GEOLOGICAL REPORT, IMAGE ANALYSIS AND GIS COMPILATION PROJECT

on the

TSS REGIONAL CLAIMS

Toodoggone River Area
Omineca and Liard Mining Divisions
British Columbia

NTS Map-Area 094E

Report By:

A. O. Birkeland P.Eng.

Date:

August 6, 2006

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SUMMARY

Arne O Birkeland, P.Eng., Owner Number 102420, is the recorded 100% interest holder in the Toodoggone Regional Claims ("the properties"). The properties, which are situated in the Toodoggone mining district in northern British Columbia, consist of 7 individual claim groups. They are located north and southeast of the Toodoggone River some 300 kilometres north of Smithers. Access is by aircraft from Smithers to an airstrip 30 kilometres south of property or by way of a secondary road linking the airstrip with Mackenzie which is northwest of Prince George and from there by helicopter.

An Image Analysis and GIS Compilation Project were conducted on a regional basis to identify exploration targets for follow-up reconnaissance field work. Data sets include Aster and Landsat Imagery, DEM, geology, airborne geophysics, RGS geochemestry, alteration and outcrop mapping. The data sets are available on three platforms being Google Earth, MapperWrapper and MapInfo. The total expenditures incurred to generate the interactive data sets and complete technical and assessment reports was $67,088.42

The data sets indicate porphyry copper – gold exploration targets are present and follow-up field work is warranted.

INTRODUCTION AND TERMS OF REFERENCE

This Technical Report and Geological Assessment Report have been prepared utilizing Image Analysis and GIS Compilation that was compiled from a collaborative effort between Arnex Resources Ltd and Cal Data Ltd. Cal Data utilized the services of Ward and Caleen Kilby, while Arnex utilized the services of Arne Birkeland, P.Eng. and other consultants.

The purpose of the compilation was to provide an interactive dataset to generate information pertaining to seven claim groups located in the Toodoggone region of north-central BC. The data set is designed to be used to generate exploration targets and provide base maps for follow-up reconnaissance style field exploration programs. Exploration data acquired in subsequent field programs will be posted to the data set on an ongoing basis.

Image analysis utilized Aster and Landsat imagery where applicable. Appropriate MapGuide data sets are also embedded. The datasets are designed to run on three platforms, being Google Earth, MapperWrapper and MapInfo.

A report dated March 31, 2006 by Cal Data explaining the technical detains of the project is provided as Appendix I.

The total expenditures incurred to generate the interactive data sets and complete technical and assessment reports was $67,088.42 as detailed in Table 1. Work values filed as Event Numbers are detailed in Table 2. Online Events are documented in Appendix II.

One paper copy of this Geological Assessment Report is submitted to the Mineral Titles Branch as required to support the Statements of Mineral Claim Exploration and Development Work. A data CD containing a copy of the Assessment Report is also filed. The CD contains a copy of the Assessment Report. A data DVD is also filed as the Cal Data Image Analysis and Data Compilation data set and technical report.

Units of measure in this report are metric unless otherwise noted.

PROPERTY DESCRIPTION AND LOCATION

The Toodoggone Regional Claims encompass seven properties consisting of both legacy and cell claims situated in the Omineca and Liard Mining Divisions of northern British Columbia, approximately

Table 1

Image Analysis, GIS Compilation and Reports
Porphyry Pearl Property

Organization	Persons	No. Days	Activities	Cost
Cal Data Inc	Ward and Caleen Kilby	Unknown	Image Analysis, GIS Compilation, Report	$20,865.00
Arnex Resources Ltd.	Arne Birkeland	60	Project Coordinator, GIS Compilation, Report	$44,243.92
Maxwell GeoServices Inc.	Caroline Gilson	2.5	MapInfo Consultant	$1,979.50
Total				**$67,088.42**

Table 2
Toodoggone Claims
Project TSS
Tenure List

Tenure Number	Claim Name	Mining Division	Owner	Map Number	Good To Date	Area	Work Event	Required Work	Work Value	PAC
Har Claim Group										
409187	HAR 1	OMINECA	102420 (100%)	094E054	2007/MAR/25	500	**4076177**			
409188	HAR 2	OMINECA	102420 (100%)	094E054	2007/MAR/25	500	**4076177**			
Subtotal						**1000**		**$4,000.00**	**$2,800.00**	**$1,200.00**
Pass Claim Group										
409191	PASS 1	OMINECA	102420 (100%)	094E055	2007/MAR/25	500	**4076178**			
409192	PASS 2	OMINECA	102420 (100%)	094E055	2007/MAR/25	500	**4076178**			
409193	PASS 3	OMINECA	102420 (100%)	094E055	2007/MAR/25	500	**4076178**			
409194	PASS 4	OMINECA	102420 (100%)	094E055	2007/MAR/25	500	**4076178**			
Subtotal						**2000**		**$8,000.00**	**$5,600.00**	**$2,400.00**
Peak-JL-Midas Claim Group										
409200	PEAK 1	OMINECA	102420 (100%)	094E046	2007/MAR/26	500	**4076184**			
409201	PEAK 2	OMINECA	102420 (100%)	094E046	2007/MAR/26	500	**4076184**			
409202	PEAK 3	OMINECA	102420 (100%)	094E046	2007/MAR/26	500	**4076184**			
409206	PEAK 4	OMINECA	102420 (100%)	094E046	2007/MAR/26	500	**4076184**			
409207	JL 1	LIARD	102420 (100%)	094E055	2007/MAR/27	500	**4076184**			
409208	JL 2	LIARD	102420 (100%)	094E055	2007/MAR/27	500	**4076184**			
409209	JL 3	LIARD	102420 (100%)	094E055	2007/MAR/27	500	**4076184**			
409210	JL 10	LIARD	102420 (100%)	094E055	2007/MAR/27	500	**4076184**			
409211	JL 4	OMINECA	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409212	JL 5	OMINECA	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409213	JL 6	OMINECA	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409214	JL 7	OMINECA	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409215	JL 8	OMINECA	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409216	JL 9	OMINECA	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409217	MIDAS 1	LIARD	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409218	MIDAS 2	LIARD	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409219	MIDAS 3	LIARD	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409220	MIDAS 4	LIARD	102420 (100%)	094E056	2007/MAR/27	500	**4076184**			
409221	MIDAS 5	LIARD	102420 (100%)	094E055	2007/MAR/27	500	**4076184**			
409222	MIDAS 6	LIARD	102420 (100%)	094E055	2007/MAR/27	500	**4076184**			
409223	MIDAS 7	LIARD	102420 (100%)	094E055	2007/MAR/27	500	**4076184**			
409224	MIDAS 8	LIARD	102420 (100%)	094E055	2007/MAR/27	500	**4076184**			

Table 2
Toodoggone Claims
Project TSS
Tenure List

Tenure Number	Claim Name	Mining Division	Owner	Map Number	Good To Date	Area	Work Event	Required Work	Work Value	PAC
Subtotal						**11000**		**$44,000.00**	**$30,800.00**	**$13,200.00**
Clair Claim Group										
409195	CLAIR 1	OMINECA	102420 (100%)	094E045	2007/MAR/26	500	**4076180**	**$2,000.00**	**$1,400.00**	**$600.00**
409228	CLAIR 2	OMINECA	102420 (100%)	094E045	2007/MAR/26	25	**4076183**			
409229	CLAIR 3	OMINECA	102420 (100%)	094E045	2007/MAR/26	25	**4076183**			
409230	CLAIR 4	OMINECA	102420 (100%)	094E045	2007/MAR/26	25	**4076183**			
409231	CLAIR 5	OMINECA	102420 (100%)	094E045	2007/MAR/26	25	**4076183**			
409232	CLAIR 6	OMINECA	102420 (100%)	094E045	2007/MAR/26	25	**4076183**			
Subtotal						**625**		**$500.00**	**$350.00**	**$150.00**
Rich Peak Claim Group										
409196	RICH PEAK 1	OMINECA	102420 (100%)	094E018	2007/MAR/26	500	**4076182**			
409197	RICH PEAK 2	OMINECA	102420 (100%)	094E018	2007/MAR/26	500	**4076182**			
Subtotal						**1000**		**$4,000.00**	**$2,800.00**	**$1,200.00**
Budd Claim Group										
409198	BUDD 1	OMINECA	102420 (100%)	094E027	2007/MAR/26	400	**4076181**			
409199	BUDD 2	OMINECA	102420 (100%)	094E027	2007/MAR/26	500	**4076181**			
Subtotal						**900**		**$3,600.00**	**$2,800.00**	**$800.00**
Gaucho Claim Group										
409233	GACHO 1	LIARD	102420 (100%)	094E053	2007/MAR/24	500	**4076073**			
409234	GACHO 2	LIARD	102420 (100%)	094E053	2007/MAR/24	500	**4076073**			
409235	GACHO 3	LIARD	102420 (100%)	094E053	2007/MAR/24	500	**4076073**			
409236	GACHO 4	LIARD	102420 (100%)	094E053	2007/MAR/24	500	**4076073**			
Subtotal						**2000**		**$8,000.00**	**$5,600.00**	**$2,400.00**

Table 2
Toodoggone Claims
Project TSS
Tenure List

Tenure Number	Claim Name	Mining Division	Owner	Map Number	Good To Date	Area	Work Event	Required Work	Work Value	PAC
Toodoggone Claim Group No 1										
517768	TOODOGGONE NO 1		102420 (100%)	094E	2006/JUL/14	418.68	2006/Jul/14			
517770	TOODOGGONE NO 2		102420 (100%)	094E	2006/JUL/14	279.05	2006/Jul/14			
517771	TOODOGGONE NO 3		102420 (100%)	094E	2006/JUL/14	313.71	2006/Jul/14			
517772	TOODOGGONE NO 4		102420 (100%)	094E	2006/JUL/14	314.02	2006/Jul/14			
517775	TOODOGGONE NO 5		102420 (100%)	094E	2006/JUL/15	104.61	2006/Jul/14			
517776	TOODOGGONE NO 6		102420 (100%)	094E	2006/JUL/15	348.61	2006/Jul/14			
517778	TOODOGGONE NO 7		102420 (100%)	094E	2006/JUL/15	279.04	2006/Jul/14			
517784	TOODOGGONE NO 13		102420 (100%)	094E	2006/JUL/15	209.31	2006/Jul/14			
517785	TOODOGGONE NO 14		102420 (100%)	094E	2006/JUL/15	69.73	2006/Jul/14			
517786	TOODOGGONE NO 15		102420 (100%)	094E	2006/JUL/15	104.63	2006/Jul/14			
517787	TOODOGGONE NO 16		102420 (100%)	094E	2006/JUL/15	104.66	2006/Jul/14			
517788	TOODOGGONE NO 17		102420 (100%)	094E	2006/JUL/15	191.83	2006/Jul/14			
517789			102420 (100%)	094E	2006/JUL/15	331.03	2006/Jul/14			
Subtotal						**3068.89**		**$12,275.55**	**$8,593.40**	**$3,682.15**
Toodoggone Claim Group No 2										
517779	SCOTIA NO 8		102420 (100%)	094E	2006/JUL/15	418.41	2006/Jul/14			
517780	TOODOGGONE NO 9		102420 (100%)	094E	2006/JUL/15	435.82	2006/Jul/14			
517781	TOODOGGONE NO 10		102420 (100%)	094E	2006/JUL/15	418.36	2006/Jul/14			
517782	TOODOGGONE NO 11		102420 (100%)	094E	2006/JUL/15	418.36	2006/Jul/14			
517783	TOODOGGONE NO 12		102420 (100%)	094E	2006/JUL/15	418.35	2006/Jul/14			
517790	TOODOGGONE NO 19		102420 (100%)	094E	2006/JUL/15	156.77	2006/Jul/14			
524927			102420 (100%)	094E	2007/MAR/23	1669.20	2006/Jul/14			
Subtotal						**3935.27**		**$9,064.31**	**$6,345.02**	**$2,719.29**

300 kilometres north of Smithers. Five of the claim groups are situated north of the Toodoggone River (map center 57˚20'N, 127˚00'W), while the remaining two claim groups are located to the southeast (Figure 2, Claim Location Map). Details of all claims are as listed in Table 2.

ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE and PHYSIOGRAPHY

The Toodoggone Regional Claims are situated in the north and east-central portion of Toodoggone District. The communities of Smithers and Prince George, both several hundred kilometres south of the property, offer the best range of supplies and services which can be trucked by way of a secondary road linking Kemess mine with Mackenzie. This road extends 35 kilometres further northwest to Sturdee airstrip which is capable of handling large aircraft, thus providing an alternate means of access into the general area.

The Toodoggone Regional Claims is situated immediately east of the boundary between the Spatsizi Plateau to the west and the Stikine Ranges of the southern Cassiar Mountains to the east. The immediate area features wide, drift-filled valleys separating the gently rolling upland surface of the Spatsizi Plateau to the west and steep-sided, maturely dissected mountains throughout the central and eastern property areas.

Scattered buck brush and locally dense alpine spruce, balsam and fir is present in valley areas up to elevations of 1600 metres above sea level above which is typical alpine terrain featuring short grasses and lichen. Bedrock is reasonably well exposed in the areas above tree line and along drainages. Abundant felsenmeer on some slopes is believed to be very close to bedrock.

Portions of the Toodoggone Regional Claims are in alpine terrain featuring locally rugged topography particularly on north and east facing slopes, with the remainder located within broad U-shaped glacial valleys. Elevations generally range from 1300 metres above sea level to more than 2000 metres at some of the highest points in the central and eastern claims.

The climate is typical of the northern regions of British Columbia with cold temperatures and abundant snow cover during the winter months which extend from mid-October through early May. Field work is best carried out between mid-June and late September when daytime temperatures average 10 to 15 degrees Celsius.

HISTORY

The Toodoggone Regional Claims are in the Toodoggone mining district. Earliest mining-related work in this area was directed to placer gold occurrences along McClair Creek, near its confluence with Toodoggone River, between 1925 and 1935. This operation, one of the first in Canada to be entirely air-supported, recovered only modest amounts of gold (3270 grams = 115 ounces).

Historical regional hard-rock exploration in the area is summarized as follows:

- Consolidated Mining and Smelting Company – 1930s – Prospecting.
- Canadian Superior Exploration, Cominco, Cordilleran Engineering and Kennco Explorations – 1960s and 1970s - regional exploration programs in the search for porphyry copper mineralization. Work by Kennco Explorations lead to the recognition of significant gold-silver mineralization at what were to become the Baker mine (Chappelle) and Lawyers (Cheni mine) deposits south of Toodoggone River. This company also discovered porphyry-style copper-gold mineralization at several sites north and south of Finlay River including the currently producing Kemess mine.
- Continued exploration between the early 1970s and the 1990s resulted in the discovery of a number of additional gold-silver deposits and occurrences throughout the area.
- Production from the Toodoggone district began with the Baker mine operation in 1981 and continues with the current South Kemess mine of Northgate Minerals Corporation.

