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## GEOLOGICAL & GEOCHEMICAL REPORT

on the

### BORDER 1 MINERAL CLAIM

Greenwood Mining Division  
 NTS 82E/2  
 Latitude 49° 01'N, Longitude 118° 52' W  
 British Columbia

by

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for

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March 1, 1991

GEOLOGICAL BRANCH  
 ASSESSMENT REPORT

21, 283

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## SUMMARY

The Border 1 claim is located 7 km west of the town of Midway in southern British Columbia. The claims are underlain by an east-west trending basement sequence of Permian and Triassic metasediments unconformably overlain by Eocene volcanics and sediments. Large Jurassic-Cretaceous granitic plutons have intruded the basement rocks in areas adjacent to the Border claim. Subvolcanic intrusions of Eocene age occur in the form of numerous sills, dikes and small stocks of diorite to syenite composition. Middle to late Tertiary extensional tectonics has produced a number of NNE trending normal faults, some of which have very shallow dips. Mineralization in the District includes copper and gold skarn deposits of probable Jurassic age hosted in Permo-Triassic rocks and epithermal gold-quartz veins of probable Tertiary age hosted in a variety of lithologies.

The current work program consisted of reconnaissance geological and geochemical surveys involving collection and analysis of 9 rock, 22 soil, and 3 heavy mineral silt samples. Bedded grey limestones of the Brooklyn Formation (Triassic age) outcropping in the NE quadrant of the claim are intruded by fine grained felsic quartz-diorite (dacite?) dikes. Pyrrhotite endoskarn and exoskarn pods contain moderately to strongly anomalous quantities of arsenic and copper. A heavy mineral silt sample from the centre of the south end of the claim returned an anomalous value of 237 ppb Au. A soil sample from near the south border of the claim returned anomalous cobalt, nickel, chrome and gold values. This sample was taken close to the projected location of a late Tertiary fault. Strongly pervasive blue-green (kaolinitic?) alteration occurs in a N-S fault zone cutting Eocene volcanic flows near the west boundary of the claim. This alteration is not geochemically anomalous for any trace metals.

Further work is recommended to follow-up on anomalies outlined to date and to continue evaluation of the claims.

## INTRODUCTION

### Location, Access, Topography

The Border 1 claim is located 7 km west of the town of Midway near the International Border in southern British Columbia. The property is centered on Latitude 49° 01' N, Longitude 118° 52' W within NTS area 82E/2. Access is gained to the south end of the claim by forestry roads, one of which follows an old railroad grade. A ranch road passes diagonally across the claim in a NW-SE direction but access is hampered by a padlocked gate. Highway 3 passes through the extreme NE corner of the claim. Topography is moderate with elevations ranging from 590 m to 1,050 m. Vegetation cover is highly variable since most of the property has been logged at some time in the past and is currently used as summer grazing by local ranchers. Most of the property is covered by semi-mature second growth with very little underbrush. Flat land in the Kettle River Valley supports a number of hay ranches.

