering an area of 1755.7 hectares (Figure 2). The registered owners are Warner Gruenwald and Roger MacInnis who each hold a 50% interest in the property. The claim is in good standing until March 6, 2009. Mineral Titles Online (MTO) records indicate several placer claims in the northwest part of the property along the creek west of Antoine Lake.



Map Datum (Zone 10)  
North American 1983 (Canada)  
Map Nos. 93A.033 & 043  
True N is 1.19° W of UTM Grid N  
Magnetic Declination: 18°36' E

◆ Mineral Occurrence

Scale: 1:50000  
0 2500 m

W. GRUENWALD & R. MACINNIS

### Claim Map

## Antoine Property

Tech Work By: GEOQUEST      Date: June, 2008  
Drawn By: EG                      Figure: 2

To accompany a report by W. Gruenwald, P. Geo. & R. Shives, B. Sc.



## **2.5 History**

### **2.5.1 Regional History**

The mining history of the Horsefly area dates to the Cariboo gold-rush days of the 1850s with placer mining along the Quesnel and Horsefly Rivers. More recent exploration resulted in locating the bedrock sources of the placer deposits at Spanish Mountain near Likely and at Frasergold Creek and McKay River near the headwaters of the Horsefly River.

Toward the mid 1900s, exploration in the Quesnel Trough resulted in the discovery of several copper-gold deposits. In 1964 Mastodon-Highland Bell Mines Limited along with Leitch Gold Mines Limited discovered copper oxide deposits approximately 57 kilometres northeast of Williams Lake. This led to the formation of Cariboo-Bell Copper Mines Limited. The property was explored by a number of companies but eventually became the main property of Imperial Metals Corp. In 1992 Imperial received a mine development certificate from the B.C. Ministry of Energy, Mines and Petroleum Resources for a 13,700 tonnes-per-day open pit mine based on an initial 10-year mining reserve of 48,983,400 tonnes grading 0.38 per cent copper and 0.54 gram per tonne gold. Following a merger with Bethlehem Resources Corporation in 1995, Imperial completed an in-house feasibility study. Financing was arranged with Sumitomo Corporation through a joint venture with SC Minerals Canada that culminated in the formation of Mount Polley Mining Corporation (MPMC) in April 1996. The mine officially opened on September 13th, 1997 with ore planned to come first from the Cariboo and then the Bell and Springer pits. In September 2001 however mining and milling operations were suspended due to continued depressed copper and gold prices.

In 2003, Imperial Metals drilled four holes to test the potential below the unmined Springer zone. The first hole, which was vertical, was mineralized over its entire 466.3 metre length and averaged 0.61 per cent copper and 0.49 grams per tonne gold for the 267.5 metres it extended beneath the existing pit design depth. In March, 2005 the company reopened the Mount Polley as a 20,000 tonne per day operation. The Northeast Zone (Wight pit), a newly discovered high-grade zone was an integral part of the mine restart.

Several other copper and gold deposits were explored in the region during the late 1900s by Placer Development Ltd. including the Megabucks and Takom (Figure 3). In 1981 Dome Mines announced delineation of 950,000 tons grading 0.21 oz/ton gold at the QR deposit located southeast of Quesnel. In June, 1995 this deposit was put into production by Kinross Gold Corporation with an average milling rate of 1056 tonnes per day. In March, 1998 lower production and increased costs forced the cessation of mining. In April, 2004 Cross Lake Minerals Ltd. purchased the QR mine from Kinross Gold Corporation. With the increased gold price and discovery of new mineralized zones Cross Lake announced recommencement of mining operations on November 28, 2007.

The encouragement provided by the Mt. Polley and QR discoveries spurred exploration activity in the region. At least one other discovery, Eureka Resources' Frasergold deposit, was credited to this activity. Over the past few years Fjordland Resources Ltd. announced significant copper-gold drill intersections on their Woodjam situated 20 kilometres southeast of the Antoine property (Figure 3). Further south-southeast GWR Resources has discovered significant zones of alkalic porphyry copper-gold mineralization northeast of Lac La Hache.

### 2.5.2 Local History

A small gold placer occurrence (Minfile 093A 017) is documented near the northwestern corner of the Antoine property. Placer deposits were mined from 1929 to 1935 during which time approximately 12,000 grams of gold were reportedly produced. During the 1970s Hudson Bay Oil and Gas Co. Ltd. reportedly completed some reconnaissance geochemical sampling in and around the area of the Antoine property.

Assessment reports available through BC Minfile suggest little documented work occurred over the property prior to 1984, when Asamera began a one-year (May 1984 – February 1985) field program comprising line cutting, bedrock geological mapping, limited litho-geochemical sampling. The latter consisted of an initial multimedia geochemical orientation program, followed by “B” horizon soil sampling at 100-metre intervals along 200-metre spaced grid lines. In all, 449 soil, 44 humus, 52 rock and 8 panned concentrate sample were analyzed for Au, Cu and Mo. The company also conducted ground VLF and magnetic total field geophysical surveys. Results from this work produced a target featuring coincident soil copper and gold anomalies in an area with low magnetic signature and no outcrop. An induced polarization (IP) survey was subsequently completed over this target to define possible conductive zone(s). Despite ambiguous results, the IP was interpreted as three vertical lenses or a flat-lying, near-surface body such as a clay layer within the surficial sediments.

The geophysical-geochemical target was tested by five shallow NQ holes numbered as 85-1 to 85-5. Drill hole depths were 206, 101, 150, 102 and 120 metres for a total of 679 metres. All holes were inclined at -50° with four drilled towards the east (090°) and hole 85-5 drilled towards the west (270°). A total of only 76 split core samples were analyzed for gold only. Although minor pyrite mineralization was regarded as sufficient to explain the observed IP anomalies, propylitic alteration (chloritization, carbonatization) was weak and no anomalous gold values were reported. Asamera recommended no further work.

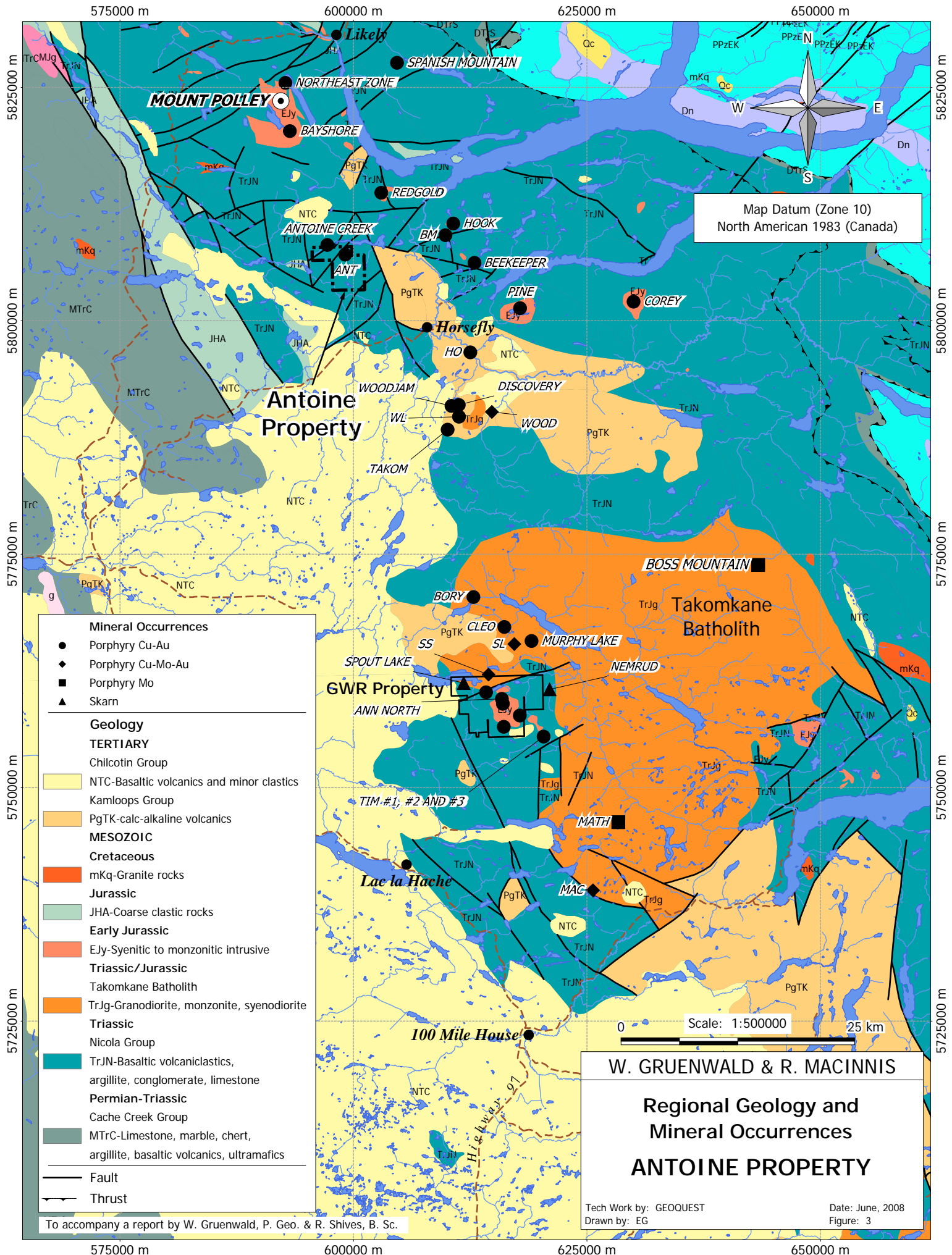
In 2004 Wave Exploration Corp. resumed work on the central part of the claims, with installation of a flagged grid, and collection of 321 B-horizon soil samples, analyzed for 36 elements by ICP-MS. Three anomalous areas were defined by copper values ranging up to 311 ppm in soil, but with insignificant gold values. One of these anomalies surrounded a new copper occurrence consisting of malachite on fractures with disseminated pyrite and chalcopyrite. A grab sample assayed 0.96% Cu. No bedrock copper sources were noted within the other two soil copper anomalies. A modest follow-up program was recommended comprised of soil sampling, bedrock mapping, prospecting, possible trenching and drilling if warranted.

The results from the Asamera and Wave work have been compiled into a single image, shown in Figure 5.

## 3.0 GEOLOGY

Regional geological descriptions are derived from British Columbia Geological Surveys (BCGS) Bulletin 97, Map 1 “Geology of the central Quesnel belt, British Columbia” (D.G. Bailey et al., 1996). Property-scale mapping by Asamera Inc. (AR # 14250, Forand and Hassell, 1984) is incorporated for additional, site-specific information.

In general, the property covers sedimentary, volcanic and volcanoclastic rocks ranging from Triassic to Cretaceous age (Figure 3). Although no intrusive rocks are noted in the regional mapping, Asamera reported a few narrow (<3 m wide) dikes and/or sills of hornblende bearing monzonites, generally east-west striking, located in the north central portion of the property. This appears to be in the vicinity of soil geochemical anomalies and is discussed



below. Assessment report #AR 27708 (Kerr, 2005) stated “*at least two small alkalic stocks have been identified on the property, one associated with a copper prospect. These stocks are mapped at approximately 100 meter diameters each, however the full outcrop extent has never been identified*”.

BCGS mapping indicates the northwestern corner of the property is underlain by **Unit 1** - dark grey and brown sandstone (pyroxene grain wacke), siltstone and shale, minor mafic tuff units. These are considered as sedimentary basin fill, back-arc or marginal basin deposits. Asamera described these as interbedded and interfingering siltstones, wackes and conglomerates with minor pyrite and carbonate.

**Unit 2a** in the southwest part of the property comprises green and grey pyroxene-phyric alkali olivine and aphanitic alkali basalt flows, breccias, minor pillow basalt, with interbedded mudstone and limestone breccias. Asamera geologists appear to have mapped a small portion of this unit (which they incorrectly interpreted as Tertiary basalt), along Antoine Creek at the western extremity of their work. They describe these rocks as dark grey, fine grained olivine basalt, locally vesicular, with buff brown weathering.

Immediately to the northeast, **Unit 2c**, is mapped as a northwest trending band of rocks that include polyolithic maroon and grey basaltic breccias with rare to absent felsic clasts, basaltic lithic tuff, and pyroxene-grain wacke. Where mapped by Asamera, these rocks are described as red-brown volcanic cobble conglomerate, with 2-10 cm subrounded to angular fragments forming up to 75% of the rock and that include intrusive clasts.

**Unit 2e** mapped as a similarly trending band of rocks northeast of Unit 2c comprises dark green and maroon analcite-bearing pyroxene basalt flows and breccias, with crystal and lithic tuffs, locally.

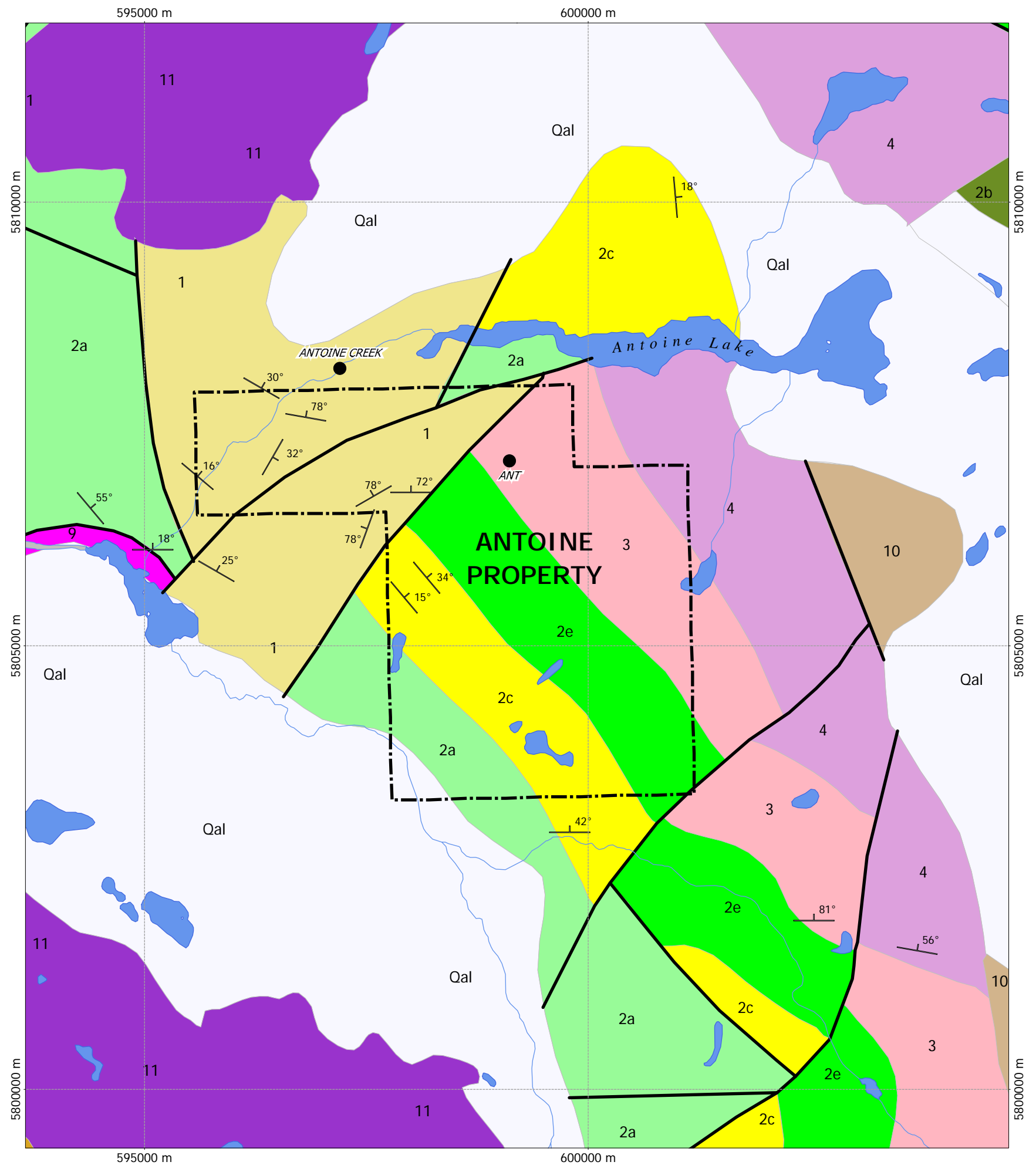
**Unit 3** underlies the northeast part of the property and comprises Jurassic polyolithic felsic breccias and feldspathic sediments and volcanoclastic rocks, flows and flow-dome complexes.