Toodoggone
Regional Claims

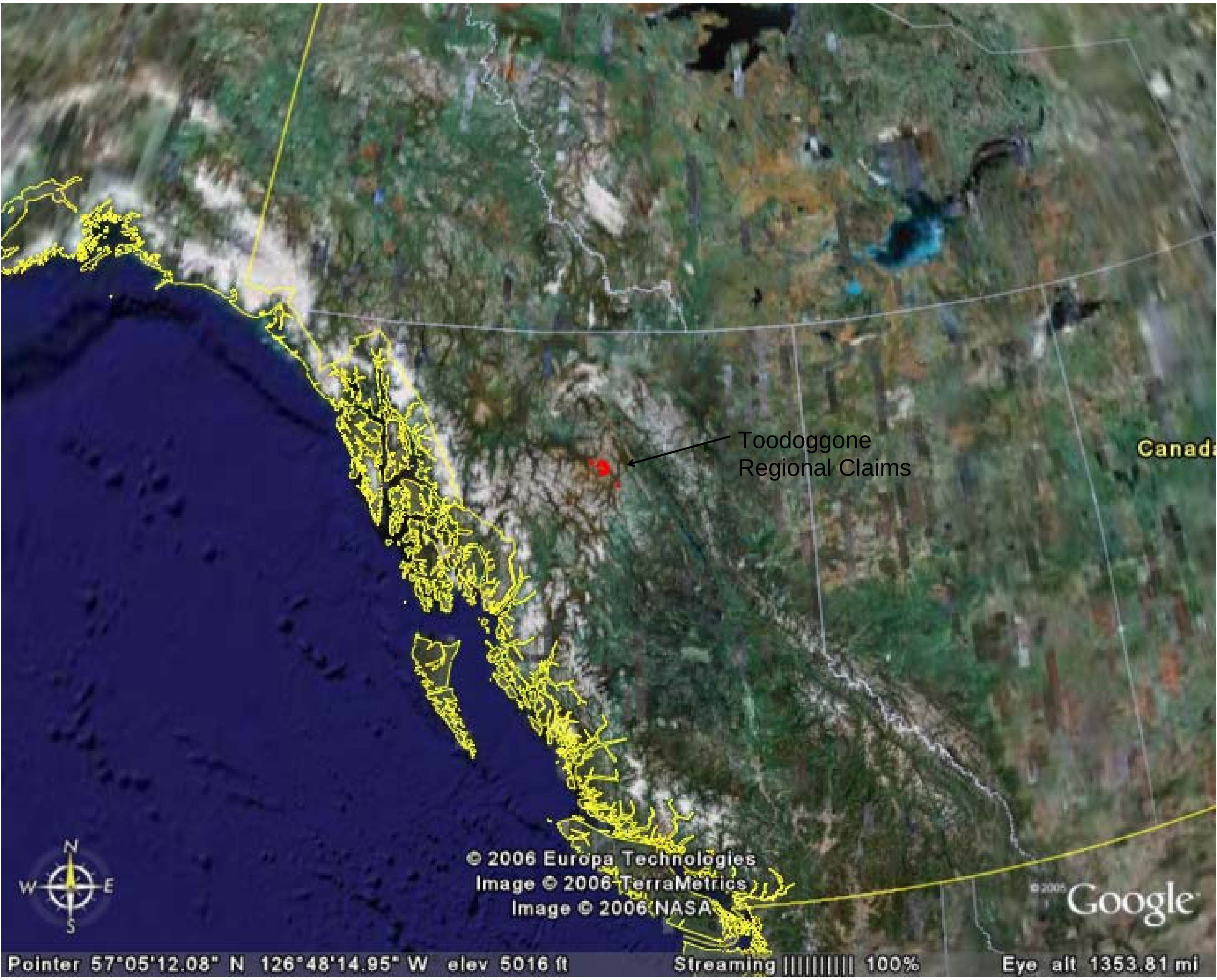

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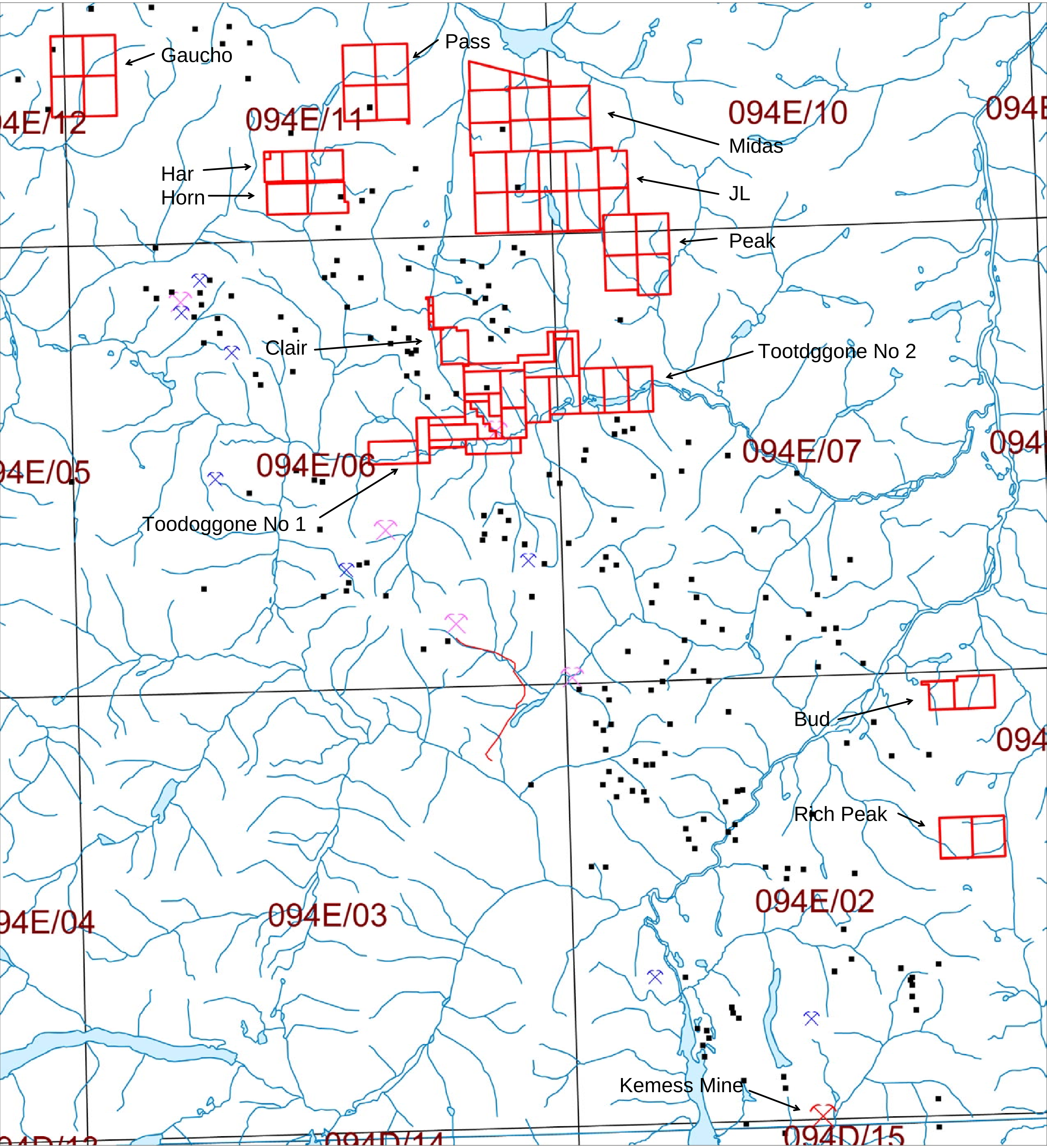
Figure 1

Toodoggone Regional Claims



SCALE 1 : 300,000

5 0 5 10 15

KILOMETERS

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Figure 2

The original Toodoggone Regional legacy claims were primarily staked to cover open anomalies identified by the multiparameter airborne geophysical survey released in march 2004 by the GSC and MEMPR. Acquisition of the claims and subsequent investigations are funded by a private syndicate. Additional cell claims were acquired as former legacy cells forfeited.

GEOLOGICAL SETTING

Regional Setting

The Toodoggone Regional Claims, situated in the northeastern part of the Intermontane tectonic belt of the Canadian Cordillera, is west of a fault contact between Quesnel terrane of the Omineca crystalline belt on the east and Stikine terrane on the west (Figure 3 and 4, Legend references OFGM2006-6 and BCGS1:250,000 Geology). Stikine terrane includes Devonian to Jurassic volcanic and sedimentary rocks which are intruded by coeval and younger plutonic rocks and are locally overlain by younger volcanic and sedimentary units.

Oldest rocks in the area illustrated by Figure 4 are intensely deformed late Carboniferous to Permian Asitka Group volcanic and sedimentary rocks. These have their greatest distribution north of Stikine River where they consist of mafic to felsic volcanic rocks which are mainly converted to chlorite and sericite schists, phyllites derived from clastic sedimentary rocks and younger rhyolites, cherts and carbonate sediments. Remnants of Asitka Group carbonates and cherts, too small to be shown on Figure 4, are present in the vicinity of Baker Mine and north and south of Finlay River and, as noted in the subsequent section of this report, may be present in the eastern part of the subject property.

Volcanic rocks of the late Triassic, Takla (Stuhini) Group, which form mountainous terrain south of Chukachida and Finlay Rivers, are comprised mainly of augite phyric basalt, andesitic flows, tuffs and breccias and subordinate interflow clastic sedimentary rocks and some limestone. Smaller areas underlain by Takla Group rocks include remnants marginal to a granitic stocks in the southern part of the area and east of the Toodoggone Regional Claims. The volcanic rocks marginal to such plutons feature limonite-rich alteration zones.

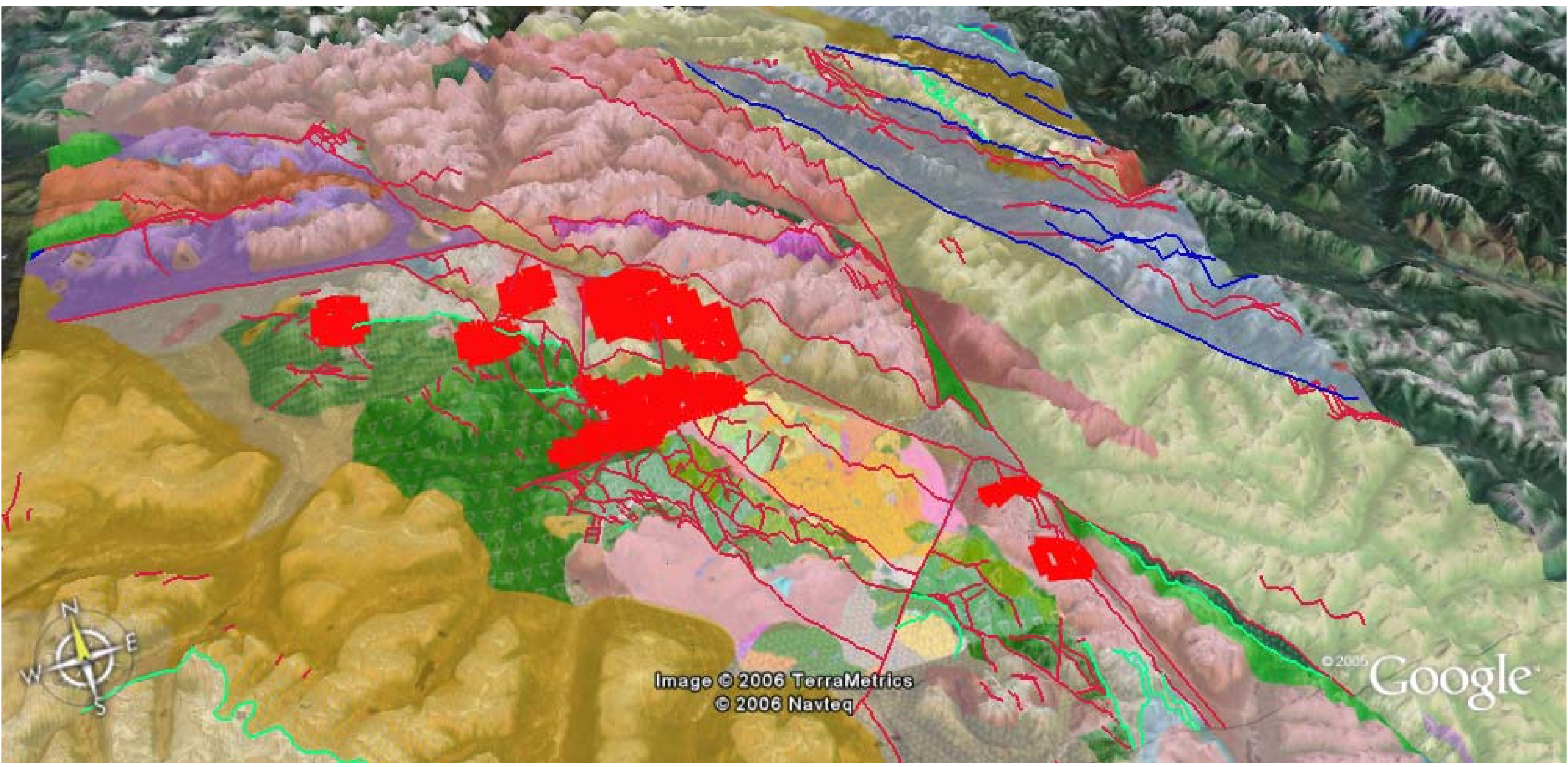
Previous geological interpretations, shown on Figure 4, suggested that early Jurassic andesite and dacite flows and volcaniclastic rocks of the Hazelton Group underlie the eastern part of the area between Chuckchida and Finlay Rivers. Recent geological mapping by Diakow et al (2004,2005) indicates that the Hazelton Group in this part of Stikine terrane is entirely comprised entirely of Toodoggone Formation volcanic rocks featuring distinctive lithologies and contained in a northwest-trending, 90 by 20-25 km belt centred on Toodoggone River. These subaerial volcanic rocks unconformably overlie, or are in fault contact with older rocks and consist principally of high potassium, calcalkaline latites and dacites (Diakow et al,1993). Two eruptive cycles have been recognized and Jurassic plutons, numerous throughout the district, are comagmatic with the earlier volcanic cycle.

Cretaceous clastic sedimentary rocks, part of the Sustut Group, unconformably overlie older rocks and form the western boundary of the area illustrated on Figure 4.

