# PORPHYRY CREEK PROPERTY

(Bear, Emer 1 to 9, Karen 3, Kliyul,
Lady Diana 1 to 4, Lady Diana 6 FR, Lemdl FR)

## 1990 PROSPECTING, MAPPING AND SAMPLING

Latitude: 56°29'N

Longitude: 125°58'W

N.T.S.: 94C/5, 12
94D/8, 9

OMENICA MINING DIVISION
British Columbia



TECK EXPLORATIONS LTD.
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KAMLOOPS, B.C.
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L. Grexton
P. Roberts

Oct/90,Jan/91

## EXECUTIVE SUMMARY

Porphyry Creek Property is situated at the northwest end of the Hogem Batholith. Covering an area of 60 $km^2$, it is underlain by Takla Gp. volcanic rocks and by a suite of basic to alkaline intrusive rocks. This setting is host to a significant number of important mineral occurrences including Cat Mountain, Lorraine and Mt. Milligan.

In 1990, Teck Explorations Ltd., in joint venture with Total Energold Corp., evaluated base and precious metal potential of the property. Emphasis was placed on Cu-Au porphyry style mineralization. The evaluation was helicopter supported and took 363 mandays at an extimated cost of $450,000. The intial program involved contour soil sampling, prospecting and mapping over the entire claim block (252 units). Favourable geochemical response over the broadly gossanous Raven area, prompted construction of a 25 line km grid and collection of 1005 soil samples. Highlights of 1990 results are shown on Figure 2.

Highly significant Au and basemetal concentrations are associated with late stage intrusive activity. The west half of the property is characterized by an oxidizing, alkaline environment with low S and $SiO_2$. Higher S, Fe and lower ph typify the east half.

Contour soil sampling was a highly successful and effective means of evaluating this large and fairly rugged property. Soil response is characterized by strong, broad, multi-element anomalies. Three areas warranting detailed evaluation have been identified. On the Raven grid, strong, multi-element soil anomalies indicate excellent Cu-Au porphyry or volcanogenic massive sulfide potential. Geological and geochemical evidence suggests the 10 km long string of gossans (Raven Trend) is a manifestation of a large scale mineralizing system and warrants immediated consideration.

An examination of the 1982 diamond drill core from the Davie Creek Stock found features previously unrecognized. Morphology of the stock as interpreted by Bema Industries (1982) is now suspect. Potential for Cu and Au mineralization peripheral to the stock is very good.

Based upon favourable geology and geochemical response, the main areas of interest are Raven, southeast Porphyry Creek and Bloom Cirque. Immediate detailed follow up in these areas should include selected terrain analyses, grid construction, rock and soil sampling, detailed mapping and ground geophysical surveys (magnetic, I.P., resistivity, VLF). Reconnaissance prospecting, mapping and infill contour soil sampling is recommended in 7 secondary areas. A helicopter supported program completing all recommended work and including a very limited drill program (2000 feet) is estimated to cost $1.5 million.

Additional staking is required to protect all areas of interest. A detailed aeromagnetic map, from an earlier United Miniere Explorations Ltd. survey, is available from Major General Resources at a cost of $5000. Its purchase is recommended.

The size and strength of the multi-element anomalies attributed to focused intrusive activity in a setting known to host economic Au and Cu mineralization, makes Porphyry Creek Property a very exciting prospect deserving immediate attention. Close proximity to an excellent haulage road (5 km) and serviceable airstrip, maintains it as a practical venture.

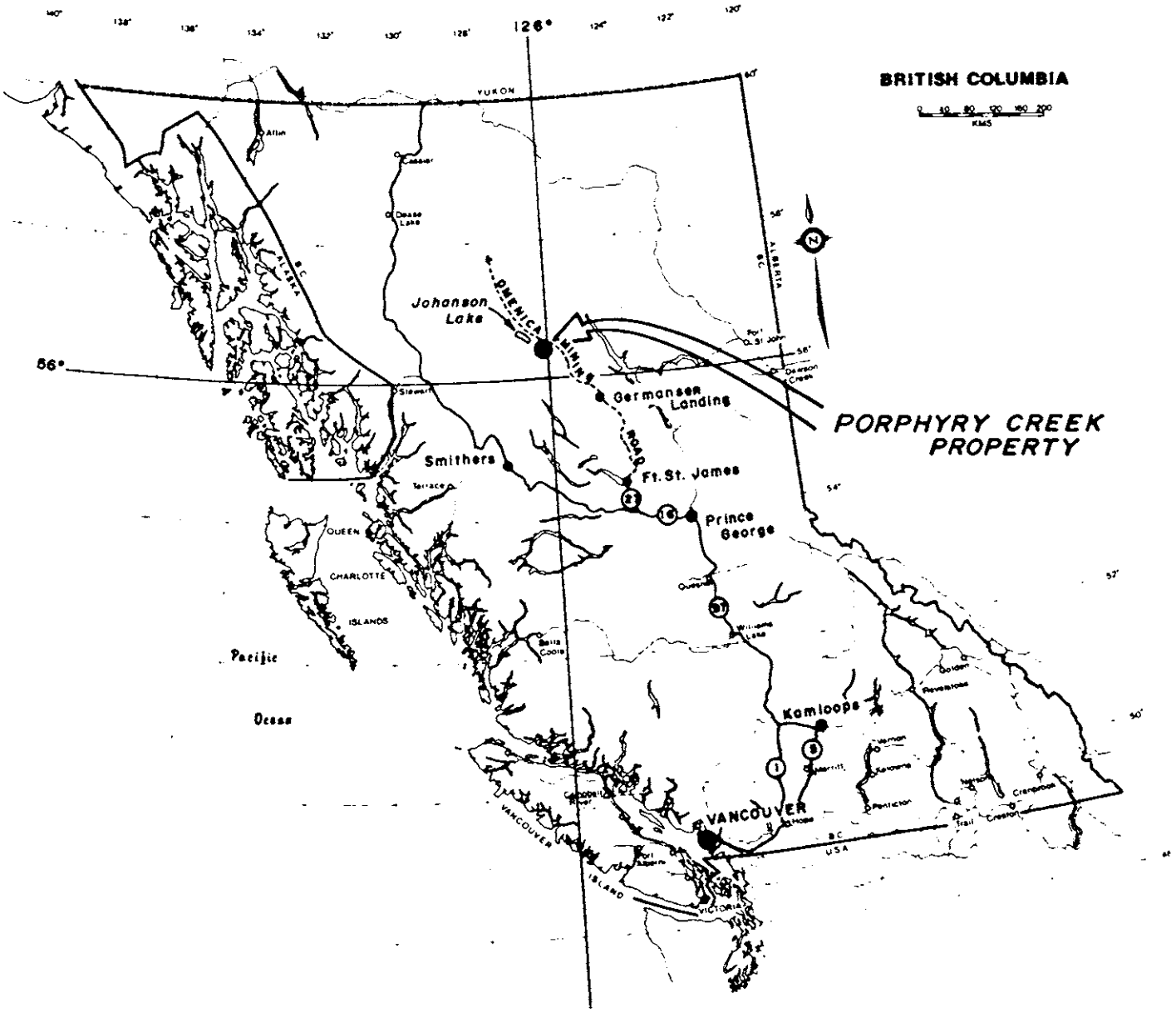



Figure 1

# LOCATION MAP

# TABLE OF CONTENTS

PAGE

## LIST OF FIGURES

# LIST OF TABLES

## APPENDICES

## DETAILED SUMMARY

The Porphyry Creek Property is located 12 km west-northwest of Aiken Lake on N.T.S. map sheets 94C/5, 12, 94D/8 and 9. Claims cover an area of rugged ridges and steep talus with broad cirque and valley floors. Road access to within 3 km of the property is possible from Ft. St. James via the Omenica Mining Road.

Comprising 252 units, the 18 contiguous claims protect an area of previously known Cu, Au and Mo mineralization. Recorded exploration dates to 1937, following discovery of auriferous quartz veins along Croydon Creek. A number of companies have prospected, mapped, trenched, conducted geophysical/soil surveys and drilled the various mineral occurrences on and around the property. In 1964, Rio Tinto recognised the Davie Creek Stock as part of a porphyry Mo system. Roughly 100,000 tonnes of 0.1% $MoS_2$ was outlined in subsequent drilling by Chevron Minerals and Getty Resources in joint venture with Teck Explortations Ltd. Most recently, Vital Pacific drilled the Cu-Au skarn on the Soup property (1989), and Pacific Rim Resources drill tested the Shell occurrence Cu-Au quartz veins (1988). A regional evaluation of the area by Teck personnel in 1989, renewed interest in the claim area as a Cu-Au porphyry target.

The property is near the northern end of the Hogem Batholith and occupies the eastern half of the Quesnellia Terrane which is on the bounded east and west by major northwest faults. Claims cover a volcano-sedimentary assemblage of Upper Triassic Takla Gp. rocks which have been intruded by a Triassic pyroxenite stock and Jurassic-Cretaceous calc-alkaline intrusions of the Hogem Batholith. A strong aeromagnetic anomaly trends northwest across the southwest half of the property, parallel to the dominant structural trend.

Between June 25 and Sept. 27, Teck personnel spent 363 mandays evaluating the base and precious metal potential of the property. Emphasis was placed on porphyry style Cu-Au mineralization. The program involved mapping at 1:10,000 scale, prospecting and contour soil sampling. Favourable geochemical response over a broadly gossanous area prompted construction of a 25 line km grid in the northeast portion of the property (Raven). Highlights of 1990 results are shown on Figure 2.

Takla Gp. comprises basic to intermediate flows, pyroclastics and lesser calcareous argillite and limestone. Intrusive bodies include minor pyroxenite, diorite, quartz diorite, granodiorite and quartz monzonite. Dyke compositions also include monzonite and rare syenite.

Alteration present in Takla Gp. volcanic rocks consists of ubiquitous chloritization, local epidotization, biotization, silicification, recrystallization, partial to total replacement of pyroxene by amphibole, carbonate alteration along faults/shears and broad hornfelsing. Alteration of intrusive rocks occurs over broad areas and in narrow zones, but is generally structurally controlled. Alteration products include epidote, saussurite, magnetite, pyrite, potassium feldspar, sericite, quartz and carbonate. Mineral assemblages indicate the west half of the property was dominated by a low SI, low S, oxidizing environment. The system on the east half of the property was more S and Fe rich and probably of lower ph. Clay alteration is absent on the west half and very localized on the east half of the claims. Quartz veining/silicification is weak and commonly restricted to shears and faults.

Ubiquitous Cu mineralization comprises chalcopyrite, with or without malachite, azurite and rare chalcocite or bornite, occurs as disseminations, fracture fillings and in shears. Specks of visible gold were found in three (quartz) carbonate veins, with or without Cu, and in pan concentrates from Porphyry Creek. Galena with or without sphalerite, occurs locally in quartz-carbonate veins. Molybdenite is found in quartz, ± carbonate, ± potassium feldspar veins and stringers west of Croydon Creek. Hematite is common along fractures and in veins on the west half of the property. Highly significant concentrations of Au and basemetals are associated with late stage intrusive activity.

Contour soil sampling highlighted a number of areas with strong, broad multi-element anomalies warranting further evaluation. The method proved to be a quick and cost effective means of evaluating a large and fairly rugged area.

Raven Grid soil sampling outlined spatially zoned, strong, multi-element anomalies. Detailed evaluation by Dr. S.J. Hoffman (separate report), has concluded the geochemical signatures indicate potential for:

1) An alkalic Au-Cu porphyry system
2) a porphyry Au system with minor Cu

or 3) a volcanogenic massive sulphide system.

Mineralization and alteration in the Raven area, appears to be part of a regional system (Raven Trend) occurring as a broad, 10 km long gossanous zone, trending northwest from the Granite Basin showings immediately east of the property.