**Unit 4** in the extreme northeast corner of the Antoine property includes maroon amygdaloidal and vesicular, analcite-bearing olivine pyroxene basalt breccias and flows.

BCGS mapping indicates that the bedding of the volcanic-sedimentary rocks range from 15° to 78°. Unit 2c is gently dipping to the northeast but Units 1 and 2a display highly varied attitudes. The possibly dominant faulting strikes to the northeast with cross-faulting indicated at north to north-north-west orientations.

Pleistocene to Recent, unconsolidated glacial, fluvio-glacial gravel, sand, silt and clay (**Unit Qa1**) are mapped regionally across the southwestern tip of the property, but Asamera noted a general lack of bedrock exposure over their grid, which covered approximately the northern 1/3 portion of the current Antoine property. As with much of this region glacial debris or overburden is extensive but not always thick. Ridges and hilltops often have thin to non-existent overburden while in valley bottoms and lakes it may be up to several tens of metres thick.

The glacial history of the property and surrounding area is uncertain. However, BCDM Bulletin 38 (Sutherland-Brown) covering the Antler Creek area approximately 80 kilometres north of Antoine states: “*The glacial history of the region is not well known beyond the fact that a mountain ice-sheet covered the entire area at least once, and, although the ice must have been almost static, some movement occurred to the southwest. Larger movements undoubtedly occurred beyond the map-area in deep valleys such as those of the Cariboo River and Quesnel Lake, down which the ice appears to have moved to the southwest and then swung round to the northwest along the*



**SEDIMENTARY AND VOLCANIC ROCKS**

**PLEISTOCENE-RECENT**

Qal Unconsolidated glacial, fluvio-glacial sediments (gravel, sand, silt and clay)

**TERTIARY**

**MIOCENE (may include some younger)**  
 11 Maroon and grey vesicular alkali olivine basalt flows, breccia

**EOCENE**  
 10 Grey, mauve trachyandesite, trachyte, latite flows, breccia ash flow tuffs, tuff

**CRETACEOUS**

9 Grey polymictic cobble conglomerate; dark grey mudstone, sandstone and conglomerate (fining-up sequences); distinctive orange weathering carbonate matrix

**JURASSIC**

**AALENIAN**  
 6 Grey and maroon polyolithic cobble and pebble conglomerate; shale, siltstone, sandstone, minor redbeds

**PLIENSCHACHIAN?**  
 4 Maroon amygdaloidal and vesicular, analcite-bearing olivine pyroxene basalt breccias and flows

**SINEMURIAN-PLIENSCHACHIAN**  
 3 Polyolithic breccias. Coarse to medium-grained plagioclase pyroxene basaltic to intermediate, feldspathic ("felsic") volcanoclastic rocks, flows, flow-dome complexes. Top of unit has conglomerate, sandstone and limestone beds

**TRIASSIC**

**CARNIAN-NORIAN**  
 2e Dark green and maroon analcite-bearing pyroxene basalt flows and breccia, locally crystal and lithic tuffs

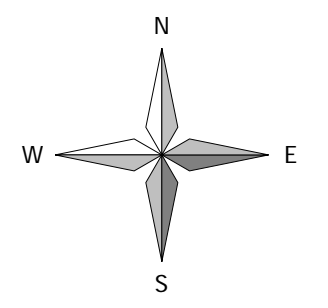
2c Polyolithic maroon and grey basaltic breccia with rare to absent felsic clasts; basaltic lithic tuff, pyroxene grain wacke

2b Maroon and grey pyroxene-pyric and plagioclase microlite alkali basalt flows, breccia, minor maroon and dark green basaltic lithic tuff, and sandstone

2a Green and grey pyroxene-phyric alkali olivine and aphanitic alkali basalt flows, breccia, minor pillow basalt; interbedded mudstone, limestone breccia

**ANISIAN-CARNIAN**  
 1 Dark grey and brown sandstone (pyroxene grain wacke), siltstone, shale; micaceous, phylitic rocks in the eastern map area. Minor mafic tuffaceous units

- Bedding
- Fault
- Mineral Occurrence



Map Datum (Zone 10)  
 North American 1983 (Canada)  
 Map Nos. 93A.033 & 043  
 True N is 1.19° W of UTM Grid N  
 Magnetic Declination: 18°36' E

Scale: 1:50,000  
 0 2500 m

W. GRUENWALD & R. MACINNIS

**Property Geology and Mineral Occurrences  
 ANTOINE PROPERTY**

Tech Work by: GEOQUEST Date: June, 2008  
 Drawn by: EG Figure: 4

After GSB Bulletin 97

To accompany a report by W. Gruenwald, P. Geo. & R. Shives, B. Sc.

*Quesnel River and out into the "lowlands." The glacial history ended, as it may have begun, with a stage of valley glaciers. Glaciation has modified the topography of the area only slightly."*

#### 4.0 MINERALIZATION

One mineral occurrence, the **Ant** (Minfile 093A-115), is found within the Antoine property. Just north of the property, **Antoine Creek** (Minfile 093A-017) is a past-producing placer gold occurrence. The locations of these mineral occurrences are shown in Figures 4 and 5.

The Ant occurrence is located approximately one kilometre to the east of the area drilled by Asamera in 1985 and is described in Minfile database as *"underlain by poly lithologic breccias containing clasts of both felsic and mafic composition. These breccias have been intruded by a small syenodioritic complex which is probably made up of dikes rather than a discrete stock. Mineralization consists of minor amounts of pyrite and chalcopyrite which occurs as disseminations in both intrusive and volcanic rocks"*.

Reference is made to three additional copper occurrences in assessment report AR #27708 by Wave Exploration Corp., as malachite and chalcopyrite in Takla-hosted veins or siliceous volcanic rocks. Two of these are described as in the northwestern part of the property. The third occurrence is malachite staining in Takla volcanics over an area of 5 by 7 meters. Malachite mostly occurs on fracture faces it is also as disseminated blebs associated with oxidized pyrite and chalcopyrite throughout the rock. Alteration of this rock is very weak consisting mainly of chlorite. A grab sample from this outcrop assayed 0.96% copper. Only one of these showings appears coincident with one of three soil copper anomalies occurring within the easternmost anomaly defined by Wave.

The Antoine Creek placer occurrence is located approximately 800 metres northwest of the area drilled by Asamera, less than 200 metres north of and down-slope from the northern property boundary. BC Minfile records state that *"Data from the Cariboo mining district indicate that supergene leaching of gold dispersed within massive sulphides by Tertiary deep weathering followed by Cenozoic erosion is the most likely explanation for the occurrence of coarse gold nuggets in Quaternary sediments"* (Exploration in British Columbia 1989, page 147).

#### 5.0 AIRBORNE DATA INTERPRETATION

This section of the report was prepared by Mr. Rob Shives of GamX Inc. who has firsthand experience with this and many of the airborne geophysical surveys conducted in British Columbia. The relationships of the airborne patterns to previous work, geology, mineralization, geochemical anomalies within the Antoine property are described below. A series of supporting images are included in Appendix B. The conclusions and recommendations are based upon this interpretation.

##### 5.1 Overview

The airborne spectrometric technique provides estimates of the concentrations of K, U and Th determined using gamma ray radioactivity which emanates naturally from the top 30 cm of the earth's surface. Unlike magnetic field measurements, there is no significant depth penetration. Radiometric responses are directly affected by soil moisture variations, such that swampy low ground and lakes attenuate the signal, resulting in lowered responses in all three measured radioactive elements. To reduce or eliminate effects due to topographic variations, soil

moisture and several other factors, radioactive element ratios can be used to detect relative variations between the elements.

## 5.2 Observations

Inherently, variations in the radioactive element patterns must be related to the combined effects of bedrock lithologic signatures, subsequent alteration by hydrothermal activity and modification of that signal by surficial cover. In general terms, the influence of mapped bedrock stratigraphy within the Antoine property on both the airborne magnetic and radiometric patterns can be observed (see several images in Appendix B where the regional geology contacts have been overlain onto the airborne geophysical gridded data), despite the presence of an extensive and variably thick cover of Quaternary glacial and recent sediments. This provides some confidence that possible K alteration signatures within the bedrock may also be detected by the airborne sensors.

Where thicker Quaternary deposits have been mapped regionally, eU, eTh and especially K values are relatively low, in part reflecting lower, wet ground and less bedrock exposure. The lower K abundances are better illustrated on the Ternary map, where lower K relative to both eU and eTh produces greenish hues over the quaternary deposits. This pattern can be used to predict areas likely to be covered with thicker till or glaciofluvial deposits, and these appear to lie predominantly outside the Antoine property boundary. The magnetic patterns are not affected significantly by the presence or absence of the Quaternary deposits.

Within the mapped volcanic/sedimentary stratigraphy which crosses the Antoine property, Units 2c and 2e appear characterized by relatively lower eTh and relatively higher K than the other bedrock Units. More specifically, the eastern portion of unit 2c appears lower in eTh and higher in K than the western part of the same mapped unit. This "elevated" K trend cuts across the northern end of mapped Unit 2e and into the western side of Unit 3. Although some of this potassium could relate to lithological K variation (regional lithogeochemical analyses by Bailey et al from Unit 2e and subunits within Unit 3, 3b contain higher potassium values of 3.40, 3.44, 3.60 per cent K<sub>2</sub>O, respectively, which contrast with Unit 1a levels of 1.76% K<sub>2</sub>O), the cross-cutting distribution of the K and related eTh/K ratio patterns is not explained by this.

Aeromagnetic patterns indicate a strong, unexplained magnetic high west of the property, but within the property boundaries, magnetic total field values are moderate and lower amplitude. Patterns on the calculated first vertical derivative (FVD) map again show correlation with stratigraphy and with mapped fault structures, where abrupt changes in magnetic signatures occur. This is most evident where the northern ends of magnetic features within Units 2a, 2c and 3 terminate across the NE trending fault located west of the Ant showing. The few reported intrusive rocks appear to correlate with magnetic lows but this cannot be confirmed with the sparse available data.

Agreement between the ground magnetic highs defined by Asamera and the airborne magnetic patterns is excellent. Although the airborne anomalies are moderate intensity, they provide flanking magnetic trends which characterize porphyry-related deposits elsewhere in this portion of the Quesnel Trough.

## 5.3 Discussion

The combined airborne magnetic and radiometric patterns over the Antoine property indicate the presence of conditions which satisfy the porphyry copper-gold exploration model established elsewhere in the Quesnel Trough namely moderate to high K coincident with low eTh/K ratio values and flanking magnetic total field responses. The resulting airborne anomaly can be delineated by the edge of the eTh/K low, and this covers approximately seven

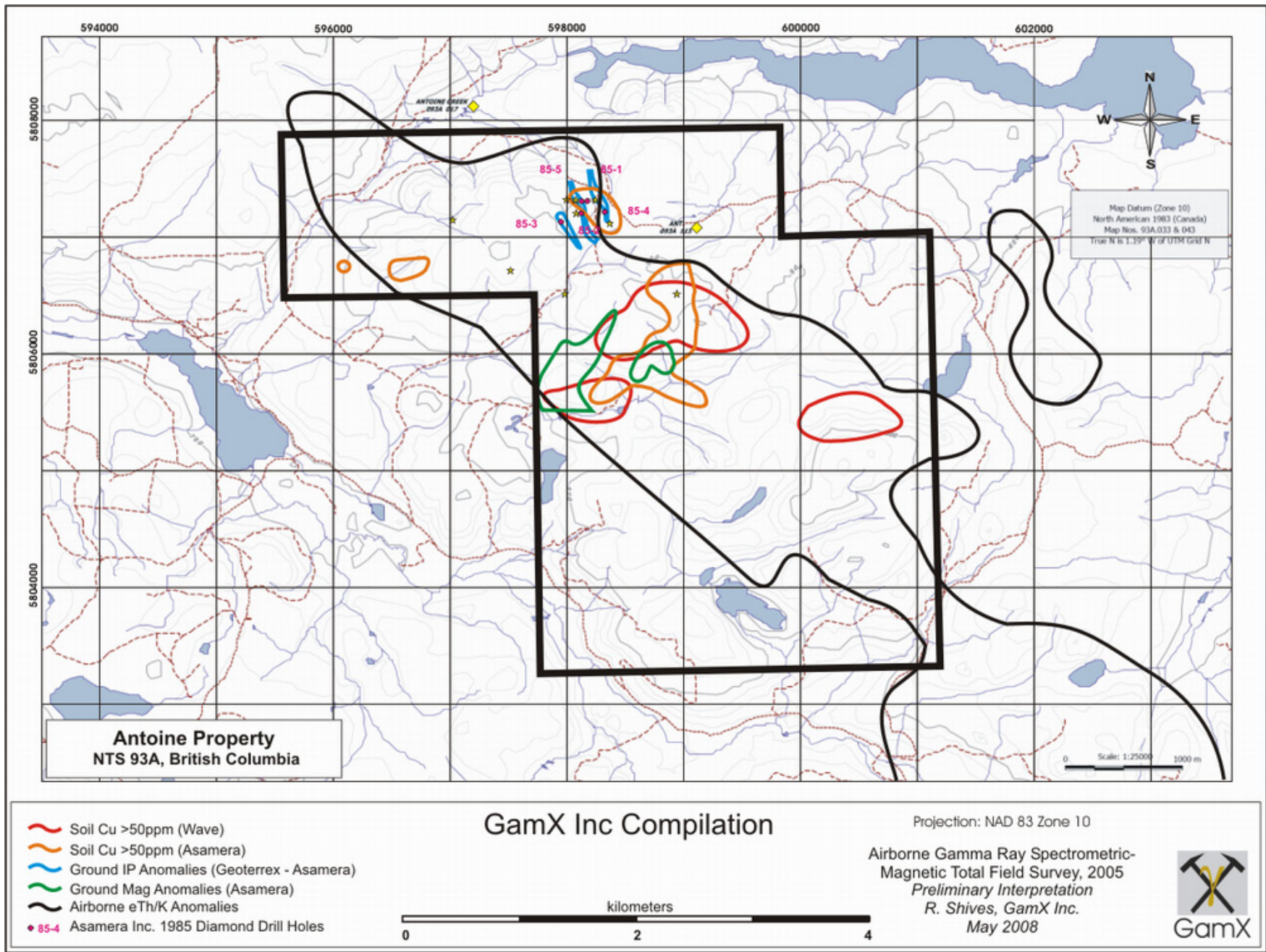


Figure 5 - Compilation Plan of Historical Exploration and Airborne Geophysical Data



square kilometers, forming a NW trending belt which crosses the property (Figure 5). Existing bedrock mineralization, copper and gold soil anomalies and the area drilled by Asamera all lie within the broadly defined anomaly boundary. However, internal variations can be used to define more focused areas on the eTh/K image, indicated by deeper blue regions in three subareas. Coincidence of these with the Wave and Asamera soil copper anomalies is excellent (both location and shapes) and this provides confidence that the airborne patterns provide possible exploration guidance, focusing additional work.