Toodoggone Regional Claims Local Geology

The geological setting of the various Toodoggone Regional Claims is illustrated by Figure 4. Most of the bedrock exposure is restricted to higher areas bordering the broad, alluvium filled valleys occupied by the major drainages and lakes. Much of the property areas are underlain by upper Triassic

Tooddogne
Regional Claims



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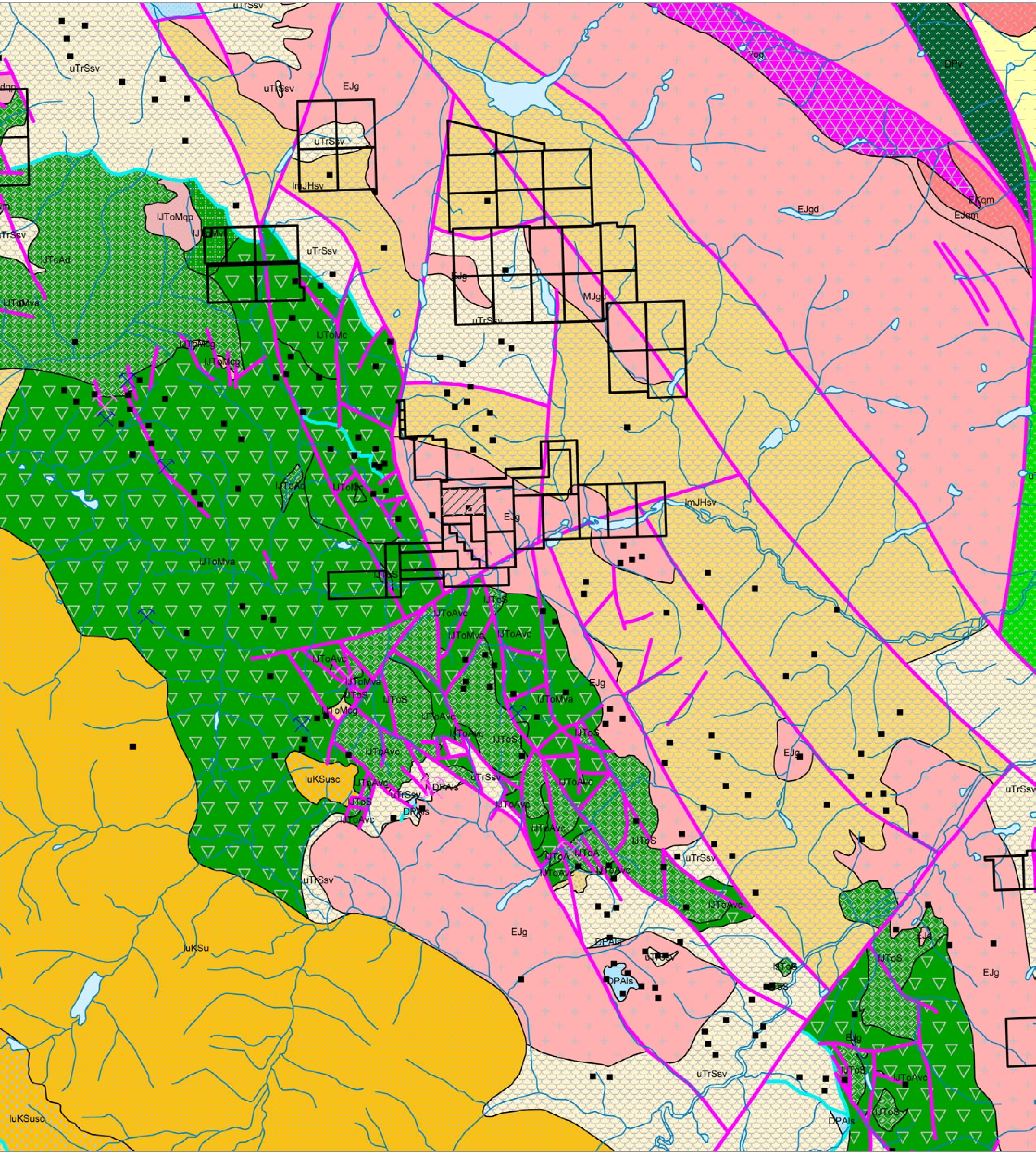
Report

Figure 3

Tooddoggone Regional Claims - Geology



SCALE 1 : 250,000

5 0 5 10 15

KILOMETERS

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Hazelton and lower Jurassic Toodoggone Formation volcanic rocks which are intruded by Toodoggone coeval lower Jurassic intrusive rocks.

Regional northwesterly trending faults are the dominant structural feature of the area. Northeast striking normal cross faults are also evident. Intersections of the two conjugicate fault systems are important as the loci at which local intrusions occur.

Where undisturbed by intrusions and late stage faulting, volcanic terrane may also feature collapsed caldera and resurgent dome structures similar in nature but different in age to the setting of the Great Basin of Nevada.

MINERALIZATION

In general, three related styles of mineralization are present in the Toodoggone Mining District that are summarized as follows:

High-level sub-volcanic intrusive related calc-alkalic porphyry copper-gold deposits hosted in lower Jurassic stocks and plutons and contact related Hazelton and lower Toodoggone volcanic rocks such as the Kemess Mine, Pine and Porphyry Pearl prospects;

Lateral distal facies silver-base deposits such as the Baker Mine;

High-level epithermal gold-silver deposits such as the Lawyers and Shas mines and the Al prospect.

A model generated for the Toodoggone Mining District by the BCGS indicates that the three general styles of mineralization are related. Of significance is the fact that the porphyry type deposits in the Toodoggone are gold-rich compared to analogues in Nevada. It is thought that this is due to the fact that the epithermal gold systems in the Toodoggone are superimposed on the porphyry systems as opposed to Nevada where the epithermal deposits may be some distinct above or lateral to the porphyry source.

The numerous gold-silver deposits of the district are related to the early Jurassic, Hazelton Group (Toodoggone Formation) magmatic event which took place between 190 and 200 million years ago. Extensional tectonics, in the form of regional northwest faults, provided channelways for the circulation of precious metals-rich hydrothermal fluids.

More particularly, several styles of mineralization are present in the Toodoggone district including volcanic-hosted epithermal gold-silver deposits, porphyry copper-gold deposits and some precious metals-bearing skarns. Epithermal deposits and occurrences are typical of the district and include two principal types of which the low sulphidation, adularia-sericite type is the best known. The Baker Mine, Lawyers and Shas deposits, plus numerous other prospects, are examples of this type and all feature quartz veins emplaced along faults and fracture zones in volcanic host rocks which feature adularia-sericite alteration marginal to the precious metals-bearing veins. Host rocks are Toodoggone Formation latite flows and dacite tuffs with the exception of Baker mine where veins are developed in older, Takla Group volcanic rocks.

The second type of epithermal mineralization is represented by high sulphidation, acid sulphate gold-silver deposits which feature alunite and barite alteration zones formed near surface or above the alunite-sericite types. Examples include the BV (Al) north of Toodoggone River and the Silver Pond prospect adjacent to the Lawyers deposit.

Porphyry copper-gold mineralization, within and marginal to early Jurassic granitic plutons, has been recognized at a number of localities in the southern part of the district. The best example of this style of mineralization is the currently producing South Kemess mine where chalcopyrite, pyrite, magnetite and minor molybdenite occur as disseminations and in quartz stockwork veinlets both within a gently-dipping, tabular monzonite sill and bordering Takla Group volcanic rocks. This deposit features a 25 metres thick supergene zone containing enhanced copper and gold values. Production of gold and copper through to the end of 2004 are reported in the preceding section; remaining proven reserves are reported by Northgate

Minerals Corporation as being 91.72 million tonnes grading 0.23% copper and 0.70 gram/tonne gold.

The adjacent Kemess North deposit, currently the subject of a feasibility study, features pyrite, chalcopyrite and minor molybdenite in quartz-K-feldspar stockwork veinlets and as disseminations related to quartz monzonite dykes which cut Takla Group volcanic rocks. A Northgate Minerals Corporation fact sheet, dated November, 2004, reported proven and probable reserves for Kemess North of 414 million tonnes grading of 0.16% copper and 0.31 gram/tonne gold. These reserve estimates were prepared by a qualified person and are in accordance with Section 1.3 of National Instrument 43-101.

EXPLORATION

No field exploration work has been conducted on the Toodoggone Regional Claims by the current owner-operator.

IMAGE ANALYSIS ANDGIS COMPILATION

Details of the Image Analysis and GIS Compilation Project are contained in Appendix I.

In general, geologic setting, distribution of outcrop and alteration zones and anomalous areas as identified by RGS and Minfile occurrences provided by the inter-active layers of the various platforms accompanying this report can be utilized to identify exploration targets for follow-up field exploration on the Toodoggone Regional Claims.

INTERPRETATION AND CONCLUSIONS

The Toodoggone Regional Claims includes three styles of gold-base metal mineralization, the most economically significant of which is porphyry copper-gold style mineralization.

From a review of the data set, exploration targets are present. Follow-up reconnaissance style base-line stream sediment and reconnaissance style soil and talus fine geochemical surveys and prospecting and rock sampling are warranted.

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CERTIFICATE OF AUTHOR

Arne O. Birkeland, P.Eng.

Arnex Resources Ltd.
2069 Westview Drive
North Vancouver, BC, Canada, V7M 3B1

I, Arne O. Birkeland, P.Eng. do hereby certify that:

1. I am currently employed as a Geological Engineer by:
   Arnex Resources Ltd.
   2069 Westview Drive,
   North Vancouver, British Columbia, Canada,
   V7M 3B1

2. I graduated with a Bachelor of Science Degree in Geological Engineering from the Colorado School of Mines in 1972. I am a 1969 graduate of BCIT obtaining a Diploma of Mining Technology.

3. I have been a practicing Professional Engineer registered with the Association of Professional Engineers and Geoscientists of British Columbia since 1975, Registration Number 9870. I am a member and chairman of the Liaison Committee of the British Columbia and Yukon Chamber of Mines (now AME BC).

4. I have worked as a geologist for a total of 34 years since my graduation from university. My primary employment since 1966 has been in the field of mineral exploration and development. My experience has encompassed a wide range of geological environments including extensive experience in classification of deposit types as well as considerable familiarization with geochemical and geophysical survey techniques and diamond drilling procedures. Since 1990, my primary involvement in exploration activities has been focused on the BC Cordillera, primarily exploring for Volcanogenic Massive Sulphide and Porphyry type targets.

5. I am responsible for the preparation of this Assessment Report titled Geological Report Image Analysis and GIS Compilation Project, Toodoggone Regional Claims, Toodoggone River Area, Omineca Mining Division, British Columbia. I have personally conducted and supervised exploration fieldwork carried out by Energex Minerals Ltd during the period 1980 to 1990 in the Toodoggone area. I have personably coordinated and been party to the generated data sets presented in this report.

6. I am not aware of any material fact or material change with respect to the subject matter of this Assessment Report that is not reflected in the Assessment Report, or the omission to disclose which makes the Assessment Report misleading.

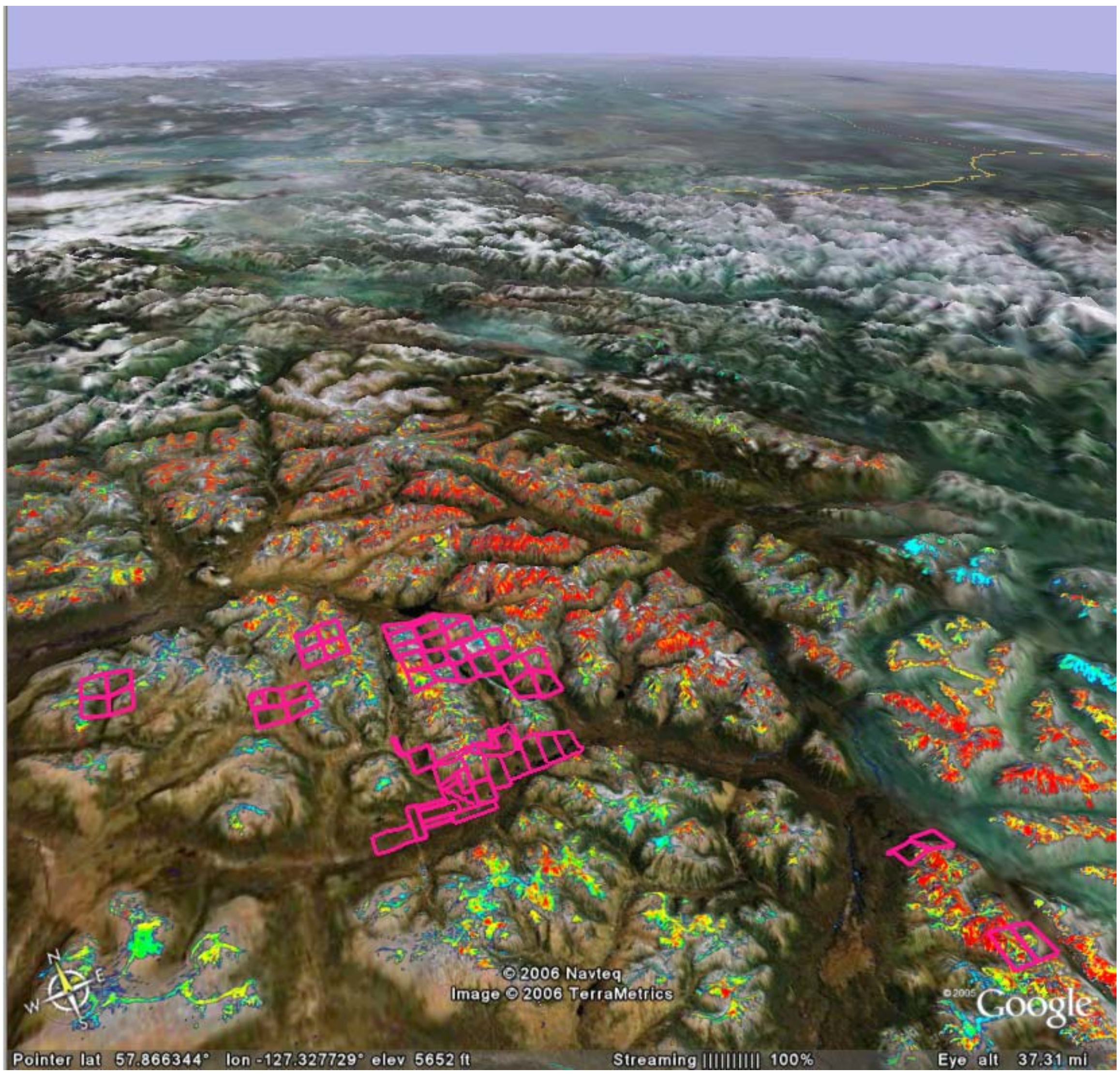
7. I have read National Instrument 43-101 and Form 43-101F1, and this Assessment Report has been prepared in substantially where possible in compliance with that instrument and form.

Dated at North Vancouver, British Columbia, this 6th day of August, 2006

"signed" *Arne O Birkeland*

Arne O. Birkeland, P. Eng.
President, Arnex Resources Ltd.

Toodoggone Image Analysis and GIS Compilation Project



Prepared for:

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North Vancouver, Canada

Prepared by:
Ward E. Kilby
Cal Data Ltd.
March 31, 2006

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INTRODUCTION

Purpose

Cal Data Ltd. was contracted by the Toodoggone Staking Syndicate (TSS) to compile existing mineral exploration related geographic information (GIS data) from public sources and generate new information from the analysis of multi-spectral imagery. ASTER and Landsat ETM 7+ imagery were used for the image analysis component. Information collected from the provincial, federal and US sources was used to generate the final GIS compilation.

The compilation and imagery analysis results are made available in three viewing styles; 1) MapGuide web-map, 2) Google Earth and 3) desktop mapping/GIS. Each viewing system provides unique strengths in the analysis of the exploration information. The TSS MapGuide viewing option provides excellent web-based mapping features and links to information available through the MapPlace with newly generated information generated by this project. The TSS Google Earth viewing option takes advantage of the spectacular capabilities of the Google Earth viewer. The viewer provides the user with a great deal of flexibility in the building of a display. The fly-through capabilities of the viewer provide an excellent opportunity to visualize the available exploration data in three dimensions. The Google Earth option provides a limited set of generated project information and very limited MapPlace information. The TSS Desktop Mapping/GIS delivery option provides the compiled imagery and GIS data in a format compatible with a software package commonly used in the exploration community. The standalone GIS option provides the best hardcopy map production capabilities but does not provide the same dynamic data linkage capabilities of the MapGuide option nor the ease of use associated with Google Earth. The availability of all three viewing options provides a comprehensive set of tools for the examination of the available exploration data.

The TSS MapGuide and TSS Google Earth options require the TSS specific information to be integrated into the preexisting information available from these two sources. For the initial six month period following the construction of the TSS information set this information will be served off a Cal Data Ltd. server. Following this period the TSS information will be migrated into standalone forms that are compatible with these two display options. This will provide an archival product and one that does not require the services of a TSS specific server.

Area

The area under investigation during this project is contained in 65 individual tenure units. Contiguous units form 7 claim blocks all of which are contained in the NTS 094E Map sheet area (Figure 1). Much of the public domain information compiled for the project was obtained for the whole NTS map sheet area. This additional information outside the individual claim areas improves the interpretability of the various data sets within the TSS claim areas.