From the 1990 results, it is apparent that at least two, complex, mineralizing systems are present. Economic potential for Au and Cu porphyry style mineralization is excellent. Areas requiring detailed evaluation involving grid construction, soil sampling, geophysical surveys (magnetic, I.P., VLF) and mapping are: Raven, southeast Porphyry Creek and Bloom Cirque. Further contour soil sampling and prospecting is required in North and South Sarah Cirques, on the outer slopes of the ridges of Bloom Cirque, the Raven Trend and Porphyry Creek. In light of subtle mineralization but strong geochemical signature present on the Raven, reevaluation of the Raven Trend is a priority. It is recommended that an 80 unit block be staked contiguous with the east half of the Porphyry Creek Property. Staking 80 units, contiguous with Emer 7, along East Croydon Creek, is recommended in order to protect a poorly exposed, extension (?) of the highly anomalous (Cu) diorite in Bloom Cirque. This intrusion may follow a major structure and is possibly related to nearby Cu bearing quartz veins and biotite alteration on the ridge immediately to the north. Evaluation of these areas could be made quickly and relatively cheaply by running contour soil lines. La may be a useful indicator element for mineralizing activity. The ground adjacent to Porphyry Creek Property in these two areas is currently open for staking. In the interest of avoiding future costly option agreements it is recommended that ground be acquired as soon as possible.

The size and strength of the multi-element anomalies attributed to focused intrusive activity, in a setting known to host economic Au and Cu mineralization, makes Porphyry Creek Property a very exciting prospect deserving immediate attention. Close proximity to an excellent haulage road (5 km) and serviceable airstrip, maintains it as a practical venture. A budget of $1.5 million is required to evaluate all primary and secondary targets including limited drill testing of selected anomalies.

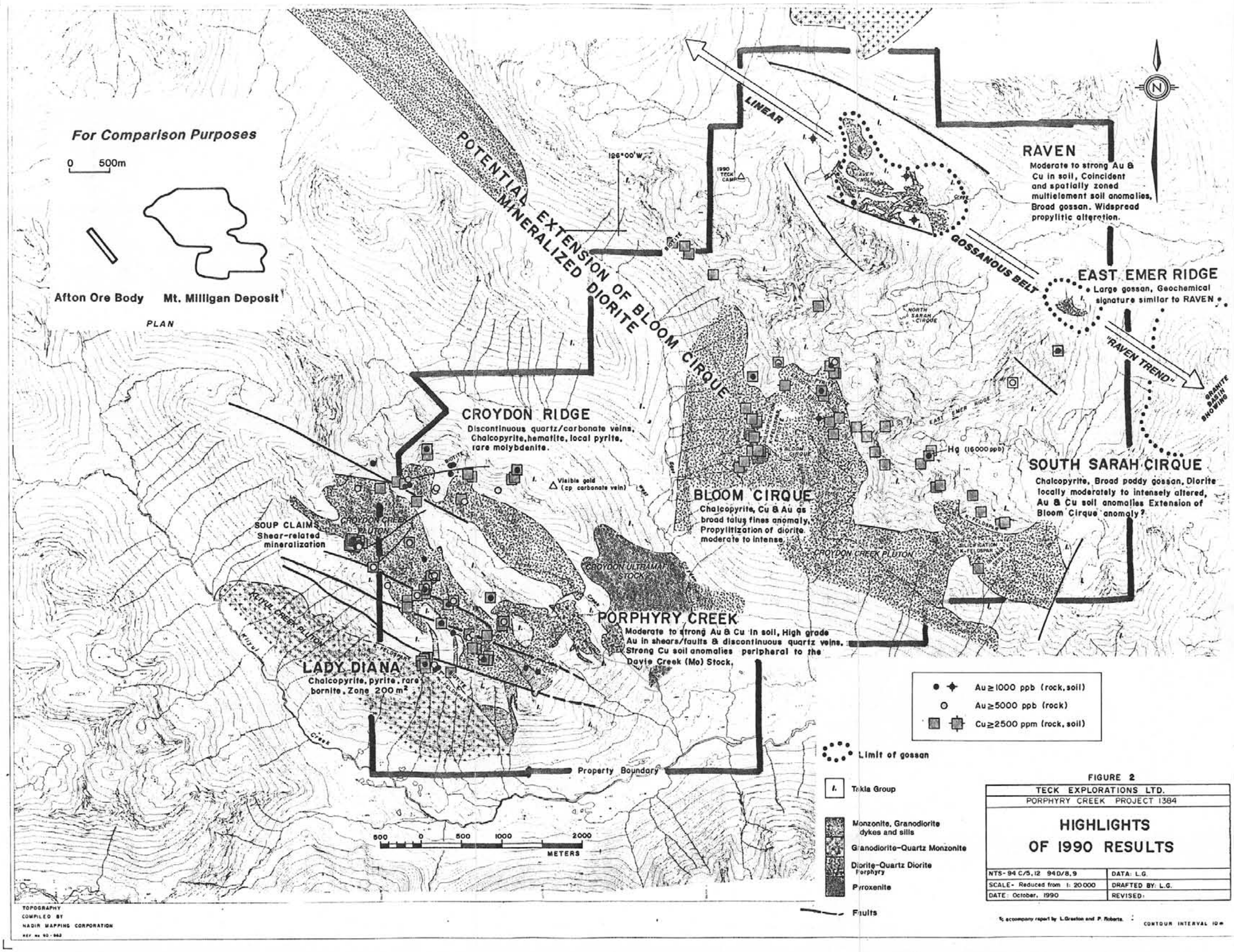



FIGURE 2

| TECK EXPLORATIONS LTD. | |
|---|---|
| PORPHYRY CREEK PROJECT 1384 | |
| **HIGHLIGHTS OF 1990 RESULTS** | |
| NTS- 94 C/5,12 94D/8,9 | DATA: L.G. |
| SCALE- Reduced from 1: 20000 | DRAFTED BY: L.G. |
| DATE: October, 1990 | REVISED: |

To accompany report by L.Groeton and P. Roberts. CONTOUR INTERVAL 10m

## CONCLUSIONS

**1.** Large scale, multiphase intrusive processes, related to the protracted emplacement of the Hogem Batholith, have been active along a northwest trending, regional crustal weakness. Kliyul Creek PLuton exhibits a unique geochemical signature with enhanced Sr, Ba, La and depleted Ca and Mg content. Takla volcanic rocks appear genetically related to the Croydon Ultramafic Stock and the Croydon Creek Pluton.

**2.** Significant Au and basemetal concentrations are spatially assocated with late stage intrusive activity but mineralization is conspicuously absent from within the Kliyul Creek Pluton and late stage dykes. The mineralizing system on the west half of the property is characterized by a low S, low $SiO_2$, oxidizing environment with alkaline affinities. Alteration assemblages indicate that mineralizing systems on the east half of the property were higher in S, Fe and of lower ph (acidic).

**3.** Contour soil sampling was a highly successful and relatively efficient method of evaluating this large and fairly rugged property. Soil response is characterized by strong, broad, multi-element anomalies. Anomaly boundaries are poorly defined due to the nature of the sampling.

**4.** Bloom Cirque, Raven and Porphyry Creek are three areas warranting detailed evaluation. Seven areas currently of secondary importance and requiring further regional style follow up are South Sarah Cirque, Bloom Extension, South Boundary, North Arm, Raven Trend, Karen Cirque and Upper Porphyry Creek.

**5.** Strong, multi-element soil anomalies on the Raven grid indicate excellent poptential for a large mineralizing system with possible Cu-Au porphyry or volcanogenic massive sulfide affinities.

**6.** Geological and geochemical similarities between Raven and East Emer Ridge suggests the Raven Trend is a manifestation of a regional scale mineralizing system.

**7.** Davie Creek Stock, and/or alteration and mineralization within the stock, is genetically related to late stage intrusive activity. The presence of large screens, xenoliths and previously unrecognized intrusive breccia zones, throw suspicion on the morphology of the stock as interpreted by Bema Industries. Potential for Cu and Au mineralization peripheral to the stock is very good.

**8.** Broad hornfelsing and local strong biotite alteration imply proximity to an intrusive body along East Croydon Creek. The Bloom Cirque intrusive body may be connected with an elongated intrusion shown on government maps in the broad saddle at the head of East Croydon Creek.

**9.** Topography and high Hg (16000 ppb) indicate a large scale, deep seated structure may be present along East Croydon Creek and extend through Bloom Cirque. Such a structure could be a controlling factor in the broad mineralization and alteration present in Bloom Cirque and South Sarah Cirque.

**10.** La is associated with late stage intrusive activity and thus indirectly to the mineralizing event(s). Values of +9 ppm in soil and +10 ppm in rock are considered anomalous.

**11.** Continued trace element (32-ICP) and whole rock analyses with selected thin section evaluation will greatly assist in understanding the mineralizing system(s), related alteration assemblages and ultimately lead to a better evaluation of the mineral potential of the property.

**12.** The UMEX drill program which focused on an impressive, but false Cu anomaly on the Raven, is a fine example of the pit falls that may be expected in any attempt to evaluate this target area with a very select (limited) drilling program.

## RECOMMENDATIONS

Based on 1990 results, the following recommendations are proposed for 1991:

1. Detailed evaluations conducted at Raven, southeast Porphyry Creek and Bloom Cirque.

2. At the **Raven**, detailed follow up should consist of:
   a) grid extension to the southeast, east and west as 100 m spaced lines with 25 m stations
   b) grid lines should be of sufficient NS length to adequatedly evaluate the entire **width** the Raven Trend
   c) a terrain analysis completed prior to sampling the southeast and east extensions. Interpretive problems are expected due to hydrological and glacial effects
   d) ground geophysical surveys (magnetic, I.P., resistivity and VLF)
   e) detailed mapping with particular emphasis on alteration, aided by whole rock analyses and fill-in grid construction
   f) combined trench/road construction from the Omenica Mining Road. Positioning of this road is possible without the necessity of a bridge over Lay Creek. It may be possible to extend an existing cat road at Granite Basin. A trench-road system would greately assist mapping, evaluation of soil anomalies and later drilling
   g) upon completion of the detailed evaluation diamond drilling should proceed. Statistical drilling of the anomalies at 150 to 200 m centres is strongly advised. Complex soil geochemistry, hydrologically remobilized anomalies, poor exposure and complicated geology are factors which will severely hamper drill hole location, prioritization and interpretation.

3. At **Southeast Porphyry Creek**, detailed follow up should consist of:
   a) grid construction over the periphery of the Davie Creek Stock and covering areas of anomalous Cu found by previous workers, 100 m lines with 25 m stations are suggested
   b) soil sampling
   c) ground geophysical surveys (magnetic, I.P., resistivity, VLF)
   d) detailed mapping, rock chip sampling as applicable
   e) a terrain analysis is advised prior to soil sampling

4. At Bloom Cirque:
    a) construction of an orientation grid at 100 m spacings with 25 m stations within the upper cirque basin and with every second line extended beyond the cirque walls in the east and west direction
    b) soil/talus fines collected at all stations as conditions allow
    c) ground geophysical **orientation** surveys completed on the extended lines
    d) detailed mapping, with particular attention to alteration

5. Additional staking is advised to protect the following areas:
    a) southeast Raven Trend (Granite Basin)- 80 units
    b) Bloom Extension (East Croydon Creek)- 80 units
    c) South Boundary - 20

    Contour soil sampling is recommended as follow up.

