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ASSESSMENT REPORT FOR GEOLOGICAL WORK

SAPPHO 1991 GROUP

GREENWOOD MINING DIVISION  
NTS 82E/2E

Lat: 49° 01' N  
Long: 118° 40' W

**GEOLOGICAL BRANCH  
ASSESSMENT REPORT**

**21,386**

Kettle River Resources  
Box 130  
Greenwood, B.C.

Linda Caron  
April, 1991

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## 1.0 INTRODUCTION

### 1.1 Location, Access and Terrain

The Sappho 1991 Group is located about 8 kilometres south of Greenwood, B.C., bordering on the Canada-USA border (see Figure 1). Access to the property is via the Norwegian Creek Road which leaves Highway 3 about 2 kilometres east of Midway, and by the McCarren Creek road which leaves the highway at Boundary Falls. From these roads, numerous old logging, ranching and mining roads provide good access to most of the claim group.

The Sappho 1991 claim group covers a large area of land, mostly south of Highway 3, from Midway east to the Number 7 Camp, and covering the drainages of Norwegian, McCarren, and Gidon Creeks. Elevations range from about 610 metres in Boundary Creek in the western part of the group, to about 1525 metres on Rusty Mountain in the east. The terrain is hilly; generally forest cover is moderate, with second growth pine, fir and larch forest and minimal underbrush. Local areas have recently been logged.

The climate is quite dry, with hot summers and little rainfall. Snowfall is minimal, generally less than 0.75 metres. Water for drilling is available from any of the main creeks or their tributaries.

### 1.2 Property and Ownership

The Sappho 1991 Group consists of 12 mineral claims (95 units), as shown on Figure 2. All claims are owned by Kettle River Resources Ltd. of Greenwood, B.C.. Details of the claims are listed below.