The presence of mineralized felsic intrusive rocks reported within the copper anomalies increases the potential for intrusion-related hydrothermal alteration and mineralization (porphyry-style copper  $\pm$  gold), perhaps related to smaller intrusive stocks or dikes/sills related to a possible deeper intrusion. The negative results obtained by Asamera occur in a less anomalous (airborne data) area which has weaker and smaller soil copper anomalies, well outside the more encouraging yet untested target areas defined to the south.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

Radioactive elements patterns and magnetic features derived from a regional 500-metre line spaced airborne survey flown in 2003 have been interpreted in relation to known geology, mineralization and soil geochemical anomalies produced during two brief exploration efforts within the Antoine property, near Horsefly, BC.

Correlation of airborne patterns with volcano-sedimentary bedrock and Quaternary geology is evident, but insufficient to explain low eTh/k and magnetic patterns which appear to cross geological contacts. A large central airborne anomaly coincides well with existing ground geophysical and geochemical anomalies, including copper-soil patterns defined by independent surveys. ***This newly defined airborne anomaly has not been tested.*** Ground work is recommended to search to for prospective rocks, alteration and new mineralization, through soil and rock sampling, prospecting, mapping, trenching and possible drilling.

### Recommendations

Additional ground work is definitely warranted and should be conducted as follows:

- Soil sampling at 50 m intervals along 200-metre spaced, east-west lines, to extend the existing Wave soil sampling grid south from UTM 5805000N and following diagonally along the low eTh/K anomaly right to the southeast corner of the property. Samples should be analyzed for Cu, Au and Mo.
- Prospecting and bedrock mapping should be extended across the property to confirm the few known occurrences and to search for new ones, with emphasis on eTh/K low areas. Evidence for possible blind, subcropping intrusions should be documented, to guide exploration efforts.
- Magnetic susceptibility measurements should be done on boulders and bedrock to help constrain and better explain the aeromagnetic patterns.
- In situ gamma ray spectrometry should be conducted to improve resolution of the radioactive element patterns and more importantly to determine the presence and degree of possible K alteration (vs. lithological K variation), within exposed bedrock, boulders and overburden.
- Depending on results from above, trenching and sampling should be done, with possible follow-up diamond drilling.

Submitted by,

W. Gruenwald, P.Geo.  
Geoquest Consulting Ltd.

R. Shives, B.Sc.  
GamX Inc.

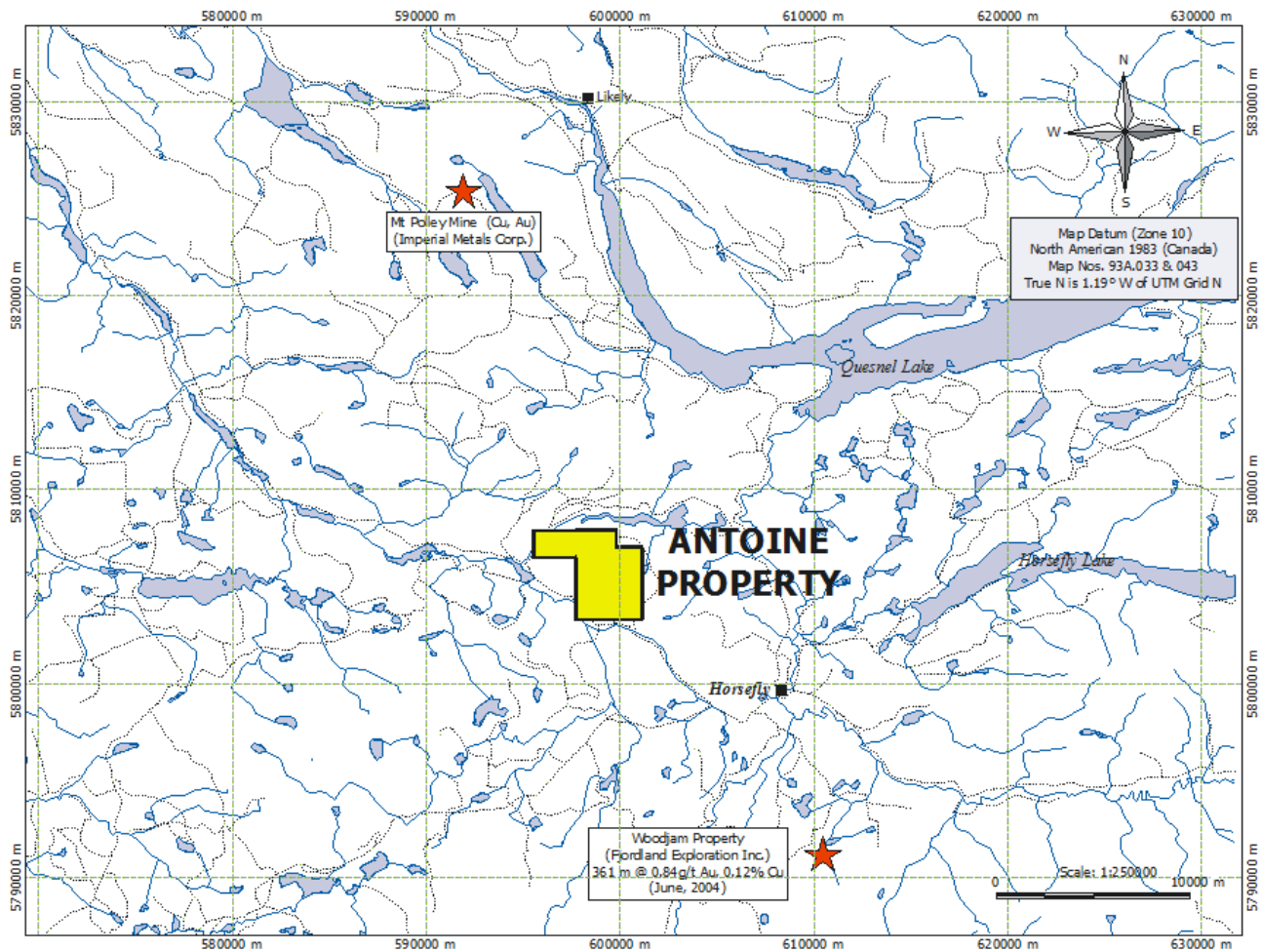
**APPENDIX A**

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**Geophysical Interpretation  
(R. Shives – GamX Inc.)**

Interpretation of Helicopterborne Gamma Ray Spectrometric  
and  
Magnetic Total Field Survey Data  
*Antoine Property*

Tenure # 506371 NTS 93A/5 British Columbia, Canada



Index map courtesy: Geoquest Consulting Ltd.

R. B. K. Shives  
Ottawa, May 2008



Gamma Ray Spectrometry for Exploration

# **Interpretation of Helicopterborne Gamma Ray Spectrometric and Magnetic Total Field Survey Data**

## ***Antoine Property***

### ***British Columbia***

#### **Summary**

Airborne magnetic total field and gamma ray spectrometric survey patterns over known porphyry copper-gold-(+/- molybdenum) deposits and occurrences throughout British Columbia's Quesnel Trough define a characteristic fingerprint. Coincident low-magnetic total field values (or local lows along the edges of magnetic total field highs) and low-eTh/K ratio values (with or without positive potassium anomalies) occur over prospects, deposits and producing mines in the Afton, Mount Polley, Mount Milligan, Kwanika, Lorraine and many other areas. These geophysical criteria have been used in combination with existing ground information to define new exploration targets within the Antoine Property, located approximately 10 km northwest of Horsefly, between the Woodjam and Mount Polley properties, British Columbia (refer to cover page figure). Further work is recommended.

#### **Introduction**

Airborne radioactivity surveys have been used worldwide for over 40 years to map the radioactive element concentrations in the upper 30 cm of the earth's surface. The resulting data has been applied to bedrock and surficial geological mapping, mineral exploration for a wide range of commodities and environmental radiation issues. In British Columbia the technique, in combination with aeromagnetic data, has proven particularly effective for detection and mapping of alteration associated with porphyry Cu-Au-(Mo) mineralization and related epithermal systems, throughout the Quesnel Trough.

In September, 2003 the Geological Survey of Canada contracted Fugro Airborne Surveys Limited, Toronto, to conduct a high sensitivity helicopterborne geophysical survey of the Horsefly area in British Columbia. Funding was provided by the British Columbia and Yukon Chamber of Mines "Rocks to Riches" Program. A portion of this survey covers the Antoine Property.

#### **Airborne Survey**

Flight lines were oriented 045 degrees and spaced at 500 m intervals. Tie lines, required for magnetic leveling, were oriented 135 degrees and spaced at 4000 m intervals.

Geophysical sensors were flown at 135 m nominal terrain clearance, using an Aerospatial AStar AS350B-2 helicopter (registration C-FZTA) flown at a nominal speed of 90 kilometers per hour (Figure 1). Magnetic data were sampled at ten times per second (equivalent to 1 reading every 2.5 m along the ground) and the spectrometric data were sampled once per second (every 25 m along the ground).

**Figure 1**

*Helicopter used to complete the airborne survey over the Antoine Property area.*



Sensors included a bird-mounted 0.01 nT sensitivity split-beam cesium vapour magnetometer suspended 25 m below the helicopter (Figure 1) , and a 256 channel Exploranium GR820 gamma ray spectrometer using 33.4 liters downward-looking sodium iodide detectors, carried onboard (Figure 2). A 4.2 liter upward-looking NaI detector provided radon monitoring. The system was calibrated pre-survey under GSC supervision to national standards, using calibration pads and a local hover test site. A complete description of the survey logistics, instrumentation, procedures and data corrections is provided in a separate report by Fugro, available from GSC-Radiation Geophysics Section, Ottawa. All data were released in 2004 as a series of 20 paper colour maps (GSC Open File 4615 at 1:50,000 scale and GSC Open File 4616 at 1:250,000 scale). Additional products included colour images in PDF format, available on MapPlace.ca, and digital line data available at no cost from GSC Ottawa.

**Figure 2**

*The cesium vapour magnetometer was carried in a towed bird (foreground) suspended 25m below the aircraft, which was flown at nominal terrain clearance of 135 m*

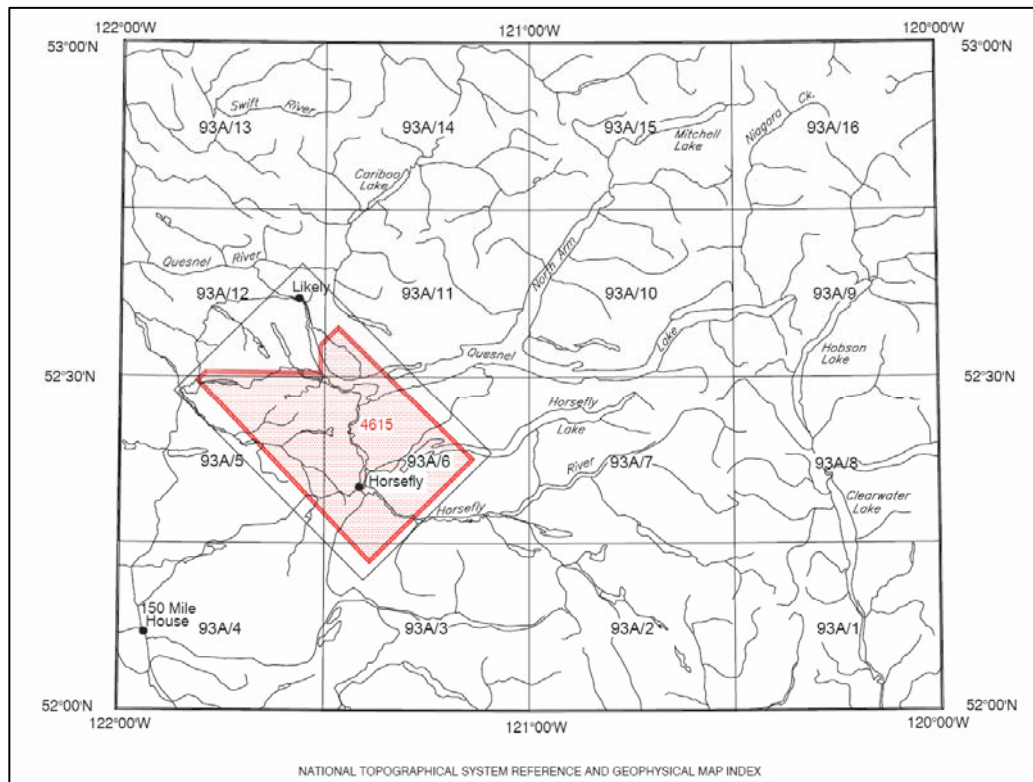


**Figure 3**

An Exploranium GR820 256 channel gamma ray spectrometer received signals from 33.4 l NaI detectors (a 2-pack system) carried on board (Note one of the orange packs shown).



The Horsefly survey covered parts of four 1:50,000 NTS sheets (NTS 93 A/3, 5, 6, 11) including 100% coverage of the Antoine Property located NW of Horsefly, and adjoining areas in all directions (Figure 4).