### Property Definition

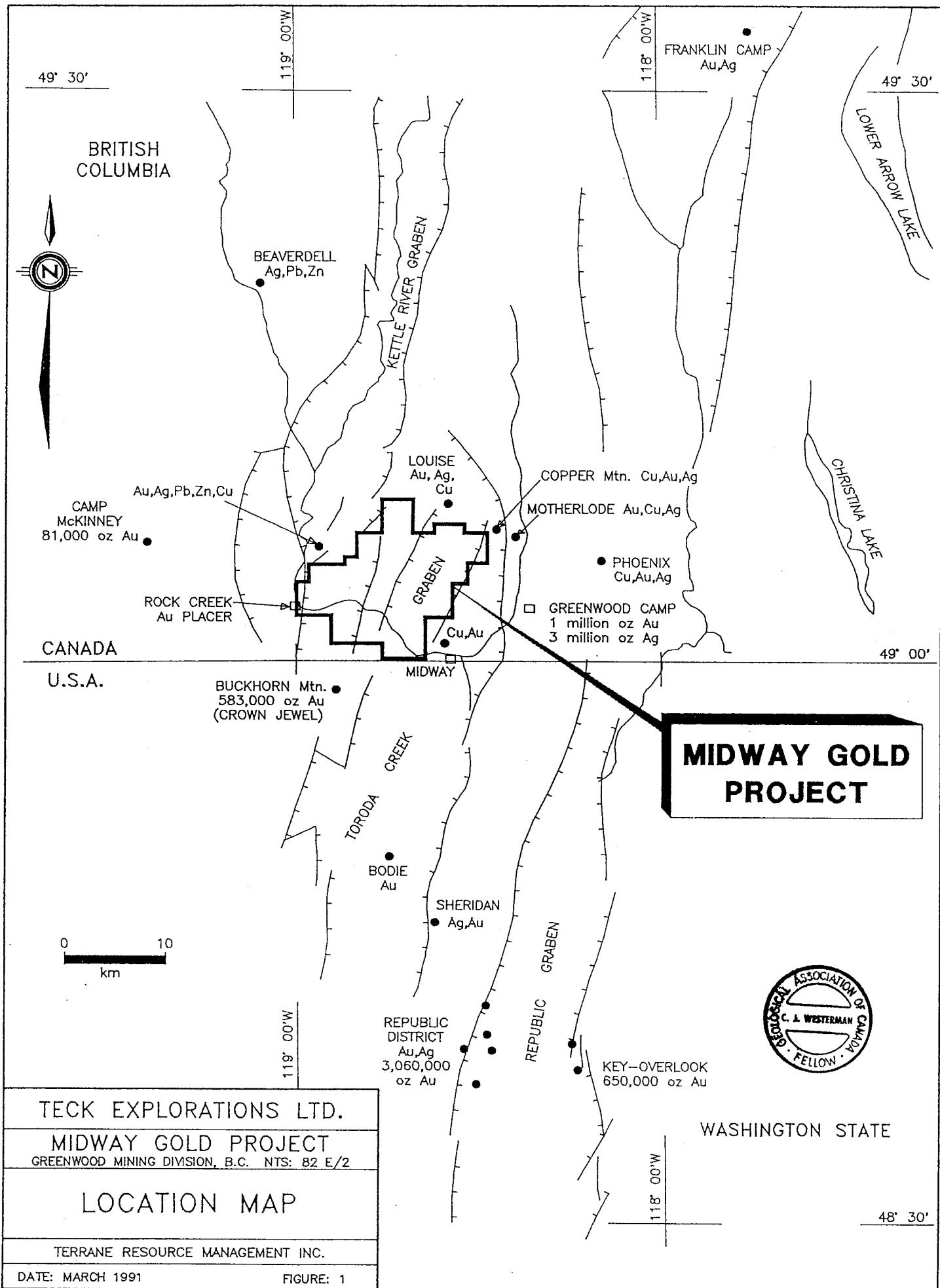
The Border 1 property consists of one (1) metric grid system mineral claim totalling 18 units within the Greenwood Mining Division of British Columbia. The claim was originally staked in March 1990 for Amex Exploration Services Ltd. which transferred title to James Robertson in May 1990 who subsequently transferred title to Teck Corporation pursuant to an agreement dated February 7, 1991.

TABLE 1

#### Mineral Claims

Name	Units	Record No.	Record Date	Expiry Date*
Border 1	18	5692	March 12, 1990	March 12, 1991

\*Note: expiry date based on acceptance of this report.



TECK EXPLORATIONS LTD.

MIDWAY GOLD PROJECT

GREENWOOD MINING DIVISION, B.C. NTS: 82 E/2

CLAIM MAP

TERRANE RESOURCE MANAGEMENT INC.