6. Additional reconnaissance prospecting, mapping, rock and soil sampling is recommended in the following areas:
    a) Raven Trend
    b) South Sarah Cirque
    c) Bloom Extension/East Croydon Creek
    d) hillside above North Arm Anomaly
    e) Karen Cirque
    f) Upper Porphyry Creek

    In the event of planned grid construction at southeast Porphyry Creek, priority should be given to Karen Cirque and Upper Porphyry Creek. It is necessary to determine if Au and Cu soil anomalies are insitu and not transported from high grade structures in the cliffs above the soil line. Currently this anomaly is suspicious as unlike other areas, except for spotty Pb, only Cu and Au are present.

7. Purchase of UMEX aeromagnetic data for the property, including areas covered by recommended claims and Raven Trend. The map for a 1970's detailed survey, oriented northeast across the property, has been offered by Mr. B. H. Kahlert of Major General Resources. Cost of the map is $5000.

8. Cost for the recommended evaluation of all primary and secondary targets including drill testing of selected anomalies, but excluding road construction, is estimated to be in excess of $1.5 million.

## LOCATION AND ACCESS

Roughly centred on latitude 56°29'N and longitude 125°58'W, the Porphyry Creek property is located 12 km west-northwest of Aiken Lake, 23 km southwest of Johanson Lake and 215 km north-northeast of Smithers, B.C. It conveniently occupies portions of N.T.S. mapsheets 94C/5, 12, 94D/8 and 9. Figure 1 shows the property location.

Road access to within 3 km of the property is possible from Ft. St. James, via the Omenica Mining Road. A gravel airstrip at Johanson Lake allows aircraft as large as a twin otter to service the area. Travel time is roughly 8 hours by gravel road from Ft. St. James or 1 hour by air from Smithers.

Russell Transfer Ltd. transported equipment and supplies by truck from Ft. St. James to a staging area along the Omenica Mining Road, 3 km north of the Emer 9 mineral claim. A Highland Helicopters Bell 206 ferried personnel and equipment to the property. The Bell 206 was based in camp until August 29.

A Northern Mountain Bell 206 helicopter, based at Johanson Lake, was used to demobilize camp on September 17th. Russell Transfer hauled the gear to a warehouse in Ft. St. James. Teck personnel transported the gear to the Kamloops warehouse in a rented 5 ton truck.

Total helicopter flight time for mobilization in to camp was 3.4 hours while the demobilization took 2.5 hours. Trucking costs were less than $1500 per round trip to Johanson Lake.

## TOPOGRAPHY, VEGETATION AND GLACIATION

The property covers an area of rugged ridges and steep talus with broad cirque and valley floors. Alpine vegetation covers more gentle slopes and higher portions of the valleys. Scrub willow, alder and forests of spruce thrive at lower elevations. Treeline is about 1500m a.s.l. Property elevations range from 1130 to 2300m a.s.l. A number of small, year-round, alpine lakes are scattered over the property.

Most of the region was covered by a Pleistocene ice sheet, and later modified by alpine glaciation. Evidence of ice movement is poorly preserved but it was in part, from southwest to northeast. Glacial till is restricted to the floors of valleys and cirques and extends roughly to treeline. Thickness varies from +15m in valley bottoms to less than 1m on the upper slopes.

## CLAIM DATA

The property comprises 252 units as 16 contiguous, 4 post claims and two fractional claims. Emer 7, 8, 9 and Lemdi FR were staked in August to protect interesting mineralization found during the 1990 program. The large rectangular fraction shown on government claim maps, between the Lady Diana 2, 3 and Kliyul claims, does not exist. Field examination found the legal corner post, on the southwest block of West Croydon Creek, to be common to Lady Diana 2, 3, 4 and Kliyul. The mines inspector has yet to be informed of this matter. Claim statistics are presented below in Table 1 and locations are shown on Figures 1 and 3. Copies of claim affidavits are in Appendix II.

**TABLE I** **CLAIM DATA**

| NAME | TAG # | DIMENSIONS | UNITS | RECORD # | STAKED | EXPIRES | REGISTERED OWNER |
|---|---|---|---|---|---|---|---|
| Karen 3 | 49503 | 4S x 2W | 8 | 2263 | Sept. 29/79 | Oct. 29/93 | Teck Corp. |
| Lady Diana 1 | 71633 | 3S x 4W | 12 | 3999 | July 10/81 | July 28/93 | Getty Resources Ltd. |
| Lady Diana 2 | 71635 | 3N x 6W | 18 | 4000 | July 11/81 | July 28/93 | ↓ |
| Lady Diana 3 | 71636 | 3N x 3E | 9 | 4001 | July 12/81 | July 28/93 | |
| Lady Diana 4 | 26895 | 5S x 3E | 15 | 4002 | July12/ 81 | July 28/93 | Teck Corp |
| Bear | 51360 | 3S x 4E | 12 | 1997 | Aug. 13/79 | Aug. 24/93 | |
| Kliyul | 35980 | 4S x 5W | 20 | 1581 | Dec. 14/81 | Dec. 19/93 | |
| Emer 1 | 110558 | 4S x 5E | 20 | 11787 | April 28/90 | April 28/91 | |
| Emer 2 | 110559 | 5S x 4E | 20 | 11788 | April 28/90 | April 28/91 | |
| Emer 3 | 110560 | 4N x 5W | 20 | 11789 | April 28/90 | April 28/91 | |
| Emer 4 | 110565 | 4N x 5E | 20 | 11790 | April 28/90 | April 28/91 | |
| Emer 5 | 110566 | 4N x 5E | 20 | 11791 | April 28/90 | April 28/91 | |
| Emer 6 | 110567 | 4S x 5W | 20 | 11792 | April 28/90 | April 28/91 | |
| Emer 7 | 209824 | 4S x 4E | 16 | 12453 | Aug. 20/90 | Aug. 20/91 | |
| Emer 8 | 209825 | 4N x 2E | 8 | 12454 | Aug. 20/90 | Aug. 20/91 | |
| Emer 9 | 209826 | 4N x 3W | 12 | 12455 | Aug. 20/90 | Aug. 20/91 | ↓ |
| FRACTIONAL CLAIMS | | | | | | | |
| Lady Diana 6 | 26894 | | | 4003 | July 11/81 | July 28/93 | Getty Resources Ltd. |
| Lemdi | 209822 | | | 12407 | Aug. 8/90 | Aug. 8/91 | Teck Corp. |

## 1990 EXPLORATION ACTIVITY

Rio Algom staked the Link claim over a strongly gossanous but wickedly rugged peak, 1.5 km southeast of the Bear claim.

On the Kil property, 6 km northwest of Karen 3, a Placer Dome crew constructed and sampled a soil grid. Exact coverage and other work performed are not known.

Golden Rule Resources restaked the Goldway Peak showings. A drill program is rumoured to have been planned. In July, Golden Rule staked a large tract of land extending from Goldway Peak to the Soup claims and along the southern boundary of the Porphyry Creek property. These claims were very poorly staked, by one individual who used a helicopter to place posts. After observing this activity, Teck personnel spot checked portions of the claims. Legal corner posts were found to be only 2" x 6" x roughly 4' high, and except for an occasional scattering of flagging, no attempt had been made to walk the lines.

Major General Resources staked the Joh 1 to 12 claims northwest of Karen 3, in July.

Along Lay creek and 12 km east of Emer 1, William Halleran restaked the Vega showing as the Jay claim.

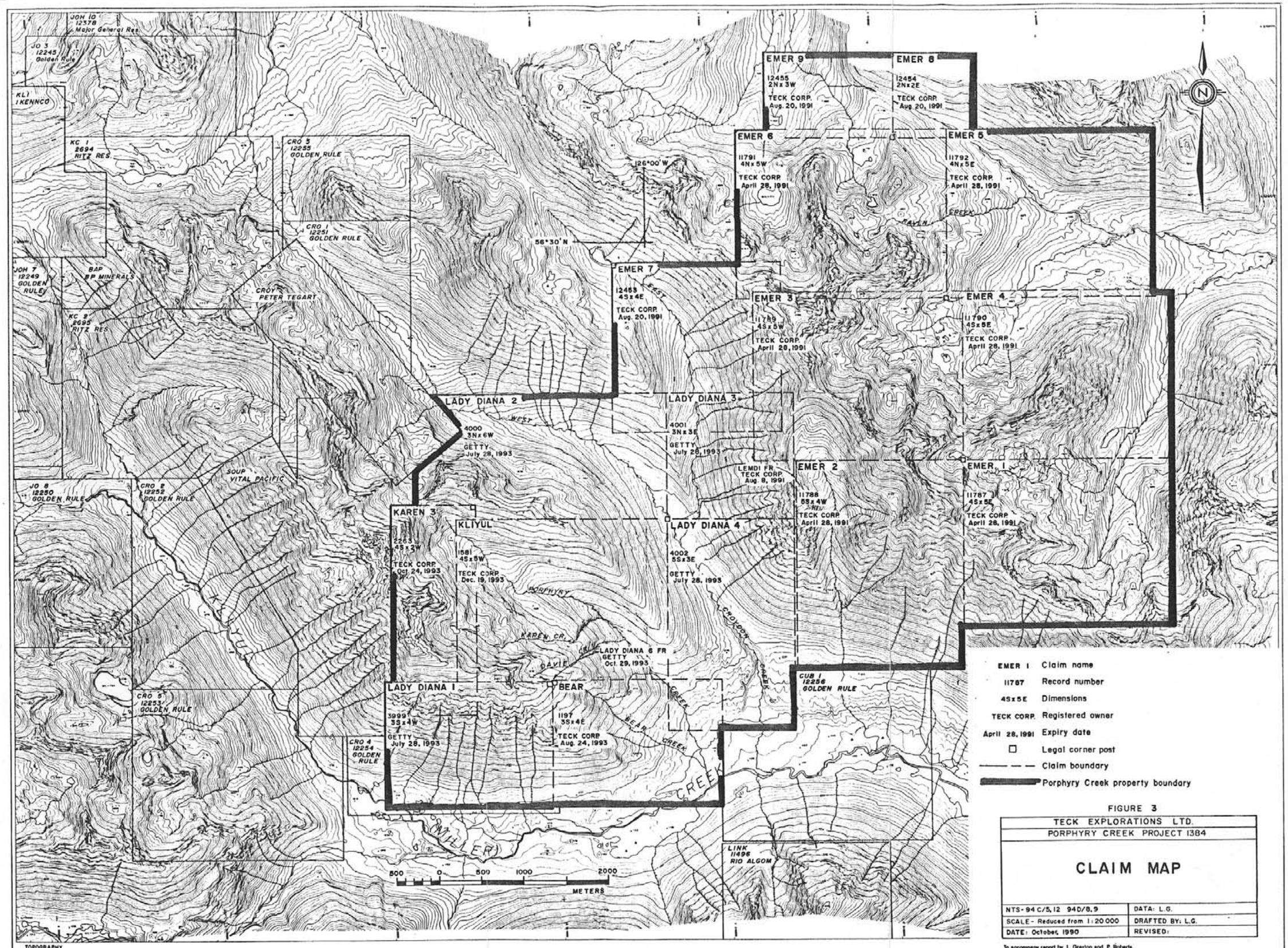



FIGURE 3

| TECK EXPLORATIONS LTD. | |
|---|---|
| PORPHYRY CREEK PROJECT 1384 | |
| **CLAIM MAP** | |
| NTS - 94 C/5,12 94D/8,9 | DATA: L.G. |
| SCALE - Reduced from 1:20 000 | DRAFTED BY: L.G. |
| DATE: October, 1990 | REVISED: |

To accompany report by L. Greston and P. Roberts.

TOPOGRAPHY
COMPILED BY
NADIR MAPPING CORPORATION
REF. No. 90-068

CONTOUR INTERVAL 10m

## 1990 PROGRAM

Purpose of the program was to evaluate base and precious metal potential of the property. Emphasis was placed on porphyry style copper and gold mineralization.

