ASSESSMENT REPORT

CHURCHILL PROJECT

PRELIMINARY REMOTE SENSING INVESTIGATION ON THE

KEY 1, KEY 2, KEY 3, KEY 21 and KEY 22 CLAIMS

NTS 94 K/11
58° 32' NORTH LATITUDE
125° 29' WEST LONGITUDE
LIARD MINING DIVISION
BRITISH COLUMBIA

FOR

BGM DIVERSIFIED ENERGY INC.
1016 - 1030 WEST GEORGIA STREET
VANCOUVER, BRITISH COLUMBIA V6E 2Y3

BY

CREST GEOLOGICAL CONSULTANTS LTD.
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COQUITLAM, BRITISH COLUMBIA V3J 6T1

Craig W. Payne M.Sc., P.Geo.
March 22, 1999

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SUMMARY AND CONCLUSIONS

Landsat TM(optical) and JERS-1(radar) images were acquired in October, 1998 covering the Davis Keays and Magnum Mine areas located in the northern Rocky Mountains in northeastern British Columbia.

The area is underlain by folded northwest striking Precambrian aged Tuchodi, Aida and Gataga Formation calcareous argillites, dolomitic shales, limestone, siltstone and mudstone. Northeasterly orientated shears and faults have cut these rocks. Significant copper mineralization has been emplaced along the shear/fault zones in multi-stage quartz carbonate veining with locally intense silicification and sericitization of the wall rock.

Copper occurrences in the region have been known since the 1940's and were actively explored in the 1950's to early 1970's. The chief deposits are the Magnum, Davis Keays and Fort Reliance deposits. The Magnum Mine produced approximately 549,000 tons of 3% copper from 1970 to 1971 and 1973 to 1974 at a production rate of 750 tons per day. The Magnum Mine reserves (proven and probable, 1969) totalled 1,178,100 tons grading 3.92% copper. Proven and probable resource for the Davis Keays deposit is 1,569,684 tons at a grade of 3.42% copper. Reserves are contained in chalcopyrite and minor bornite within near vertical quartz carbonate veins varying in width from less than a metre to 19.8 metres. Associated with some of the veins are post mineral gabbro and diabase dykes that have intruded along the same planes of weakness.

The purpose of the Landsat TM optical imagery was to determine if there is visual evidence of the quartz carbonate veining and alteration envelopes associated with the sulphide rich Eagle vein (Davis Keays) and the Magnum vein (Magnum Mine). Iron and hydroxyl (alteration) polygons (top 2.5%) were determined using the De Crosta method.

Visual evidence of the northeast orientated vein structures and/or down slope dispersion pattern of the veins using the Landsat TM 3,2,1 and 5,4,3 wave bands could not be determined. The iron plot in the area of the Eagle vein produced an area of small spotty anomalies which are interpreted to represent the down slope dispersion of the vein structure. Hydroxyl polygon plot (alteration) did not coincide with either the Magnum or Eagle vein structures.

Preliminary interpretation of the JERS-1 radar image suggests there are two northwest orientated linears (fault zones) which bisect the Davis Keays property. The faults appear to extend southeasterly to the northeast of the Magnum property. The faults are interpreted to be post mineralization and appear to terminate the Eagle vein to the southwest, the Magnum and Lady Luck veins to the northeast. Based on similarity of the style of vein emplacement, alteration patterns and mineralization, it is possible that the three veins were formed from the same mineralizing event and faulted (en echelon, left lateral movement) to their present position.

If the structural interpretation is correct, several areas between Davis Keays, Magnum Mine and Lady Luck deposits may contain more vein structures with accompanying copper mineralization.

Field work is absolutely necessary to test the remote sensing interpretation presented above.

Further work is recommended on the Davis Keays and Magnum Mine properties of merit.

INTRODUCTION

This report describes the preliminary results of a remote sensing interpretation using Landsat TM optical imagery and JERS-1 radar imagery covering the area of the Davis Keays and Magnum Mine properties located in northeastern British Columbia. This study was undertaken at the request of BGM Diversified Energy Inc. which has an option agreement with Sequro Consultants Inc. to explore and develop the Davis Keays Property. BGM Diversified Energy Inc. owns 100% of the Magnum Property.

LOCATION AND ACCESS

The Churchill Project, Davis Keays and Magnum Mine properties are located on NTS sheets 94 K/6 and 11 in the Liard Mining Division of northeast British Columbia (Figure 1). The properties are centred at 58° 32' north latitude and 125° 29' west longitude.

Access to the area is poor with unimproved gravel roads and four wheel drive trails/roads accessing both Davis Keays and Magnum properties.

Access to the Davis Keays property is south from the Alaska Highway at mile 438 for 37km along the Yedhe Creek road. A serviceable(?) airstrip is located in the Yedhe Creek valley some 24km south from the Alaska Highway.

The Magnum Mine is 50km south from mile 401 on the Alaska Highway along an unimproved gravel road which crosses the Racing River. Airstrips of unknown condition are located at the Magnum Mill site and 11km to the south at the junction of the Churchill and Goat Creeks.

CLAIMS STATUS

The Churchill Project consists of three claim blocks located in the Liard Mining Division, northeast British Columbia. The Davis Keays property consists of two claim blocks totalling 70 units (1750ha; owned by Antony Simon) straddling a north flowing drainage into Yedhe Creek. Two contiguous mining leases (tenure no.'s 226140 and 226141; owned 100% by BGM Diversified Energy Inc.) form the Magnum Mine property totalling 593.46ha. Table 1 provides pertinent claims data on which assessment work is being applied (Figure 2).

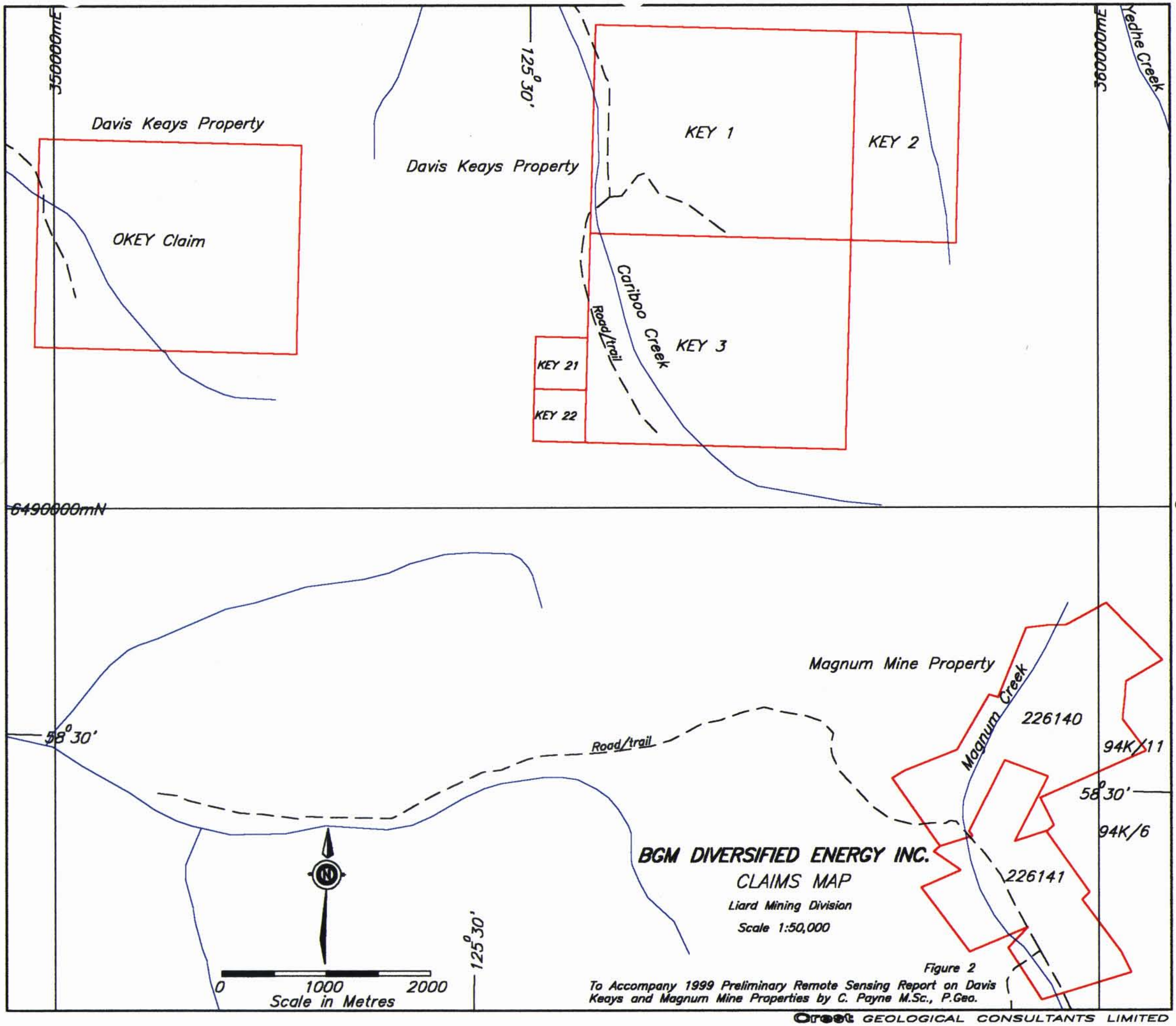
TABLE 1 CLAIMS DATA

CHURCHILL PROPERTY			
CLAIM NAME	TENURE NO.	NO. OF UNITS	EXPIRY DATE
Key 1	313178	20	September 10, 2000*
Key 2	313179	8	September 10, 2000*
Key 3	313180	20	September 11, 2000*
Key 21	313181	1	September 11, 2000*
Key 22	313182	1	September 11, 2000*
Okey	324922	20	April 17, 2002**
Total Number of Units		70	

*Subject to acceptance of 1999 assessment work.
**No work being applied to claim.