DATE: MARCH 1991

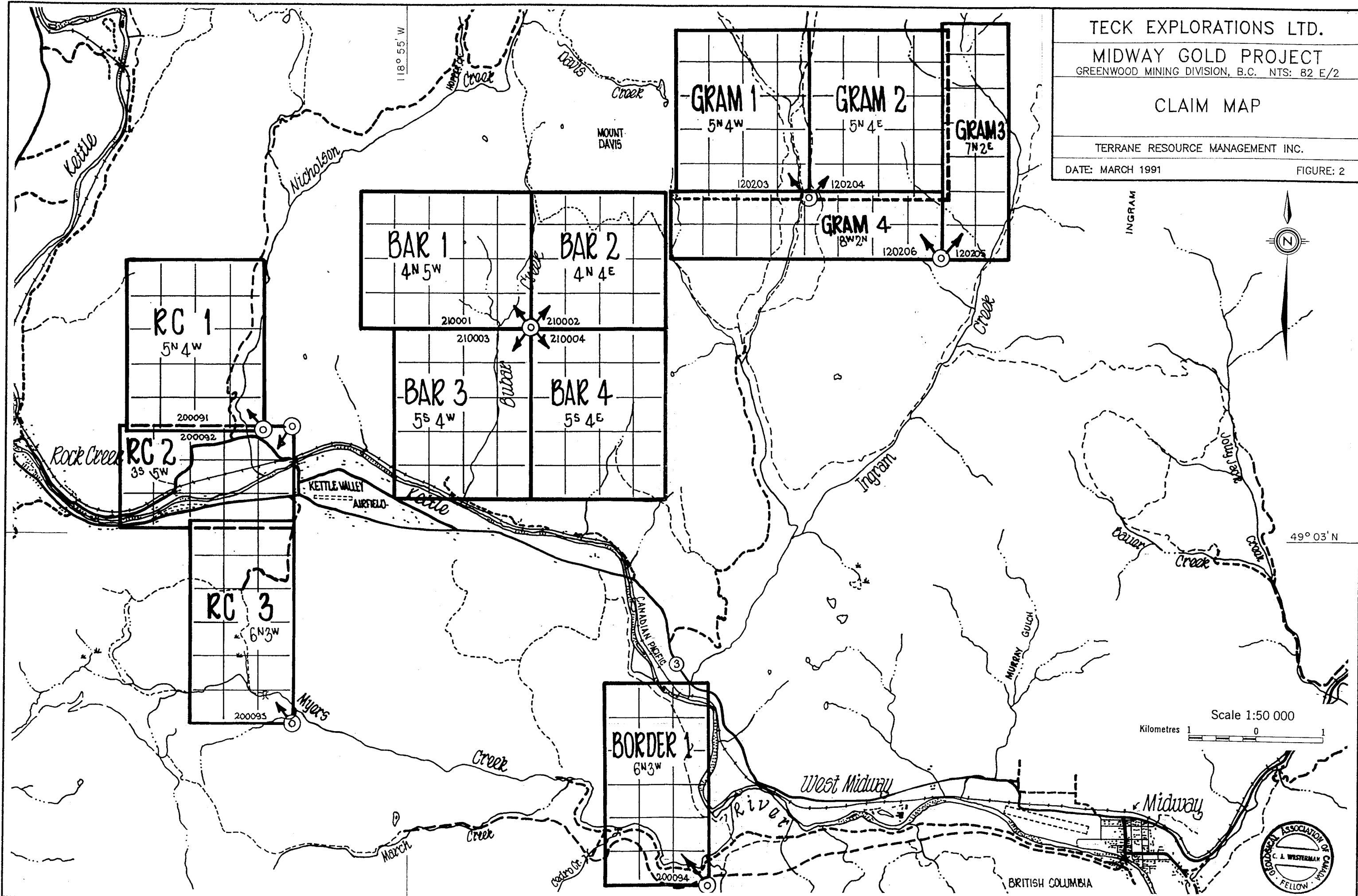
FIGURE: 2

INGRAM



49° 03' N

Scale 1:50 000  
Kilometres 1 0 1



### History

The area of the Border 1 claim has been covered in the past by other mineral claims, but there is little public record of any previous exploration work undertaken on those claims. Radiometric and geologic surveys were undertaken on the claim area in 1977 by Harold Jones for Dolmage Campbell & Associates. No anomalies were detected.

### Current Work Program

The current field work program was undertaken in the period February 17-22, 1991 by R. Farmer and C.J. Westerman. The program was designed as an initial reconnaissance survey of the claims and will be followed by a more comprehensive evaluation currently being planned by Teck Explorations Ltd. The current program involved geological examination of available outcrops, initial prospecting, and collection of 9 rock, 22 soil, and 3 heavy mineral silt samples. All samples were analyzed at Min-En Laboratories, North Vancouver, B.C. for gold, mercury and 31 trace elements. Details of sample collection and analytical procedures are given in Appendix 3, analytical results are present in Appendix 4.

### References

H.W. Little (1983) - Geology of the Greenwood Map-Area, British Columbia. Geol. Surv. Canada, Paper 79-29.