Between June 25th and September 17th, geologists Lynn Grexton, Paul Roberts, prospector Ted Archibald, and geology students Andrew McIntosh and Hugh Stewart spent 363 mandays on the property. A deep snow accumulation followed by a late spring with heavy rains, which washed out several bridges on the Omenica Mining Road, precluded an earlier start. On June 26th, 40 to 80% of the area above 1700 m a.s.l. was still snow covered, even on south facing slopes.

The program involved mapping at 1:10,000 scale, prospecting and contour soil sampling. Nadir Mapping Corp., Vancouver, constructed 1:10,000 and 1:20,000 topographic base maps at a 10 m contour interval. Traverse lines are shown on Figure 4. Mattocks/shovels and wet strength kraft bags were used to collect soil samples. Wherever possible, material from the "B" horizon was chosen. Areas sampled were generally moderate to steep, rocky slopes with poor to moderate soil development. Contour sampling was slow and arduous, averaging 25 sites per day.

Favourable geochemical response on Emer 5, 6, 8, 9, prompted grid construction over the former United Miniere Exploration Ltd. (UMEX) "Raven" property. Soil samples were collected at 25m intervals along 100m lines, and the area was mapped at 1:5000 scale.

A total of 558 rock, 1372 soil/talus fines, 22 silt, 74 moss matte, 7 pan and 10 water samples were collected in the initial evaluation. An additional 1005 soil/talus fines samples were collected from the Raven grid. Twenty-two rock specimens were sent to Vancouver Petrographics Ltd. for thin section examination. Petrographic descriptions are in Appendix IV. Sixteen whole rock analyses were completed.

Samples were sent to Rossbacher Laboratory, Burnaby, B.C. They were analyzed for Cu, Mo plus 30 other elements using I.C.P., and Au by atomic absorption. Values of ≥1000 ppb Au were checked by fire assay with an atomic absorption finish. All Hg values of greater than 10 ppm and selected samples with 3 to 9 ppm Hg were reanalysed by atomic absorption. Raven Grid soil samples with greater than 399 ppm Ba were reanalysed by atomic absorption following a total digestion. ph determinations were made for soil and silt samples. Certificates of analyses, methods and detection limits are presented in Appendix VI.

Stan Hoffman of Prime Geochemical Methods Ltd., Vancouver, was contracted to evaluate results from the soil surveys. This evaluation is covered in detail, as two separate reports, along with elemental geochemical plots. Highlights of this report are shown on Figures 2 and 10e.

REGIONAL GEOLOGY (G.S.C. Open File 342, Mem. 251, 274)

Porphyry Creek property occupies the eastern half of the Quesnellia Terrane, at the northern end of the Hogem Batholith. The Ingenika Fault, a large, northwest-trending extension of the Pinchi Fault, forms the western boundary between Quesnellia and the Stikinia Terrane. Of similar scale and northwest trend, the Swannell Fault marks the boundary between Quesnellia and the Cassiar Terrane to the east.

In the Quesnellia Terrane, (Upper Triassic) Takla Gp. volcanic and sedimentary rocks have been intruded by the (Jurassic-Cretaceous) Hogem Batholith and its related intrusions. Takla Gp. rocks consist of basic to intermediate volcanic flows, breccias and lesser sedimentary rocks. West of the Pinchi Fault, Takla basalts are reported to have alkaline affinities. In the vicinity of Germansen Landing, extensions of the Takla Gp. are alkaline with initial mafic and later intermediate phases. West of the Pinchi-Ingenika Faults, the pile has been divided into the 300 to 800 m thick Dewar Formation (lower), the 1700 to 3000 m thick Savage Mtn. Formation and the 900 to 1800 m thick Moosevale Formation (upper). The group not has been formally subdivided east of the faults, but the rocks are thought to correlate with the Dewar and Savage Mtn. Formations. East of the Pinchi Fault, they are characteristically metamorphosed to greenschist facies. Fossil evidence suggests a relatively short period of deposition for the Takla Gp. Intrusions throughout the area are predominantly calc-alkaline with ultramafic and alkaline assemblages occurring locally. Several Late Triassic, basic to ultramafic stocks have been outlined. Regional geology is shown on Figure 5a.

Government Mineral Inventory maps locate 48 mineral occurrences in the Quesnellia Terrane within the area covered by Figure 5a. Cu mineralization dominates, with minor Pb, Zn and Mo. Au mineralization is reported in 17 occurrences. Mineralization most commonly occurs in veins and shears hosted by both Takla Gp. and intrusive rocks. Mineral occurrences are also shown on Figure 5a.

From government aeromagnetic maps (Figure 5b), a strong magnetic high trends northwest across the southwest half of the property. Two peaks within the "high" are present along Porphyry Creek. The easterly peak coincides with the Croydon Ultramafic Stock. The western peak may, in part, be a topographic effect. North Sarah Cirque and Raven Grid areas are part of a flat magnetic low, which parallels the northwest magnetic high. Effects of the ultramafic body in Porphyry Creek appears to overshadow these areas. "Blips" on the flank of the magnetic high, occur southwest of the Raven area and south of the Granite Basin, and a small thumb print anomaly occurs northwest of Raven Grid. Crews encountered severe compassing problems during past grid construction along Porphyry Creek, and during 1990 along Raven Creek. Baseline 50N and the crosslines were pulled to the west (clockwise) during Raven Grid construction

## EXPLORATION HISTORY AND PREVIOUS RESULTS

Six areas on, and immediately adjacent to, the Porphyry Creek property have been the focus of previous exploration activity. Details concerning property ownership and work performed are presented in Table 2. Highlights of results are shown on Figure 6.

The earliest recorded work in the area was in 1937, on the Croydon property. Consolidated Mining and Smelting Ltd. explored auriferous quartz-pyrite veins discovered along Croydon Creek in 1936. Exploratory underground drifting (Croydon Mine) outlined several, fault related, north-south striking quartz veins of subeconomic tenor. Work was halted in 1938 after a forest fire destroyed the camp, located a short distance downstream from the workings. Subsequent investigations by Cominco, (Bralorne, Noranda, Canex) and Rio Tinto failed to delineate economic mineralization in the area surrounding the Croydon Mine. Geophysical surveys, trenching and diamond drilling found nothing warranting further work. Geophysical anomalies were attributed to water-filled pyritic faults and magnetite bearing pyroxenite. Uneconomic concentrations of chalcopyrite were found in narrow fractures and shears. Rio Tinto drill core was described as being barren of economic mineralization, but also containing minor chalcocite. The core was not analyzed.

Renewed interest in the region in 1946 to 1948 sparked the discovery of numerous gold and base metal showings. The Shell prospect was originally staked by Springer-Sturgeon Gold Mines in 1946. Subsequent investigations outlined 80,000 tons of 0.16 oz/ton Au and 3% Cu in several, northwest trending chalcopyrite-pyrite-pyrrhotite veins. In 1988, Pacific Rim Resources drilled an additional 8 holes, totalling 542m. Cu averages 1.5%. Au is reportedly concentrated near surface.

Southwest of the Shell prospect, the Soup Skarn was originally staked in 1964. It has been subjected to numerous evaluations with variable results and geological interpretations. Vital Pacific Resources Ltd. drilled 7 short holes in 1989. An oxidized quartz-magnetite shear trending northeasterly across the skarn returned the best intersections; 7.9 g/t Au, 0.4% Cu over 4.57 m and 49.0 g/t Au, 0.17% Cu over 3.2 m. Teck Explorations Ltd. completed an extensive mapping and chip sampling program in 1990.

United Miniere Explorations Ltd. (UMEX) staked the Raven claims in 1970, to cover a copper anomaly discovered during a regional sampling program. Follow-up soil sampling delineated a 4000' x 250' zone of moderate copper enrichment. The zone follows along Raven Creek in an area of strongly leached bedrock. Minor disseminated chalcopyrite and ubiquitous pyrite occur within hornfelsed volcanic andesite and diorite. Follow-up work was restricted to roughly 1000' of drilling in two holes. Limited analyses of 1 foot samples per 20 feet of core indicate a maximum Cu value of 1840 ppm and 360 ppb Au. Further work was not recommended. Data concerning drilling is not in the public domain. Mr. B. Kahlert of Major General Resources kindly provided UMEX data. Major General currently owns the UMEX data base.

In 1973, Stellac Exploration Ltd. staked Sarah 1 - 50, immediately south of the Raven claims. Prospecting led to the discovery of chalcopyrite and pyrite as widespread disseminations and shear related fracture fillings. The claims were allowed to lapse. Record of further work has not been found.

Cu-Mo potential of the Davie Creek Stock along Porphyry Creek was recognized by Rio Tinto in 1964. Drilling by Rio Tinto and Teck Explorations with Chevron and Getty Resources has outlined 100 million tonnes of 0.1% $MoS0_2$. Mineralization is within a tabular (750m x 260m) potassically zoned, calc-alkaline intrusion. A weak Cu halo, locally coincident with weak W, exists peripheral to the main zone. Gold was not detected in drill core but analyses are few. Soil samples were not analyzed for Au. Results from a Teck Explorations regional survey in 1989, generated interest in the area as a Cu-Au porphyry target.

**TABLE 2** **HISTORY**

| *Year* | *Company* | *Property* | *Claims* | *Work* | *Results* |
|---|---|---|---|---|---|
| 1936 | Consolidated Mining and Smelting Ltd. | Croydon | Jane | Prospecting, discovered auriferous quartz veins. | |
| 1937/38 | " | " | " | Explored qtz veins, 1480 ft. of tunneling. | Poor results, abandoned. |
| 1944/45 | Cominco | " | " | 600 ft. hydraulic trenching, mag survey. | NW mag. anomaly, no bedrock exposed,abandoned. |
| 1946 | Springer Sturgeon Gold Mines | Shell | Shell | Trenched auriferous Cu- bearing qtz veins. | Eventually abandoned. |
| 1958 | Braiorne | Croydon | Jane, Don | Grid, dip needle survey, diamond drilling, tested geophysical anomalies. | Poor results,abandoned. |
| 1963 | Rio Tinto | " | Jane, Don, Vee | I.P.,mag., recce mapping, discovered Davie Creek Stock | Drilling recommended. |
| 1964 | Rio Tinto | Croydon | Jane, Don, Vee Doug | Mapping, mag., soil survey, 671 m. diamond drilling Croydon Ck.,187 m. Davie Ck.Stock. | Recommended further evaluation of Davie Creek Stock. Croydon deemed uneconomic, abandoned. |
| 1970/71 | El Paso | Shell | Don | Sampling,trenching,outlined 250 ft. zone 1.43% Cu across 10.7 ft., 115 ft. zone 9.24% Cu across 4.0 ft. , possibly drilled in 1971. | |
| 1970/71 | UMEX | Raven | Raven | Mapping, prospecting, soil sampling,outlined 4000 ft. x 200 ft. Cu in soils, 1000 ft. diamond drilling,2 holes. | Poor results,no further work. |
| 1978 | Teck Explorations | Porphyry Creek | Kliyul, Karen | Staked Davie Ck. Stock | |
| 1979 | Teck , Chevron | " | Kliyul, Bear | Staked Bear claims, soil grid, detail mapping, 518 m diamond drilling, 2 holes | Confirmed Mo porphyry mineralization, recommended mag. survey, roadbuilding. |
| 1981 | Teck, Getty Res. | " | Kliyul, Bear, Karen, Lady Diana | Mapping, soil sampling,additional staking 1260m diamond drilling, 3 holes. | Subeconomic Cu, Mo. |
| 1982 | " | " | " | Soil geochemistry, mag., chip sampling of creek exposures, 922 m diamond drilling. | Further defined Davie Creek Stock @ 100 ma tons 0.1% MoS2, good potential for additional mineralization. No further work due to economic climate. |
| 1986/87 | Lemming Res. | Soup | Soup | Rock chip sampling. | Determined potential for substantial width of Au-Cu mineralization. |
| 1988 | P. Tegart | Shell | Croy | 542 m. diamond drilling, 8 holes by Pacific Rim Res. | |
| 1989 | Athlone Resources | Soup | , Soup | Diamond drilling, 7 short holes. | Best Au intersection from 4.0-20.5 ft. in shear.1.43 opt Au across 10.5 ft. 1.14 opt Au across 3.0 ft. |
| 1989 | Teck | | | Regional reconnaisance. | Recognized Cu-Au porphyry potential. Prospecting, soil sampling, mapping recommended. |