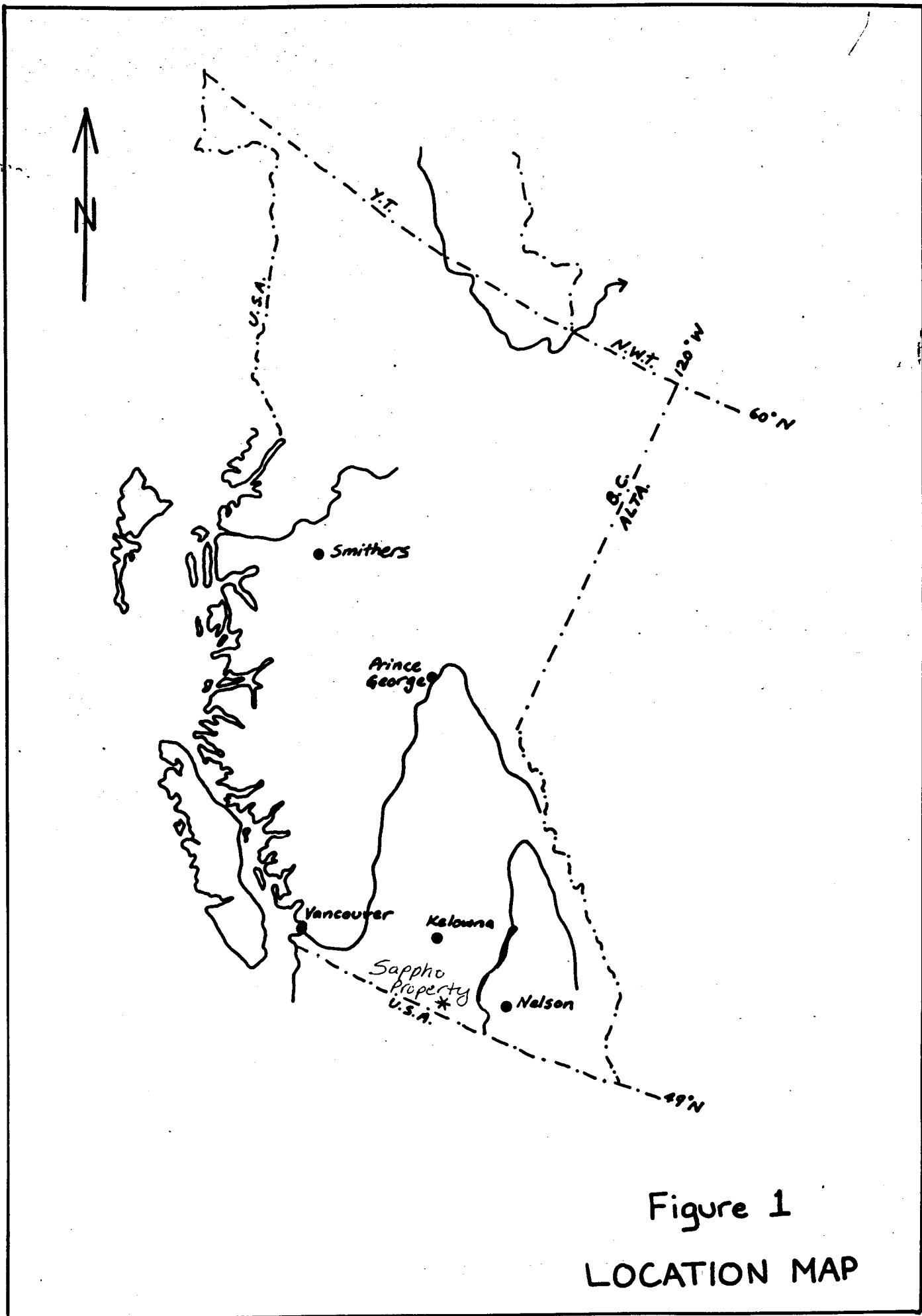


Figure 1  
LOCATION MAP

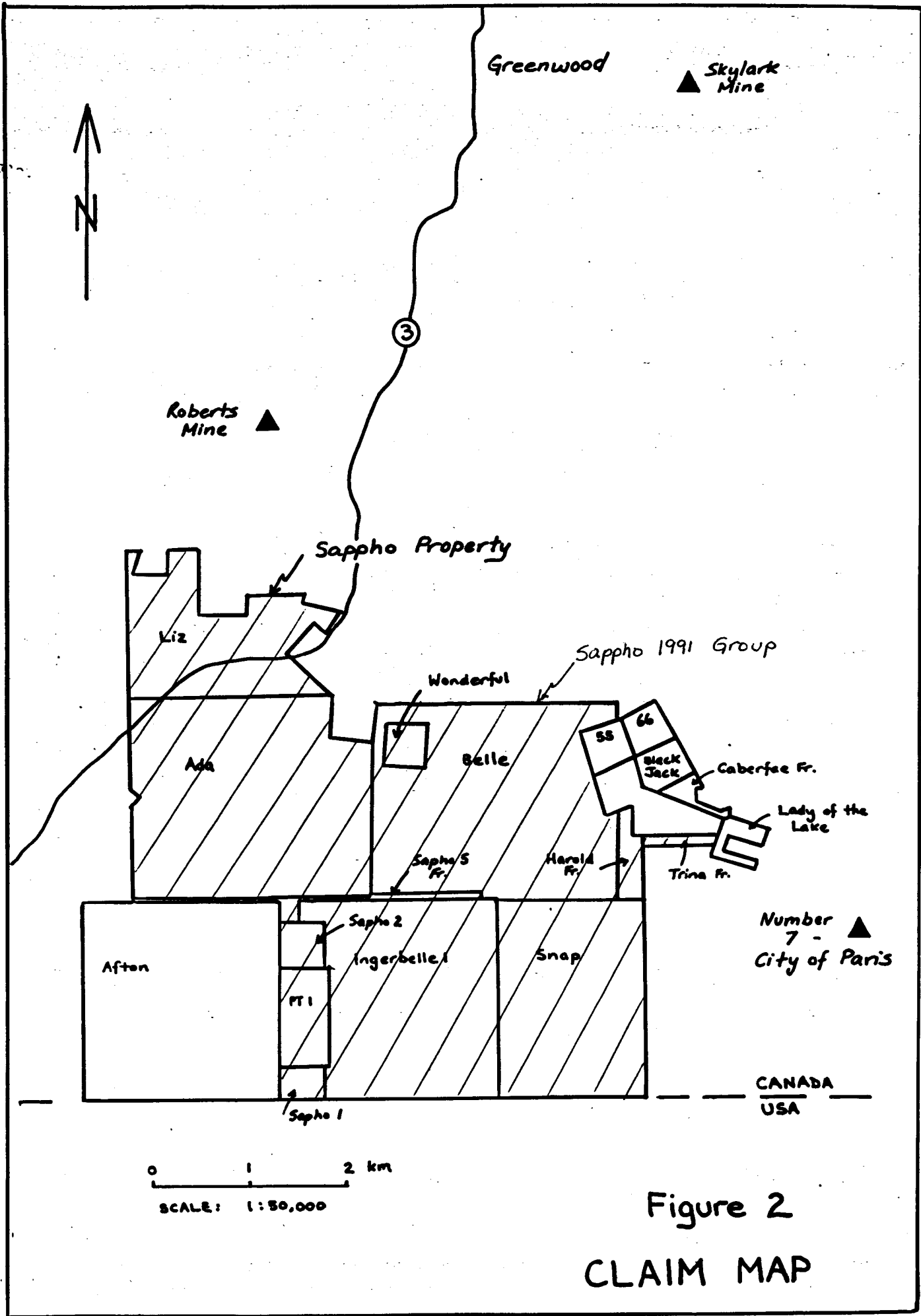


Figure 2  
CLAIM MAP

SAPPHO 1991 GROUP:

<u>Claim Name</u>	<u>Units</u>	<u>Record Number</u>	<u>Expiry Date *</u>
PT #1	2	43	06/10/91
Sapho #1	1	2281	06/17/91
Sapho #2	1	2282	06/17/91
Sappho 5 Fr.	1	2731	06/12/91
Wonderful	1	2961	12/03/91
Ada	20	4604	06/17/91
Harold Fr.	1	4619	06/25/91
Trina	1	4933	05/11/92
Liz	15	4934	05/11/92
Ingerbelle 1	16	5208	07/15/91
Snap	12	5402	04/18/92
Belle	20	6154	03/20/92

\* after acceptance of this report

### 1.3 History

A significant amount of exploration work has been done on the claim group in the past, as summarized in the following account (taken in part from Keating, 1986).

- 1909 - Small pits, cuts and shafts dug in Sappho area.
- 1916-18 - 112 tons of ore was shipped from the Sappho workings, grading 1.8 oz/t Ag, 5.6% Cu, yielding a total of 197 oz Ag and 13,580 lbs Cu.
- 1927-28 - 10 tons of ore mined from a 50 foot tunnel in the area of the PT #1 claim. A sample of cpy-py ore from this tunnel assayed 3.2% Cu and 0.03 oz/t Pt.
- 1963-64 - Triform Mining Ltd. and Coast Exploration Ltd. conducted geophysical surveys and completed 2300' of trenching and 1580' of diamond drilling in the vicinity of the Sappho showings (Hilchey, 1964).
- 1967 - Silver Standard Mines Ltd. conducted geological mapping, rock sampling and magnetometer surveys and 1800' of trenching.
- 1968-69 - The present Belle claim was covered in part by the Dew and the New Find claims.
- 1971 - The present Belle claim was covered in part by the Tom claims.