LOCATION MAP
CHURCHILL PROJECT
BGM DIVERSIFIED ENERGY INC.
MAGNUM AND DAVIS KEAYS PROPERTIES
0 40 80 120 160 200
SCALE IN KILOMETRES
Project:
Figure 1
CHURCHILL PROJECT AREA
Muncho Lake
Fort Nelson
Lower Post
Fort St. John
Dawson Creek
PRINCE GEORGE
Quesnel
McLeese Lake
Williams Lake
CACHE CREEK
KAMLOOPS
Lillooet
VERNON
KELOWNA
PENTICTON
NELSON
TRAIL
HOPE
VANCOUVER
BELLINGHAM
NANAIMO
PORT ALBERNI
VICTORIA
VANCOUVER ISLAND
PRINCE RUPERT
Revelstoke
Golden
Banff
CALGARY
Y U K O N
N.W.T.
A L B E R T A
U. S. A.
P A C I F I C O C E A N
136°
128°
120°
60°
56°
52°
49°

2


350000mE
125°30'
360000mE
Yedhe Creek
Davis Keays Property
Davis Keays Property
KEY 1
KEY 2
OKEY Claim
Cariboo Creek
Road/trail
KEY 3
KEY 21
KEY 22
6490000mN
3
Magnum Mine Property
Magnum Creek
226140
94K/11
58°30'
58°30'
94K/6
Road/trail
226141
BGM DIVERSIFIED ENERGY INC.
CLAIMS MAP
Liard Mining Division
Scale 1:50,000
125°30'
0
1000
2000
Scale in Metres
Figure 2
To Accompany 1999 Preliminary Remote Sensing Report on Davis Keays and Magnum Mine Properties by C. Payne M.Sc., P.Geo.
Crest GEOLOGICAL CONSULTANTS LIMITED

TOPOGRAPHY AND VEGETATION

The property lies between 1220m and 2286m elevations in the northern Rocky Mountains. Only the flat valley bottoms are forested with stands of mixed poplar and pine. Higher elevations are rocky and barren or sparsely vegetated with alpine grasses and shrubs.

The climate is typical of northern alpine regions. Temperatures range from -44^{0}C to 24^{0}C. Average annual precipitation is in the order of 510mm with daily maximums in excess of 60mm. Although winter accumulations are small, drifting snow does present avalanche hazards at the higher elevations.

HISTORY

The Magnum mine, discovered in 1943 and staked in 1950, was the only prospect in the area to produce copper. A total of 549,000 tons of ore at approximately 3% copper was milled from 1970 to 1971 and 1973 and 1974 at a rate of 750 tons per day. Churchill Copper Corp. Ltd. and Teck Corp. Ltd. previous owners of the property did not work the mine after it closed in 1974.

The Toad River copper property owned by Fort Reliance Minerals Ltd. was discovered in 1956 and explored in 1958 and 1959. Subsequent work consisted of re-evaluation of the 1958 and 1959 data.

Many other copper occurrences in the area were discovered in the mid to late 1940's, after the construction of the Alaska Highway. It was not until the mid 1950's to early 1970's that active exploration was carried out. Considerable work including surface exploration, ground geophysics, surface and underground drilling, drifting and road construction was performed on several of the satellite properties in the area.

Little work has been done in the area since the downturn of copper prices in 1973 and a majority of the claim blocks have been allowed to lapse. As the lapsed claim blocks became available Cariboo Hide Resources Inc. subsequently re-staked them. Cariboo Hide Resources Inc. has been prospecting and staking in the area up to the early 1990's but has since relinquished ground as they became due.

The Davis Keays and Toad River deposits are the only other properties that approached production stage. The Davis Keays deposit of Davis Keays Mining Corp. was discovered by prospectors Harry Davis and Robert Keays in August 1967. Drilling and underground drifting began in 1968 and continued through 1970. Feasibility studies were performed on the project but the 1973 downturn in copper prices halted further work.

The Davis Keays area was restaked in 1992 and the claims are now held by Antony Simon.

REGIONAL GEOLOGY

The region is underlain by carbonate and clastic rocks ranging in age from Helikian through Cretaceous. Rocks younger than Helikian Gataga Formation do not host copper vein mineralization and are not considered at this time to be of economic significance. Proterozoic units hosting copper deposits in the region comprise the Tuchodi, Aida and Gataga Formations (Figure 3).

The Tuchodi Formation, a 1524m thick succession of feldspathic quartzites, silty and argillaceous dolomites, is the lower most unit. Conformably overlying the Tuchodi Formation is the Aida and Gataga Formations. These two units represent the uppermost formations in the Helikian carbonate-clastic succession. The Aida Formation, several hundreds of metres thick comprises three units. The lowermost grey weathering thin bedded limestones and interbedded calcareous shales are overlain by buff to orange weathering dolomite interbedded with dolomitic shale and local algal dolomite. The uppermost unit comprises a grey weathering calcareous shale with minor impure bedded limestone. Gataga Formation siltstones, slates, phyllites and interbedded carbonates conformably overlie the Aida Formation rocks.

Bedding generally strikes northwest and dips gently 15°-30° west. Aida and Gataga rocks host most of the copper prospects in the area.

The Precambrian strata is folded about an axis that strikes northwest and plunges gently southeast. Folds are asymmetric, with steep northeast limbs and gentle southwest limbs. Diabase dykes, <1m thick to 91m thick are common. The dykes strike northeast and dip vertically or steeply northwest. Cupiferous quartz carbonate veins occupy the same planes of weakness as the dykes.

Magnum Mine

The Magnum prospect, an old producer is situated at the head of Magnum Creek some 56km south from mile 401 on the Alaska Highway. Here, Aida Formation sediments underlie the mine area. Cupiferous quartz-carbonate veins lie in thin bedded calcareous shale and interbedded calcareous shale and limestone. The magnum zone occupies a steeply dipping shear zone striking northeast. The veins consist of varying amounts of ankerite, quartz, chalcopyrite and pyrite and are some 1m to 7.6m thick. Three principle veins occur over a distance of 46m but as many as ten subsidiary anastomising veins are present. The vein system is continuous over hundreds of metres along strike and at depth. The magnum vein system remains open to the northeast and southwest.

Underground work on the Magnum Mine began in 1969 with 2,835m of drifting and raising and 3,780m of underground drilling. After production had ceased in October of 1971, over 6,309m of drifting and raising, 9,389m of underground drilling and 1,250m of surface drilling were completed. Surface work comprised installation of a processing plant, permanent camp, mill and tailings disposal area. Only foundations for the structures presently exist on site.

Remaining reserves are estimated at 580,000 at 4.8% copper.

Davis Keays

The Davis Keays deposit is situated at the head waters of a northerly flowing creek into Yedhe Creek some 40km southeast from mile 437 on the Alaska Highway. The access road and 800m airstrip in the Yedhe Creek valley require upgrading.

The Davis Keays mineralization consists of chalcopyrite rich lodes which form vertical to steeply dipping quartz-carbonate veins lying perpendicular to the plane of regional folding within Aida Formation, calcareous and non-calcareous shale, siltstone and argillite. Several veins are located on the property, however only the Eagle vein contains significant reserves. The Eagle vein pinches and swells from a width of 5cm to over 4m. The structure has been explored along strike for 1,372m and over a vertical distance of 488m.

On strike with the Eagle vein is the Keays and Keays North veins some 3.2km to the southwest. The Keays vein is exposed over 67m of strike length and contains assays of 3.57% Cu over a width of 2.4m. The Keays North vein, 1.1m thick, is low grade. Nearby, Creek and Harris veins are low grade and discontinuous. The Ridge, Oscar and Sheep veins are all covered by a thick mantle of scree and are poorly exposed. Talus sampling shows them to contain appreciable amounts of lead, silver and minor cobalt.

Work to date on the Eagle vein consists of surface and underground mapping, trenching, underground drifting and surface drilling. Underground work includes 2,438m of drifting comprising four levels, three sublevels and a number of connecting raises driven primarily along the vein. A total of 266m of underground drilling has been done.

A geologic resource determined by standard polygons are 1,007,362 tons at 3.56% copper proven, 562,322 tons at 3.18% copper probable.

1998-1999 WORK PROGRAM

In November, 1998 BGM Diversified Energy Inc. contracted ERSI Inc. to acquire a full scene JERS-1 radar image (JERS-1 SAR Path 566 Row 202) and a Landsat TM miniscene (25km by 25km) centred on the area covering the Davis Keays and Magnum Mine.

Only a preliminary study of the imagery data sets has been completed at this time, consisting of structural interpretation in the area of the Magnum and Davis Keays properties using the JERS-1 radar image and the determination of iron and hydroxyl enrichment based on the Landsat TM optical data.