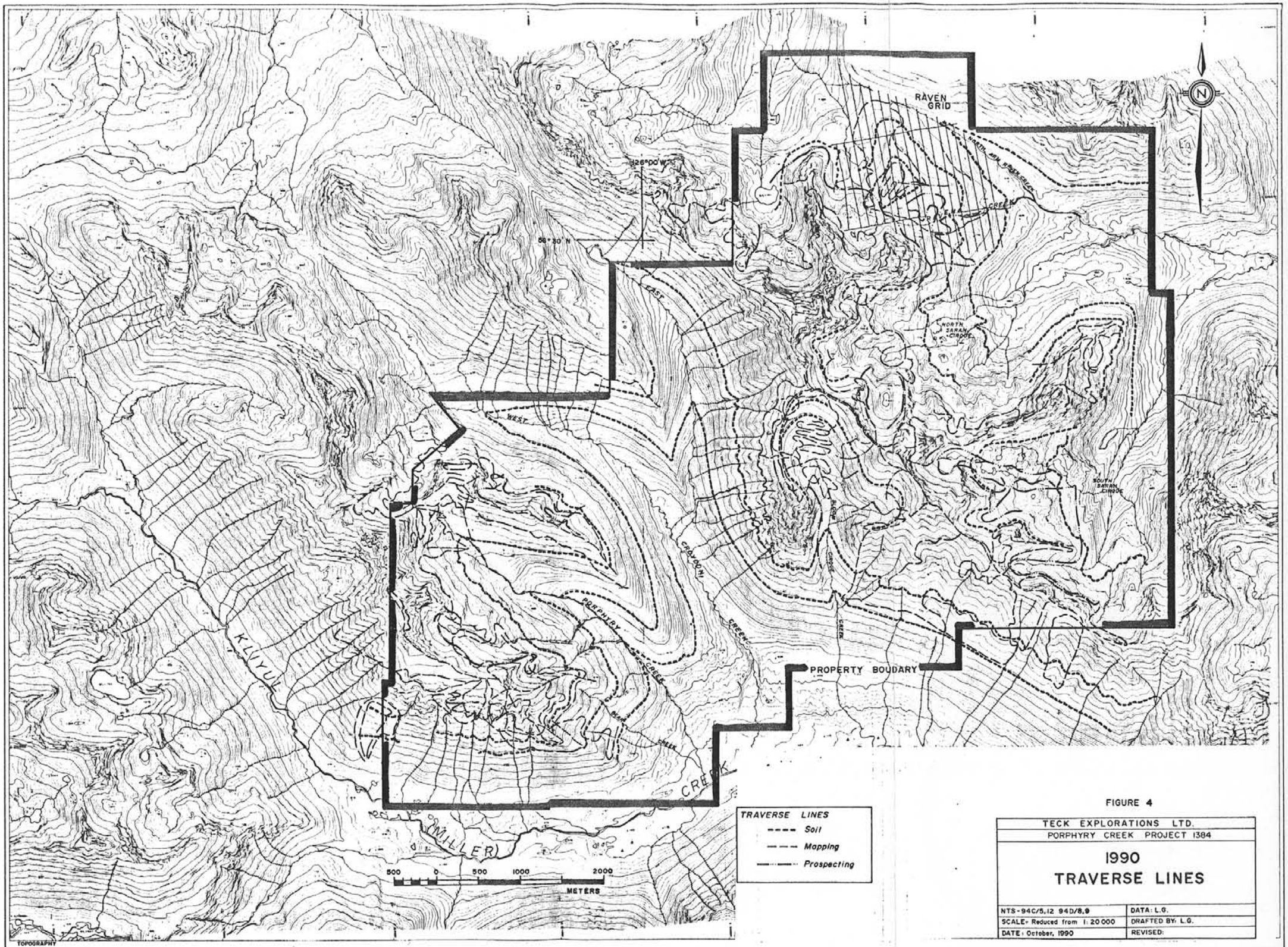


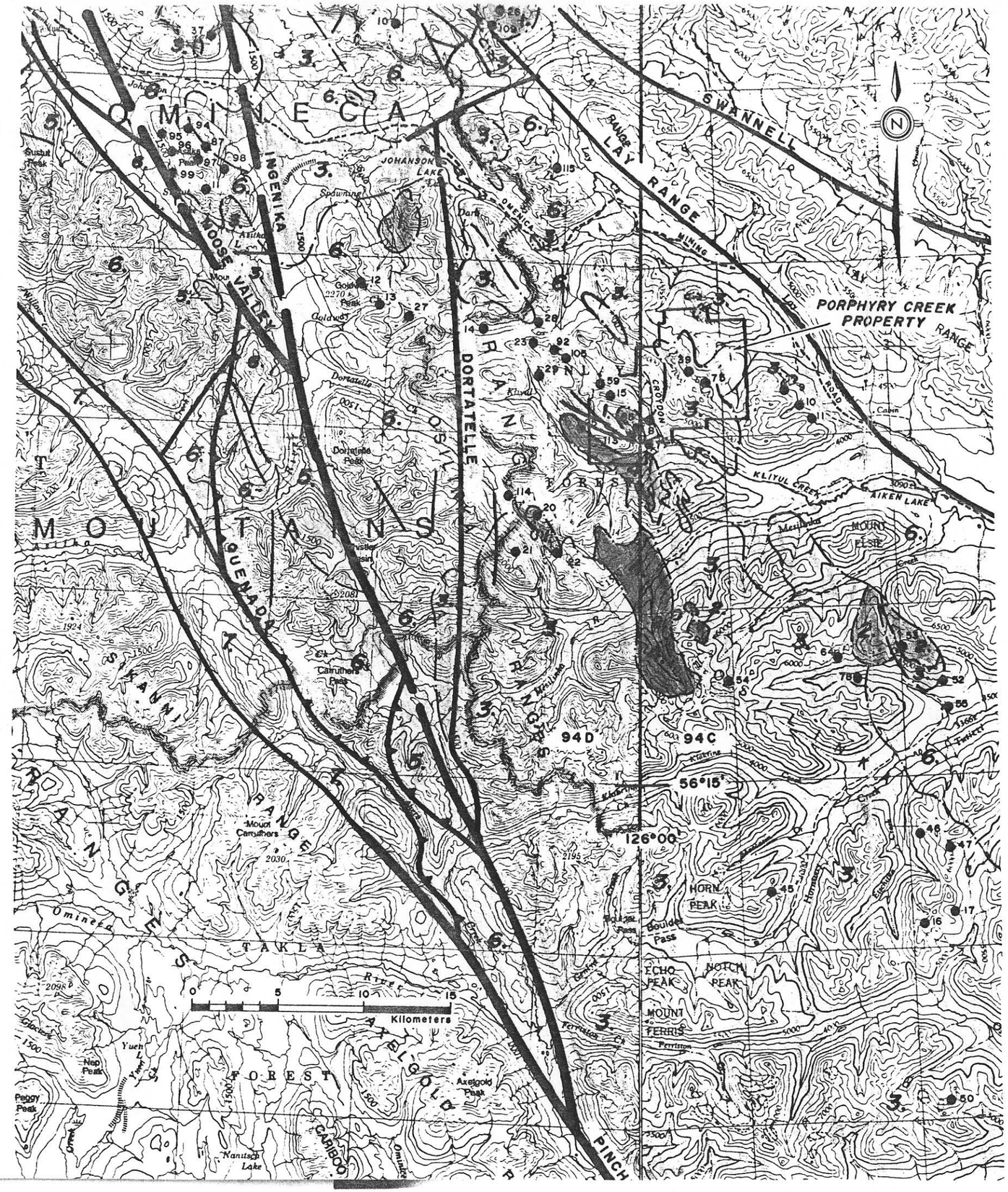

FIGURE 4

| TECK EXPLORATIONS LTD. | |
|---|---|
| PORPHYRY CREEK PROJECT 1384 | |
| **1990 TRAVERSE LINES** | |
| NTS - 94C/5,12 94D/8,9 | DATA: L.G. |
| SCALE- Reduced from 1:20000 | DRAFTED BY: L.G. |
| DATE: October, 1990 | REVISED: |

TOPOGRAPHY
COMPILED BY
NADIR MAPPING CORPORATION
REF. No. 90-062

To accompany report by L. Groston and P. Roberts.

CONTOUR INTERVAL 10 m




## LEGEND

STRATIFIED ROCKS

*LOWER JURASSIC*

7 **HAZELTON GP.** TELKWA FM. basalt, andesite, dacite, rhyolite flows, breccias, tuffs; sedimentary rocks

*UPPER TRIASSIC*

6 **TAKLA GP.** basic to intermediate flows, breccias, tuffs; sedimentary rocks

*PERMIAN*

5 **ASITKA GP.** basalt, rhyolite tuffs; sedimentary rocks

INTRUSIVE ROCKS

*EARLY JURASSIC - EARLY CRETACEOUS*

4 leucogranodiorite, minor granite

3 diorite to granodiorite, minor syenite, syenodiorite, alaskite, pegmatite, lamprophyre, appinite, meladiorite, hornblendite uralite, amphibolite

2 hornblendite, appinite, meladiorite, minor peridotite, uralite, amphibolite

*LATE TRIASSIC*

1 gabbro, hornblendite, pyroxenite, dunite, includes areas formerly mapped as 2

FAULT

GEOLOGICAL CONTACT

*From G.S.C. Open File 342, Mem. 251, Mem. 274*

## MINERAL OCCURRENCES ●

94 D

| | | |
|---|---|---|
| 10 | QUYZVHX | Cu |
| 11 | ARJAY | Cu, Ag |
| 12 | SOLO | Au |
| 13 | BRUCE | Au |
| 14 | GINGER B | Au |
| 15 | SHELL (CROY) | Ag, Au, Cu |
| 16 | — — — | Zn |
| 20 | RINGO | Mo |
| 21 | — — — | Mo |
| 22 | — — — | Cr |
| 23 | KLI-KENNCO | Fe, Cu, Au |
| 25 | SOUP | Cu, Au, Fe |
| 26 | — — — | Cr |
| 27 | GOLDWAY | Au |
| 28 | INDEPENDENCE | Au |
| 29 | BANJO | Au |
| 37 | ARN | Cu |
| 59 | CROY (SHELL) | Cu |
| 92 | BAP | Cu, Pb, Zn |
| 94 | ASITKA 29 | Cu |
| 95 | ASITKA 33 | Cu |
| 96 | ASITKA 8 | Cu |
| 97 | ASITKA 19 | Cu |
| 98 | ASITKA 60 | Cu |
| 99 | BOB | Cu |
| 109 | NIK | Cu |
| 113 | KLIYUL, BEAR | Mo |
| 114 | McCONNELL | Be |
| 115 | BRECCIA | Cu, Au, Ag |