- 1975 - The PT #1 claim was staked by G. Stewart. Trenching and rock geochemistry confirmed assay results of 0.02-0.06 oz/t platinum.
- 1978 - McIntyre Mines obtained high grade copper mineralization within the pyroxenite at the main Sappho showings. This zone also contained 0.044 oz/t platinum.
- 1981 - Kettle River Resources obtained the property and began geological mapping and sampling in the area of the main Sappho showings (Gilmour, 1981).
- 1982 - A joint venture was established between Noranda and Kettle River on the claims.
- 1984 - Geological and geochemical surveys were carried out by Noranda in the area of the Sappho showings (Keating and Fyles, 1984).
- 1985 - Detailed grid geological and geochemical surveys were carried out by Noranda in follow-up of the 1984 program (Gill, 1985).
- 1986 - Heavy mineral sampling was done by Noranda in McCarren and Gidon Creeks. A grid was established in the Gidon Creek area to follow-up this survey. Geological mapping and soil sampling was done on this grid (Keating, 1986).
- 1987 - Noranda completed a small overburden sampling program in the Gidon Creek area, to test an area of anomalous soil resulting from the 1986 program. A grid was established in the Boundary Creek area (Ada claim). Geological mapping, rock and soil sampling was done on this grid (Keating, 1987).
- 1988 - Geological mapping, soil sampling and magnetometry and VLF/EM surveys were done on the Boundary Creek grid by Noranda (Bradish and Keating, 1988).
- 1990 - Prospecting was done in the Gidon Creek area by J. Graham, for Kettle River Resources.