**Figure 4:** Horsefly Survey location, NTS sheets

The purpose of this report is to describe the airborne survey patterns over the Antoine area, their relationship to known geology, mineralization, geochemical results, historical work, and to indicate suggested targets for additional field investigation. Full interpretation requires examination of nine airborne data layers: potassium (K), equivalent uranium (eU), equivalent thorium (eTh), the ratios equivalent uranium/equivalent thorium (RUT), equivalent uranium/potassium (RUK), equivalent thorium/potassium (RTK), ternary (K-eU-eTh) map, residual magnetic total field (RTF) and calculated first vertical derivative of the magnetic field (FVD).

This work has been completed by Mr. Robert B. K. Shives, President, GamX Inc., Mountain, Ontario at the request of Mr. W. Gruenwald, Geoquest Consulting Ltd., Vernon, BC. To support this interpretation, Geoquest has provided the author with base images. Additional information has been derived from various assessment reports available through Mapplace.ca (AR15250A, AR15250B, AR14250C, AR14339, AR27708).

### **Method**

Map images from all information sources were layered using CorelDraw v.11 (non-geographic, manual assembly) into a single file. Numerous derived images were exported in Portable Network Graphic (\*.png) format to support description of the airborne patterns and their spatial relationship to ground information. A total of 33 colour map images have been created for the Antoine Property. The CorelDraw file and all derived images are included on the CD which accompanies this report. Smaller versions (reduced resolution) of nine of these colour images are included in Appendix 1, accompanying this report. Colour-scales for the airborne geophysical data images are not provided in the images, as the absolute values are less important than the relative variations within and between the variables. For absolute data values the reader may consult the published maps, images or digital grid/line data provided through Mapplace.ca.



**APPENDIX B**

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**Airborne Geophysical Plans  
(R. Shives – GamX Inc.)**

## COMPILED AIRBORNE DATA IMAGES

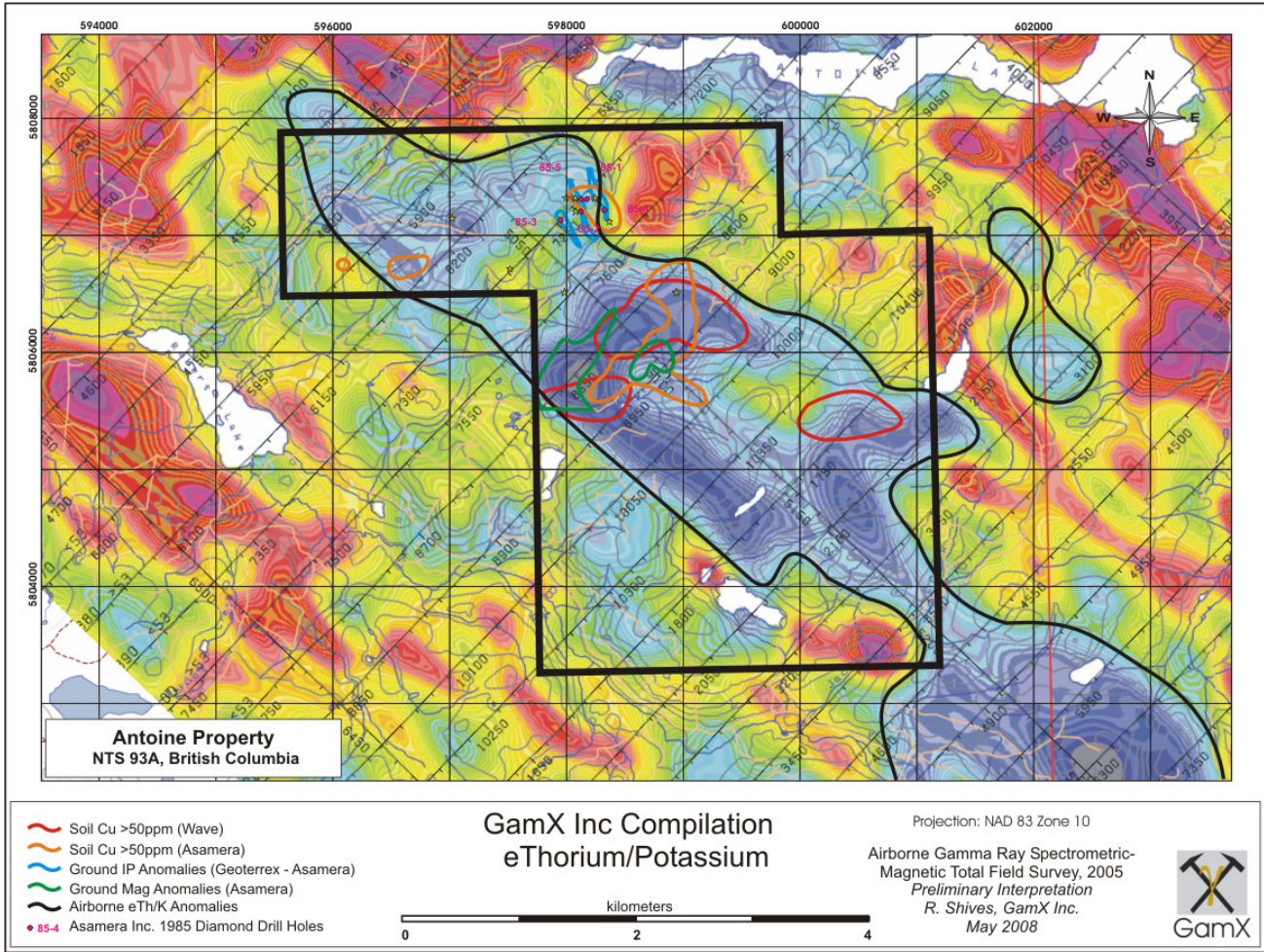
Eighteen airborne parameters are presented in the order shown below, overlain with:

a) Polygons depicting compiled/interpreted features (as shown in Figure 5 within this report)

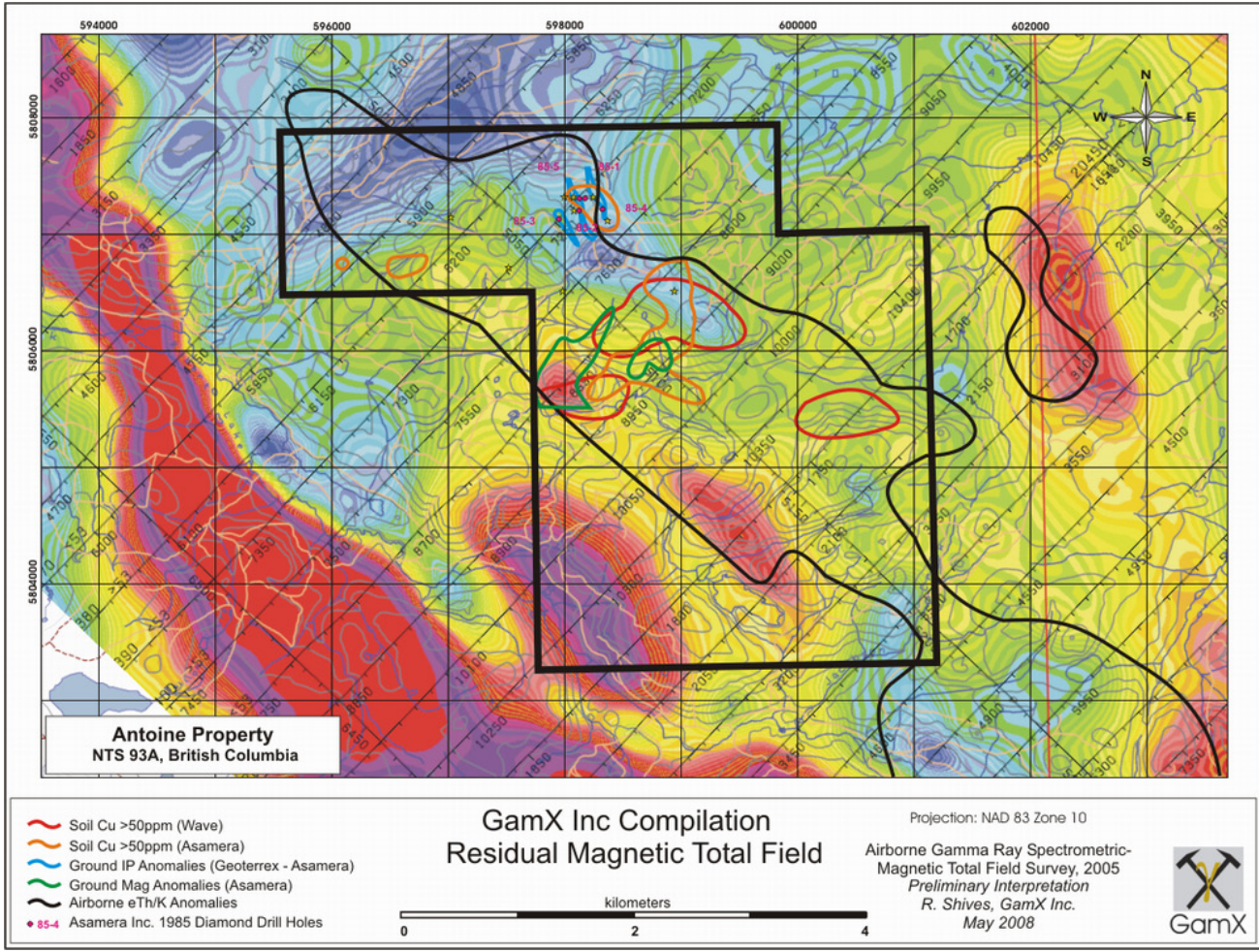
- 1a) RTK eThorium/Potassium ratio
- 2a) MTF Residual Magnetic Total Field
- 3a) FVD First Vertical Derivative of MTF
- 4a) TER Ternary Radioactive Element Map
- 5a) K Potassium
- 6a) eU equivalent Uranium
- 7a) eTh equivalent Thorium
- 8a) eU/eTh eUranium/eThorium ratio
- 9a) eU/K eUranium/Potassium

b) Regional geological contacts (as shown in Figure 4, this report).

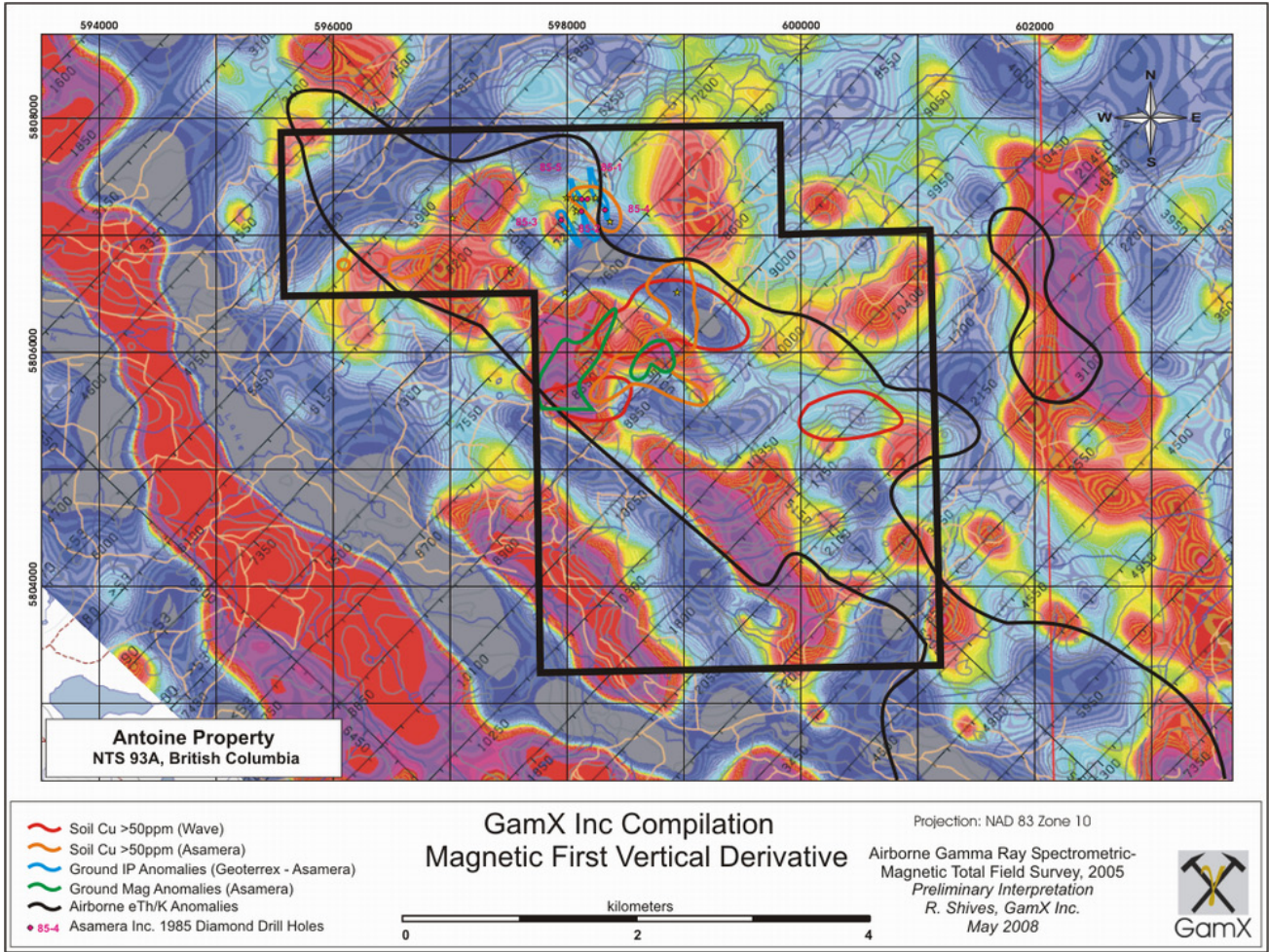
- 1b) RTK eThorium/Potassium ratio
- 2b) MTF Residual Magnetic Total Field
- 3b) FVD First Vertical Derivative of MTF
- 4b) TER Ternary Radioactive Element Map
- 5b) K Potassium
- 6b) eU equivalent Uranium
- 7b) eTh equivalent Thorium
- 8b) eU/eTh eUranium/eThorium ratio
- 9b) eU/K eUranium/Potassium