94 C

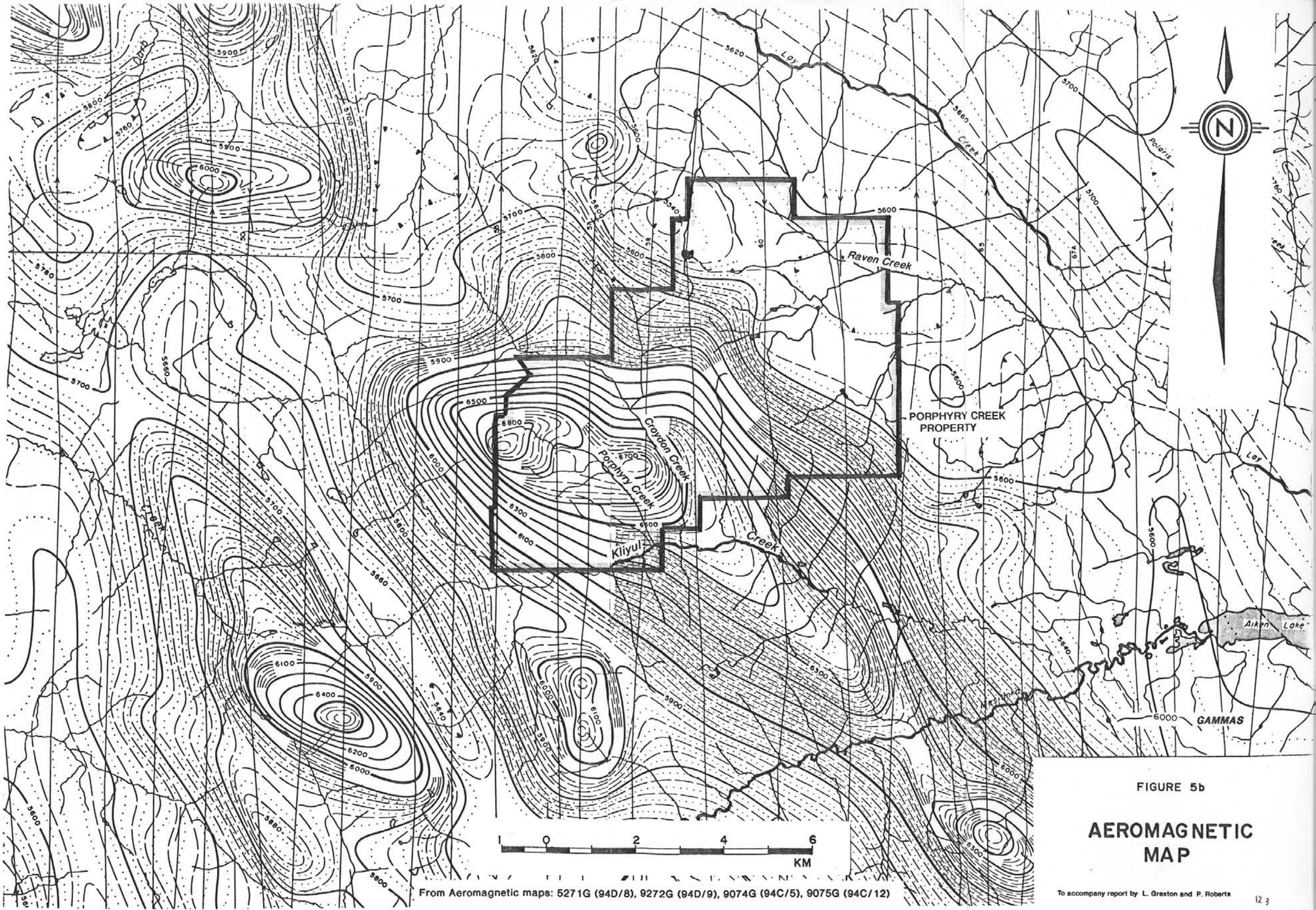
| | | |
|---|---|---|
| 7 | PORPHYRY CREEK | Cu, Mo, Au |
| 8 | CROYDON (JANE) | Au, Cu, Mo |
| 10 | HALQUIN | Au |
| 11 | RED DYKE | Au |
| 16 | CHIEF THOMAS | Cu |
| 17 | ELIZABETH | Au, Ag |
| 45 | — — — | Cu |
| 46 | — — — | Cu |
| 47 | — — — | Cu |
| 50 | — — — | Cu |
| 52 | BRIT | Cu |
| 53 | TUTIZZI LAKE | Pb, Cu |
| 54 | — — — | Cu, Pb |
| 55 | — — — | Pb |
| 64 | TUTIZZI | Mo |
| 65 | — — — | Mo |
| 75 | SARAH | Cu |
| 78 | GROUSE | Mo |
| 39 | — — — | Co |
| 9 | GRANITE BASIN | Au |

*From BCDM Minfile.*



FIGURE 5a

# REGIONAL GEOLOGY




From Aeromagnetic maps: 5271G (94D/8), 9272G (94D/9), 9074G (94C/5), 9075G (94C/12)

FIGURE 5b

# AEROMAGNETIC MAP

To accompany report by L. Grexton and P. Roberts

## PROPERTY GEOLOGY

### Lithology:

The property is underlain by a volcano-sedimentary assemblage of Takla Gp. rocks which has been intruded by the Croydon Creek Ultramafic Stock, the Kliyul Creek Pluton, the Croydon Creek Pluton and a host of related dykes, sills and small satellite stocks. All intrusions are part of the Hogem Batholith. Compositional similarities, subvolcanic phases and heterolithic volcanic-subvolcanic-intrusive assemblages with gradational and very subtle contacts, suggest the volcanic rocks are in part, coeval with the ultramafic stock and in part, coeval with the Croydon Creek Pluton. According to Government maps, ages for the intrusions are as follows:

Croydon Ultramafic Stock - Triassic
Croydon Creek Pluton - Jurassic
Kliyul Creek Pluton - early Cretaceous

Field observations categorized volcanic rocks as pyroxenite, basalt and andesite. Few specimen were stained for potassium feldspar and only one was submitted for whole rock analyses. Previous workers have suggested latite is present in the Raven Grid area.

Field observations, potassium feldspar staining, whole rock analyses and thin section examination confirm pyroxenite, diorite to granodiorite, monzonite and minor syenite occur on the property.

Strong, large scale, northwest trending, near vertical faulting is the dominant structural feature area. Subsidiary, coeval faults, trend northeast and east-northeast. The area is riddled with narrow, steeply dipping shears. A deep seated, northwest-trending, crustal weakness appears to have been a controlling factor during pluton emplacement. Although field evidence is lacking, Kliyul and Croydon Creek likely follow large structures.

On Croydon and Porphyry Ridge, bedding strikes easterly and dips about 20° southward. On the Emer claims, bedding varies from a gentle (10°) northerly dip on the west half to a moderate 15 - 30° dip in the southeast.

Figure 7a summarizes property geology. Figures 7b and 7c show 1990 mapping at 1:10,000 scale, for the west and east half on the property. Detailed descriptions for rock types, mineralization and alteration for specific areas are in Appendix III. Selected photographs of the property are in Appendix I.

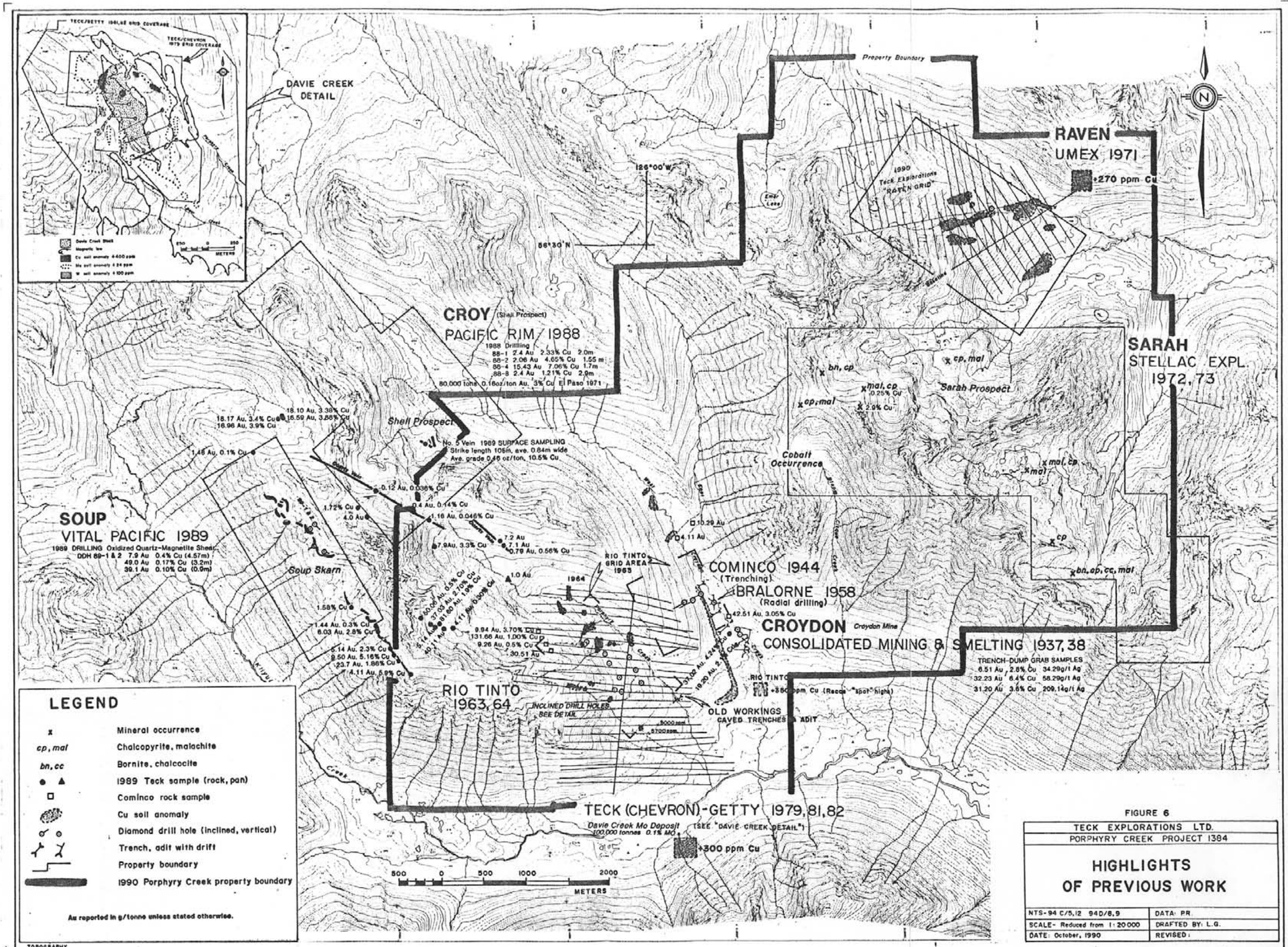



FIGURE 6

| TECK EXPLORATIONS LTD. | |
|---|---|
| PORPHYRY CREEK PROJECT 1384 | |
| **HIGHLIGHTS OF PREVIOUS WORK** | |
| NTS- 94 C/5,12 94D/8,9 | DATA: PR |
| SCALE- Reduced from 1:20 000 | DRAFTED BY: L.G. |
| DATE: October, 1990 | REVISED: |

To accompany report by L. Graston and P. Roberts

SCALE 1:20 000
CONTOUR INTERVAL 10m

The following is a summation of 1990 field observations.

**Takla Gp.** rocks consist of a varied assemblage of medium green, bedded tuffs, flows and agglomero-breccias, locally found with thin beds of argillite, mudstone and minor limestone. Majority of the units are weakly calcareous and weakly magnetic. Volcanic rocks are commonly pyritic with 2 to 15% pyroxene (augite) as anhedral to euhedral grains. Crystal faces of up to 2 cm across occur in agglomero-breccia. Hornblende 2 - 15% and/or plagioclase 2 - 15% occur locally with or without pyroxene. On the west half of the property, only one small occurrence of agglomerate was noted, occurring at the west end/north side of Croydon Ridge. On the Emer claims, a massive, 200 m thick (minimum) sequence of agglomerate, breccia and agglomero-breccia, trends northwest across the central portion of the claims. Fragments of augite basalt porphyry, 2 cm to + 1 m across, are set in a porphyritic to nonporphyritic matrix of similar composition. Fine augite and/or plagioclase phenocrysts are present in porphyritic varieties. Rare, red jasper fragments are found along the southwest side of Raven Creek. One medium grained, quartz diorite fragment was found at the head of North Sarah Cirque. Pillow basalt fragments occur southwest of Raven Fault and along East Emer Ridge. Classic volcanic bombs were occasionally noted.