#### 1.4 Summary of Work Done, 1991

A small amount of regional and fill-in geological mapping was done in the McCarren and Gidon Creek areas, in the spring of 1991. A total of 18 rock samples was collected to test new areas of alteration or mineralization, and to test areas of known soil anomalies determined in previous programs. Work was done by L. Caron between April 8-24, 1991; a total of 6 man days was spent on the claims completing the above program.



## 2.0 GEOLOGY

### 2.1 Regional Geology

The Greenwood area has been mapped on a regional basis by a number of people, most recently by Fyles (1990), and prior to this by Little (1983) and Church (1986). Although all these authors generally agree on the ages and distribution of the geological units, Fyles' work is the first to give an adequate interpretation explaining this distribution. His mapping shows that the Pre-Tertiary rocks form a series of thrust slices, which lie above a basement high grade metamorphic complex. A total of five thrust slices are recognized, all dipping gently to the north, and bounded in many places by lenses and bodies of serpentine. While earlier mapping has interpreted these serpentinite bodies as ultramafic intrusions, Fyles shows them to belong to the Knob Hill Group of late Paleozoic age, and to represent part of a disrupted ophiolite suite. The common Fe-carbonate alteration of these serpentinites to listwanite is a result of the thrusting event.

The Sappho property is shown by Fyles (1990) to be contained primarily in the lowest thrust slice. The Number 7 fault separates this package of rocks from the overlying thrust slice, and runs west-northwest through the northeastern portion of the claims. Rocks in the lower thrust slice consist of sediments of the Permian Attwood Group, overlain by greenstone of the Triassic Brooklyn Formation. A large body of Lexington quartz-feldspar porphyry intrudes the earlier rocks. A band of serpentine marks the position of the overlying thrust fault, and separates the Permian Knob Hill Group rocks from the intrusives in the lower plate. Both fault slices appear to be terminated to the west by the steep, northeast trending Bodie Mtn. Fault, which marks the eastern boundary of the Toroda Creek graben. To the west of this fault, Tertiary volcanics and sediments are dominant.

## 2.2 Property Geology

Mapping during this program was confined to a minor amount of reconnaissance scale mapping in the McCarren Creek area, and follow-up property scale mapping on the Gidon Creek grid, established in 1986. The geology is shown on Figure 3, at a scale of 1:5,000.

### 2.2.1 Lithologies

During the course of mapping, five distinct geological units, and a number of sub-units were recognized. A geological legend of the property is shown below, listing these rock types.

#### TERTIARY

Unit 5 - Marron Formation: Massive, blocky, coarse to medium grained, equigranular, dark grey, intrusives, 40% mafics, 60% fsp, minor bi. Occurring as dykes, generally N-NE trending.

#### CRETACEOUS

Unit 4 - Nelson Intrusives: Massive, medium grained, pale grey, fresh, intermediate intrusives, as rare dykes.

#### JURASSIC

Unit 3 - Quartz-Feldspar Porph. Intrusives: Pale grey to greenish, medium to coarse grained, intrusive. 10% qtz eyes, 60% fsp phenos, 30% mafics. Locally mod ep alt'n, minor diss py, stwk qtz vnlt's and silic'n.

#### TRIASSIC

Unit 2 - Brooklyn Formation: Predominantly fine grained, green-grey greenstone, locally bx, silic and with minor diss py. Interbedded with greenstone are bands of argillite.

#### PERMIAN OR CARBONIFEROUS

Unit 1 - Knob Hill Group

Unit 1b:

Interbedded metaseds and metavolcs, including greenstone, phyllite, argillite, quartzite.