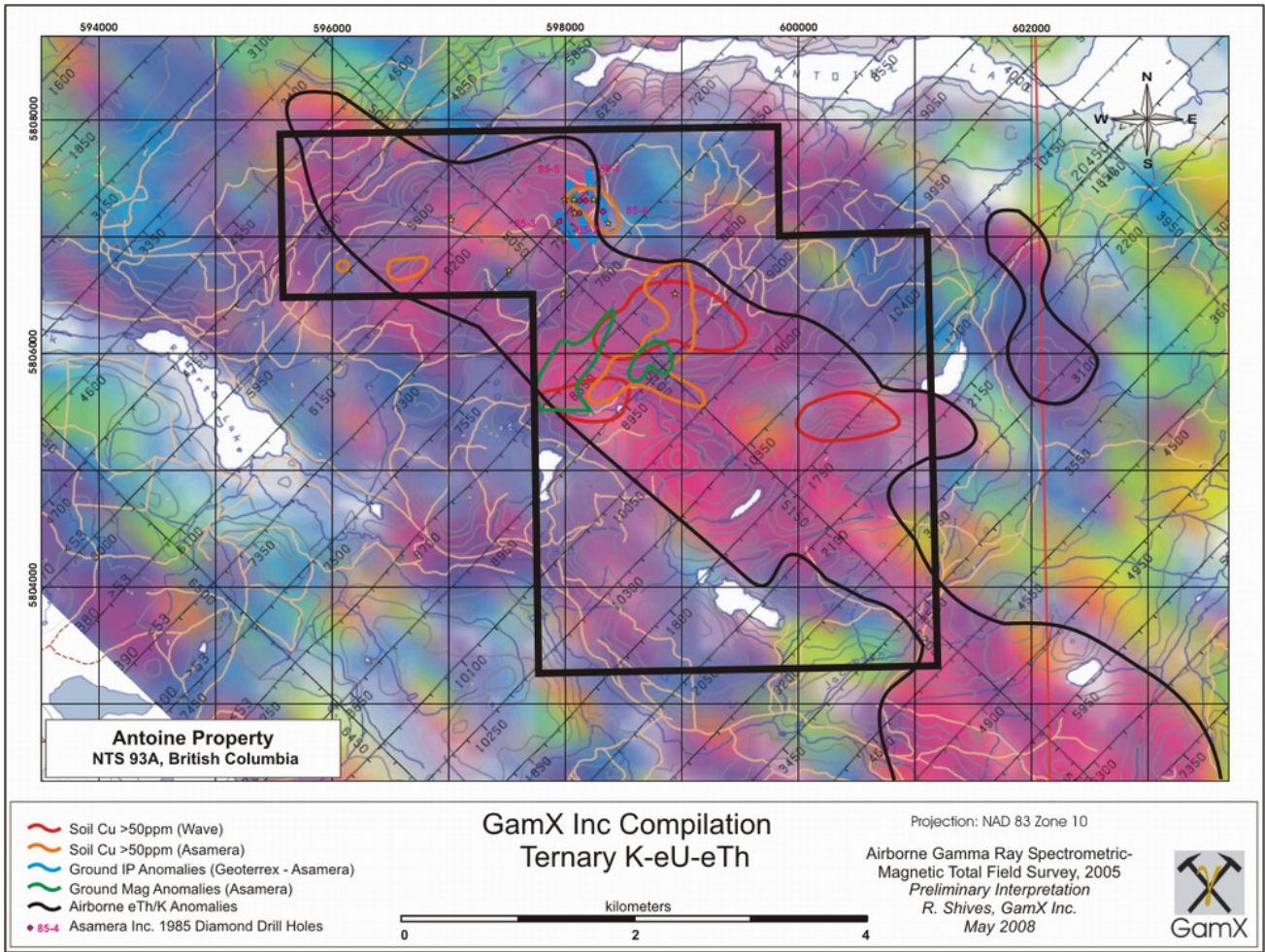
**1a - RTK ( eThorium/Potassium ratio)**



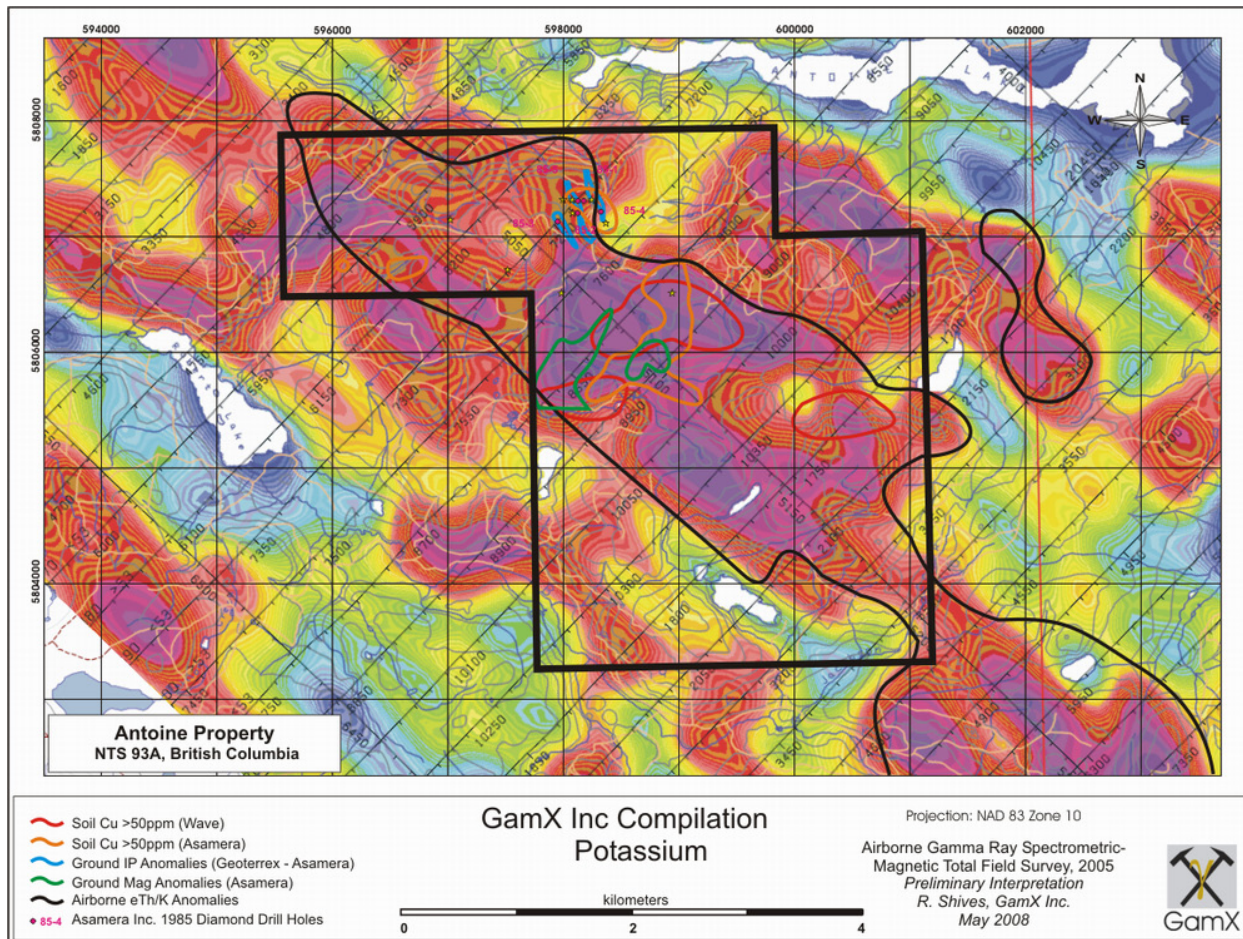
**2a - MTF ( Residual Magnetic Total Field)**



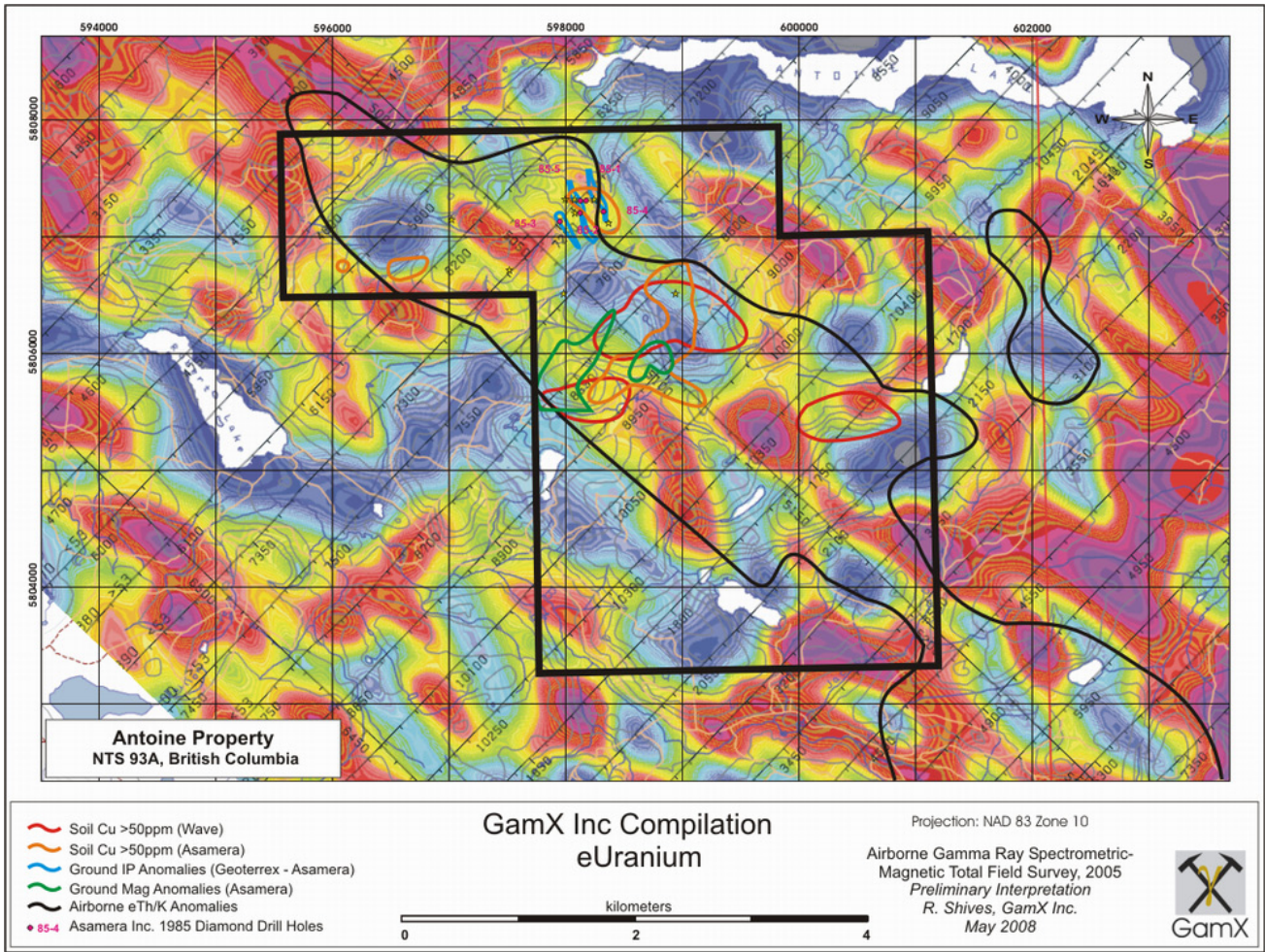
**3a - FVD (First Vertical Derivative of MTF)**