Chloritic and commonly calcareous argillite and mudstone with thin interbeds/lenses of locally fossiliferous limestone are found over the entire property. Maximum thickness of the sequence is estimated as less than 100 m. Most exposures are 20 - 50 m thick. Pentacrinoid stems found in limestone on the Emer claims dates the limestone as Upper Triassic. (personal comm. 1990 Dr. H. Tipper G.S.C.)

**Croydon Creek Pluton,** underlying about one third of the property, intrudes Takla Gp. rocks and the Croydon Creek Ultramafic Stock. Hornblende diorite to quartz diorite are the dominate rock types. Included within pluton is the Davie Creek (Mo) Stock, described by Norman (1982), as a steeply dipping, tabular body of potassically zoned granodiorite. Based on whole rock analysis of a grab core sample (DDH-82-6), taken from monotonous sequence of fresh, medium grained intrusive, the stock is in part quartz diorite. Compositions probably range from diorite to quartz monzonite. A cursory examination of the core by Teck personnel found large sections of xenolithic intrusive and intrusive breccia had been logged as "hornblendite" by Bema Industries. Also observed were several very large fragments/screens. Hole 82-6 was stopped 29 m into "wallrock", which may in fact be another screen. Hole 82-4, along section with 82-6, ended within intrusive rock and lends no support to the contact shown on their section. These observations throw suspicion on the outline of the Davie Creek Stock as mapped by Bema personnel.

East of Croydon Creek, two distinct phases comprise the pluton. Fine grained, hornblende diorite and locally quartz diorite occupies the northern portion of Bloom Cirque and extends along the ridge to the southeast. A coarse grained to chaotically pegmatitic diorite phase, composed of hornblende and plagioclase, occurs in the southern portion of Bloom Cirque and extends along the lower flanks of the ridge to the southeast. Towards the east, the pegmatoid is coarse grained and equigranular. The contact

relationships between the two phases is unclear. The contact was observed at only one locality, where brecciated fragments of each phase were present in the other. Locally "typical" pegmatoid dykes cut the fine grained phase and "typical" fine grained diorite dykes intrude the pegmatoid. According to Roots (1954), the pegmatoid predates the fine grained phase. At volcanic-intrusive contacts, weakly to strongly assimilated volcanic fragments are found in each phase. The equigranular character of the pegmatoid (east) verses the highly chaotic assemblage with variably assimilated ultramafic fragments (west) may be a contact effect. The chaotic assemblage may represent a broad, hybridized contact zone between the coarse grained diorite and the Croydon Creek Ultramafic Stock.

**Croydon Creek Ultramafic Stock** exposures were only examined along Porphyry Creek. It is very dark green to black, equigranular pyroxenite with 5 to 10%, fine to coarse grained magnetite.

**Kliyul Creek Pluton** is exposed in the southwest corner of the property. Varying from quartz diorite to granodiorite, it is typically light grey, medium grained with equigranular intergrowths of plagioclase, quartz, potassium feldspar and biotite. Based on a minor occurrence of muscovite (2%) it is assigned to the trondhjemite class of intrusive rocks. Primary biotite, 3 to 5% occurs as blackish books 2 to 3 mm across. Potassium feldspar varies from 8 to 10% as sporadic grains 0.5 to 3 mm, irregular segregations, perthitic intergrowths and occasionally as coarse grained veinlets. The pluton is potassically zoned, exhibiting decreasing biotite content, decreasing grainsize and increasing potassium feldspar content, toward the northern contact with Takla Gp. rocks. Trending northwest, the contact is fairly sharp and regular but is locally disrupted by small, northeast faults. Displacement is estimated to be in the order of 20 m vertically. The southern contact is not on the property.

**Dykes:** A series of quartz monzonite to monzonite dykes occur south of North Bear Creek Fault. Trending north-northeast to northwest, these steeply dipping dykes intrude rocks of the Croydon Creek Pluton and Takla Gp. None have been mapped within the Kliyul Creek Pluton and the relationship with a poorly exposed monzonite body, abutting the pluton to the east, is not known. Texturally, the monzonite varies from aphanitic to fine grained porphyritic to nearly equigranular. Mineral assemblages are dominated by plagioclase with 10 to 30% potassium feldspar. Quartz is locally present to a maximum of 10% with minor remnant biotite-hornblende. Dykes of similar morphology and trend occur at the head of Porphyry Creek. Although field identification estimated compositions as granodiorite, they are believed to be equivalent to the southern dykes. Syenitic equivalents to these dykes are not common, but are found locally along Porphyry Ridge and at the head of Porphyry Creek. This family of alkaline dykes predate the dominant, northwest trending fault system. At the east end of Porphyry Ridge, a larger, northwest trending body of hornblende monzonite was mapped by Rio Tinto.

Dykes along Croydon Ridge tend to be narrow, steeply dipping and strike from east-west to northeast. Field estimation of composition is quartz diorite to granodiorite. Fine grained, equigranular,

subvolcanic and porphyritic varieties are present. Hornblende is the most common mafic mineral, occurring 10 to 30% as medium to dark green, fine grained, subhedral to euhedral crystals. Plagioclase 20 to 80% is commonly interstitial to hornblende. Quartz content is up to a maximum of 10%. Strongly porphyritic dacite dykes, characteristically with large plagioclase phenocrysts, occur sporadically over the property. The anhedral to euhedral phenocrysts, 5 to 25%, are commonly 3 to 5 mm (2 cm) and are set in a buff to medium green siliceous matrix. Thin section examination found similar dykes to be monzonite, while east of Croydon Creek, whole rock determinations indicate an andesitic composition (G 294).

Narrow, late stage basalt dykes intrude all units with the exception of the Kliyul Creek Pluton.

On the east half of the property, dykes tend to be predominantly fine grained, equigranular to subvolcanic equivalents of the fine grained phase of the Croydon Creek Pluton found in Bloom Cirque. Dykes on the west side and south end of Bloom Cirque, have been identified as granodiorite in the field, but it is believed whole rock and thin section analyses would find them equivalent to the Croydon Creek Pluton.

Distinctively pink to pinkish brown, (biotite) quartz eye felsic dykes and sills are found near/in Bloom Cirque and along East Emer Ridge. Trends vary from west-northwest to southwest. Intruding Takla Gp. rocks and the fine grained phase of the Croydon Creek Pluton, these dykes have been severely disrupted by later faults and shears. The dykes may be useful in unravelling structural history. Thin section evaluation (T.S. 1384-5) and whole rock analyses (G 430) have determined a dacite composition.

Biotite, plagioclase monzonite porphyry dykes intrude Takla Gp. rocks and later diorites in the Raven Grid area.

Coarse-grained equigranular dykes of +95% pyroxene, occur in the Raven Grid Area and along East Emer Ridge. Aeromagnetic data suggests they may be related to small ultramafic bodies or they may represent recrystallization of a basaltic phase. A small, peridotite pod (T.S. 1384-20), on the southwest slope of Bloom Cirque may be a poorly exposed dyke or a pendant.

**Structure - West Half**

Vertical, west-northwest trending, left lateral strike-slip faults have been recognized as the most prominent structural element on the western half of the Porphyry Creek Property. The Porphyry Creek Fault System, Karen Creek, North Bear Creek and South Bear faults are all traceable for a minimum strike length of 2 km. The remarkable straightness across rugged terrain indicates an overall vertical dip. All four faults offset Takla Group rocks and Croydon Creek diorite in addition to numerous northerly trending alkaline to calc-alkaline dykes. Coincidently, volcanic/intrusive contacts appear to cross-cut fault planes in several places. The major faults at these locations are traceable through both units as observed along the northwest portion of the North Bear Creek Fault.

Numerous, subsidiary shears occur in the area commonly as narrow, steeply dipping, strike-slip faults. Several of the larger faults are plotted on Fig. 7b. Preferred strike orientations are towards the north-northeast, north-northwest, and northwest although all attitudes are represented. Clustering of faults of similar trends is common. Faults consist of pale to dark green, crumbly chlorite schist from one to 40 m wide with local well developed mylonite zones. Strong shattering may be seen up to 50 m away from the main widefaults. Secondary Reidel shear schistosity is well developed locally, especially along South Bear Creek Fault.

Steep topography with felsenmeer on the ridgetops and rubble in the basins obscures much of the area that could otherwise lead to the establishment of real displacement vectors. Regionally, dextral strike-slip faults predominate with fault displacements on the orders of several to hundreds of kilometers. On a property scale, no fully reliable markers have been found to indicate fault displacement. Lithologic contacts are too unreliable while the abundance of pre-fault dykes leads to ambiguous interpretations. Left-lateral fault movement along major structures shown on Fig. 7b is tenuously based upon alkaline dyke displacement but no reliable structural data was obtained to confirm this. Regional mapping along with detailed mapping and petrographic studies are required for a reliable reconstruction of pre-faulting geology.

On a regional scale, right lateral displacement is obscured along the northwest trending Pinchi-Ingenika Fault and nearby north-south trending Dortatelle Fault located approximately seven kilometres west of the property. A west-northwest, left-lateral sense of displacement could be explained as being a result of antithetic shearing related to the large-scale regional right-lateral north-northwest strike-slip faults. This scenario requires the Croydon Creek Diorite to have originated as a compact body that has subsequently undergone extensional lengthening to form an elongate linear body as it now exists. Alternatively, a right-lateral sense of movement is indicated as the prevalent regional trend of virtually all similar trending faults found locally to the west and northwest (G. Zhana and A. Hynes 1990). This requires a long linear diorite body to have undergone compressional shortening along the Porphyry Ridge.

No evidence of significant folding has been discovered with the exception of rare shear-related drag folds found associated with minor subsidiary shears. The possibility of large scale flexures has not been fully investigated but there is some evidence to suggest that the emplacement of the Croydon Creek Pluton has created an antiformal structure as suggested by tuff bed attitudes northeast and southwest of the pluton. Along Croydon Ridge, numerous small north-northwest to north-northeast trending shears have been mapped. Of interest is a 080°/80° NW fault zone, 2 - 4 m wide with a strike length of greater than 1 km. In the vicinity of its intersection with the Porphyry Creek Fault System, strong fracture controlled Cu and Au mineralization occurs. Fault structures and truncated monzonite dyke footwalls subsidiary to the Karen Creek and North Bear faults display strong Cu and Au mineralization in several exposures. Of special interest are fault intersections, where strong Cu and Au occasionally with Pb and Zn, are found as mineralized shoots and fractures. Large, relatively flat-lying to vertical fissure-type quartz veins are found

in all rock types. Locally on Croydon and Porphyry Ridge, an attitude of approx. 090°/20°S has been recognized in Takla Gp. rocks. Abundant faulting combined with low-grade greenschist facies metamorphism has made bedding attitudes difficult to establish. On the Soup claims, immediately west of Porphyry Ridge, well bedded tuffs trend approximately 150°/30°NE.