Unit 1a:

Strongly foliated, dark green serpentine and orange-brown Fe-carbonate altered serpentine (listwanite).

The oldest rocks identified during the course of mapping belong to the Permian or Carboniferous Knob Hill Group. A thick band of serpentine (largely altered to listwanite) occurs at the eastern edge of the property, striking westerly across the claims. This serpentine band marks the position of the Number 7 Fault, and separates the first and second thrust slices described by Fyles (1990). Overlying the serpentine band are interbedded metasediments and volcanics of the Knob Hill Group, cut by rare dykes of Marron and Nelson Intrusives.

In the southeast corner of the Gidon Creek grid, south of the serpentine band, a northeast trending zone of greenstone of the Brooklyn Formation (?) is exposed. Minor argillite (Knob Hill or Brooklyn?) also occurs in this area. A large body of quartz-feldspar porphyry separates the Brooklyn rocks from the serpentine band; both the intrusive and the greenstone are cut by a series of generally northeast trending Tertiary Marron dykes.

#### 2.2.2 Structure

The map area is cut by an east-west trending belt of serpentine, largely altered to listwanite, as described above. This alteration is presumed to be a result of a major thrusting event. Foliation in the listwanite indicates that the thrust fault (the Number 7 Fault) dips to the north at about 40 degrees. The large body of Jurassic quartz-feldspar porphyry is believed to have intruded up along this thrust plane.

A second major structure is a steep northeast trending fault in the north-central part of the property. Regional mapping suggests that this is the northern extension of the Bodie Mtn. Fault, Tertiary in age. A series of northeast trending Tertiary Marron dykes confirms tectonic activity at this time.

### 2.2.3 Alteration and Mineralization

A large area of spotty anomalous gold in soils was identified by Noranda during their 1986 and 1987 exploration programs in the Gidon Creek area. Mapping and sampling in this area was intended to test this zone and to identify any possible source for the anomalous gold. The anomalous values form a roughly northeast trending belt which coincides approximately with the contact of the quartz-feldspar porphyry and the older greenstones of the Brooklyn Formation. This contact is marked in the central grid area by a northeast trending Tertiary dyke. Adjacent to the contact the porphyry is locally silicified, moderate to strongly epidotized and cut by stockwork quartz veinlets. Silicification and pyrite mineralization was also noted in the greenstone near this contact.

In the northeast corner of the grid area, several old shafts, trenches and a decline have been dug on quartz veins, hosted within the quartz-feldspar porphyry, near the serpentine contact. Pyrite mineralization in the porphyry is common near these veins.

Above the thrust fault, several quartz veins and metamorphic sweat zones were noted in the Knob Hill Group rocks. These veins and sweat zones contain minor disseminated pyrite. Also in the upper thrust slice, strong chlorite alteration was observed in the mafic volcanics of the Knob Hill Group, adjacent to a steep north-northeast fault zone.

### 3.0 ROCK GEOCHEMISTRY

A total of 18 rock samples was collected from the McCarren and Gidon Creek areas during this program (see Figure 3). Sample descriptions are contained in Appendix I. Complete analytical results are included in Appendix II, and shown on Figure 4.

All rock samples were shipped to Min-En Labs in North Vancouver for preparation and analysis. Samples were dried and crushed by a jaw crusher and then pulverized on a ring mill pulverizer. Samples were analyzed for silver by atomic absorption and for gold by fire geochemical methods. Detection limits for these analyses are 1 ppm for Ag and 1 ppb for Au.

Sampling of outcrop and float was done in the area of anomalous soils in the Gidon Creek grid area. Three samples, SPH-08, -13 and -18, were weakly anomalous in gold (19, 46 and 24 ppb, respectively). Sample SPH-08 represents coarse grained quartz-feldspar porphyry, with 4% disseminated pyrite, collected from the dump of an old trench. Sample SPH-13 was collected from a small outcrop of epidotized quartz-feldspar porphyry, with minor quartz stockwork veining. Finally, Sample SPH-18 was collected from an old blast pit in coarse grained quartz-feldspar porphyry, in the south-central grid area. The porphyry is cut by about 10% stockwork quartz veinlets at this location. All three samples were spatially very close to Tertiary dykes, suggesting that alteration in the porphyry may be controlled by these dykes, or by the structures that control the dykes.