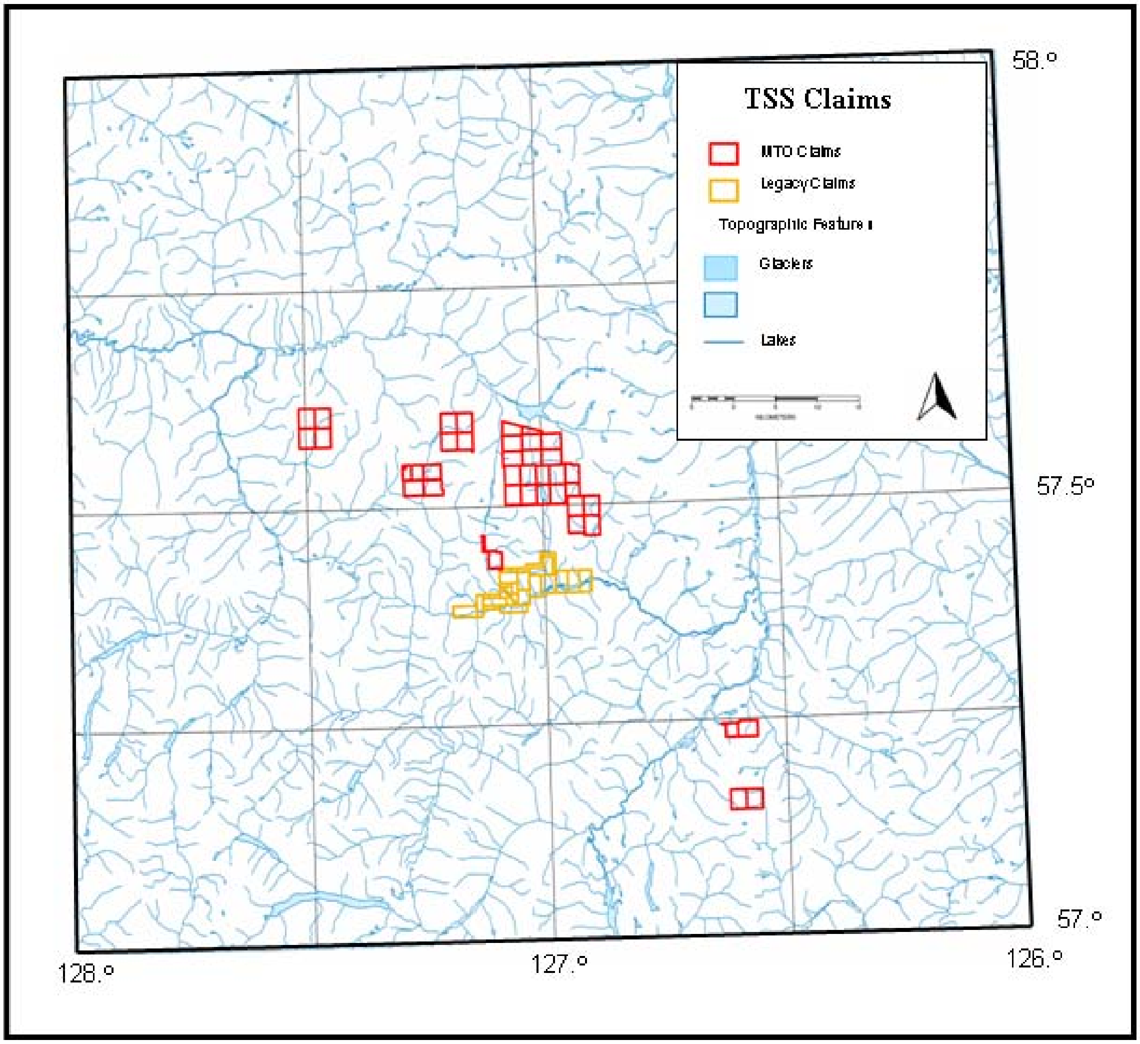

Figure 1. NTS map sheet 094E showing the distribution of the TSS land holdings.

IMAGE ANALYSIS

Multispectral imagery were obtained and analyzed in an attempt to identify trends that could be used to localize exploration efforts. The project area is heavily vegetated with exposed rocks being present above tree line and in limited steep exposures elsewhere. Only where rocks are exposed can they be investigated directly with image analysis. Trends in vegetation characteristics may prove useful in vegetated areas as in indicator to the underlying geology. The project area is partially covered by an ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) image and completely covered using two Landsat 7 ETM+ images. The raw ASTER image data was downloaded from the MapPlace (image A108), processed to relative reflectance and analyzed. The two Landsat images were downloaded from the federal government's 'Geogratis' site. These two Landsat images were available from the MapPlace site but in a form that did not allow processing to relative reflectance therefore they were downloaded in the less processed level L1G form. A complete list of the products available from the image analysis process are contained in the section on GIS / Desktop Mapping Framework.

ASTER

The ASTER image used in this study was collected on July 7th, 2002 at 19:49:05 UTC. Unfortunately a recent snow fall covered most of the rock outcrops at higher elevations (Figure 2).The ASTER image data was processed from it's original format that provided 'at sensor radiance' to relative reflectance and it was orthorectified. The orthorectification process was performed with the ASTERdtm software that generates a digital elevation model from the image data and then calculates the true ground coordinates of each image pixel. The atmospheric correction function was performed with the ACORN5 software.

Preprocessing:

Processing of the ASTER image included correcting both spatial and spectral characteristics. The first step was to correct the spatial attributes by orthorectifying the image. This process was performed with a software add-on to the ENVI image analysis package called ASTERdtm. This program generates an elevation model (DEM) and then uses this model to reposition each image pixel to its proper location (orthorectification). This program also applies the appropriate gains and offsets to the image measurement values (DN). The result of the ASTERdtm process is an orthorectified and calibrated image data cube of 14 bands and a DEM.

Atmospheric correction was performed using specialized software called ACORN5 that compensates for the effects of atmospheric gases on the amount of light energy that penetrates and is reflected by the atmosphere. The original ASTER data is in the form of 'at sensor radiance' which is a measure of the amount of light the satellite sensor receives from all sources. A significant amount of the light that the sensor sees is reflected from the atmosphere and never reached the ground surface. This light obviously provides not information about the ground features and should be removed. The atmosphere also absorbs or otherwise scatters some of the light reflected from the ground surface. This missing light at the sensor is calculated by knowing the incident light value and general atmospheric conditions. Water vapour has the largest effect on the ability of light to penetrate the atmosphere. The relative reflectance values obtained from this process provide a spectra shape similar to what would be obtained with a field spectrometer or in a laboratory setting. This processing is essential so that the various band measurements at a given pixel have standard relative values. Otherwise the standard ratios and band formula used to identify minerals or mineral groups would be of little value.

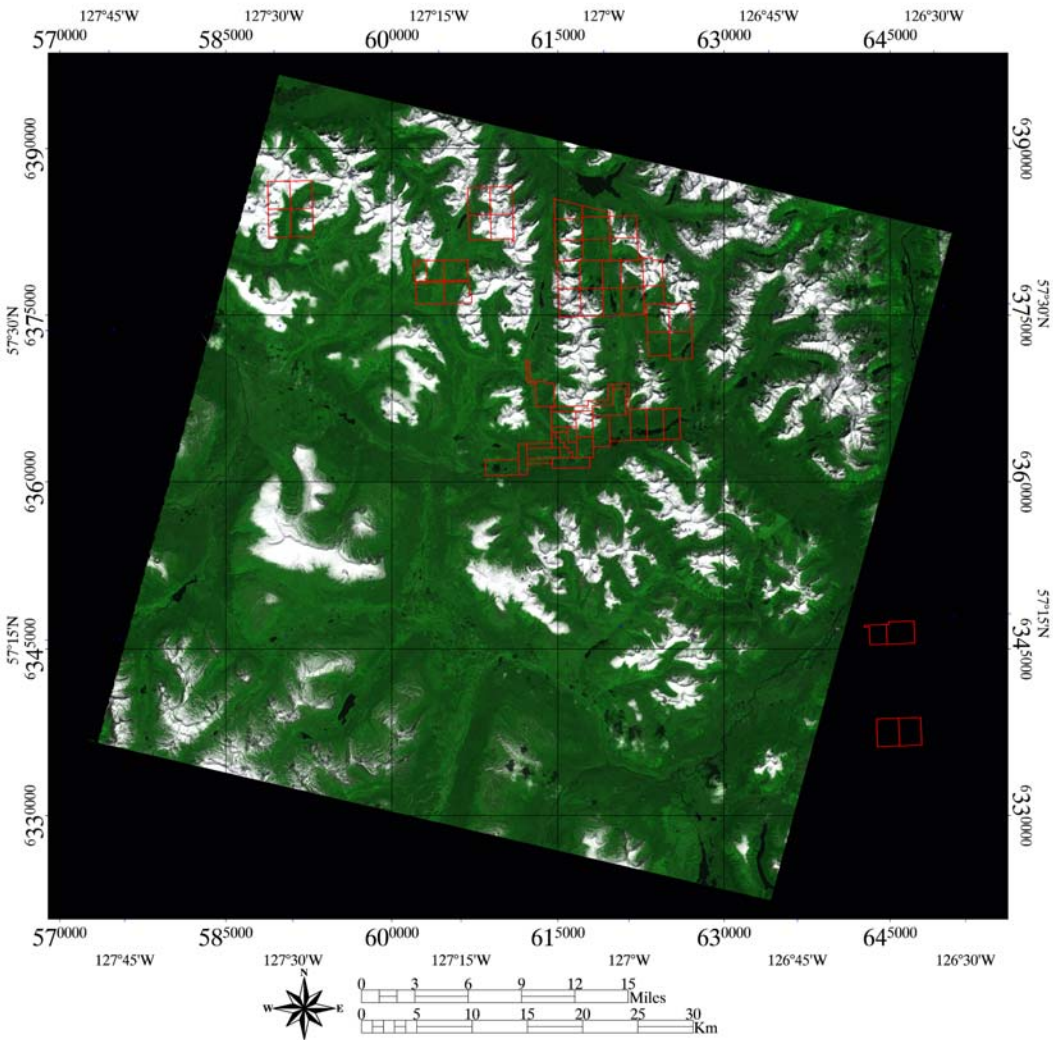

Figure 2. Distribution of TSS claims on ASTER image. Note the snow cover on higher ground.

Products:

Once the spatial and spectral preprocessing is completed the image data is in form for analysis. Various combinations of bands can be used to identify groups of minerals where there is good rock exposure. ASTER with its 14 spectral bands has proven very effective for this purpose in many settings around the world. A number of these procedures were applied to the ASTER dataset but in the end the lack of reasonable exposure negated their potential usefulness. Figure 2 illustrates the lack of bare outcrop in the areas within the TSS claim groups.

As a result the only useful products that were generated from the ASTER imagery were a near-natural coloured image (Fig. 2) and the DEM.

Landsat

Two Landsat 7 ETM+ images were used to completely cover the TSS claim areas. These images were available for download from the MapPlace. Their MapPlace identification is L52 and L68. The format of the images available by download from the MapPlace is not amenable to some additional processing such as atmospheric correction. As a result new image data was downloaded from 'GeoGratis' by using the links provided on the MapPlace. The level L1G data was downloaded. This data set is not orthorectified but provided instrument readings in a less processed form that could then be corrected for atmospheric effects. Image L52 (western image) was collected on August 12, 2001 at 19:25:00 UTC and image L68 (eastern image) was collected on August 14, 2001 at 16:12:36. Figure 3 shows the distribution of the two Landsat images relative to the TSS claims.

Preprocessing:

Atmospheric correction of the Landsat images was performed using ACORN5. The reasons for atmospheric correction and the results of such a correction are discussed above in the ASTER section. Once the atmospheric correction was completed the images were spatially corrected to remove the effects of topography and viewing angle. The images were not directly orthorectified but were warped to match their orthorectified equivalent images that were available from the MapPlace. Three to four hundred common tie points were identified between the matching images and the atmospherically corrected level L1G images were warped to match the orthrectified images.

Image masks were constructed for the Landsat images to blank out all pixels that did not represent bare ground. Snow, vegetation and water are relatively easy to identify and add to the mask but the edges of clouds are nearly impossible to completely remove without removing a significant portion of bare ground pixels. For this reason there is often a small rind of pixels that are not masked around clouds. Caution must therefore be taken when interpreting the results of any analysis made on the masked image. But it is a simple matter to compare the masked analysis results with a natural coloured image to see if specific pixels are in fact associated with cloud edges.

Products:

A number of analysis products were generated from the warped, atmospherically corrected Landsat data sets. Each image was processed independently because they were collected several days apart and conditions of the collection as well as the general characteristics of the areas samples result it slightly different pixel values. In most cases the results of the band manipulations are visually comparable. The results have been kept separate, in two images, to reduce and distortions in one image caused by the other that would have occurred if they were combined in a single mosaic and an attempt was made to artificially match the images. For each of the images a mask was determined that removed all non-rock exposure pixels from the calculations. In addition an NDVI (Normative Difference Vegetation Index) and Tasseled Cap transformation image were prepared. Both of these images included the whole image and provide very general information. The NDVI image maps chlorophyll content and can be used to identify areas of differential plant growth. The cause of the differential plant growth may be due to geological effects such as moisture along a fault, metal contamination from a specific formation or mineral concentration (zinc moss). The Tasseled Cap image attempts to simplify the image into three main components; water, vegetation and outcrop (in these images). Red hues in these images denote areas of no plants or water. They could be identifying rock exposures, buildings, snow or clouds (Figure 4).

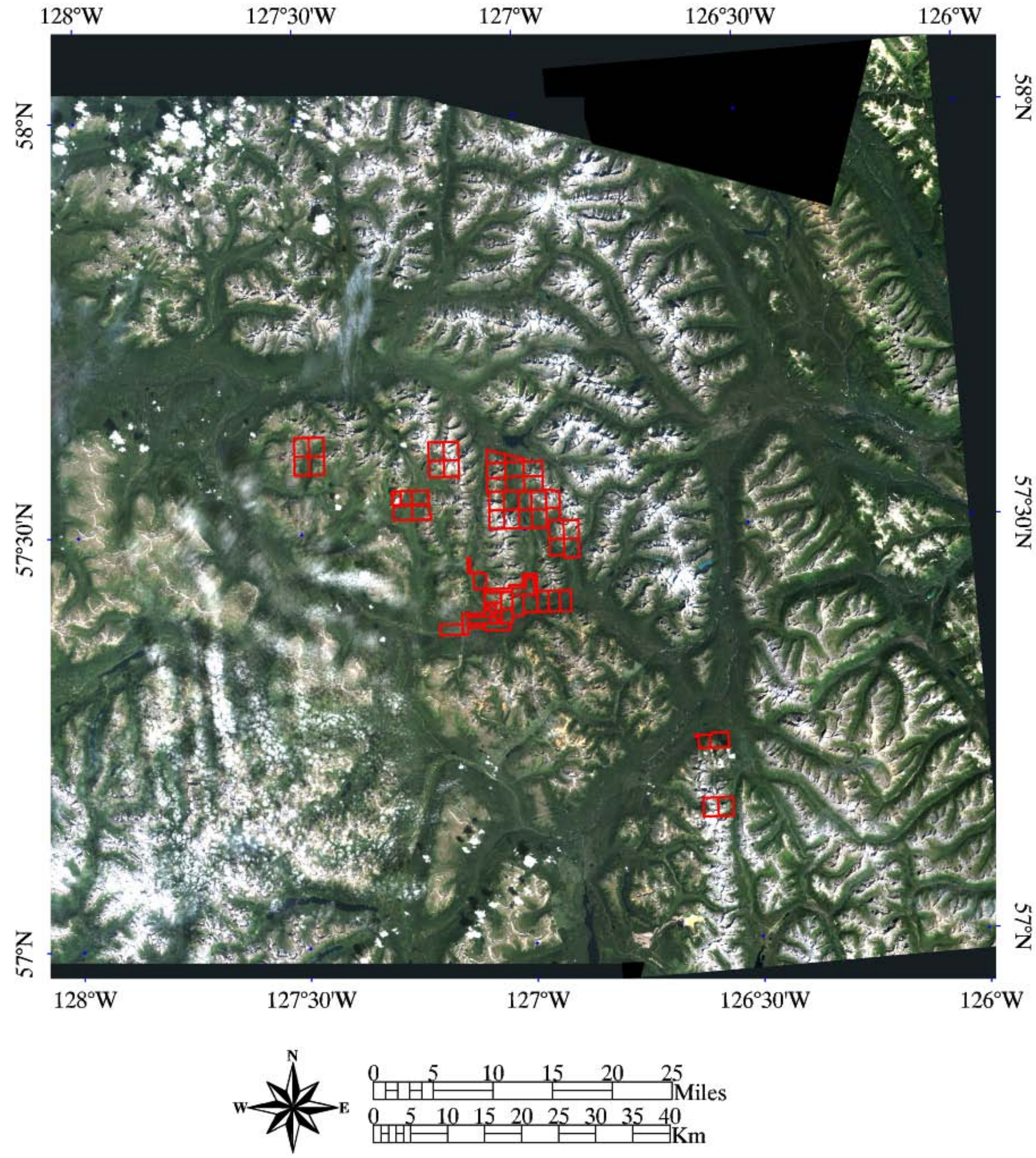

Figure 3. Distribution of the TSS claims on a natural colour mosaic made from the two Landsat images. The yellow line marks the boundary between the two images. Note the Kemess South operation near the bottom of the image and the yellow boundary line.