J.T. Fyles (1990) - Geology of the Greenwood - Grand Forks Area, British Columbia NTS 82E/1, 2. B.C. - EMPR - Geol. Surv. Branch - Mineral Resources Division Open File 1990-25.

H. Jones (1977) - Geologic and Radiometric Surveys of the Midway 1 and 2 Claims for Dolmage Campbell and Associates, BCEMPR Assessment Report No. 6613.

## GEOLOGY

Geology of the Midway - Greenwood District has been described in some detail recently by Little (1983) and Fyles (1990). The framework of the District consists of five north-dipping thrust slices of Permian and Triassic sediments and volcanics metamorphosed to greenschist facies which lie on unexposed high grade metamorphic complexes. The Permian-Triassic rocks are intruded by Jurassic-Cretaceous granitic plutons and are unconformably overlain by Tertiary sediments and volcanics with small associated subvolcanic intrusions. Distribution of Tertiary rocks is controlled by a complex network of extensional faults of late Tertiary age.

A variety of mineral deposits occur in the District. The most notable are copper-gold magnetite skarns and replacements in Brooklyn Formation limestones (Triassic age) in B.C. and gold-magnetite skarns in Knob Hill Formation calcareous rocks (Permian age) in Washington State. Examples of the former are the previously mined Phoenix deposit (22.7 million tonnes grading 1.14% Cu and 1.51 g/t Au) and Motherlode - Greyhound deposits (3.5 million tonnes grading 1.00% Cu and 1.47 g/t Au). The Crown Jewel deposit at Buckhorn Mountain in Washington State (6.6 million tonnes grading 5.59 g/t Au) is an example of the latter type. In addition, the District has many occurrences of gold - quartz veins with epithermal characteristics, some of which are of Eocene age.

The geology of the Border 1 claim can be considered in two parts separated by a NNW trending fault of late Tertiary age. The area to the east of this fault in the northeast quadrant of the claim is underlain by Triassic age rocks of the Brooklynn Formation. Outcrops exposed in the old railroad grade are well bedded grey limestones dipping north at about 45°. These rocks are intruded by complex sills and dikes of fine grained hornblende quartz-diorite (dacite?) which are at the early stages of endoskarn formation. The intrusive rocks are variably silicified and carry about 5% fine grained disseminated pyrite and pyrrhotite. Small lenses of exoskarn within the limestone carry semi-massive fine grained pyrrhotite. Samples of these rocks have returned geochemically anomalous copper and arsenic values. The age of the intrusive rocks is currently uncertain. Little (1983) and Fyles (1990)

correlate them with the Lexington quartz porphyry intrusions of Goosmus Creek, south of Greenwood which are of Early Jurassic age and host pyritic disseminated gold deposits.

The area west of the late Tertiary fault and most of the extreme south end of the claim has rocks of Eocene age at surface. These are primarily trachytic and andesitic flows of the Marron Formation. Locally, however, at the south end of the claim thin bedded siltstones are exposed immediately underlying the Marron volcanic flows. These sediments may represent the upper part of the Kettle River Formation. Marron Formation volcanic rocks are cut by a number of fracture zones which trend N-S. Some of these can be inferred from topographic depressions whilst others are actually exposed in outcrop. These are probably antithetic to the major NNW trending fault, the scarp of which forms the western side of the Kettle River Valley. A fracture zone exposed near the west boundary of the claim has been subjected to significant alteration. A pervasive pale blue-green alteration mineral in these rocks is tentatively identified as kaolinite. The colour and texture of this mineral initially suggested the presence of malachite, scorodite or complex nickel hydroxides. Geochemical analysis (90 WR 134), however, reveals that all trace metals are at background levels. Minor, fracture coating magnetite is associated with the alteration.

Recent fluvial sediments within the Kettle River Valley support a number of hay ranches. Elsewhere on the property bedrock exposure is reasonably good. A low elevation bench in the southern half of the property is covered by a variable thickness of glacio-lacustrine sands and gravels.

Rock sample descriptions are presented in Appendix 5.