The the northeast corner of the grid area, several samples were collected from the dump piles of old workings. The following table summarizes the results from this area (more detailed sample descriptions are included in Appendix I).

Sample Number	Description	Au (ppb)	Ag (ppm)
SPH-09	QFP host, trench dump	16	0.2
SPH-10	Qtz vn, shaft dump	111	0.2
SPH-11	QFP host, decline dump	410	0.5
SPH-12	Qtz vn, decline dump	820	4.8

As described previously, the showings are located in the quartz-feldspar porphyry, near the contact with the serpentine. Alteration and mineralization appears to be controlled by the thrust fault defined by the serpentine belt. The fact that the host of the veins is carrying anomalous values in this area is encouraging.

There were no significant results from samples collected elsewhere on the property.

#### 4.0 SUMMARY AND CONCLUSIONS

A large area of anomalous soil was identified by Noranda in the Gidon Creek area during 1986 and 1987. The current program was designed to explore this area in an attempt to identify possible sources of the anomaly, and to identify potential trench targets. The program was also designed to prospect the McCarren Creek area to the north, where little previous exploration was known.

The soil anomaly was found to occur in an area underlain by Jurassic quartz-feldspar porphyry, near its contact with Brooklyn (?) greenstone. Alteration of the porphyry is relatively common and consists of epidotization, local silicification, stockwork quartz veining and minor disseminated pyrite. The alteration appears to be spatially associated with northeast trending Tertiary dykes. Weakly anomalous gold values occur in samples of the porphyry with stockwork veining and pyrite mineralization.

Anomalous gold and silver values occur in quartz veins in the northeast corner of the grid. The veins are hosted within the quartz-feldspar porphyry near the serpentine contact; values to 410 ppb Au were also returned from the altered porphyry host.

## 5.0 RECOMMENDATIONS

Backhoe trenching is recommended to further test the area of anomalous soils and altered quartz-feldspar porphyry, in the Gidon Creek area. Proposed trench sites are shown in dashed lines on Figure 3. Approximately 800 metres of trenching is suggested.

Because of the closeness to the property boundary, at the present time, no further work is recommended to follow-up anomalous values in quartz veins and porphyry in the northeast corner of the grid. If additional ground could be acquired in this area, or if the proposed trenching program has encouraging results, further work should be considered for this area.



## 6.0 REFERENCES

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Little, H.W., 1983.

Geology of the Greenwood Map area, British Columbia. GSC Paper 79-29.

**APPENDIX I**  
**ROCK SAMPLE DESCRIPTIONS**

## ROCK SAMPLE DESCRIPTIONS

- SPH-01 White crystalline qtz with 10% rusty clay altered inclusions from old pit.
- SPH-02 Outcrop in roadcut above Radford field. Quartz "vein" - metamorphic sweat/quartzite. Minor py - diss and stringers.
- SPH-03 Same loc'n as 02. Intermed. dyke cutting metamorphic rocks. Rusty weathering, weak perv silic, mafics alt'd to chl, minor diss py.
- SPH-04 Quartz "sweat" with minor chlorite inclusions from large area of Knob Hill metaseds and volcs N of W end of Trainer's field.
- SPH-05 Dark green, fine grained, chloritic mafic volc in N-S fault draw at switchback in road between Hill and Trainer places.
- SPH-06 Float of rusty weathering, fine grained, black graphitic argillite with finely diss py. From road up S fork Gidon Ck, before cabin.
- SPH-07 Float of strongly epidotized QFP, pale pinkish grey, 10% qtz eyes, 10-15% epidote - perv and as stringers. 100+50E, 85+10N.
- SPH-08 Coarse grained QFP with 4% fine diss py from dump of old trench at about 100+50E, 85+60N.
- SPH-09 QFP, coarse grained, 2-3% fine diss py, rare qtz vnlt, weak chl alt'n of mafics, mod fol'n. From dump of trench at 104+50E, 89+00N.
- SPH-10 Rusty white qtz vn flt from waste dump of shafts at 104+50E, 89+00N.
- SPH-11 Sample of QFP host from decline dump at about 107+00E, 88+75N. Med grained, weak silic, 5% py (diss and pods), mod Mn-Fe stain.
- SPH-12 Rusty white qtz vn from decline dump at 107+00E, 88+75N.
- SPH-13 Small outcrop of QFP in logging slash at 101+70E, 86+00N. Med grained, mod ep alt'n, 2% stockwork qtz vnlt to 1.5 cm.
- SPH-14 Float of str silic'd, white-rosy QFP with drusy qtz vnlt. In logging slash at about 103+50E, 86+75N.