Method

The JERS-1 radar image was orthorectified using 1:50,000 topographic maps in a NAD 83 ellipsoid, UTM Zone 10. A subset of data, centred over the Davis Keays and Magnum Mine area was extracted and used for the generation of image maps and preliminary study. Generally the JERS-1 radar image data is of too coarse a nature to be of significant use in the determination/definition of diabase dykes or quartz-carbonate vein structures. Basic characteristics of the JERS-1 imagery is provided in Appendix I.

However, the high resolution Landsat TM miniscene which is also orthorectified using the 1:50,000 topographic maps has been useful in defining areas interpreted to contain significant iron and hydroxyl (alteration) patterns. Basic principles and characteristics of Landsat TM imagery are provided in Appendix II.

Conventional feature analysis and interpretation procedures are followed working with Landsat TM imagery. Two factors are considered; the spectral aspects (relative brightness and colour combinations) and the spatial aspects (distribution of data groups). Analysis of imagery is concerned only with the spectral aspects Laughlin (1991). In contrast, interpretation is the explanation of the meaning or significance of any part with respect to the whole and relates to both spectral and spatial aspects of the data as well as their relevance to the surficial conditions which they reflect or the subsurface relationships which they are imposed upon. Image interpretation in the current study is the preliminary identification of structurally correlated elements of landscape consisting of landform, drainage and cover patterns according to the spatial aspects as well as detailed spectral analysis of the iron and hydroxyl hues.

Cover patterns are determined by spatially related spectroradiometric groups of data that relate to the reflective properties of surficial materials (vegetation, soil, rock, etc). The topographic position of these patterns is not a necessary parameter in establishing their presence or boundaries. Geologic materials and/or conditions can be direct or indirect evidence.

Landform patterns are determined by spatially related spectroradiometric groups of data that relate to topographic conditions of the landscape without respect to the materials present. In the manual interpretative technique, familiar to any airphoto interpreter, these boundaries are usually determined by a change in slope or alignment. The objective is to classify an area into terrain units, based on landform shape, size, drainage density, etc., the premise being that an area of similar landform infers similar resistance to surficial agents of erosion and/or to the competence of geologic materials.

Drainage is a special condition of landform; that being the line(s) of lowest landform per unit area. There are three important factors in assessing drainage: pattern, density and gully shape. Landsat imagery can evaluate and compare the first two of these cases up to scales of 1:25,000 but gully shape can only be assessed in a general way.

Lineaments are mappable simple or composite linear features which may be geomorphic (caused by relief) or tonal (caused by reflectance contrasts). Their inference is dependant upon various assumptions. Geomorphic lineaments may be landforms, linear boundaries between different types of terrain or breaks within uniform terrain. Tonal lineaments may be a straight boundary between areas of contrasting tone or a stripe against a background of contrasting tone. Differences in vegetation, moisture, soil or rock type or land use practices account for most tonal contrasts.

PRELIMINARY RESULTS

Field work is absolutely necessary to test any conclusions based on colour or radar imagery interpretations. At best the interpretation can provide an overview with large scale compilation benefits which hopefully leads to some hypothesis for subsequent field work focus.

Landsat TM Imaging

A number of band combinations, ratios and principal components were experimented with.

Figure 4 is a compilation of bands 3,2,1 which is believed to portray a simulated natural colour image of the study area. Darker green hues are confined to valley floors and slopes representing vegetation. The mottled "darker" (possibly coniferous; less reflectance) and "lighter" green hues (deciduous; higher reflectance) suggests a mixed forest cover with generally higher reflectance deciduous cover near stream courses. Within the area of Davis Keays Property, the ridge crest and upper slopes are orange-tan in colour with local discontinuous lighter lenses. The reflectance is moderately high with this area underlain by intercalated mudstone-siltstone (orange-tan hues) while the lighter tan to bluish tan hues probably represent minor discontinuous beds of limestone and dolostone.

The darker brown to greyish black hues observed at the Magnum Mine are due to the poor angle at which the image was captured. Also, there is evidence of disturbance of the ground cover which has obscured the natural reflectance in the area.

Within the image area, namely the southwestern and northeastern parts, there is several linear northwest orientated light bluish to white bands which represent dolostone based on described lithologies from GSC map 1343A.

TM 345(BGR) showing the most differentiation of cover types (Figure 5). Primary deciduous and coniferous forest cover in the TM 345 composites is shown by the dark green hues along drainage courses and in the alpine areas shown by the lime to yellow-green hues. Bedrock is shown by brown to magenta to grey hues and water by black. Ice, snow and glaciers show up as white to light blue hues (in part based on topographic location) in the southern and eastern parts of the image. Patchy to linear reddish-orange coloured hues are locally present within talus slopes. Cause of the colour contrast with surrounding hues is unknown at this time and requires a field visit for definition and confirmation.

Figure 6 is an iron plot over laid on the regional geology. The iron plot (polygons) is derived using a multivariate statistical technique which selects uncorrelated linear combinations of variables based on absorption in the visible TM bands 1 and 2 and higher reflectance in TM 3. This mathematical treatment of a multispectral image data set is known as the De Crosta technique Crosta and McM. Moore (1989) and Laughlin (1991). The iron plot shows a weak and spotty correlation with the Eagle vein system on the Davis Keays property and no correlation with the Magnum vein system.

Figure 7 is a hydroxyl plot over laid on the regional geology. The hydroxyl polygons (top 2.5%) are derived using the De Crosta method. The hydroxyl polygons are based on absorption in TM 7 band and higher reflectance in the TM 5 band. Generally, the hydroxyl plot does not show any correlation with known quartz carbonate veining in the image area. However there is a strong correlation with the edges of permanent ice and snow packs and higher reflectance areas such as large areas covered by sand, gravel and water.

JERS-1 Image

The JERS-1 radar image has an 18m by 18m resolution covering the study area. Generally the image shows a moderate to strong northeast-southwest "fabric" which illustrates the well developed regional shearing throughout the study area (Figure 8). Quartz carbonate veining at both Davis Keays and Magnum Mine along with younger gabbroic dykes have developed along fault zones within this northeast-southwest orientated shear fabric. Bisecting the Davis Keays and Magnum Mine properties are linear northwest orientated linears (faults) which appear to have offset the mineralized quartz-carbonate veins. Based on similar mineralogy, copper grade distribution and alteration patterns it is possible that the Lady Luck, Magnum Mine, and Eagle vein systems, could, prior to deformation and displacement be part of the same mineralizing system. This theory, if proven correct based on ground follow-up work would suggest that more mineralized vein systems could be found within the fault blocks.

RECOMMENDATIONS

Further detailed compilation of property geology airborne magnetic survey data, ground geophysical surveys, soil geochemical surveys should be compiled in conjunction with the radar and Landsat TM data to establish further exploration targets between Davis Keays, Magnum Mine and the Lady Luck areas.

It is recommended that more ground be staked to the northeast of the Magnum Mine to cover potential strike extent of known vein mineralization in that direction. The Lady Luck area should also be staked. Prospecting and geological mapping should be carried out between Davis Keays, Magnum Mine and the Lady Luck as follow-up to the detailed compilation work. Reconnaissance style magnetometer, VLF, detailed prospecting and soil geochemical surveys should be carried out between the three areas of known copper mineralization.

It is estimated that the compilation work would cost $16,500.

Follow-up field work including staking is estimated to cost 95,500.

Respectfully Submitted,

CREST GEOLOGICAL CONSULTANTS LIMITED

Craig W. Payne, M.Sc., P.Geo.
March 22, 1999

ITEMIZED COST STATEMENT

Image Data Processing and Rectification of Imagery	2,375.00
Image Data Acquisition (JERS-1 and Landsat TM data)	3,283.85
1:250,000 Digital Base Map of Study Area	456.55
Digital Elevation Model	275.00
Topographic Maps	135.81
Courier	19.85
Preliminary Interpretation and Report Writing	3,853.94
TOTAL	**$10,400.00**

STATEMENT OF QUALIFICATIONS

I, Craig W. Payne of Coquitlam, British Columbia do hereby certify that I:

1. am a graduate of Brock University, St. Catharines, Ontario with a Master of Science degree in Geological Sciences, 1979.

2. am a Fellow of the Geological Association of Canada.

3. am a member of the Association of Professional Engineers and Geoscientists of British Columbia.

4. have practiced my profession since 1972.

5. am consulting geologist with Crest Geological Consultants Limited.

6. am the author of the report entitled "Preliminary Remote Sensing Investigation on the Key 1, Key 2, Key 3, Key 21, Key 22 Claims"; Liard Mining Division, dated: March 22,1999.

Dated at Coquitlam, B.C. this 22nd day of March, 1999.

Respectfully submitted,

CREST GEOLOGICAL CONSULTANTS LIMITED

Craig W. Payne M.Sc., P.Geo.
March 22, 1999

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APPENDIX I

BASIC RADAR AND OPTICAL CHARCTERISTICS OF JERS-1 SATELLITE

The JERS-1 satellite was launched on February 11, 1992 from the National Space Development Agency of Japan (NASDA) into a solar-synchronous sub-recurrent orbit at an altitude of 568 kilometres with a recurrent period of 44 days. The purpose of the JERS-1 is an Earth Observation Satellite to cover global land area for national land survey, agriculture, forestry, fishery, environmental protection, disaster protection, coastal monitoring and focusing on resource exploitation.