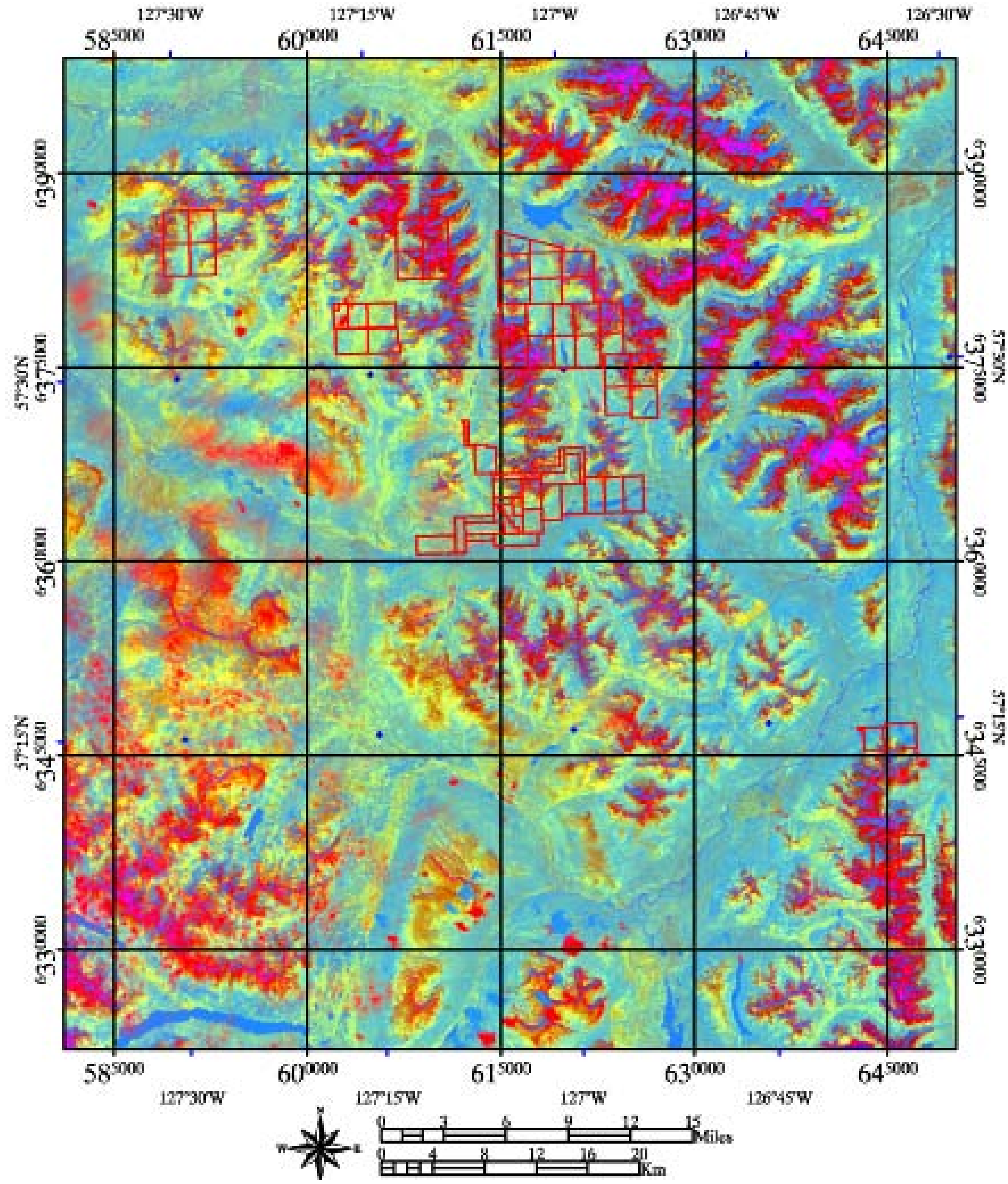

Figure 4. Tasseled Cap image of the general TSS claim area. The image is a mosaic formed from the two Landsat images. Blues and yellows represent water and vegetation and the reds represent rocks, snow and clouds.

Mineral alteration maps were constructed for each Landsat image by using various combinations of the bands that have proven useful in the past by other workers in other areas. These maps are based on relatively simple formula and make some major assumptions. It must always be remembered that these maps are actually band ratio maps that may indicate the presence of substances such as clays, oxides and ferrous minerals. They are valuable as a first analysis of an area when little or no ground knowledge is available. They may or may not indicate the minerals associated with their names but they often present patterns that can prove useful in sorting out structures and identifying alteration zones. Once some knowledge of the mineralogy at specific locations has been gained there are a variety of analysis techniques that can be employed to map the distribution of the identified material. Landsat is a multispectral instrument with very wide sample bandwidths and it does not have the ability to identify specific minerals but it can be used to identify classes of minerals such as clays, oxides and iron rich units. Three alteration maps have been prepared; clay (band 5 / band 7) (Figure 5), ferrous (band 5 / band 4) (Figure 6) and oxide (band 3 / band 1) (Figure 7). Small scale examples are presented in this document but the complete suite of detailed maps for all the claim groups are contained in the digital data sets that are viewable by all three viewing options.

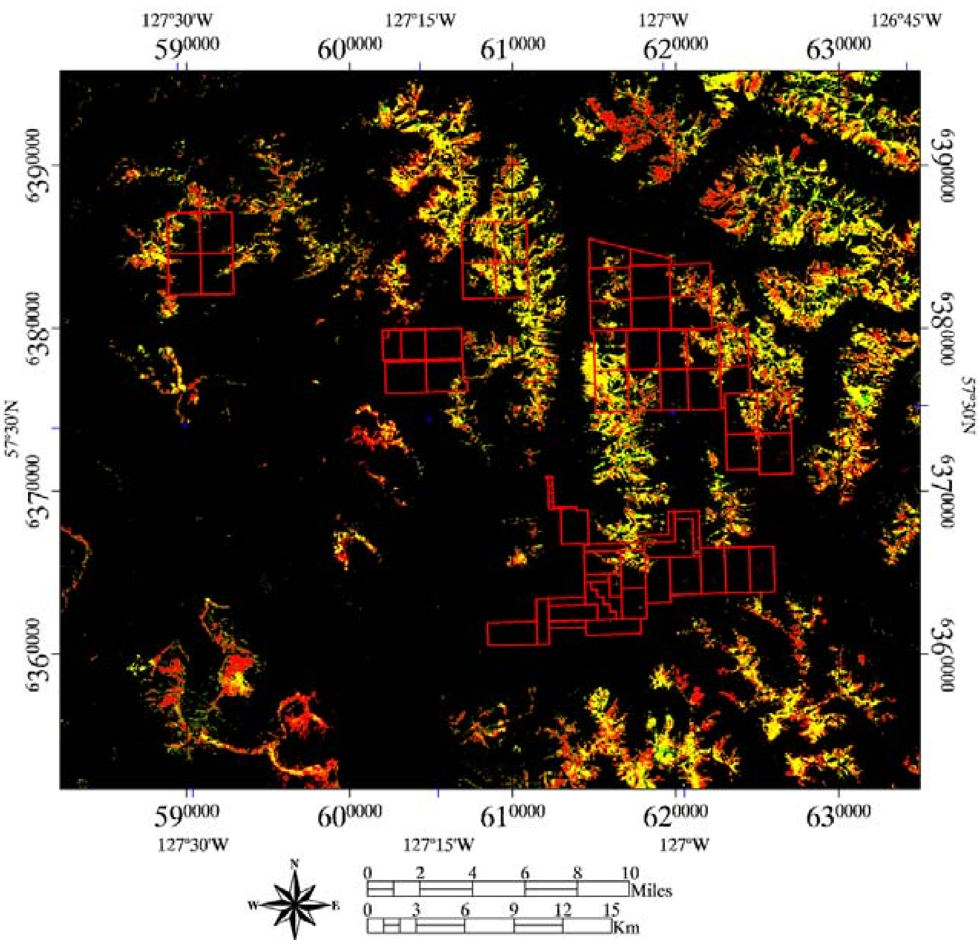

Figure 5. Clay Map is a simple band ratio of band 5 over band 7. The higher values of this ration (reddish hues) have been used to identify clay rich materials. The black areas of the image are the result of applying a mask which removes all vegetation, clouds, water and snow from the calculations. Some of the TSS claims are shown in this example.

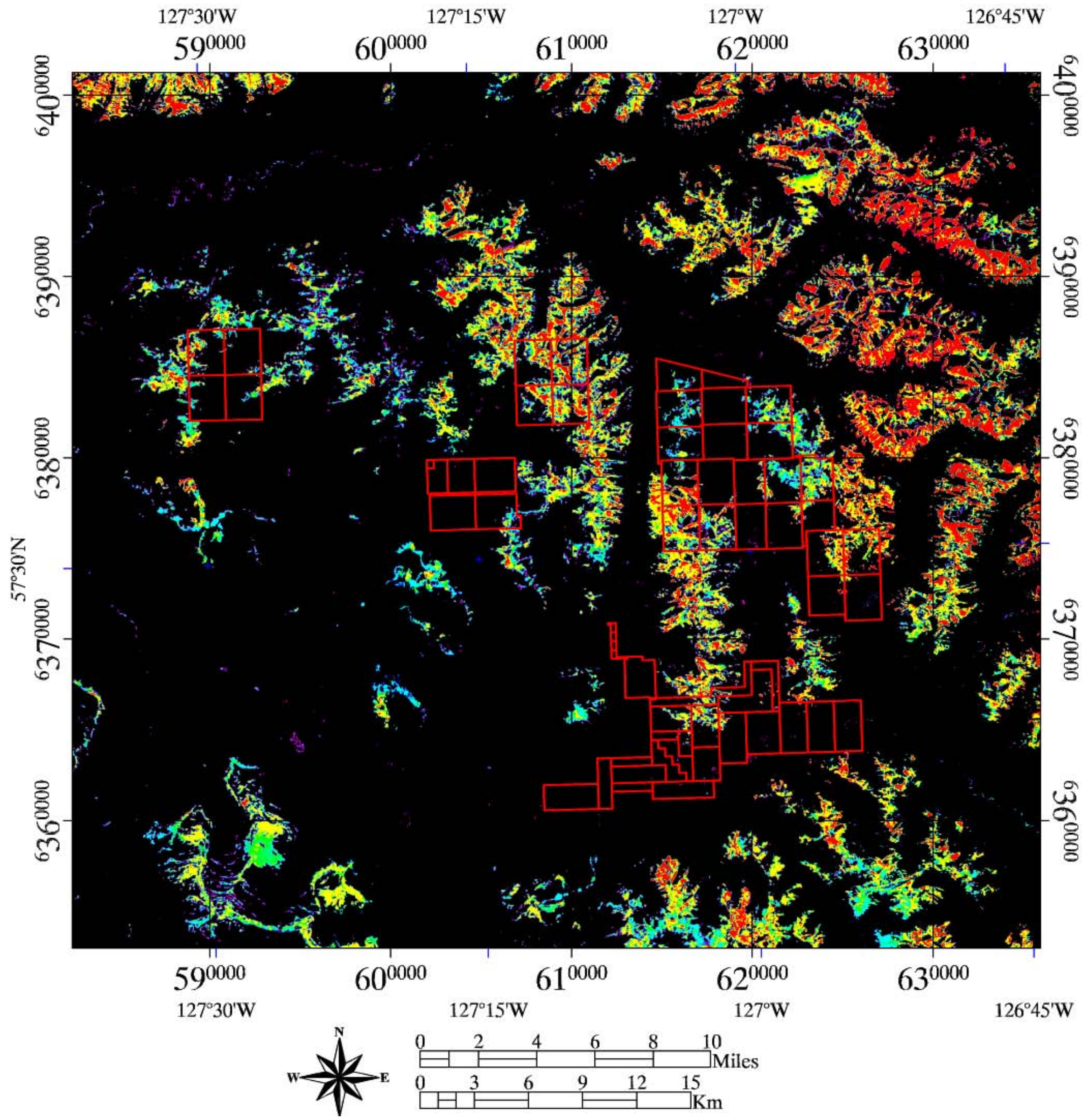

Figure 6. Ferrous Map is a simple band ratio of band 5 over band 4. The higher values of this ration (reddish hues) have been used to identify ferrous mineral rich materials. The black areas of the image are the result of applying a mask which removes all vegetation, clouds, water and snow from the calculations. Some of the TSS claims are shown in this example.