## GEOCHEMISTRY

The current reconnaissance program collected a total of 9 rock, 22 soil, and 3 heavy mineral silt samples from the Border claim. Sample locations (Figure 3) were determined by geology and ease of access with no attempt made to complete a grid based survey. Sampling and analytical methods are detailed in Appendix 3. Analytical results are presented in Appendix 4. No attempt to undertake statistical analysis of the results has been made due to the small sample populations and highly variable bedrock and surficial geology. Anomaly threshold values have been assigned on the basis of over 23 years of practical field exploration experience by the author.

### Silt Samples

Three heavy mineral silt samples were taken from Myers Creek which crosses the southern part of the claim. The central sample (90 WL 106 HM) returned an anomalous value of 237 ppb Au.

### Soil Samples

One soil from near the south border of the claim returned the following geochemically anomalous values. 90 WS 371, 26 ppm Co, 99 ppm Ni, 92 ppm Cr, 20 ppb Au. This sample was taken from close to the projected location of the major NNW trending fault mapped by Little (1983).

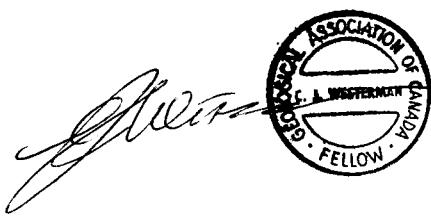
### Rock Samples

Two samples from the northeast corner of the claim returned anomalous arsenic and copper values. Sample 90 WR 136 from a small exoskarn pod in Brooklynn Limestone returned 60 ppm As and 903 ppm Cu. Sample 90 WR 137 from an endoskarn quartz diorite dike cutting Brooklynn Limestone returned 43 ppm As and 237 ppm Cu.

The significance of these geochemically anomalous samples is not known at present and additional work is recommended.

## CONCLUSIONS AND RECOMMENDATIONS

The current program represents only the initial phase of a far more complete evaluation of the claims currently at the planning stage. Further geology, prospecting and geochemical sampling surveys are recommended to follow-up on geochemical anomalies revealed by the current survey and to complete coverage of the claim group.



March 1, 1991  
Vancouver, B.C.

C.J. Westerman, Ph.D.  
Consulting Geologist

APPENDIX I  
**STATEMENT OF EXPENDITURES**  
**BORDER CLAIM (18 Units)**  
**Record No. 5692**  
**Greenwood Mining Division**

**Labour**

C.J. Westerman - consulting geologist: 2½ days at \$450	\$ 1,125.00
Field: Feb 19, 1991: travel Feb 22(½) 1991	
Office: 1 day consolidated	
R. Farmer - project geologist: 1 day at \$250	250.00
Field: Feb 19, 1991	

**Geochemical Analyses**

22 soils at \$19.80	\$ 435.60
9 rocks at \$22.47	202.23
3 HM silt at \$55.91	<u>167.73</u>
All analyzed for Au & Hg plus 31 ICP trace elements	805.56

**Vehicle**

1½ days at \$50	\$ 75.00
343 km at 10¢	34.30
Gas	<u>51.52</u>
	160.82

**Accommodation**

45.78

**Meals**

27.78

**Office, copying, communications**

73.87

**Drafting**

75.79

**TOTAL**

\$ 2,564.60

The stamp is circular with the text "C.J. WESTERMAN" in the center. Around the perimeter, it reads "PROFESSIONAL ASSOCIATION OF CANADA" at the top and "FELLOW" at the bottom.

March 1, 1991  
Vancouver, B.C.

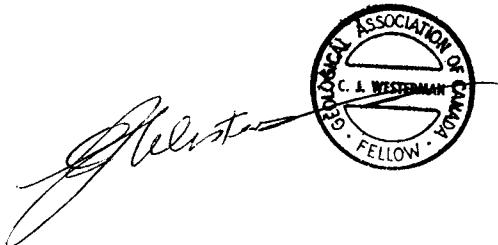
C.J. Westerman, Ph.D., FGAC  
Consulting Geologist

## APPENDIX II

### STATEMENT OF QUALIFICATIONS

I, Christopher John Westerman, hereby certify that:

1. I am an independent Consulting Geologist with an office at 1010 - 470 Granville Street, Vancouver, British Columbia, V6C 1V5.
2. I am a graduate of London University, England with the degree of Bachelor of Science in Geology (1967); of the University of British Columbia with the degree of Master of Science in Geology (1970) and of McMaster University, Ontario with the degree of Doctor of Philosophy in Geology (1977).
3. I am a Fellow of the Geological Association of Canada (F.525) and a member of the Canadian Institute of Mining and Metallurgy.
4. I have practised my profession in North America since 1967, having worked as employee and consultant for several International Mining Corporations and Junior Resource Companies.
5. This report is based upon field work undertaken on the property in the period Feb 17-22, 1991.