ROCK SAMPLE DESCRIPTIONS, CONT...

- SPH-15 1 m white sugary qtz "vein" or rext. qtzite band. Large euhedral py cubes. From old pit on N side of McCarren Ck road, about 200 metres past Trainer's.
- SPH-16 Dark green foliated chl schist from hanging wall of qtz, same loc'n as 15.
- SPH-17 Small outcrop of cherty silic'd bx greenstone with minor py from about 97+75E, 79+50N.
- SPH-18 V. coarse qtz-fsp porphyry intrusive from old blast pit. 20% 0.5-1 cm euhedral white fsp phenos, minor smaller qtz eyes, in finer grained greenish gmass. Weak fol'n. 10% white qtz vnltts, to 1 cm, generally parallel to fol'n.

**APPENDIX II**  
**ANALYTICAL RESULTS - ROCK SAMPLES**



APR 23 '91 11:25

# MIN-EN LABORATORIES

(DIVISION OF ASSAYERS CORP.)

SPECIALISTS IN MINERAL ENVIRONMENTS  
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004 P02  
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FAX (807) 623-5931

**SMITHERS LAB.:**  
TELEPHONE/FAX (804) 847-3004

## Geochemical Analysis Certificate

1V-0356-RG1

Company: KETTLE RIVER RESOURCES  
Project:  
Attn: LINDA CARON

Date: APR-23-91  
Copy 1. KETTLE RIVER RESOURCES, GREENWOOD, B.C.

We hereby certify the following Geochemical Analysis of 18 ROCK samples submitted APR-17-91 by LINDA CARON.

Sample Number	AU-FIRE PFB	AG PPM
SPH-001	2	0.3
SPH-002	2	0.2
SPH-003	1	0.4
SPH-004	1	0.2
SPH-005	2	0.7
-----		
SPH-006	3	0.3
SPH-007	1	0.3
SPH-008	19	0.2
SPH-009	16	0.2
SPH-010	111	0.2
-----		
SPH-011	410	0.5
SPH-012	820	4.8
SPH-013	46	0.2
SPH-014	3	0.2
SPH-015	1	0.3
-----		
SPH-016	17	0.9
SPH-017	6	0.7
SPH-018	24	0.3