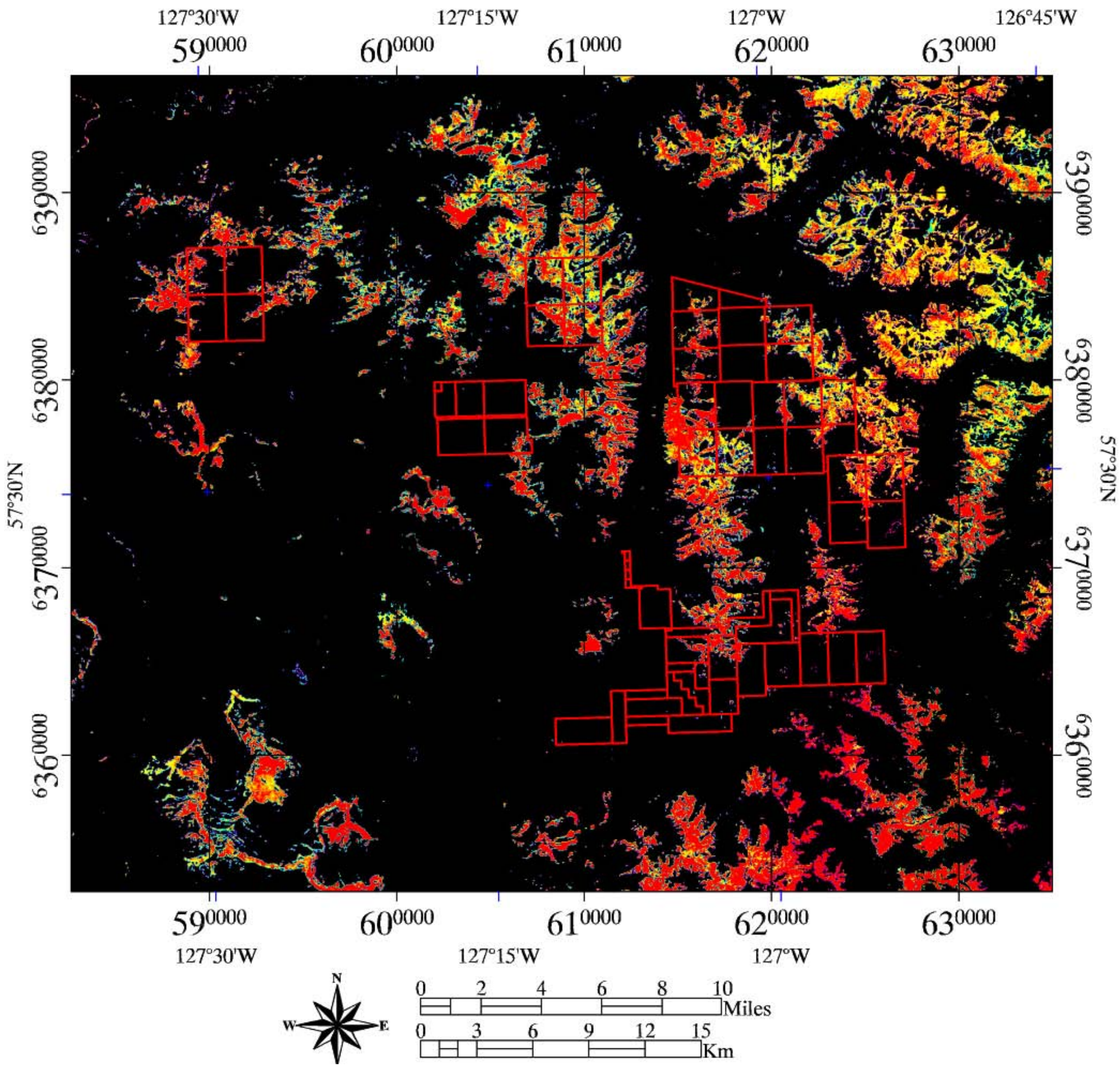

Figure 7. Oxide Map is a simple band ratio of band 3 over band 1. The higher values of this ration (reddish hues) have been used to identify oxide mineral rich materials. The black areas of the image are the result of applying a mask which removes all vegetation, clouds, water and snow from the calculations. Some of the TSS claims are shown in this example.

GIS COMPILATION

Compilation of information relevant to mineral exploration on the TSS claims was performed. The information compiled consisted of both base map information and mineral exploration specific information. All of the information used during this project was available in digital format. In some cases the data required manipulation to be compatible with the software used for its viewing. In a few cases new information was generated from the acquired digital data. Each of the compiled data set is discussed below with a description of the data source, the manipulations performed and the viewing options.

TSS Tenure

Tenure information for the area was obtained by downloading an ESRI Shapefile of all the tenure polygons for BC from the BC Government web site (www.em.gov.bc.ca/DL/BC-Maps/SHP/mto_bc_dd.zip). The file used in this study was last updated on March 30, 2006. The shape file was reduced to only those claims that fell within the 094E map sheet and along trend with the TSS holdings. The claims held by TSS were further separated into those that were ground staked (legacy claims) and those that were obtained through on-line staking. These files were reformatted into MapGuide and Google Earth specific formats. The reduced ESRI Shapefiles were in a format directly compatible with most common GIS systems and required no additional formatting. Figure 1 is a MapGuide generated figure using the MapGuide version of this data set.

Landsat Mosaic (2000)

The 2000 version of the NASA Landsat mosaic was obtained to provide an image background for the MapGuide and GIS viewing options (https://zulu.ssc.nasa.gov/mrsid). The mosaic image resolution is about 15 metres. This mosaic forms the global background image for the Google Earth display with more detailed imagery being available locally. The mosaic was obtained in the same projection that is used in the MapGuide and GIS systems (UTM zone 9, NAD 83). The mosaic is delivered as a large MrSid file that was then subsetted to cover the 094E Mapsheet. To facilitate rapid delivery of the imagery over the WEB the image was recompressed in ECW format after being subsetted.

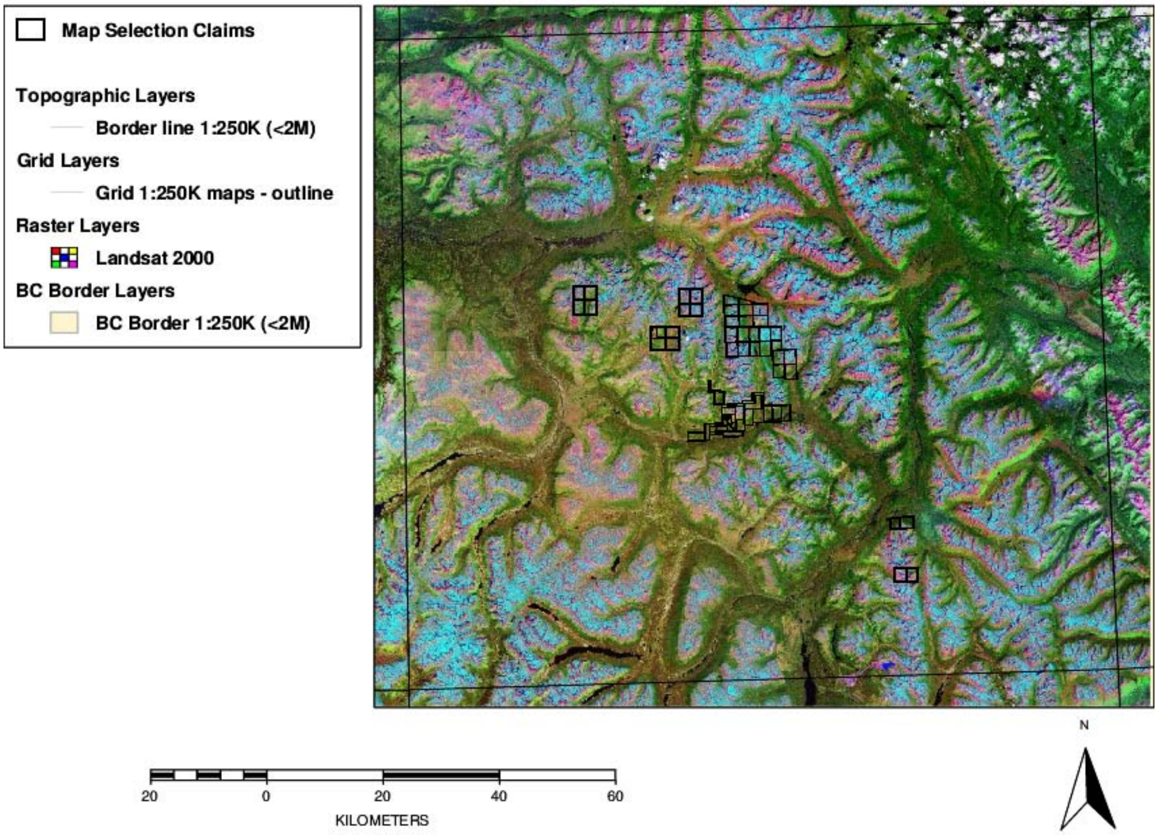

Figure 8. A MapGuide view of the Landsat 2000 Mosaic coverage for 094E with the TSS claim holdings displayed.

Topography/DEM

Topographic information is presented in a variety of ways in the three viewer options used for this project. Traditionally contour lines are used to display the topographic features in map view. Often hillshaded DEMs are used to provide a 2 dimensional view of the topographic character of the land base and occasionally information is draped over a DEM to provide a 3 dimensional view. In addition some software (Google Earth) uses a digital elevation model to provide continuous elevation readouts corresponding to the cursor position. For this project the Shuttle Radar Topographic Mission (SRTM) data set was used. The most recent version of this data set became available during this project and significantly improved the quality of this product. The required information was obtained from the NASA site; ftp://e0srp01u.ecs.nasa.gov. This is also the source of the topographic information used in the Google Earth viewer. This information was used to construct hillshaded views of the claim areas and generate contours for map displays. ENVI was used to generate four hillshaded views with sun inclinations of 35 degrees and directions of 90, 135, 180 and 225 degrees. These images were produced in formats compatible with MapGuide, Google Earth and GIS. Figure 9 contains map sheet scale examples of these four hillshaded images. To provide contour lines for the GIS the Manifold GIS was used to extract 20 metre contour lines from the SRTM DEM. These lines were saved in ESRI Shapefile format for easy inclusion in any GIS.

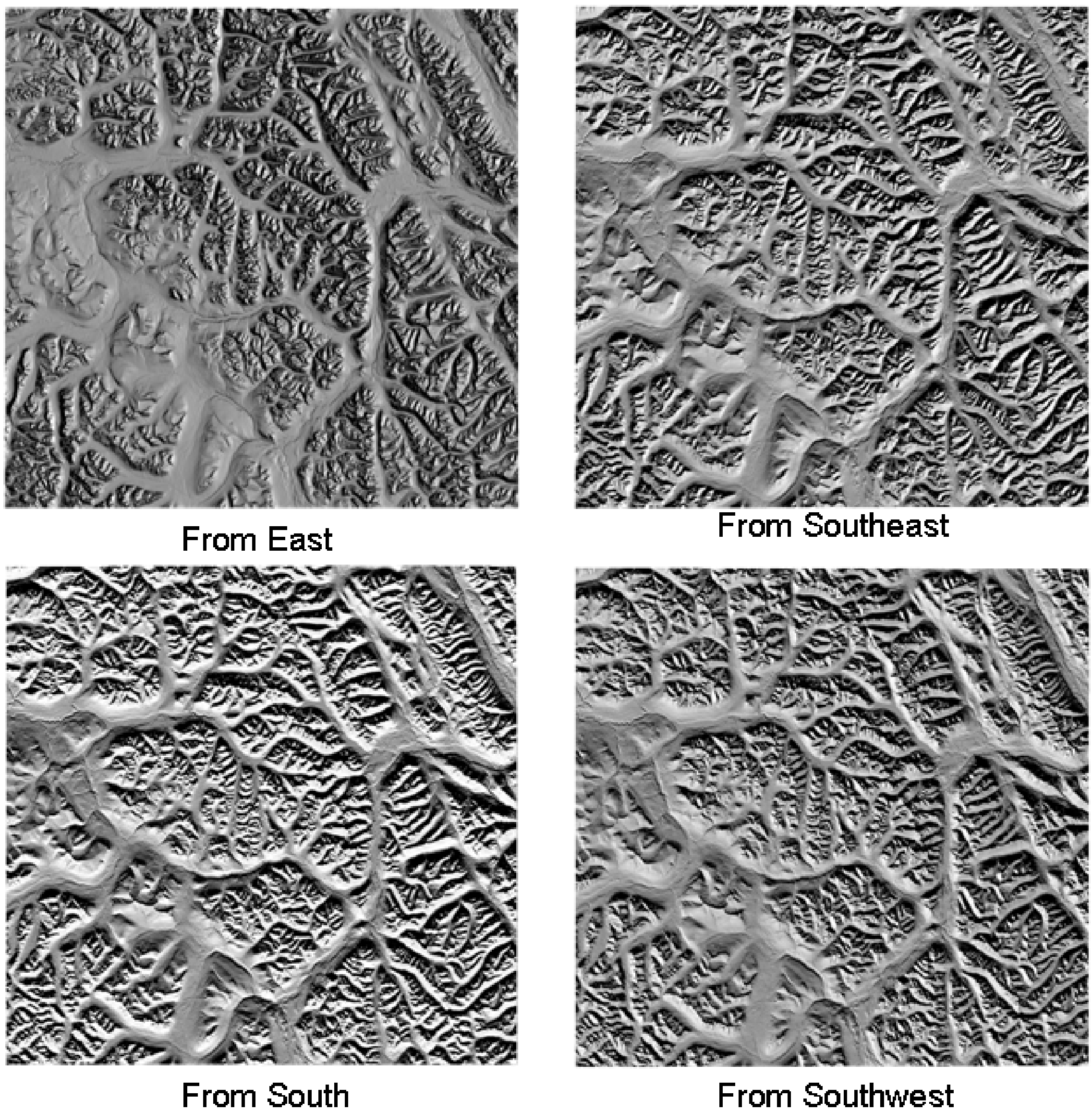

Figure 9. Four topographic hillshade views of the SRTM DEM for the 094E map sheet.

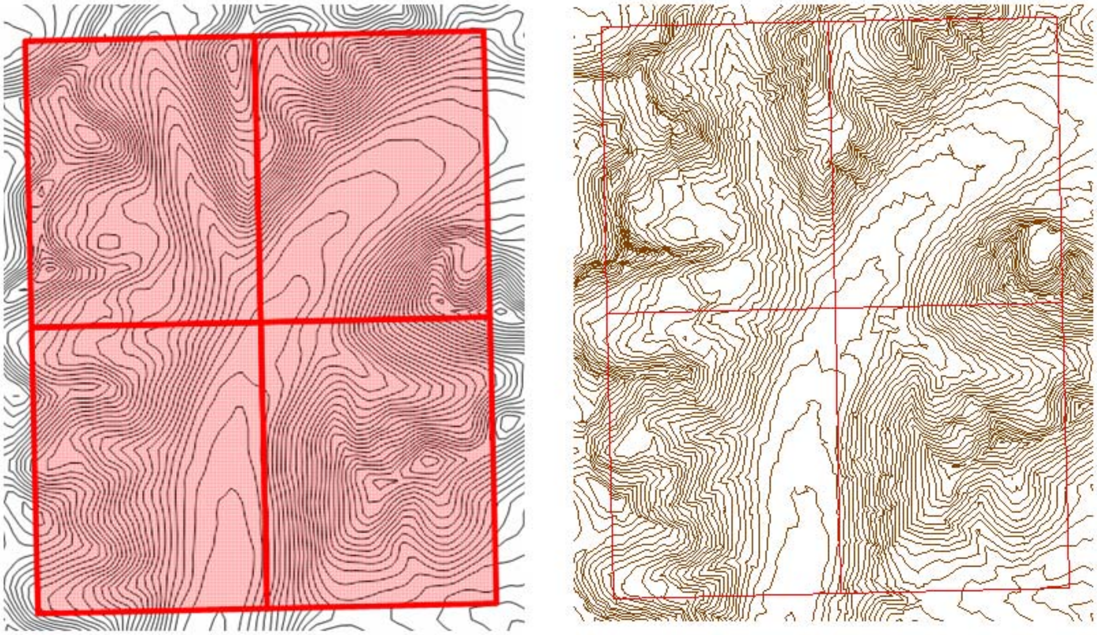

Figure 10. Comparison of 20 metre contours generated from the SRTM DEM (left) with the TRIM contours available for viewing on the MapPlace. The GACHO 1-4 claim block is shown for reference.