The satellite has been collecting data with a mission data recorder by the high performance synthetic aperture radar (SAR) and optical sensor (OPS).

SAR is an active sensor which transmits microwaves and observes characteristics, inequality, slope in the surface of the earth without being influenced by weather day or night due to scattered waves from the earth.

OPS can observe in seven bands from the visible region to short wave infrared band and is capable of observation by forward looking of 15.3 degrees from nadir in the near infrared band and is highly usable for identifying lithology, rocks and minerals.

Basic Parameters of the SAR Synthetic Aperature Radar are:
Resolution: 18m by 18m
Swath: 75 kilometres
Frequency: 1275 MHz (L Band)

Basic Parameters of the OPS Optical Sensors are:
Resolution: 18m by 24m
Swath: 75 kilometres
Bands(microns):

1) 0.52-0.60	5) 1.60-1.71
2) 0.63-0.69	6) 2.01-2.12
3) 0.76-0.86	7) 2.13-2.25
4) 0.76-0.86*	8) 2.27-2.40

*band 4 is for forward viewing (15.33 degrees) band 3 and 4 make a stereo pair

The following listing is a detailed description of the georeferencing of the JERS-1 SAR image for the study area:

JERS-1 SAR Path 566 Row 202; image acquired July 18, 1993

Output Georeferenced Units: UTM 10 V E008
Projection: UTM Zone 10V
Earth Ellipsoid: GRS 1980 (NAD 83)
Upper Left Corner: 295130.993 E 6528049.874 N
Upper Right Corner: 385118.493 E 6528049.874 N
Image Centre: 340124.743 E 6483331.124 N
Lower Left Corner: 295130.993 E 6438612.374 N
Lower Right Corner: 385118.493 E 6438612.374 N
Pixel Size: 12.500 E 12.500 N

Upper Left Corner: 126d33'03.05" W Lon 58d50'36.24" N Lat
Upper Right Corner: 124d59'33.63" W Lon 58d52'36.66" N Lat
Image Centre: 125d44'25.96" W Lon 58d27'40.73" N Lat
Lower Left Corner: 126d28'15.25" W Lon 58d02'29.87" N Lat
Lower Right Corner: 124d56'51.84" W Lon 58d04'26.59" N Lat

APPENDIX II

BASIC CHARCTERISTICS OF LANDSAT TM MAPPER

The first of the five Landsat satellites that provided digital imagery for earth observation was launched by the United States in 1972. Landsat 5 is currently operational and like others before it carries electro-optical sensors. The satellite orbit is near-polar passing north to south over the day-time side of the planet several times daily. The orbit shifts progressively westward so that the entire surface of the earth can be imaged in 16 days.

The scanner aboard Landsat 5 is known as the Thematic Mapper TM. This measures the brightness values over different portions of the electromagnetic spectrum, known as wavebands, with digital numbers (DM) between 0 and 255 (the range of 8 bit data). TM records data from 7 wavebands. The brightness values, or grey levels are recorded over individual spectral sampling areas known as pixels (from picture elements). The pixel size is nominally 30m by 30m for the visible and reflected infrared bands and 120m by 120m for the thermal infrared band. The wavebands are compared in Figure 1 together with wavebands recorded in other satellite systems. The current study utilized TM data because of its superior qualities of ground cell resolution and spectral range.

The seven TM wavebands are the three visible bands (TM 1, 2 and 3 in the order of blue, green and red), one near-infrared band (TM 4), two short-wave infrared bands (TM 5 and 7) and one band in the thermal infrared region (TM 6). Waveband TM 6, 10.4 to 12.5 micrometres, plots off-scale in (Figure 1, Appendix II). The energy measured by bands 1 to 5 and 7 is that reflected from the sun; only TM 6 measures energy emitted at the surface. Radiation reflected from the earth's surface back to the satellite (i.e. TM 1 to 5 and 7) has not penetrated more than a few micrometres into the surface material.

Some typical reflectance curves for common materials are presented in (Figure 2, Appendix II). These curves represent the percent of incident light reflected by a material as a function of wavelength. They are routinely used in image processing and analysis to recognize spectral regions in which various materials can be differentiated and to provide a comparative standard for identifying spectra of unknown materials. Image processing techniques are developed by examining spectral curves and noting where the reflectance of a particular material behaves differently than other materials. Mathematical procedures are then applied to the digital data set so as to distinguish between various cover types such as vegetation, clay alteration or some particular lithology.

Digital imagery is commonly viewed either as a single band grayscale image or as a multiband composite. (Table 1, Appendix II) and the spectral curve for healthy vegetation (Figure 2, Appendix II) illustrates how such curves can be used to predict the resultant colour in a three band composite. For example, vegetation has the highest reflectance values in the green portion of the spectrum (TM 2) over the range of the three visible bands. This is why our eyes perceive a green colour in our natural colour composite (Case 1, Table 1, Appendix II). However, vegetation has even higher reflectance in the near-infrared (TM 4) and this is why IR (infrared) film or imagery which ignores the visible blue component and projects visible green, red and near-infrared wavebands with blue, green and red components, represents broad leaf vegetation with bright red colours (Case 2, Table 1, Appendix II). Similarly, a composite of TM 3, 4 and 5 (also written as TM 345) represented in the order of blue, green and red (written as BGR) shows the same vegetation with green hues (Case 3, Table 1, Appendix II).

Table 1 (Appendix II) Colour Composite Generation

		Colour Representation or Projection		
Case	**BLUE**	**GREEN**	**RED**	**Resultant Colour Represention on Composite Image**
1	TM 1 (blue)	TM 2 (green) X	TM 3 (red)	green
2	TM 2 (green	TM 3 (red)	TM 4 (NIR) X	red
3	TM 3 (red)	TM 4 (NIR) X	TM 5 (SWIR)	green

Dominant (bright) band of each 3 band composite shown by "X"

The following listing is a detailed description of the georeferencing of the Landsat TM Miniscene image for the study area:

Landsat TM Path 051 row 019; image acquired August 16, 1993

Output Georeferenced Units: UTM 10 E008
Projection: Universal Transverse Mercator Zone 10
Earth Ellipsoid: GRS 1980 (NAD 83)
Upper Left Corner: 345750.000 E 6501300.000 N
Upper Right Corner: 370750.000 E 6501300.000 N
Image Centre: 358250.000 E 6488800.000 N
Lower Left Corner: 345750.000 E 6476300.000 N
Lower Right Corner: 370750.000 E 6476300.000 N
Pixel Size: 25.000 E 25.000 N

Upper Left Corner : 125d39'23.09" W Lon 58d37'28.37" N Lat
Upper Right Corner: 125d13'34.64" W Lon 58d37'57.76" N Lat
Image Centre: 125d26'00.90" W Lon 58d30'59.92" N Lat
Lower Left Corner: 125d38'22.24" W Lon 58d24'00.91" N Lat
Lower Right Corner: 125d12'43.61" W Lon 58d24'30.05" N Lat

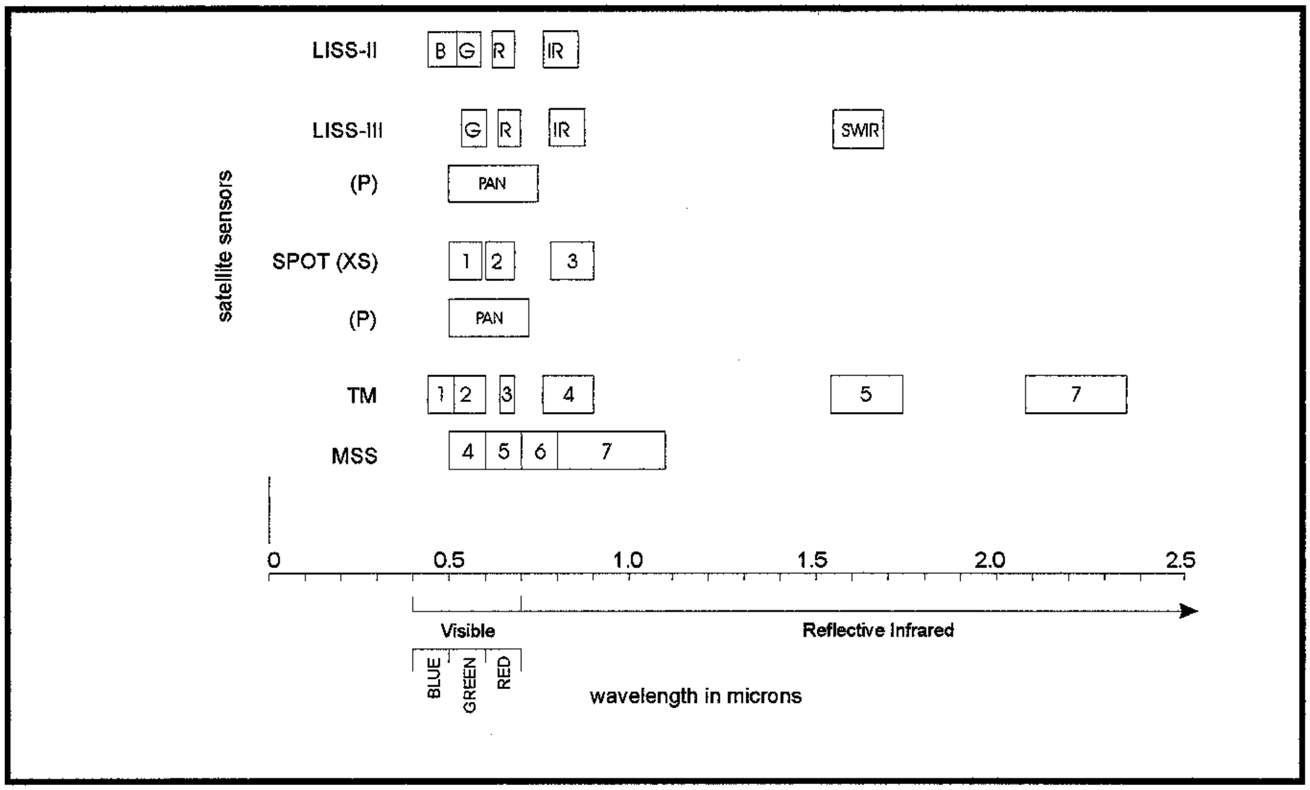


Figure 1 (Appendix II). Satellite scanner wavebands or bandpasses.