**4a - TER (Ternary Radioactive Element Map )**

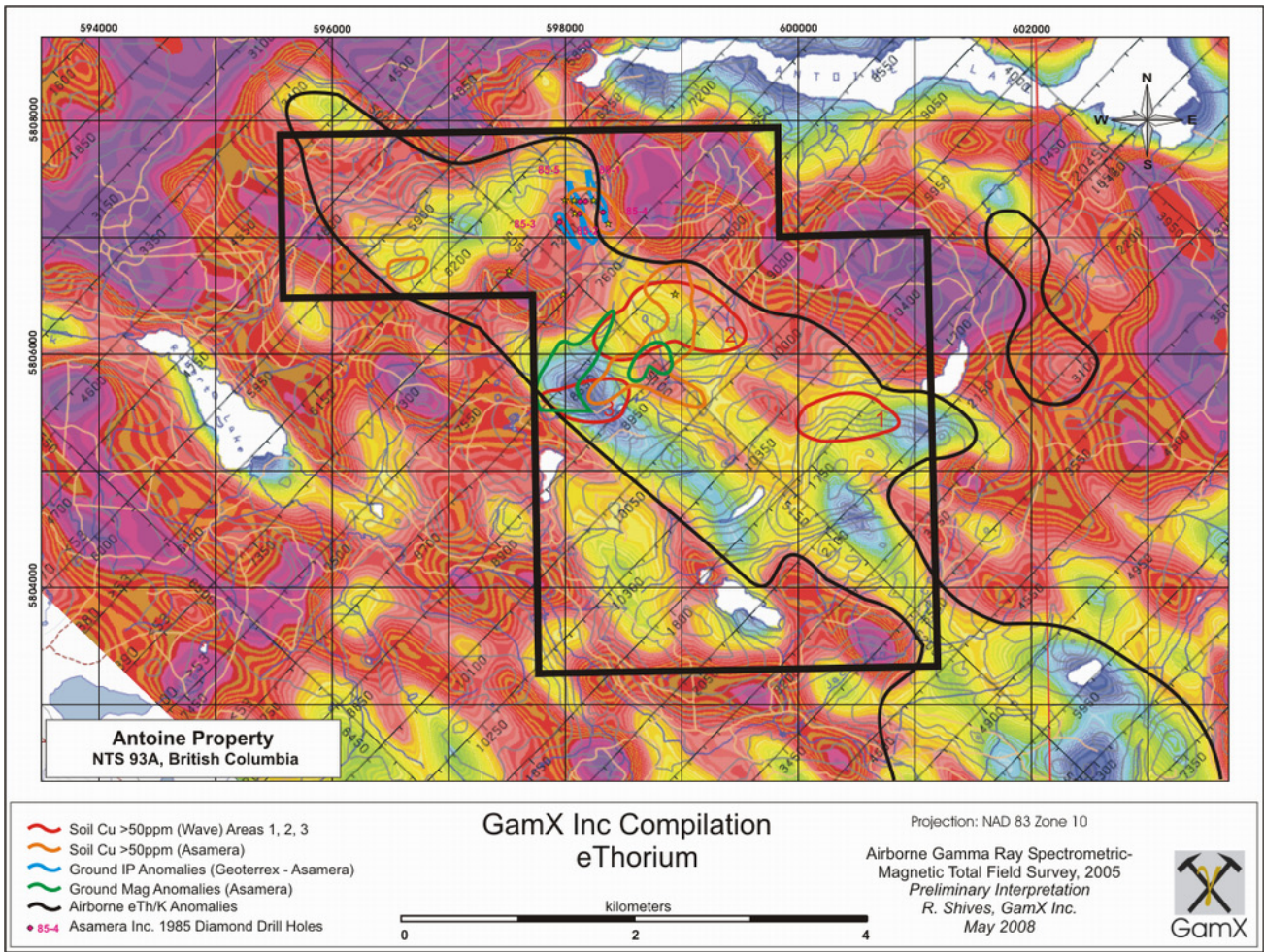


**5a – K (Potassium)**

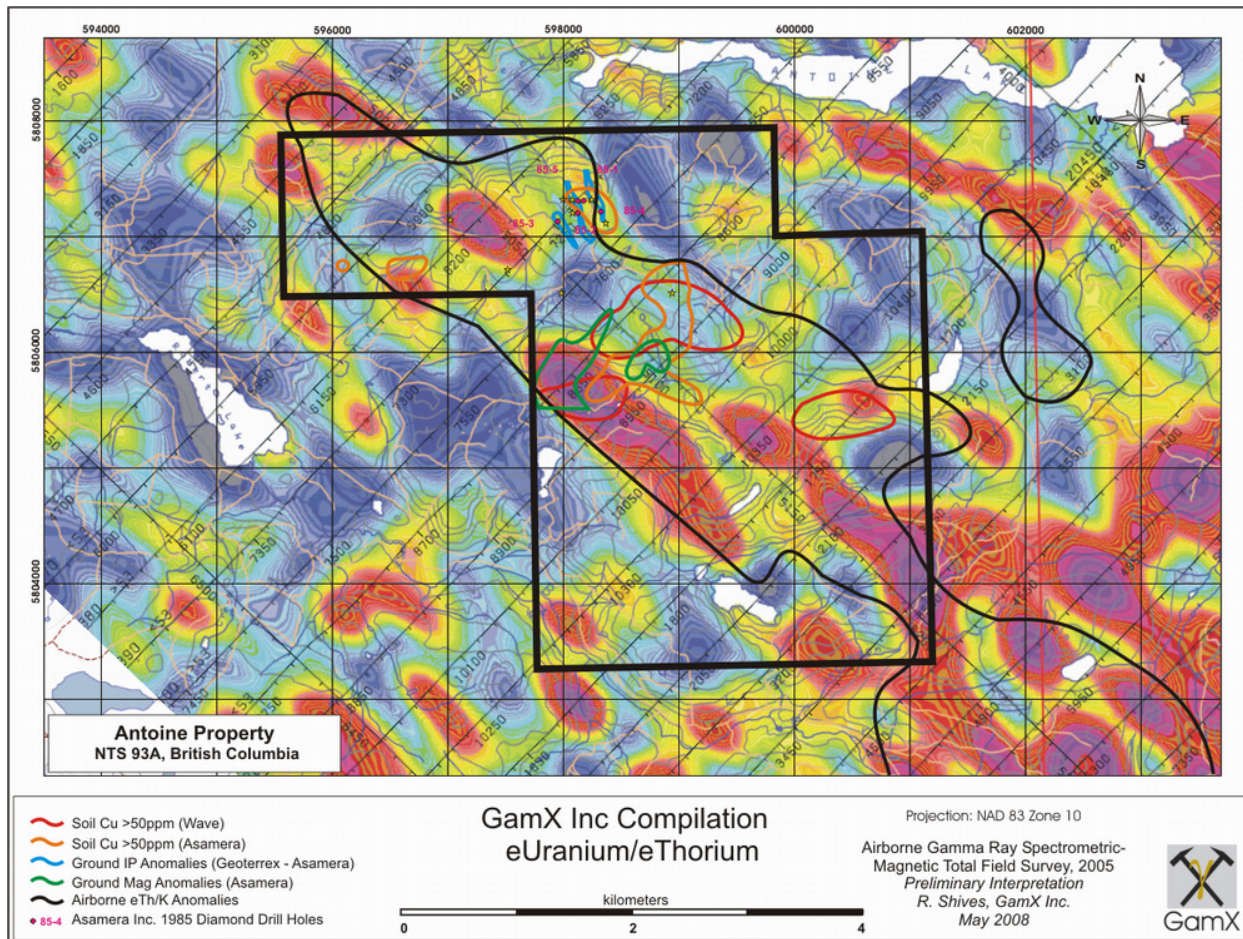


**6a - eU (equivalent Uranium )**

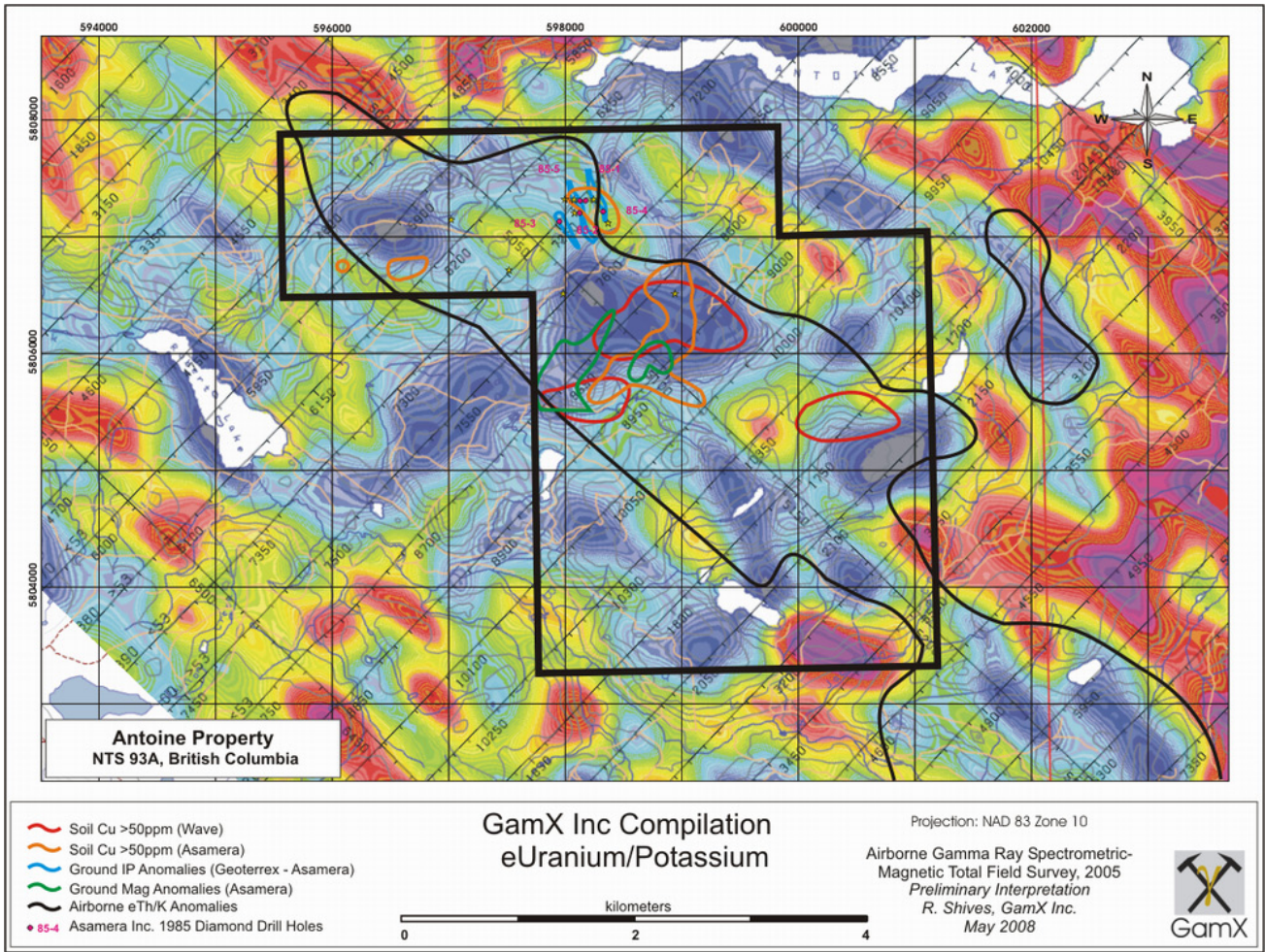




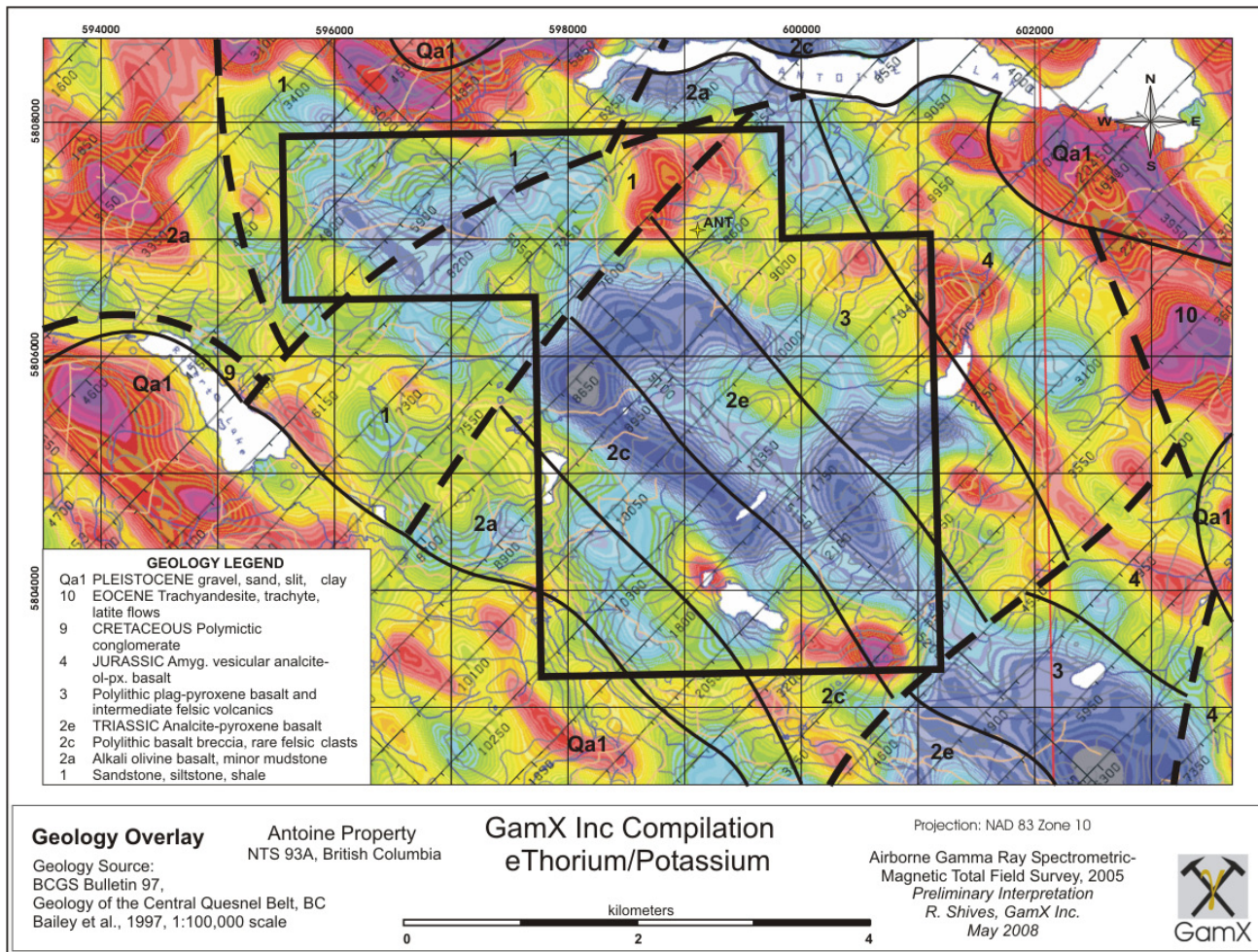
**7a - eTh (equivalent Thorium)**



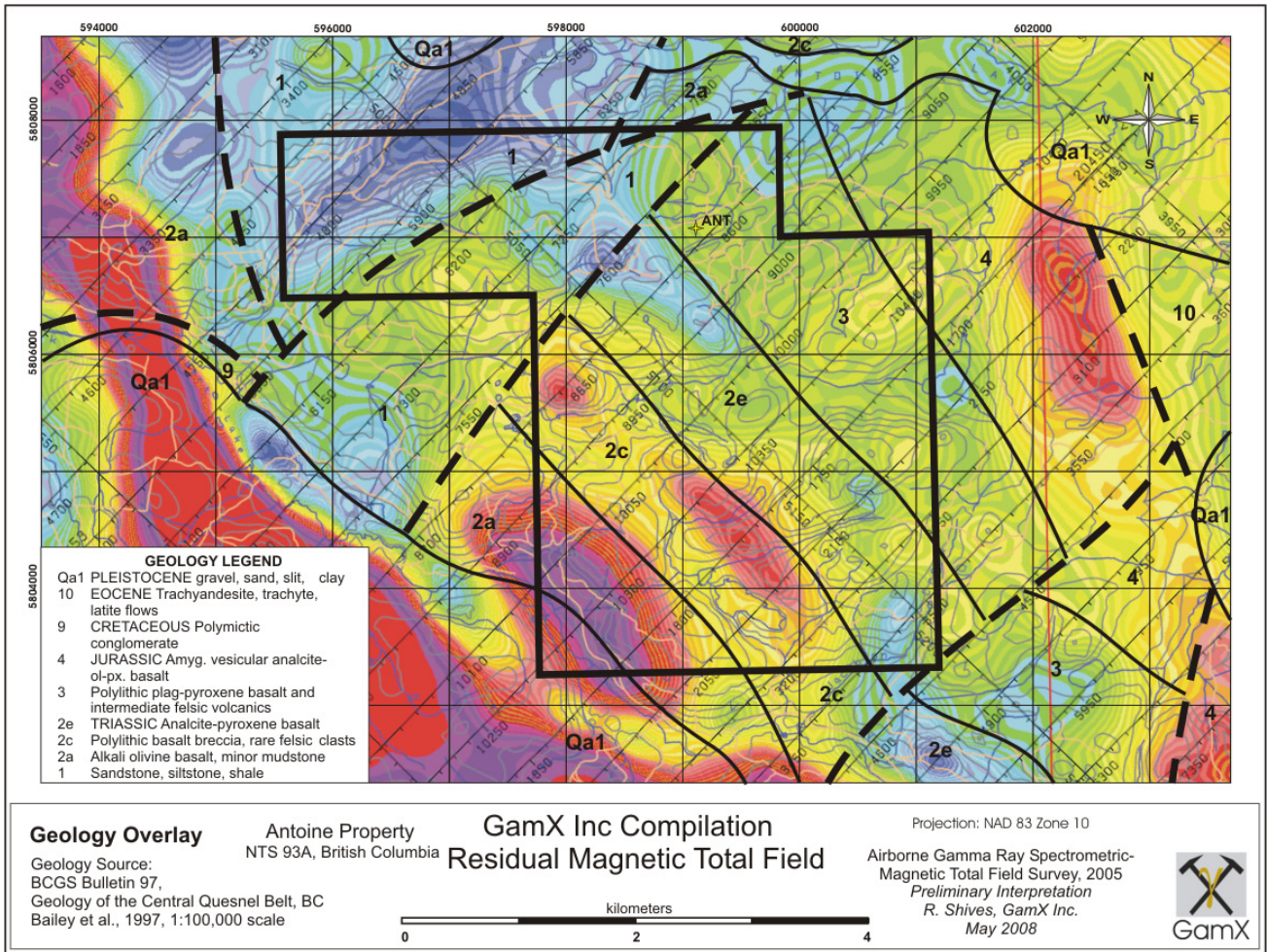
**8a - eU/eTh (eUranium/eThorium ratio)**