Geophysics

Detailed geophysics was available for much of the TSS claim area in the Toodoggone Multisensor Geophysical Survey (BCMEM Open File 2004-8 / GSC Open Files 4606-4613). This data set was downloaded from the MapPlace. The ten geophysical themes used were:

MTF - Magnetic total field (nT);
CVG - Calculated magnetic vertical gradient (computed, nT/m);
POT - Potassium (K, %);
URA - equivalent Uranium (eU, ppm);
TER - Ternary radioelement map (K, eU, eTh);
ADRN - Natural air absorbed dose rate (ADRN, nGy/h);
RUT - equivalent Uranium/equivalent Thorium (eU/eTh);
RUK - e quivalent Uranium/Potassium (eU/K, ppm/%);
RTK - e quivalent Thorium/Potassium (eTh/K, ppm/%);
TER - Ternary radioelement map (K, eU, eTh).

The data was available as TIFF images in the projection required for display on the MapGuide maps and in the GIS. These images were reprojected into latitude and longitude coordinates for display on Google Earth. Figure 11 contains a view of the MTF dataset draped over the terrain in the Google Earth viewer.

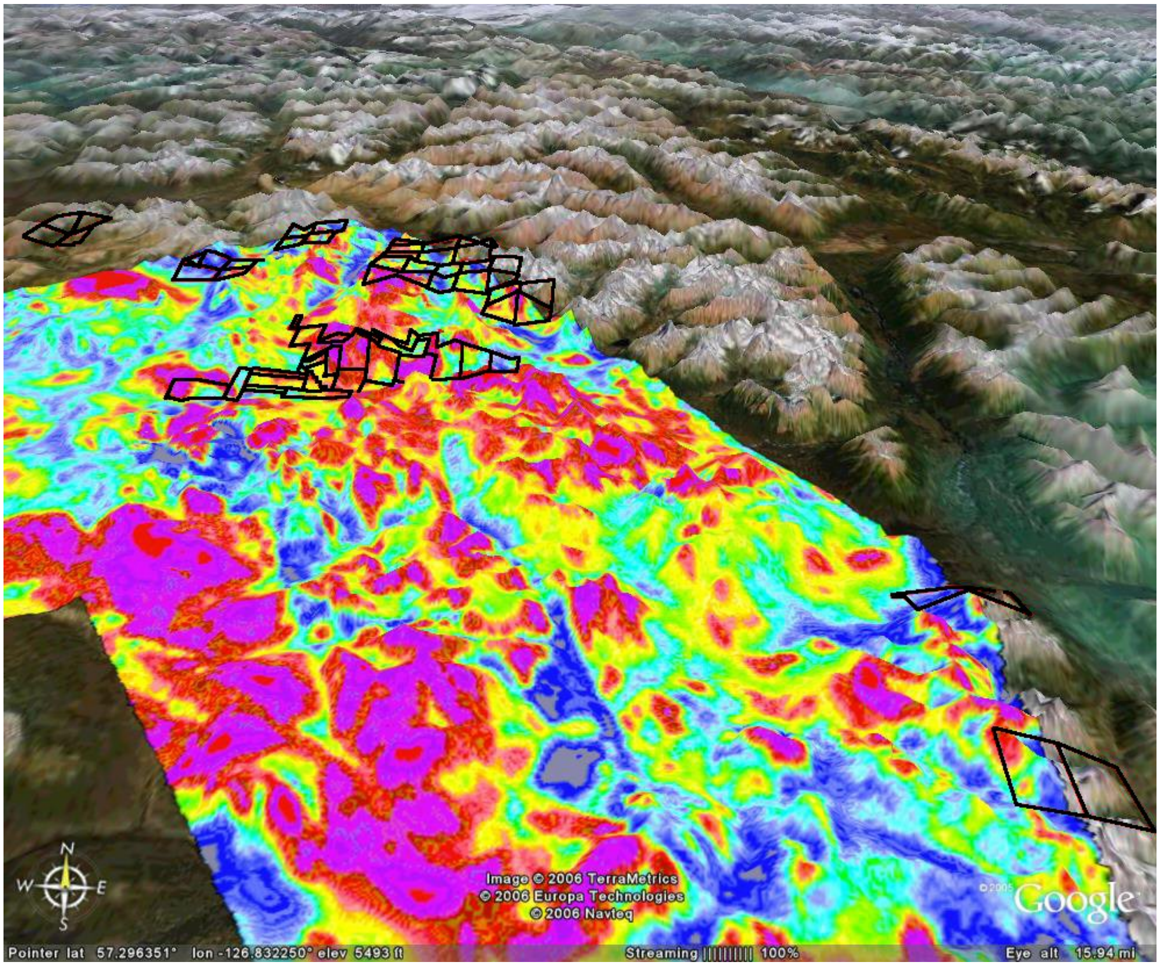

Figure 11. View of the MTF geophysics dataset in the Google Earth viewer. TSS claims are defined by the red outlines.

Toodoggone Geology

Detailed geology (1:50 000 scale) for the Toodoggone area was released during this project by the BC Geological Survey in the form of a PDF map as publication GM2006-6. This PDF map was converted to a raster image and georeferenced for inclusion in MapGuide, Google Earth and GIS displays. The map covers only a portion of the area contained in TSS claims. But for those areas it does cover it is the most detailed publicly available geology. Figure 12 shows the distribution of the claims relative to this geology map.

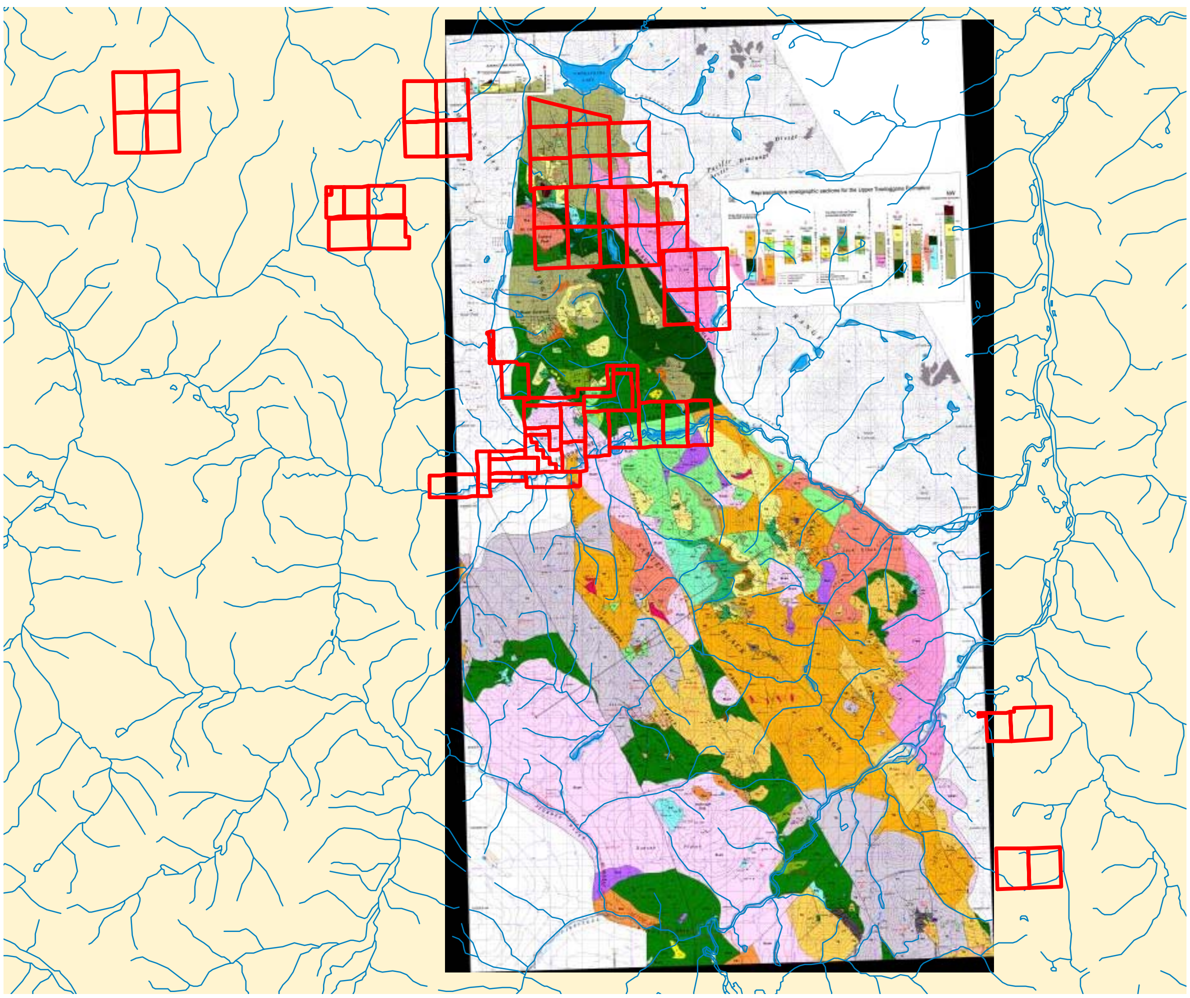

Figure 12. Georeferenced geology map GM2006-6 in MapGuide display with the TSS claim holdings shown for reference.

Provincial Scale Geology 1:250 000 scale

Geology for the entire TSS claim area was available at a scale of 1:250 000 from the MapPlace as integrated layers in the MapGuide view or as download for inclusion in a GIS (www.em.gov.bc.ca/DL/BC_maps/Geology/N09_utm.zip). Geology linework, unit patterns and labels are also available in the Google Earth display as a rasterized WMS (web mapping service) overlay. The downloadable geology file also contains useful geographic information such as lakes, rivers, roads and topographic contours.

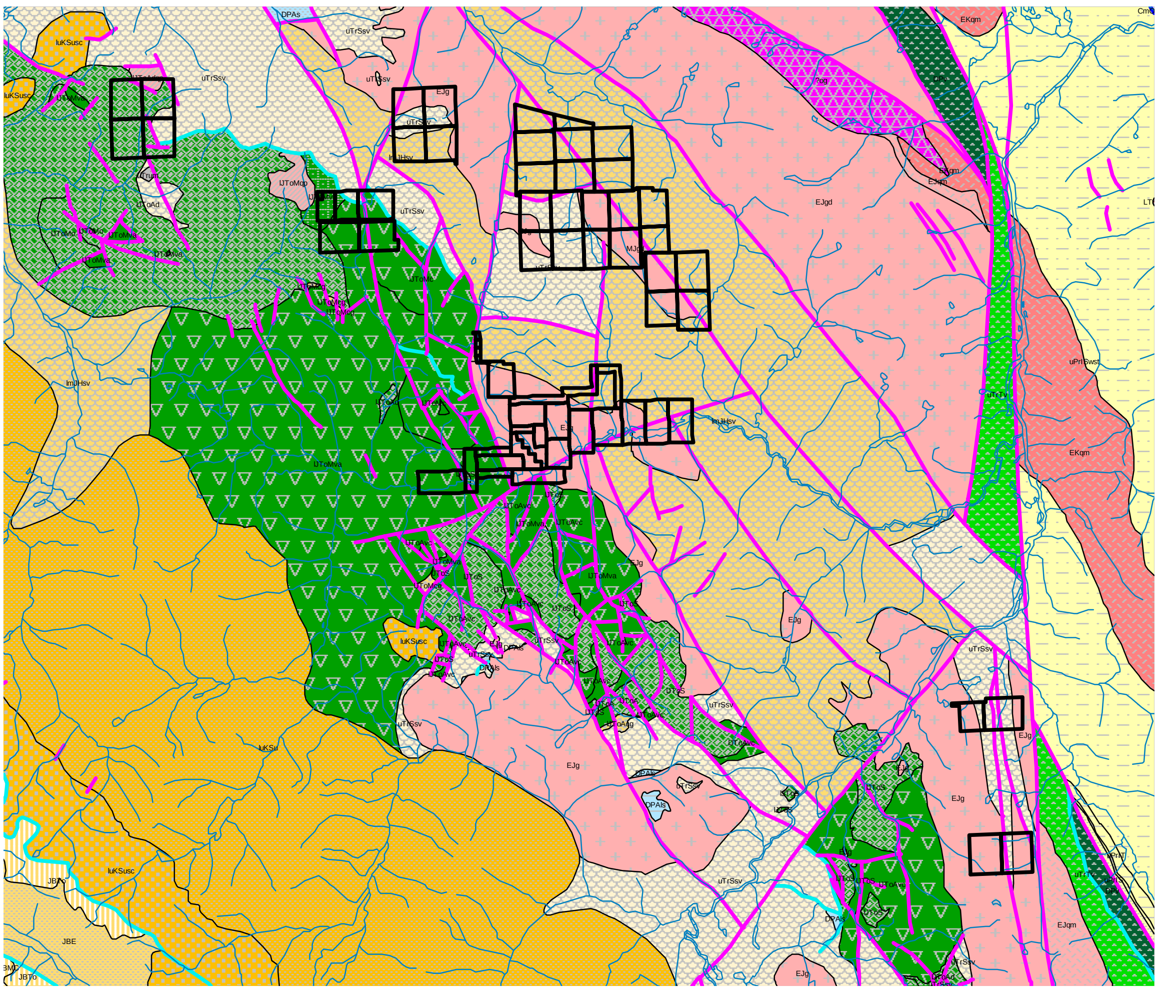

Figure 13. BCGS Geology 2005 layers from the MapPlace with TSS claims for reference. This display has the same coverage as Figure 12.

Geochemistry

Geochemistry for the 094E map sheet was downloaded from the MapPlace (www.em.gov.bc.ca/DL/GSBPubs/RGS_data/RGS094E.zip) for inclusion in the GIS viewing option. The full RGS data set for the map sheet is available from the integrated map layers included in the MapGuide viewing option. In addition the "MineMatch Anomaly Clusters" can be accessed through the MapGuide viewing option.

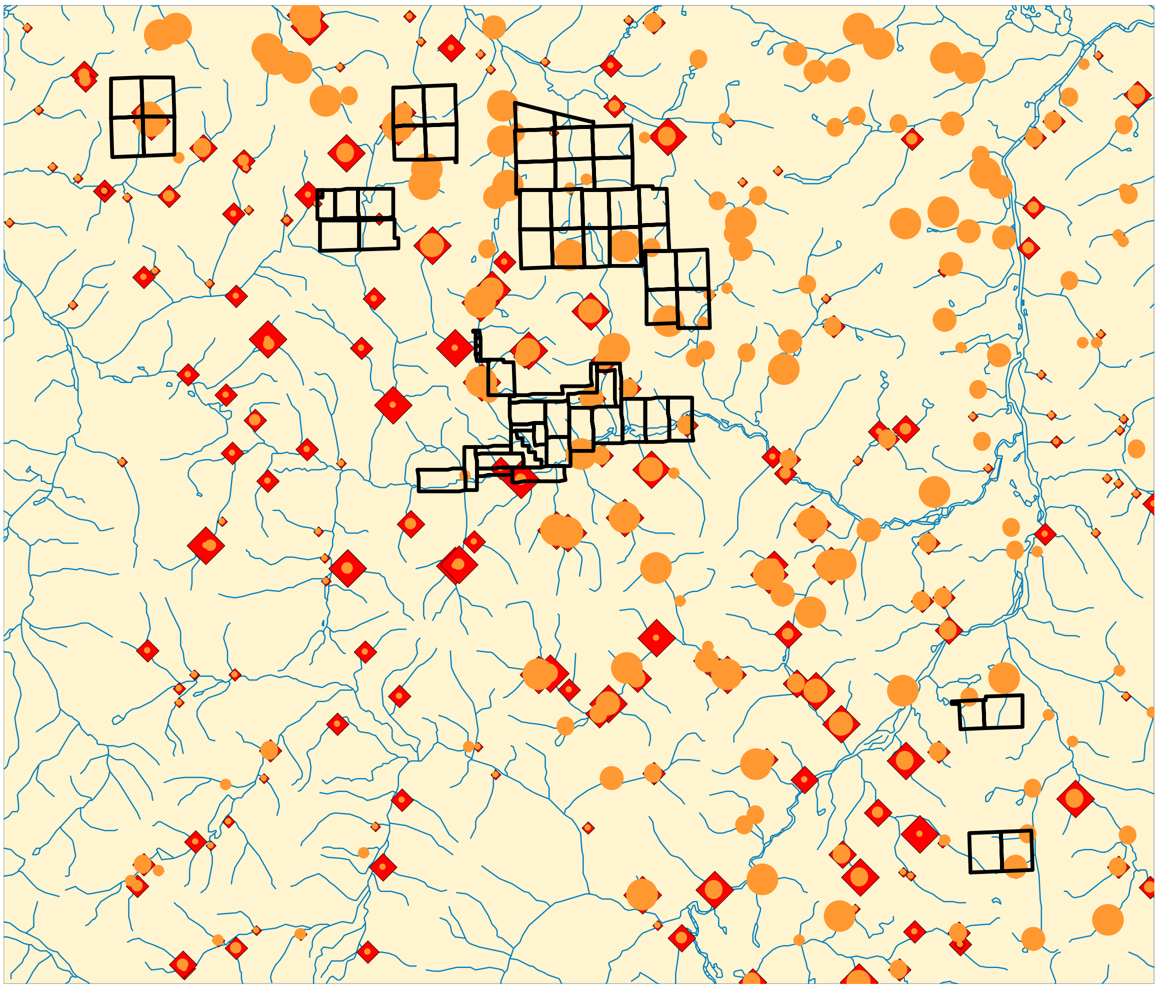

Figure 14. Copper and gold Regional Geochemistry Survey (RGS) samples shown relative to the TSS claims in a MapGuide view. Copper values are represented by the brown circles and the gold values by the red diamonds.