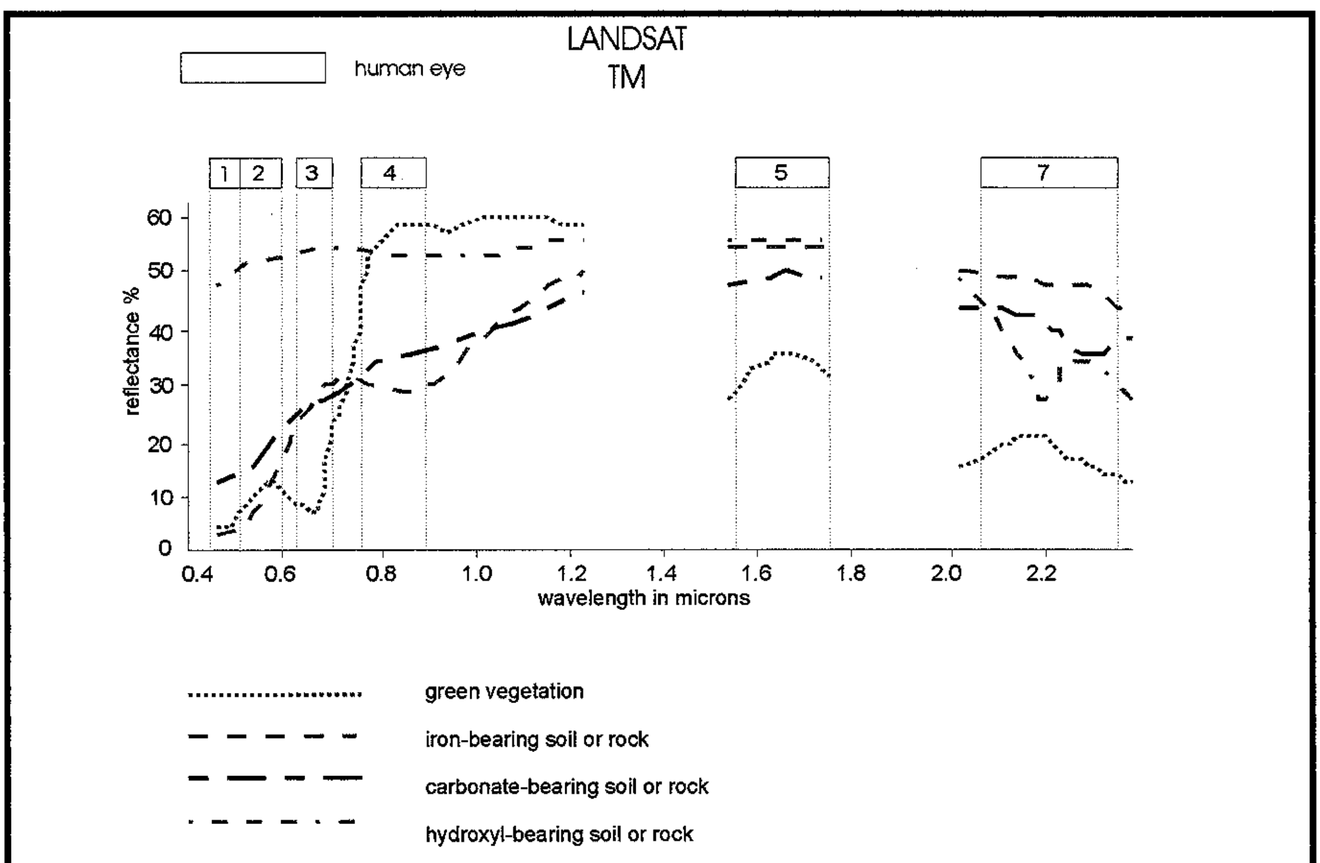
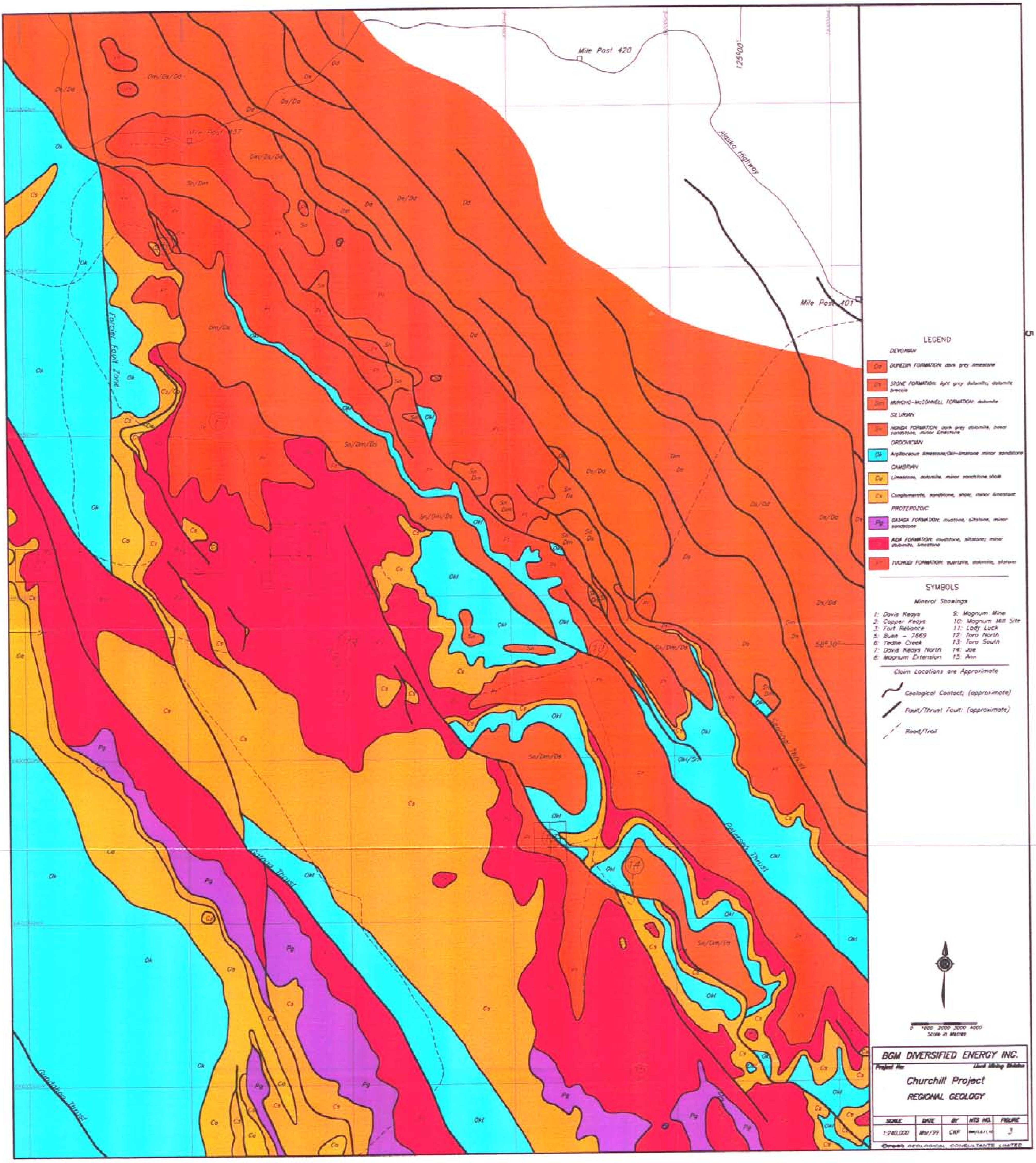
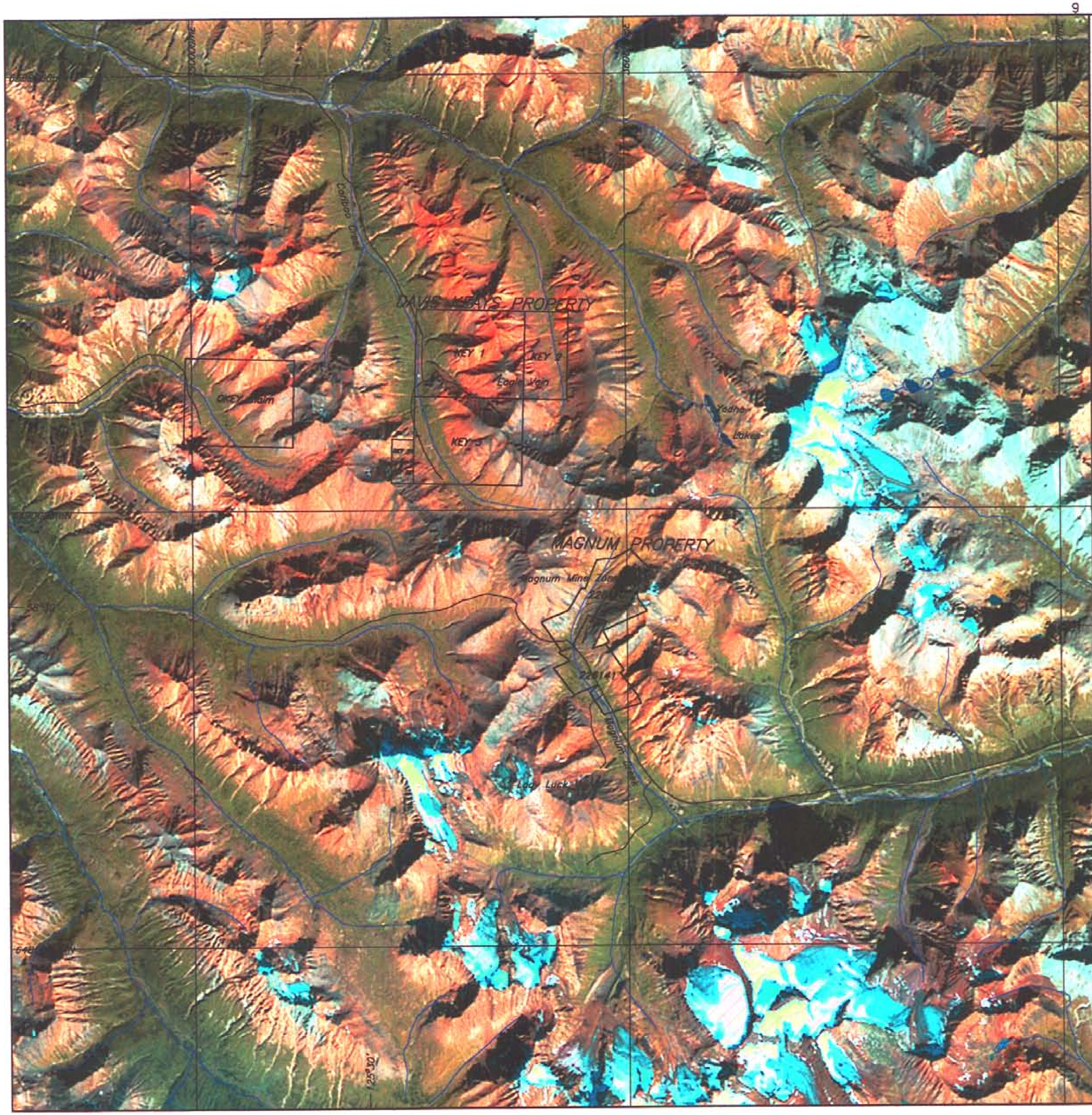