March 1, 1991  
Vancouver, B.C.

C.J. Westerman, Ph.D., F.G.A.C.  
Consulting Geologist

### APPENDIX III

#### SAMPLING AND ANALYTICAL PROCEDURES

Soil samples for geochemical analysis were collected with a mattock from 'B' horizon material at depths of 15 - 30 cm. The majority of the soil samples were collected adjacent to access roads and spaced at either 50 metre or 100 metre intervals. Additional soil samples were collected at random spacing along reconnaissance traverses undertaken during geological mapping and prospecting. All soil samples were placed in numbered Kraft wet strength bags. Rock chip samples were taken at geologically significant locations and placed in numbered plastic bags. Heavy mineral silt samples were collected from centre stream gravel bars, sieved to minus 40 mesh and placed in numbered Kraft wet strength bags. Standard silt samples were collected directly from the fine fraction of stream sediment material and placed in Kraft bags. Moss mat silt samples were collected from centre stream moss mats on boulders, placed directly in Kraft wet strength bags and dried at the laboratory. All samples were analyzed by Min-En Laboratories Ltd. in North Vancouver. Samples were air dried to prevent volatilization loss of mercury. Soil and silt samples were sieved to -80 mesh to produce sufficient material for analysis. Rock samples were crushed and pulverized. Heavy mineral silt separation was achieved by flotation in a liquid with specific gravity of 2.93. The following elements were analyzed by Jarrell Ash 9000 Induction Coupled Plasma (ICP) analysis after digestion in a  $\text{HNO}_3$  -  $\text{H}_2\text{CO}_4$  mixture: Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Sr, Th, U, V, Zn, Ga, Sn, W, Cr. Mercury (Hg) was analyzed by flameless atomic absorption. A 15 gram sample was analyzed by fire assay for gold (Au).

## APPENDIX IV

### GEOCHEMICAL RESULTS

Samples collected from the Border claim:

**Silts:**

90 WL 104 HM to 90 WL 106 HM inclusive

**Rocks:**

90 WR 131 to 90 WR 139 inclusive

**Soils:**

90 WS 361 to 90 WS 363 inclusive

90 WS 365 to 90 WS 373 inclusive

90 WS 375 to 90 WS 384 inclusive

















## APPENDIX V

### ROCK SAMPLE DESCRIPTIONS

- 90 WR 131** Fracture zone 10 cm wide with minor quartz-calcite veinlets and weak iron oxide staining cutting massive Marron Fm. trachytic flows.
- 90 WR 132** Thin bedded siltstones of Kettle River Fm. beneath massive Marron Fm. trachytic flow are bleached and cut by high angle calcite-quartz stringers.
- 90 WR 133** Quartz stringer vein 2 cm wide with weak iron oxide staining cuts massive trachyte flow of Marron Fm.
- 90 WR 134** Large outcrop of Marron Fm. trachyte and andesite flows dipping 15°N. Steep dipping N-S fracture zone at east end of outcrop is 20 m wide (chip sample). Strong pervasive alteration by pale blue-green mineral (kaolinite?). Minor magnetite in fractures.
- 90 WR 135** Location as 90 WR 134. Sample is 1 cm wide quartz-calcite stringer in steep fracture in centre of outcrop.
- 90 WR 136** Irregular band of pyrrhotite skarn 75 cm wide in bedded grey limestone (Brooklynn Fm). Terminates against semi-concordant lamprophyre dike (Eocene?).
- 90 WR 137** Medium to fine grained felsic hornblende diorite (dacite?) dike 6 metres wide is silicified and contains 5-10% fine disseminated pyrrhotite and pyrite. Early stage endoskarn. Intrudes at high angle a massive bedded grey limestone unit (Brooklynn Fm).
- 90 WR 138** Fine grained silicified pyritized dike similar to 90 WR 137.
- 90 WR 139** Silicified limestone of Brooklynn Fm. with minor pyritic concentrations in anastomosing fault breccia veinlets.