MINFILE and ARIS

MINFILE and ARIS locations and links to more detailed information are available through the MapGuide layers that are linked to the MapPlace. This linkage option is possible with some GIS systems but has not been implemented during this project. The provincial scale databases for both these datasets were downloaded and those sites enclosed in map sheet 094E were selected and retained for display and use in this project. The basic MINFILE data was obtained from www.em.gov.bc.ca/DL/BC_maps/MDBC/minfile_dbf.zip. The ARIS information was downloaded from www.em.gov.bc.ca/DL/BC_maps/MDBC/aris_dbf.zip.

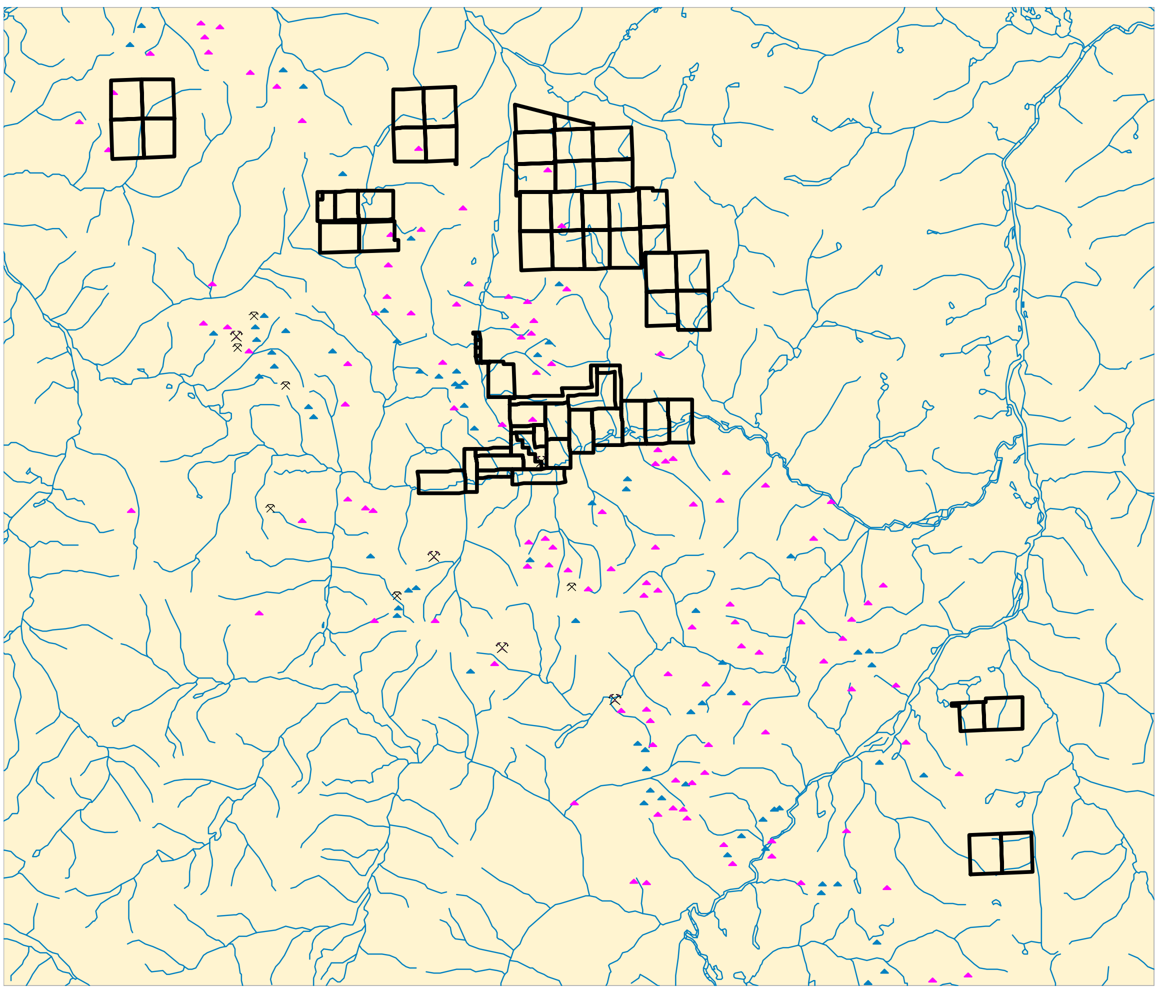

Figure 15. Distribution of MINFILE and ARIS data relative to the TSS mineral claims. This view produced from the MapGuide view option.

GIS FRAMEWORK OPTIONS

The purpose of the GIS data compilation portion of this project was to construct a digital framework for use in ongoing analysis of exploration information available for the claim area. As well, the framework is to be used to house new information from public and private sources. Three GIS frameworks for the compiled mineral exploration data and image analysis results were prepared. Each of the options has its own strengths and weaknesses but together they provide a very comprehensive set of viewing capabilities and included data sets with linkages to other web-based data systems. Traditionally, this type of compilation and analysis has been performed on stand alone GIS or desktop mapping systems such as MapInfo and Manifold. However, the last 10 years has seen increased use and capabilities of web-based GISs such as the MapPlace. More recently web-based 3D visualizing systems such as Google Earth have become very powerful and popular.

MapGuide Framework

MapGuide is the software used by the BC Geological Survey's MapPlace. It has the capability to broadcast over the WEB individual map layers which can be incorporated in third party MapGuide maps. For this project a TSS specific MapGuide map was prepared which used many of the layers made available from the MapPlace plus information produced by this project and specific to the TSS claim area. The TSS specific information is served from a Cal Data Ltd. MapGuide server. The amount of information available through the MapPlace simply cannot be duplicated on a stand alone GIS. By integrating TSS map layers with those from the MapPlace this viewing option provides the best access to the available information. Much of the information from the MapPlace is maintained daily, such as the mineral tenure layer, something that would be extremely time consuming with a stand alone system. Some information freely available through the MapPlace would have to be purchased at significant expense if it was to be included in a stand alone system, for example the TRIM topographic data. Simple WEB add-on tools distributed through the MapPlace provide the capability to add make simple modifications to the MapGuide map such as user defined grids without recourse to standard MapGuide software. The "MappperWrapper" and "Unplugger" provide the ability to adjust the published TSS MapGuide map and use the map when not liked to the Internet.

TSS specific layers that have been added to layers available from the MapPlace include:

- specialized displays of TSS only tenure
- 2000 NASA Landsat mosaics
- Raster view of the GM2006-6 geology map
- BCGS 1:250 000 Geology map
- Hillshaded DEMS
- Results of the image analysis performed in this study.

These layers have been blended with MapPlace layers that form parts of several maps on the MapPlace to make a unique combination of layers specific to this project. The MapGuide map generated for this project is named ARNEX.MWF and is contained in Appendix 1. The free MapGuide Viewer is required to view this file.

GOOGLE EARTH Framework

The Google Earth viewer is rapidly becoming the most used and convenient method to display map style information over the WEB. In addition it provides several features that are extremely useful to the explorationist's geological interpretation efforts. The viewer deals with different data themes as layers just as in MapGuide and GISs. It comes with an extensive and constantly improving set of base data such as Landsat imagery, transportation infrastructure, hydrology and an interactive terrain base. The terrain base can be adjusted to various vertical exaggerations and resolution. The user can view the terrain from any direction to provide the most advantageous perspective of geological data which can be projected onto the 3D terrain image. Raster layers such as scanned geology maps and geophysics can have their opacity interactively adjusted to allow easy comparison of underlying features. The viewer can interactively adjust line and polygon display characteristics of any map object in the display to provide the best possible viewing characteristics.

The Google Earth viewing option created for this project combines information from Google Earth, the MapPlace and Cal Data Ltd. servers. The layers and sources of information are listed below.

<u>Google Earth</u>

- NASA Landsat Mosaic (2000) or better imagery
- Infrastructure
- Hydrology
- DEM (SRTM)

<u>the MapPlace</u>

- Formation contacts and Faults
- MINFILE locations
- Formation labels and patterns

<u>Cal Data Ltd.</u>

- Geophysics
- Landsat image analysis products
- ASTER image analysis products
- Mineral tenure
- Hillshaded imagery
- Detailed geology map (GM2006-6)
- BCGS 1:250 000 scale geology.

The Google Earth (KMZ) file that contains or provides access to all the above layers forms Appendix 2.

GIS / Desktop Mapping Framework

The traditional method of viewing compiled information of the type resulting from this project has been with stand alone software residing on a desktop computer. All the required information must reside on the system. This includes all the base data such as topography, hydrology and roads. Recently some systems have added the ability to link to external data sets over the Internet, as long as these datasets have been made publicly available. For this project the data was limited to what could be obtained and contained in a stand alone mode of operation. The information was initially collected and combined in the Manifold GIS system and then converted to a transfer file format compatible with the client's preferred system, MapInfo, or most other GISs. The information was all projected into one standard projection system, UTM zone 9, NAD 83. GeoTiff and PNG formats were used for raster images. The MapInfo MID/MIF data transfer file structure was used to pass vector data from the Manifold to MapInfo systems. The MapInfo workspace and related TAB files are contained in Appendix 3. Following is a list of the TAB files associated with the workspace and a brief comment on their contents.

Raster Files

TSS-LandsatMosaic: Natural colour mosaic from the two Landsat images.
TSS-TCMosaic: Tasseled Cap image mosaic from the two Landsat images.
TSS-NDVI-West: Normative Difference Vegetation Index, west side (PNG).
TSS-NDVI-East: Normative Difference Vegetation Index, east side (PNG).
ASTER-NC: Near colour image from ASTER.
Hillshade-E: Hillshade image of SRTM DEM, sun in the east at 35° above horizon.
Hillshade-SE: Hillshade image of SRTM DEM, sun in the southeast at 35° above horizon.
Hillshade-S: Hillshade image of SRTM DEM, sun in the south at 35° above horizon.
Hillshade-SW: Hillshade image of SRTM DEM, sun in the southwest at 35° above horizon.
GM2006-6: Image of detailed Toodoggone geology from BC GM2006-6.
TSS-Landsat2000: 094E section of the NASA Landsat Mosaic.
Clay-East: Clay mineral map image, east side.
Clay-West: Clay mineral map image, west side.
Oxide-East: Oxide mineral map image, east side.
Oxide-West: Oxide mineral map image, west side.
Ferrous-East: Ferrous mineral map image, east side.
Ferrous-West: Ferrous mineral map image, west side.
T_ADRN: Toodoggone geophysical image.
T_CVG: Toodoggone geophysical image.
T_MTF: Toodoggone geophysical image.
T_POT: Toodoggone geophysical image.
T_RTK: Toodoggone geophysical image.
T_RUK: Toodoggone geophysical image.

T_RUT: Toodoggone geophysical image.
T_TER: Toodoggone geophysical image.
T_THO: Toodoggone geophysical image.
T_URA: Toodoggone geophysical image.

<u>Vector Files</u>

ARIS: ARIS file segment for 094E mapsheet.
MINFILE: MINFILE file segment for 094E mapsheet.
094E-Boundary: Outline of the 094E mapsheet.
Faults: Fault lines within area.
Geology: Geology polygons within area.
Ice: Glaciers within area:
Lake: Lakes within area:
River-Line: River linework.
River-Poly: River polygons:
Quaternary: Quaternary polygons.
Road: Road linework.
RGS: Regional geochemistry survey data within 094E
SRTM-Contours: 20 metre topographic contours derived from the SRTM DEM.
Claims-Regional: Land status of the area as of March 30, 2006
Claims-TSS_MTO: Claims obtained by TSS though online staking.
Claims-TSS_ALL: All claims held by TSS in the area.

CONCLUSIONS and RECOMENDATIONS

This report documents the analysis of two types of multi-spectral satellite imagery and the compilation of mineral exploration related data into three different GIS like viewing frameworks.

The image analysis portion of the study was not able to make use of the ASTER image that covered most of the claim area due to very low outcrop exposure as the result of a late season snow fall. ASTER with its 14 bands may have provided more detailed results than were obtainable with the Landsat imagery. Two Landsat images were used to cover the report area. These images were collected within days of each other and were of excellent quality. The limited number of bands and their large bandwidths reduced the ability of the analysis to identify certain mineral species. The Landsat did provide the ability to generate band ratio images which have proven useful in mapping the distribution of mineral groups such as clays. The results of the image analysis are a series of images that can be used to identify trends that may help delineate geological features. Once some field identification of specific rock types has been made the imagery can be calibrated to better map specific rock types. It is recommended that other imagery types with more spatial and spectral detail be acquired to better define the mineral characteristics of the claim areas. New ASTER imagery could be ordered or may become available if this imagery is requested by someone else. Hyperspectral imagery such as Hyperion or PROBE could be acquired but due to the limited outcrop a system with small ground sample spacing should be employed such as the airborne PROBE. The area is heavily vegetated so whatever system is employed it will only be effective for those areas with good exposure so acquisition time will be critical to minimize the amount of snow cover.

The GIS information compilation was very successful. The three developed styles of viewing provide access and flexible viewing options to virtually all the publicly available data for the project area. Most of the information was obtained from a number of BC Geological Survey web sites. The Geogratis (NRCAN) site and NASA web sites provided the remained of the information used in the compilation. All of the information was transformed into several formats and projections to fit within the three frameworks. The MapGuide option provides the most comprehensive access to information for the area. The Google Earth option provides the best visualization abilities and the GIS option provides the best hardcopy output options. The ability to access, visualize and reproduce formatted output is essential to exploration work on any project. At present the three provided options are required to meet these requirements. However, through interoperability, a convergence is occurring that will bring all these functions together in very short order. The provided frameworks afford the best available combination of tools to achieve the objectives of this project.

APPENDIX 1: TSS-MapGuide Map (on DVD)

APPENDIX 2: TSS-Google Earth View (on DVD)

APPENDIX 3: TSS-GIS Compilation (on DVD)

MapInfo workspace
MapInfo TAB and related files