Figure 2 (Appendix II). Diagrammatic spectra, illustrating positions of diagnostic iron, clay, carbonate and chlorophyll absorption bands and the bandpasses of TM sensors.


Mile Post 420
125°00'
Alaska Highway
Mile Post 401
Mile Post 437
Forcier Fault Zone
Gataga Thrust
Gundahoo Thrust
Petersen Thrust
LEGEND
DEVONIAN
DUNEDIN FORMATION: dark grey limestone
STONE FORMATION: light grey dolomite, dolomite breccia
MUNCHO-McCONNELL FORMATION: dolomite
SILURIAN
NONDA FORMATION: dark grey dolomite, basal sandstone, minor limestone
ORDOVICIAN
Argillaceous limestone/Ok-limestone minor sandstone
CAMBRIAN
Limestone, dolomite, minor sandstone,shale
Conglomerate, sandstone, shale, minor limestone
PROTEROZOIC
GATAGA FORMATION: mudstone, siltstone, minor sandstone
AIDA FORMATION: mudstone, siltstone; minor dolomite, limestone
TUCHODI FORMATION: quartzite, dolomite, siltstone
SYMBOLS
Mineral Showings
1: Davis Keays
2: Copper Keays
3: Fort Reliance
5: Bush – 7669
6: Yedhe Creek
7: Davis Keays North
8: Magnum Extension
9: Magnum Mine
10: Magnum Mill Site
11: Lady Luck
12: Toro North
13: Toro South
14: Joe
15: Ann
Claim Locations are Approximate
Geological Contact; (approximate)
Fault/Thrust Fault: (approximate)
Road/Trail
0 1000 2000 3000 4000
Scale in Metres
BGM DIVERSIFIED ENERGY INC.
Churchill Project
REGIONAL GEOLOGY
SCALE
DATE
BY
NTS NO.
FIGURE
1:240,000
Mar/99
CWP
3
GEOLOGICAL CONSULTANTS LIMITED



SYMBOLS

Quartz–carbonate vein structures

Trail/road

Permanent Ice and/or Snow Cover

0 1000 2000 3000 4000
Scale in Metres

To Accompany 1999 Preliminary Remote Sensing Report on Davis Keays and Magnum Mine Properties by C. Payne M.Sc. P.Geo.

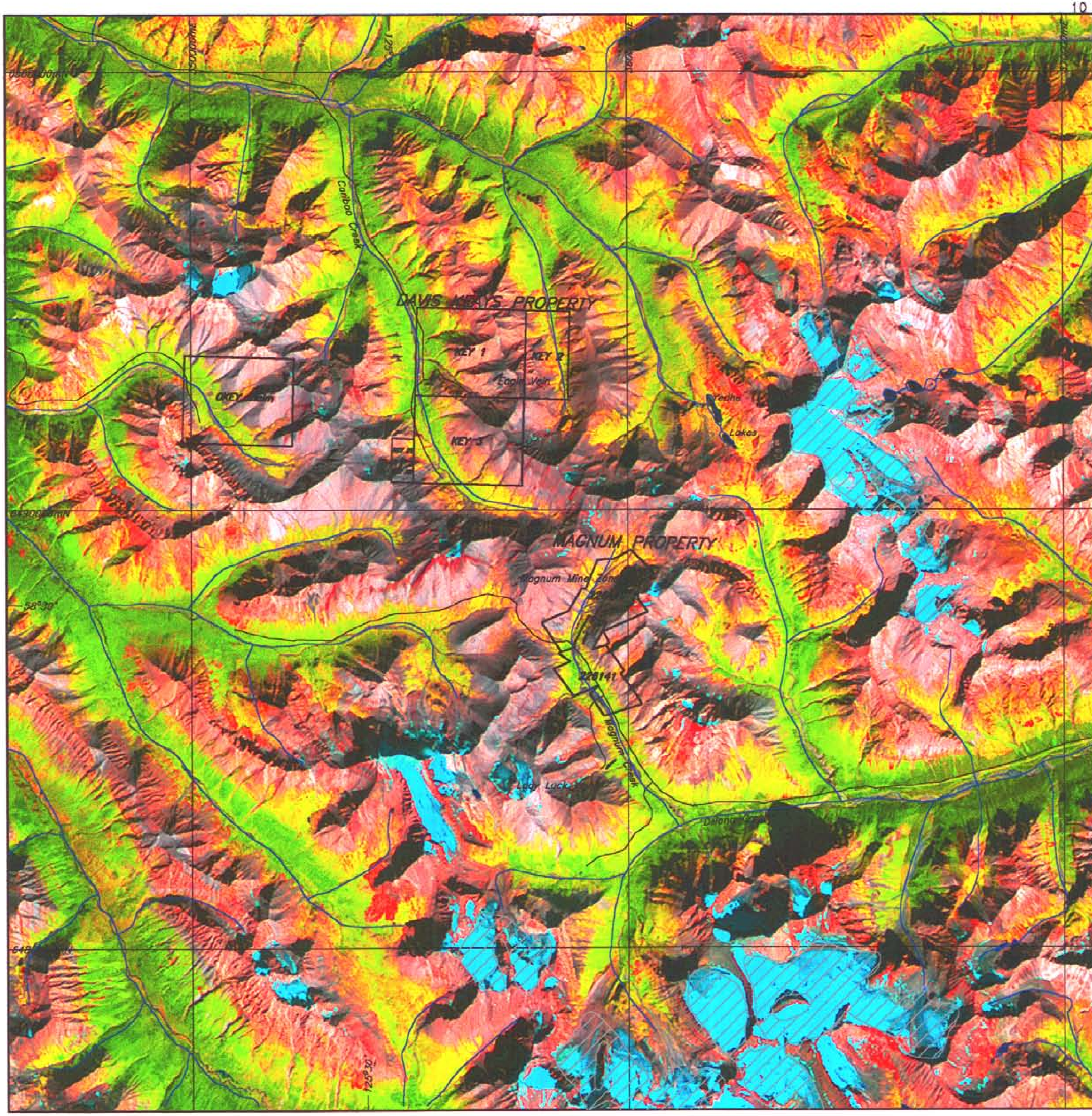
BGM DIVERSIFIED ENERGY INC.