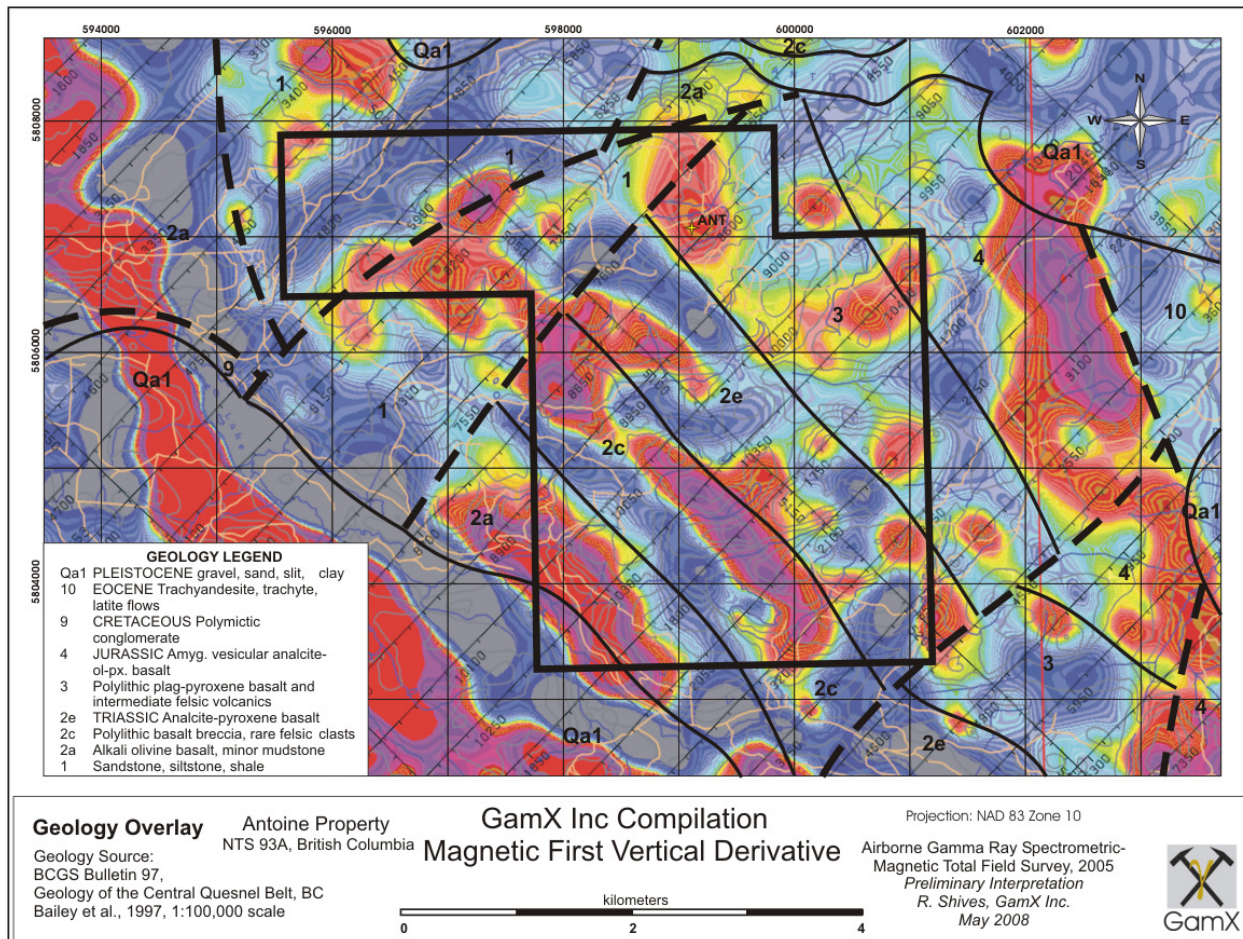
**9a - eU/K (eUranium/Potassium )**



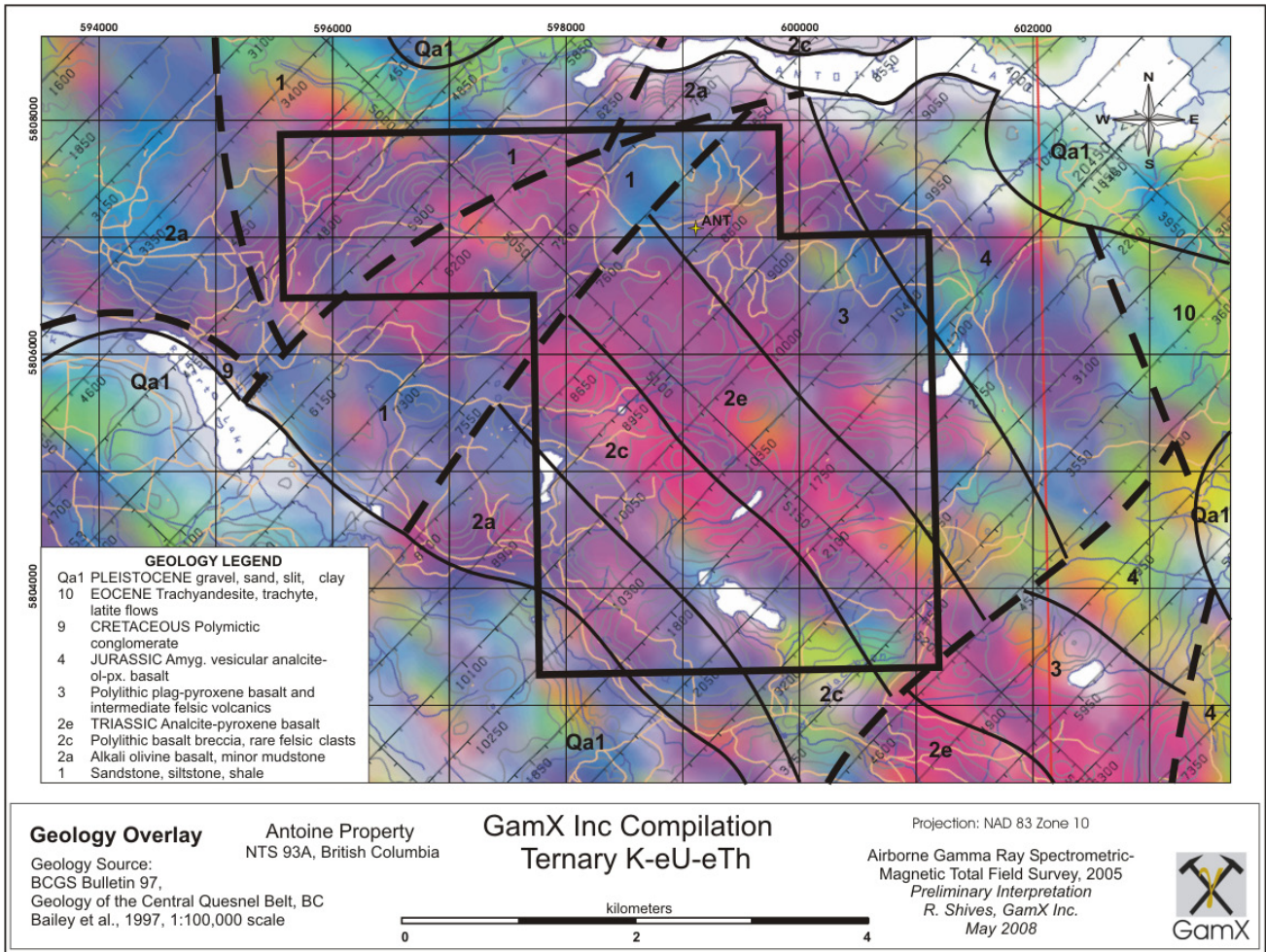
**1b – RTK ( eThorium/Potassium ratio)**



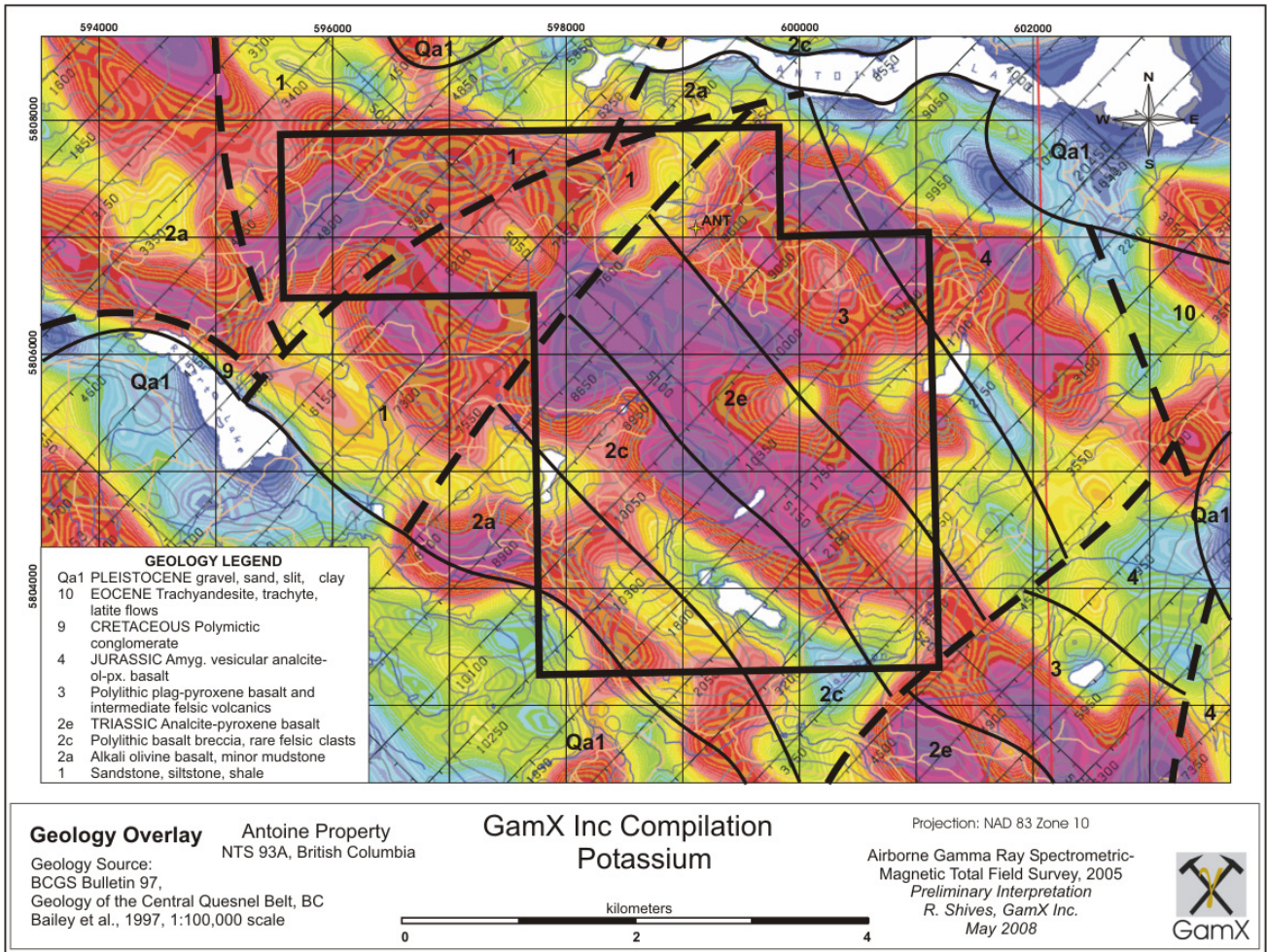
**2b - MTF ( Residual Magnetic Total Field )**