Certified by \_\_\_\_\_

MIN-EN LABORATORIES

**APPENDIX III**  
**COST STATEMENT**



## COST STATEMENT

1.0 Fees and Wages

L. Caron, Geologist    6 days @ \$250/day                      \$1,500.00

2.0 Analytical Results

Rock Samples:    18 @ \$22/sample                      \$396.00

3.0 Transportation and Accommodation

Truck rental    6 days @ \$45/day                      \$270.00

Fuel and Supplies    80.00

Room and Board    6 man days @ \$45/day                      270.00

TOTAL:              \$2,516.00

**APPENDIX IV**  
**STATEMENT OF QUALIFICATIONS**

**STATEMENT OF QUALIFICATIONS**

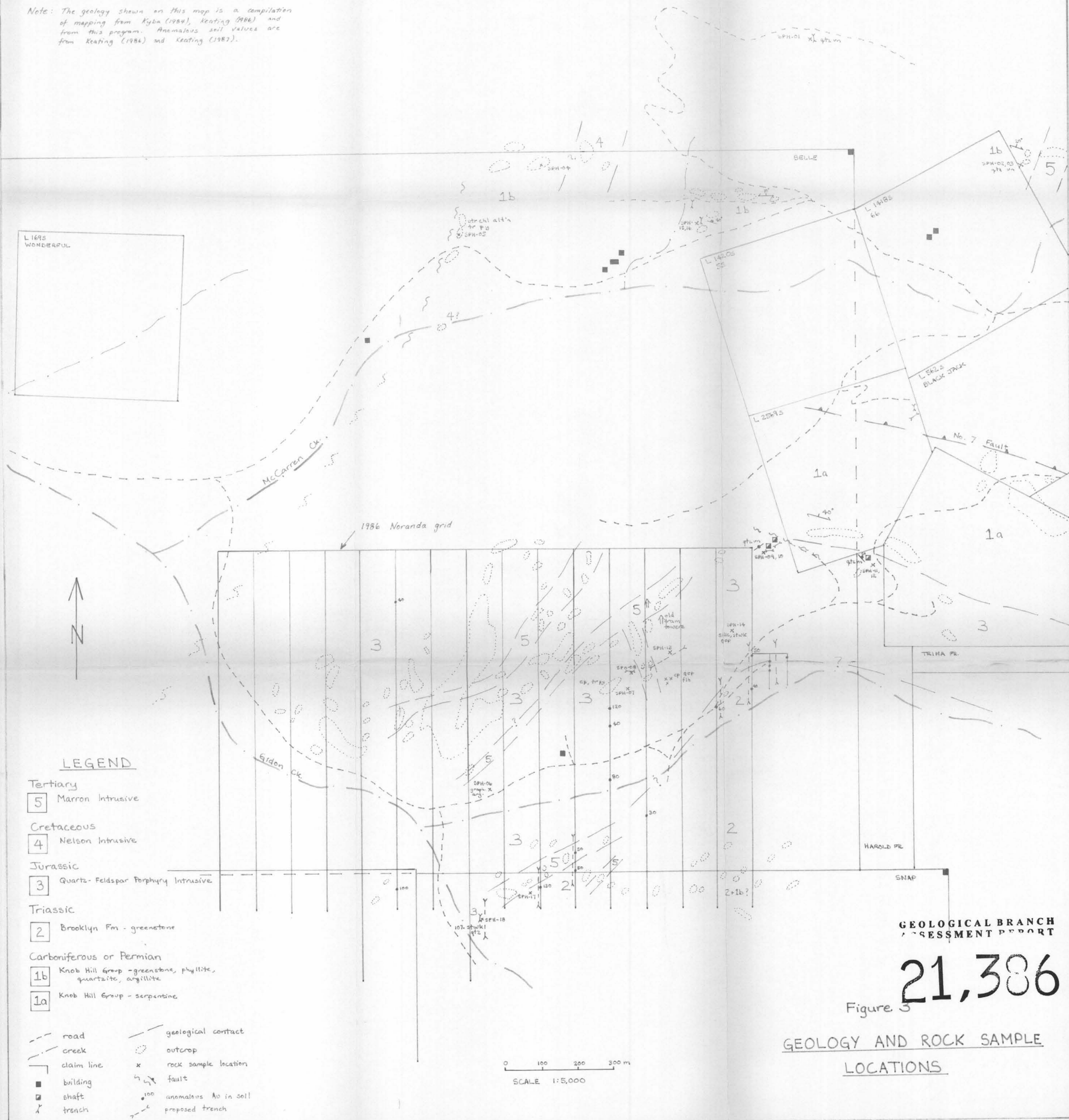
I, Linda J. Caron, certify that:

- 1.0 I am an exploration geologist residing at Lind Creek Road (Box 248) Greenwood, B.C.
- 2.0 I obtained a B.A.Sc. in Geological Engineering (Honours) in the Mineral Exploration Option, from the University of British Columbia (1985).
- 3.0 I graduated with a M.Sc. in Geology and Geophysics from the University of Calgary (1988).
- 4.0 I have practised my profession continually since 1987 and have worked in the mineral exploration industry since 1980.
- 5.0 I was employed as an independent contractor by Kettle River Resources Ltd. to complete the work described in this report and have no other interests in the property. I have personally carried out this work program.

Date: April 24/91

L. Caron  
Linda Caron

Note: The geology shown on this map is a compilation of mapping from Kyba (1984), Keating (1986) and from this program. Anomalous soil values are from Keating (1986) and Keating (1987).



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Figure 3

GEOLGY AND ROCK SAMPLE  
LOCATIONS



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Figure 4

ROCK SAMPLE RESULTS