Project No: Liard Mining Division

LANDSAT TM BANDS 3,2,1(R,G,B)
(Simulated Natural Colour)

SCALE	DATE	BY	NTS NO.	FIGURE
1:100,000	Mar/99	CWP	94K/3,6,11,12	4

Orest GEOLOGICAL CONSULTANTS LIMITED



SYMBOLS

Quartz–carbonate vein structures

Trail/road

Permanent Ice and/or Snow Cover

Bands 5 and 4 have been sharpened using a PCI FSHARP filter.

0 1000 2000 3000 4000
Scale in Metres

To Accompany 1999 Preliminary Remote Sensing Report on Davis Keays and Magnum Mine Properties by C. Payne M.Sc., P.Geo.

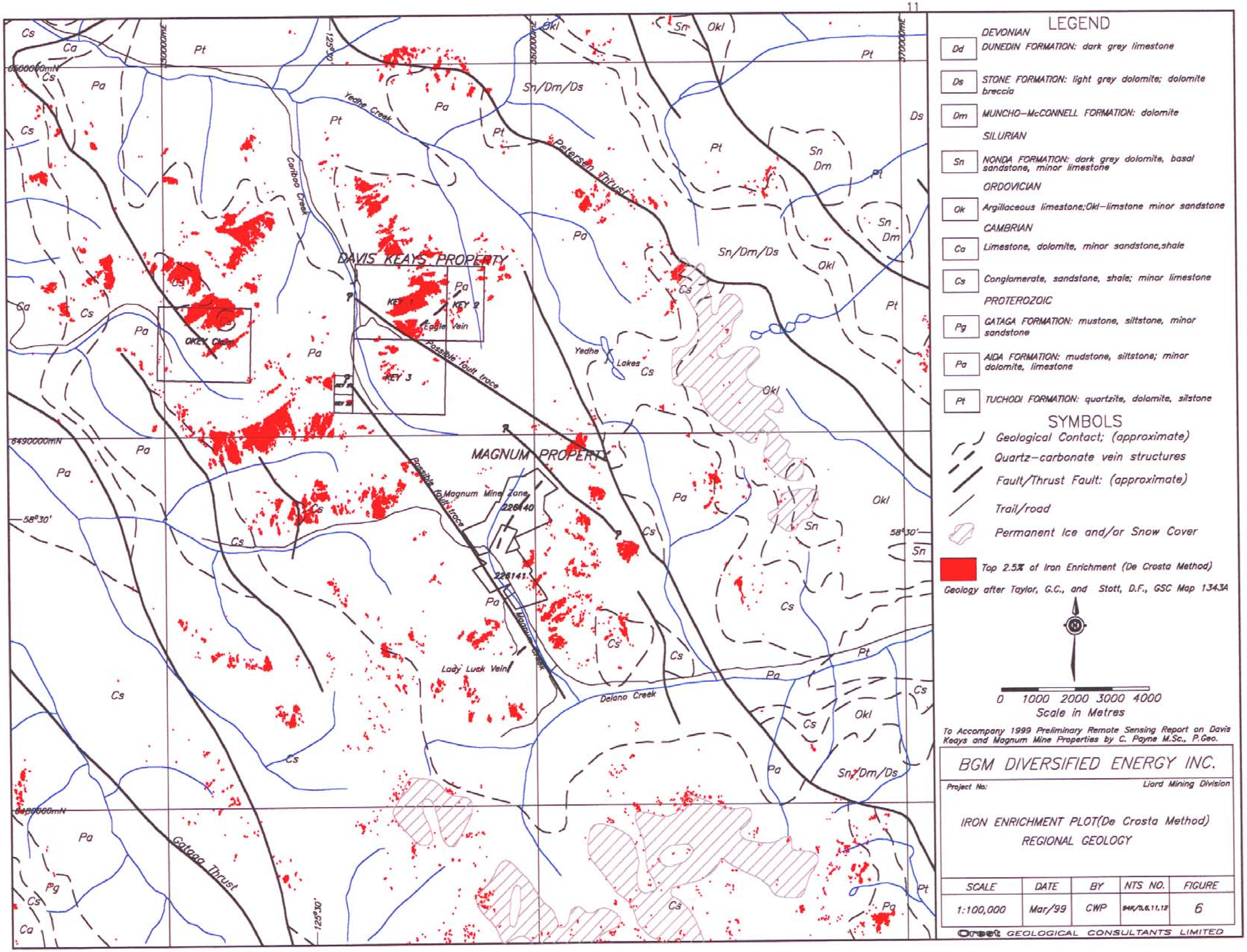
BGM DIVERSIFIED ENERGY INC.

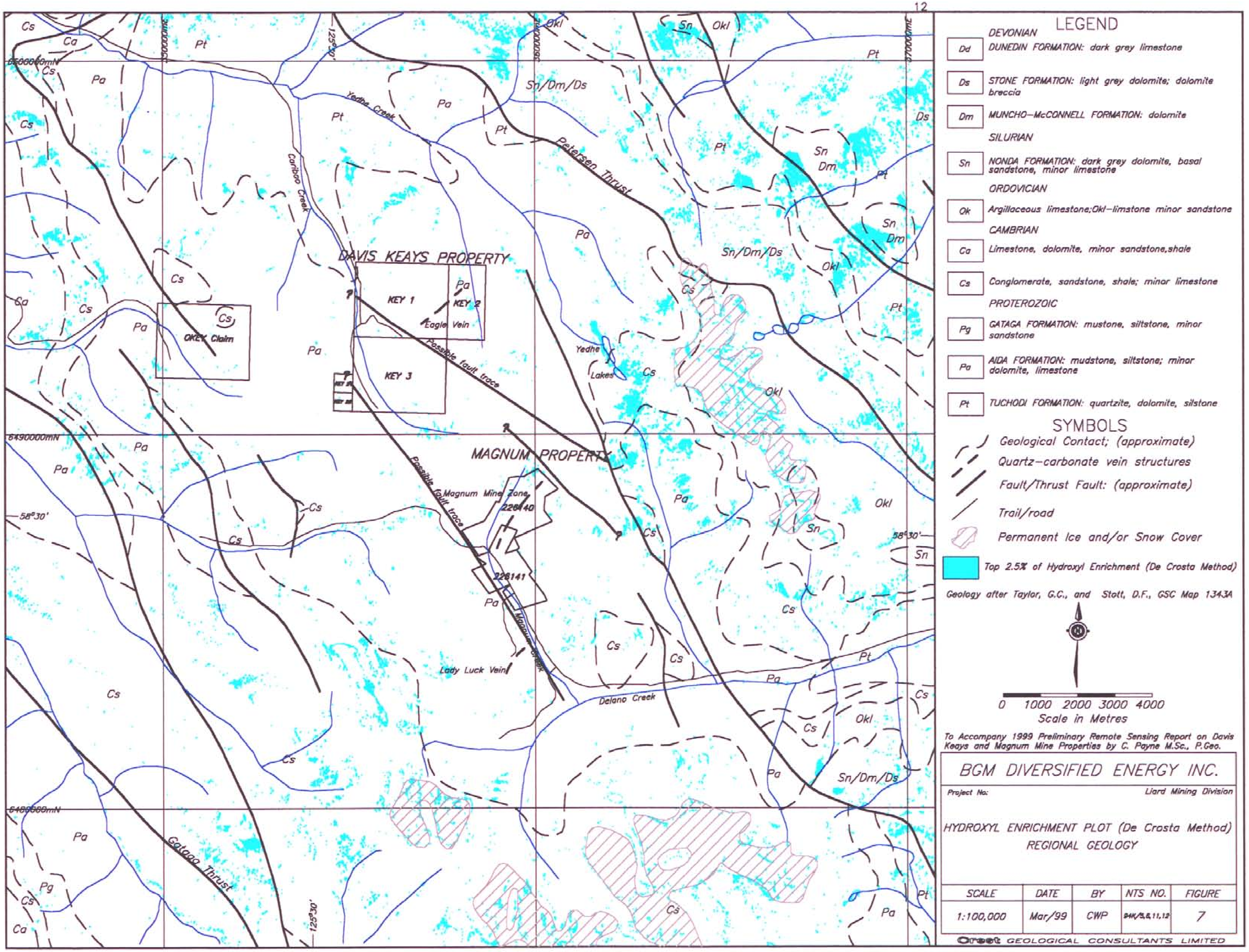
Project No: Liard Mining Division

LANDSAT TM BANDS 5,4,3
(Simulated False Colour)