**3b - FVD (First Vertical Derivative of MTF )**

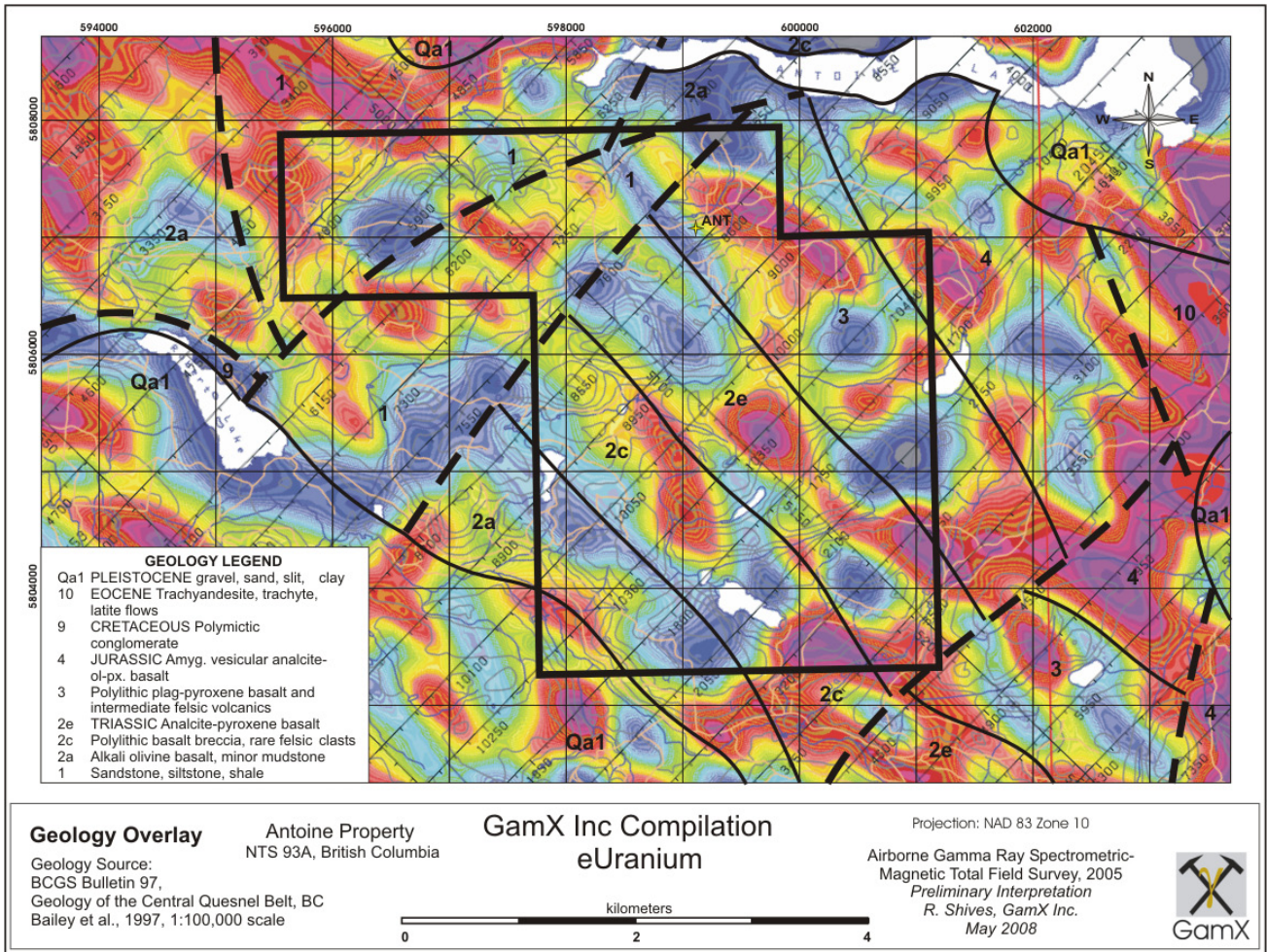


**4b - TER (Ternary Radioactive Element Map )**

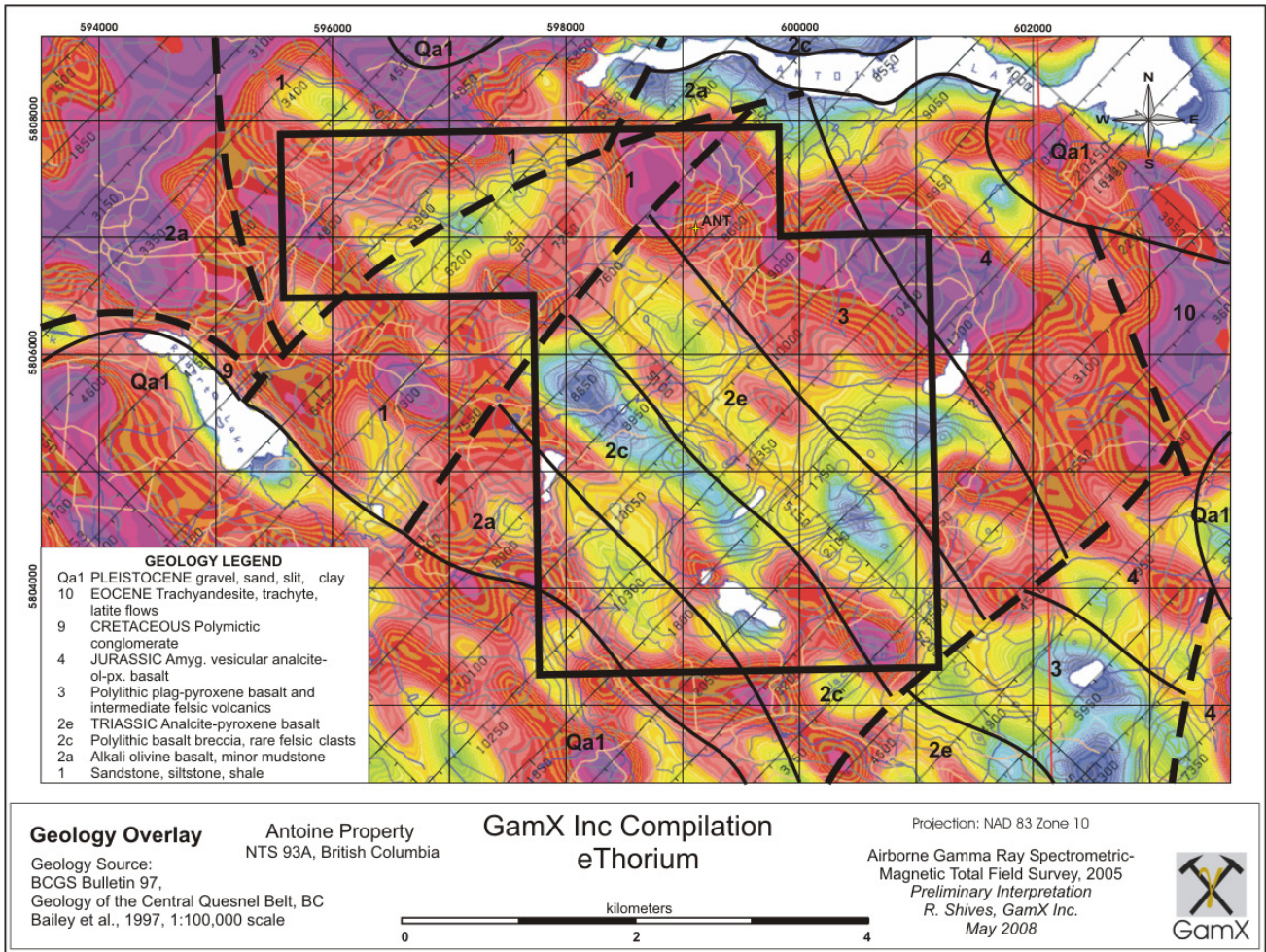


**5b - K (Potassium)**

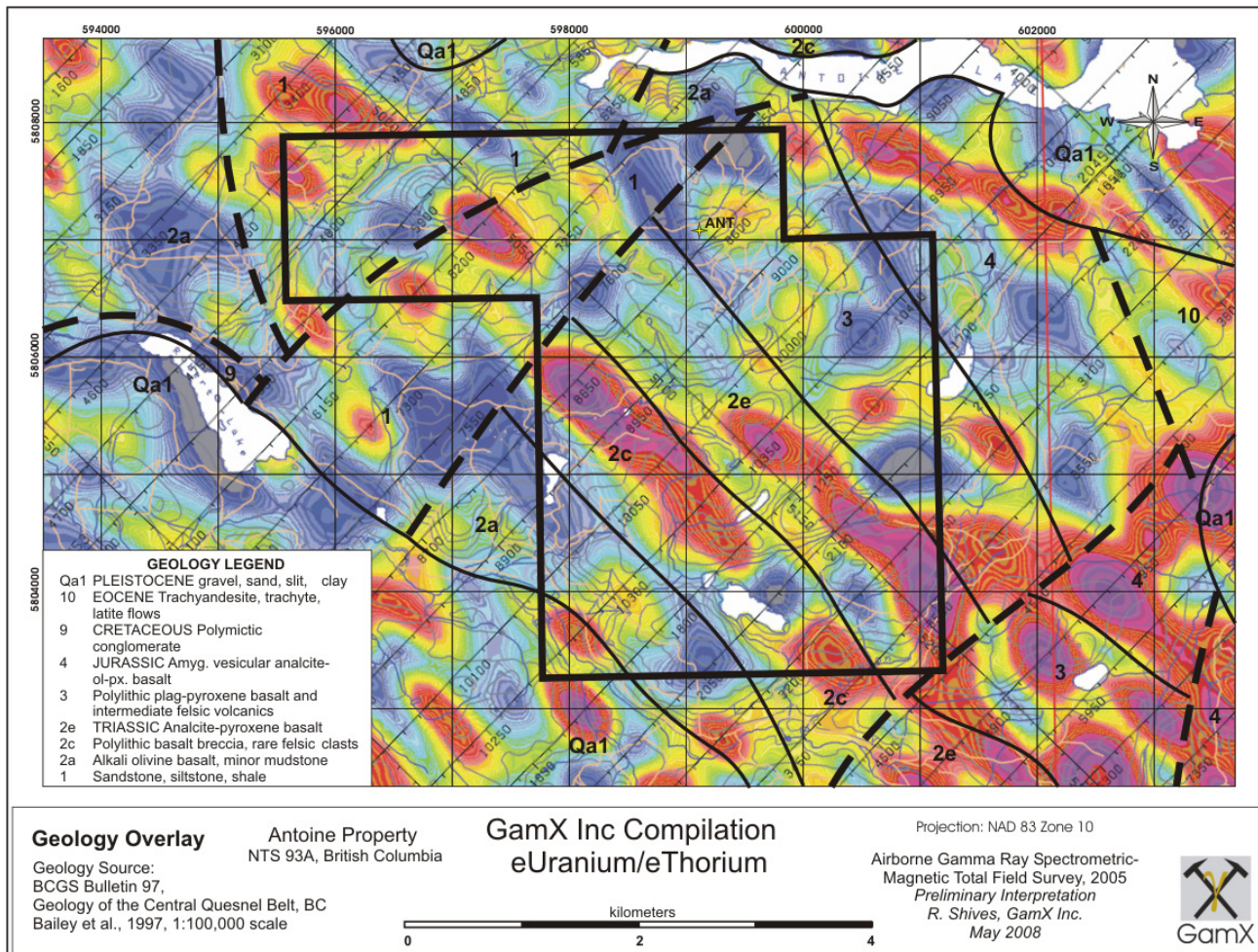




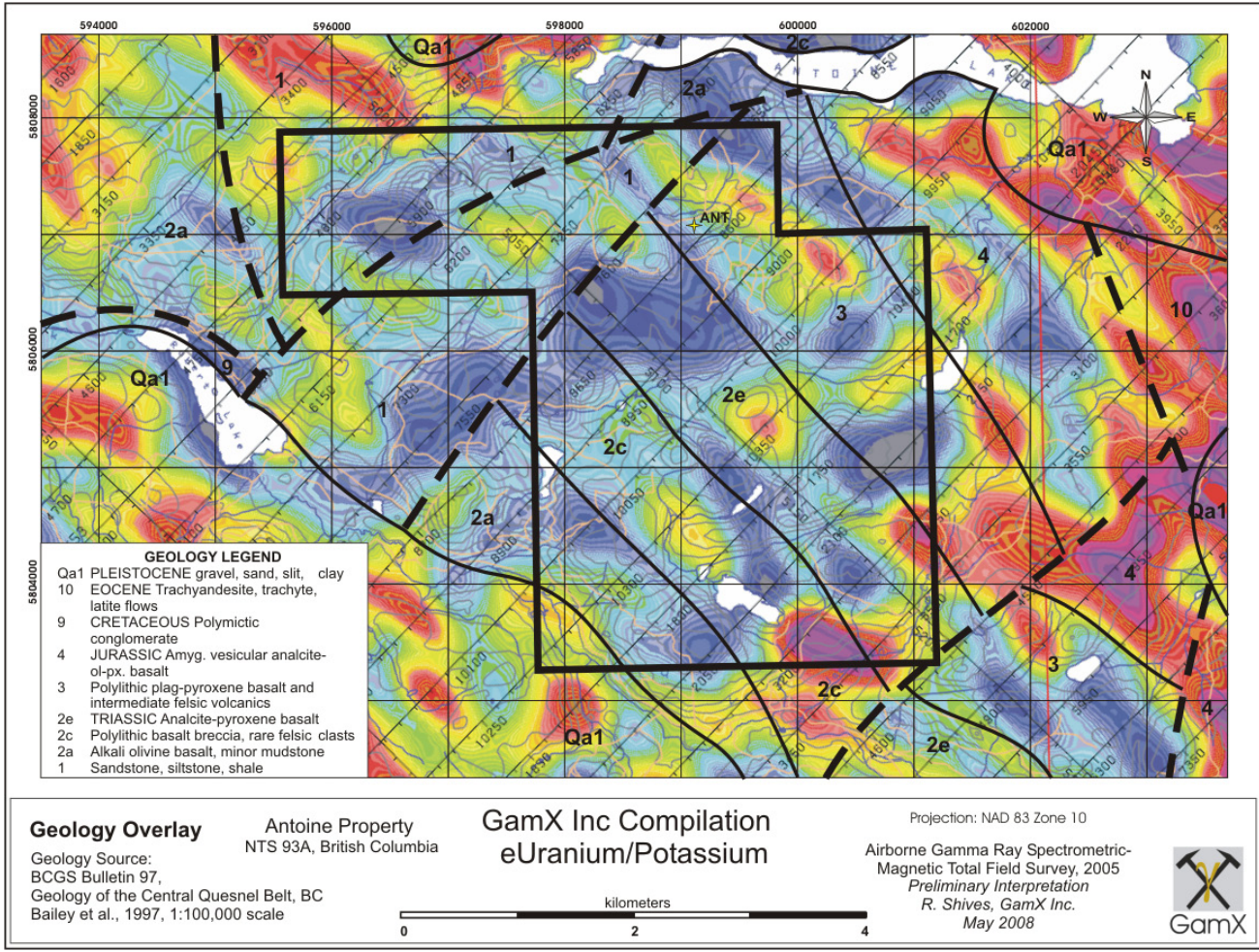
**6b - eU (equivalent Uranium)**



**7b - eTh (equivalent Thorium)**



**8b – eU /eTh (eUranium/eThorium ratio)**



**9b - U/K (eUranium/Potassium)**

**APPENDIX C**  
**Personnel**

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**Geoquest Consulting Ltd.**

W. Gruenwald, P. Geo.

(Mar 01, June 07-12, 2008)

14 hours

E. Gruenwald, Report Compilation, Map Preparation

(Apr 07- June 12, 2008)

20 hours

**GamX Inc.**

R. Shives

(Feb 08 - Jun 03, 2008)

32 hours

**APPENDIX D**  
**Statement of Expenditures**

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**Professional Services**

GamX Inc. (R. Shives-Geophysical Consultant)	3,360	
Geoquest Consulting Ltd.	<u>1,286</u>	4,646

**Report Compilation**

Drafting, Report Compilation	945	
Map printing, photocopies, binding	<u>100</u>	<u>1,045</u>

**TOTAL:** **\$5,691**

## APPENDIX E

### References

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- |  |   |
|--|---|
| Sutherland-Brown, A (1957)   | Geology of the Antler Creek Area, British Columbia, British Columbia Department of Mines, Bulletin 38.  |
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| BC Minfile (2008)  | Minfile Occurrence Records for the Antoine property area.   |

**APPENDIX F**  
**Certificate**

---

**I, WARNER GRUENWALD OF THE CITY OF VERNON, BRITISH COLUMBIA HEREBY CERTIFY THAT:**

1. I am a graduate of the University of British Columbia with a B. Sc. degree in Geology (1972).
2. I am a registered member of the Professional Engineers and Geoscientists of British Columbia (#23202).
3. I am a fellow of the Geological Association of Canada (F2958)
4. I am employed as consulting geologist and president of Geoquest Consulting Ltd., Vernon, BC.
5. I have practiced continuously as a Geologist for the past 34 years in western Canada and the US.
6. I am co-author of this report on the Antoine property.

W. Gruenwald, P. Geo  
Dated: June 12, 2008



## Certificate

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**I, ROBERT B. K. SHIVES, OF THE TOWN OF MOUNTAIN, ONTARIO HEREBY CERTIFY THAT:**

1. I am a graduate of Carleton University with a B. Sc. degree in Geology (1979).
2. Following 6 years in the private sector and 23 years with the Geological Survey of Canada, Ottawa (Head, Radiation Geophysics Section), I have applied to become a registered member of the Association of Professional Geoscientists of Ontario (submission #8116).
3. Since April, 2007, I am employed as consulting geologist and president of GamX Inc., Mountain, ON.
4. I have practiced continuously as a Geologist for the past 29 years throughout Canada, and in USA, Brazil and Australia.
5. I am co-author of this report on the Antoine property.

Rob Shives, B.Sc.

Dated: June 12, 2008