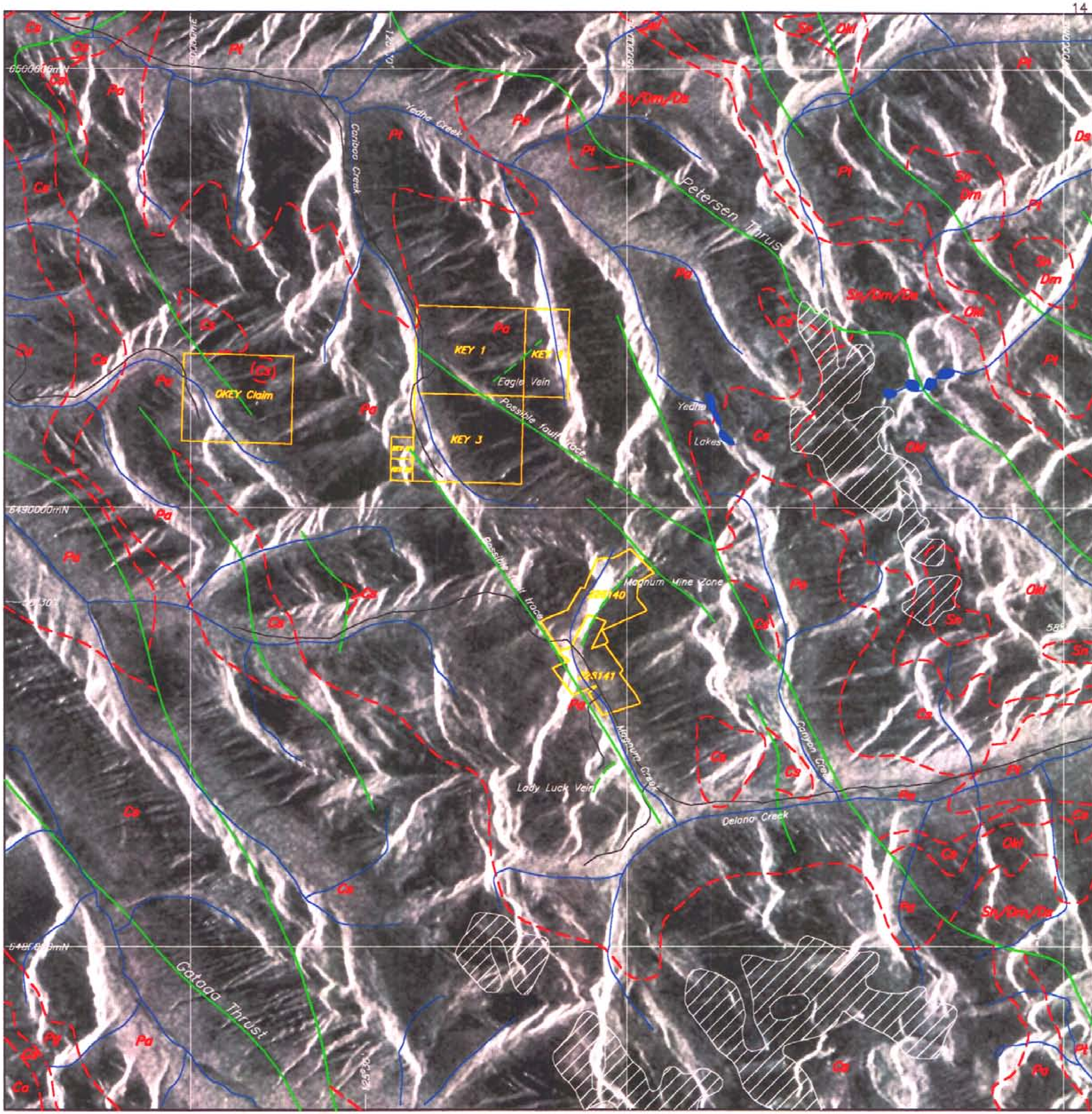
SCALE	DATE	BY	NTS NO.	FIGURE
1:100,000	Mar/99	CWP	94K/5,6,11,12	5

Orest GEOLOGICAL CONSULTANTS LIMITED


LEGEND
DEVONIAN
Dd DUNEDIN FORMATION: dark grey limestone
Ds STONE FORMATION: light grey dolomite; dolomite breccia
Dm MUNCHO–McCONNELL FORMATION: dolomite
SILURIAN
Sn NONDA FORMATION: dark grey dolomite, basal sandstone, minor limestone
ORDOVICIAN
Ok Argillaceous limestone;Okl–limstone minor sandstone
CAMBRIAN
Ca Limestone, dolomite, minor sandstone,shale
Cs Conglomerate, sandstone, shale; minor limestone
PROTEROZOIC
Pg GATAGA FORMATION: mustone, siltstone, minor sandstone
Pa AIDA FORMATION: mudstone, siltstone; minor dolomite, limestone
Pt TUCHODI FORMATION: quartzite, dolomite, silstone
SYMBOLS
Geological Contact; (approximate)
Quartz–carbonate vein structures
Fault/Thrust Fault: (approximate)
Trail/road
Permanent Ice and/or Snow Cover
Top 2.5% of Iron Enrichment (De Crosta Method)
Geology after Taylor, G.C., and Stott, D.F., GSC Map 1343A
0 1000 2000 3000 4000
Scale in Metres
To Accompany 1999 Preliminary Remote Sensing Report on Davis Keays and Magnum Mine Properties by C. Payne M.Sc., P.Geo.
BGM DIVERSIFIED ENERGY INC.
Project No:
Liard Mining Division
IRON ENRICHMENT PLOT(De Crosta Method)
REGIONAL GEOLOGY
SCALE 1:100,000
DATE Mar/99
BY CWP
NTS NO. 94K/5,6,11,12
FIGURE 6
Orest GEOLOGICAL CONSULTANTS LIMITED
DAVIS KEAYS PROPERTY
KEY 1
KEY 2
KEY 3
Eagle Vein
OKEY Claim
MAGNUM PROPERTY
Magnum Mine Zone
226140
226141
Lady Luck Vein
Possible fault trace
Petersen Thrust
Gataga Thrust
Yedhe Creek
Cariboo Creek
Magnum Creek
Delano Creek
Yedhe Lakes
6500000mN
6490000mN
6480000mN
58°30'
125°30'
Cs
Ca
Pt
Pa
Pg
Sn/Dm/Ds
Sn
Dm
Ds
Okl



LEGEND
DEVONIAN
Dd DUNEDIN FORMATION: dark grey limestone
Ds STONE FORMATION: light grey dolomite; dolomite breccia
Dm MUNCHO–McCONNELL FORMATION: dolomite
SILURIAN
Sn NONDA FORMATION: dark grey dolomite, basal sandstone, minor limestone
ORDOVICIAN
Ok Argillaceous limestone;Okl–limstone minor sandstone
CAMBRIAN
Ca Limestone, dolomite, minor sandstone,shale
Cs Conglomerate, sandstone, shale; minor limestone
PROTEROZOIC
Pg GATAGA FORMATION: mustone, siltstone, minor sandstone
Pa AIDA FORMATION: mudstone, siltstone; minor dolomite, limestone
Pt TUCHODI FORMATION: quartzite, dolomite, silstone
SYMBOLS
Geological Contact; (approximate)
Quartz–carbonate vein structures
Fault/Thrust Fault: (approximate)
Trail/road
Permanent Ice and/or Snow Cover
Top 2.5% of Hydroxyl Enrichment (De Crosta Method)
Geology after Taylor, G.C., and Stott, D.F., GSC Map 1343A
0 1000 2000 3000 4000
Scale in Metres
To Accompany 1999 Preliminary Remote Sensing Report on Davis Keays and Magnum Mine Properties by C. Payne M.Sc., P.Geo.
BGM DIVERSIFIED ENERGY INC.
Project No:
Liard Mining Division
HYDROXYL ENRICHMENT PLOT (De Crosta Method)
REGIONAL GEOLOGY
SCALE 1:100,000
DATE Mar/99
BY CWP
NTS NO. 94K/5,6,11,12
FIGURE 7
GEOLOGICAL CONSULTANTS LIMITED
DAVIS KEAYS PROPERTY
KEY 1
KEY 2
KEY 3
Eagle Vein
OKEY Claim
Possible fault trace
MAGNUM PROPERTY
Magnum Mine Zone
228140
228141
Lady Luck Vein
Yedhe Creek
Cariboo Creek
Petersen Thrust
Yedhe Lakes
Delano Creek
Magnum Creek
Gataga Thrust
6500000mN
6490000mN
6480000mN
58°30'
125°30'



LEGEND

DEVONIAN

Dd	DUNEDIN FORMATION: dark grey limestone
Ds	STONE FORMATION: light grey dolomite; dolomite breccia
Dm	MUNCHO–McCONNELL FORMATION: dolomite

SILURIAN

Sn	NONDA FORMATION: dark grey dolomite, basal sandstone, minor limestone

ORDOVICIAN

Ok	Argillaceous limestone;Okl–limstone minor sandstone

CAMBRIAN

Ca	Limestone, dolomite, minor sandstone,shale
Cs	Conglomerate, sandstone, shale; minor limestone

PROTEROZOIC

Pg	GATAGA FORMATION: mustone, siltstone, minor sandstone
Pa	AIDA FORMATION: mudstone, siltstone; minor dolomite, limestone
Pt	TUCHODI FORMATION: quartzite, dolomite, silstone

SYMBOLS

Geological Contact; (approximate)

Fault/Thrust Fault: (approximate)

Trail/road

Permanent Ice and/or Snow Cover

Geology after Taylor, G.C., and Stott, D.F., GSC Map 1343A

0 1000 2000 3000 4000
Scale in Metres

To Accompany 1999 Preliminary Remote Sensing Report on Davis Keays and Magnum Mine Properties by C. Payne M.Sc., P.Geo.

BGM DIVERSIFIED ENERGY INC.

Project No: Liard Mining Division

JERS–1 RADAR IMAGE
and
PRELIMINARY STRUCTURAL INTERPRETATION

SCALE	DATE	BY	NTS NO.	FIGURE
1:100,000	Mar/99	CWP	94K/3,6,11,12	8

Orest GEOLOGICAL CONSULTANTS LIMITED