**Structure - East Half:**

Within the Croydon Creek Pluton, small northeast to east-northeast trending faults with moderate to steep dips towards the NW or SE predominate. Faults are rarely traceable for more than 200 - 300 m due to talus cover. Many structures are closely associated with moderate to strong fracture-controlled pyrite and chalcopyrite mineralization. Trends persist into the bordering Takla volcanic rocks along the northeast margin of the pluton. Local minor northwest trending faults/shears occur in the vicinity of the pluton, but not at the scale observed along Porphyry Ridge. Croydon Creek Pluton appears to have been emplaced along a preexisting large-scale, northwest trending, structurally controlled break or lithostratigraphic contact.

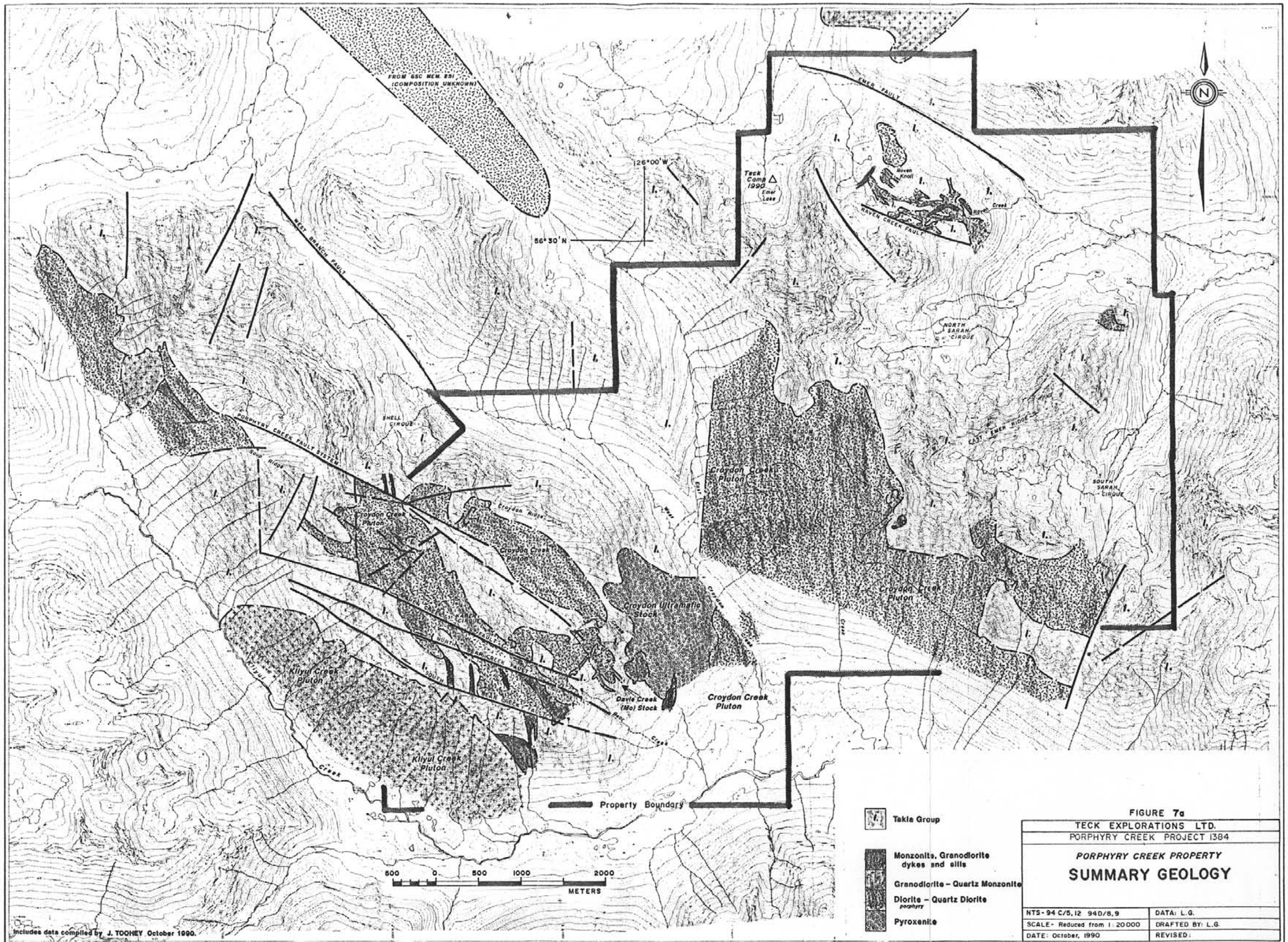
Early underground work along the Croydon Creek Pluton, north of the Croydon Ultramafic Stock is in north-south fault contact with the Takla Gp. This has not been verified due to the lack of outcrop exposure in the area. Takla Gp. rocks have been partially subdivided east of the pluton into three mappable units; agglomerobreccia, augite porphyry and finely bedded tuff. The agglomerate is particularly evident immediately east of the pluton, trending northwest as a 100 - 300 m thick band interbedded with ash tuff and minor fossiliferous limestone. This lithostratigraphic unit has not been identified on the west side of the pluton, supporting the idea of structurally controlled pluton emplacement.

Large scale west-northwest to northwest trending faults are evident in the Raven Trend area (see Figures. 7a, 7c). The Emer Fault, striking 110°, exists as a broadly shattered zone 10 - 20 m across with numerous subsidiary shears. It is defined by a natural linear trench with poor outcrop exposure. The dip is poorly defined but it is likely steep southwesterly.

Raven Creek Fault, 1.5 km to the south, striking 105. is largely obscured by blocky talus. It appears to form the southern boundary for diorite intrusion and widespread metasomatic alteration present on the north side of the fault. Several narrow northwest to north-northwest structurally controlled dykes of similar appearance and composition are found south of the Raven Creek Fault. Their relationship to the Raven diorites is unknown.

The East Emer Ridge, southeast of North Sarah Cirque, displays both a structural similarity and similar widespread pyritic hornfels alteration as at the Raven area. The possibility that the two areas are related should be investigated. Most of the basin between the two areas is till covered and has not been examined.

Northwest of the agglomeratic volcanic unit, the structural trend appears to change from east-northeast to northwest. Little mapping has been undertaken around the margin or within North Sarah Cirque. As only the linear ridge-crests, which trend primarily northeast have been traversed, northwest trending faults are more likely to be encountered in the area. This makes generalizations about dominant structural trends difficult but there appears to be a dominant northwest trending fault orientation paralleling the northwest trending lithostratigraphic units.




Includes data compiled by J. TOOHEY October 1990.

TOPOGRAPHY
COMPILED BY
NADIR MAPPING CORPORATION

FIGURE 7a

| TECK EXPLORATIONS LTD. | |
|---|---|
| PORPHYRY CREEK PROJECT 1384 | |
| *PORPHYRY CREEK PROPERTY* **SUMMARY GEOLOGY** | |
| NTS - 94 C/5,12 94D/8,9 | DATA: L.G. |
| SCALE - Reduced from 1:20000 | DRAFTED BY: L.G. |
| DATE: October, 1990 | REVISED: |

To accompany report by L. Greston and P. Roberts

CONTOUR INTERVAL 40 m

**Mineralization - West Half:**

**Takla Gp:** *Sulphide mineralization* occurs within veins, faults, shears, fractures and as local disseminations proximal to intrusive bodies. Chalcopyrite is ubiquitous, occurring as fine to coarse grained, anhedral aggregates and disseminations. Malachite, with or without minor azurite, is present as fracture and vein coatings but not in the abundances expected from chalcopyrite distribution. Pyrite, commonly weakly oxidized, is found locally as fine to medium grained anhedral aggregates and subhedral disseminations. A broad, strongly gossanous, hornfelsed zone is peripheral to the Davie Creek Deposit *and extends south*-eastward along Porphyry Ridge.

Veins are typically of three types - *quartz, quartz with minor* dolomitic calcite and dolomite calcite with or without minor quartz. Quartz veins are generally 20 to 50 cm wide while veins with carbonate are less than 20 cm wide and most often less than 5 cm wide. The veins occur within faults, shears or along *bedding planes and lack continuity* in length and width. Vein mineralization is typically poddy and erratic. Quartz veins may be barren or host 2 to 10% sulphides, primarily as chalcopyrite and/or pyrite. Galena with or without chalcopyrite was found in quartz talus at the east end of Porphyry Ridge. *It is also present in a 45 cm wide quartz vein within a strong fault north of Croydon Ridge.* Carbonate veins and (carbonate) quartz veins are commonly mineralized with coarse aggregate of chalcopyrite with or without hematite, weak chalcocite or minor pyrite. Spotty molybdenite with *hematite occurs in flat lying carbonate quartz veins at* the western end of Croydon Ridge. A coarse grain of visible gold in a massive coarsely crystalline talus cobble of dolomitic calcite was found on the north side of Croydon Ridge. Coarse chalcopyrite aggregates (8%) is present *with a hint of malachite* but the gold is within massive carbonate.

A probable extension of SOUP skarn was found as minor subcrop at the west end of Porphyry Ridge. *Elsewhere, minor* magnetite occurs sporadically as discontinuous stringers and irregular masses.

Pyrrhotite was found in three locations on the southeast side of Porphyry Ridge, *occurring as* anhedral aggregates (3 to 5%).

A 200 m wide by 200 m long zone (Lady Diana) *of pyrite and chalcopyrite as stringers,* fracture fillings and disseminations was found on the south side of Porphyry Ridge. Secondary biotite (5 to 20%) is patchy within the zone. The zone follows the contact with the Kliyul Creek Pluton and is bounded to the north by South Bear Creek Fault. *Within an area* of 50 x 200 m, closely spaced stringers radiate outward from the pluton. Mineralization is more spotty and erratic within the rest of the zone.

**Intrusive Rocks:** Mineralization is confined to veins, faults, shears, fractures and occurs rarely as disseminations. Veins tend to be wider (50 cm x 2 m) than in Takla Gp. rocks. Quartz is the dominant gangue locally accompanied by poddy and erratic chalcopyrite and weak pyrite. A massive, 40 cm wide pod of galena, sphalerite, pyrite and minor chalcopyrite occurs with quartz along a steeply plunging fault intersection in Karen Cirque. Estimated sulphide content is 40%. Immediately south of North Bear Creek Fault, possible gold was noted with 10% pyrite, trace chalcopyrite and malachite hosted by quartz within a shear.

A brief examination of core from the Davie Creek Stock found molybdenite as minor disseminations and aggregates within potassium feldspar and/or quartz stringers. Locally stringers formed weak stockwork. Trace chalcopyrite was found in one quartz stringer. Mineralization is described in detail reports by Bema Industries.

More than 500 grains scheelite and minor powellite were found in pans from Porphyry Creek, downstream from Davie Creek. Coarseness of some grains indicate a source within 100 m or less. Scheelite was reported within the Davie Creek Stock by previous workers. A few, very fine gold flakes were found in a pan from Porphyry Creek, downstream from Karen Creek.

All mineralization was found within rocks of Croydon Creek Pluton. With the exception of rare and weakly mineralized shears, mineralization was not found within Kliyul Creek Pluton nor in the monzonite to "granodiorite" dykes which post date the Croydon Creek Pluton. Along Porphyry Ridge, minor chalcopyrite, pyrite and malachite occur within fractures and as disseminations within the diorite near monzonite to latite dyke contacts.

**Mineralization - East Half:**

**Takla Gp:** Mineralization is primarily confined to quartz carbonate veins and fracture fillings. Veins are commonly less than 20 cm wide, pinch and swell, and are usually less than 20 m long. Massive calcite lenses occur up to 1.5 m wide in South Sarah Cirque. Chalcopyrite is ubiquitous. Pyrite is much more widespread and more abundant than on the west half of the property. Very fine grained, disseminated pyrite, 1 to 3% and locally 15%, appears to be confined to particular "horizons" in the hornfelsed volcanic pile. These exposures weather as distinct gossans and occur proximal to intrusive bodies (see photographs on P5 and P6 Appendix I). On the ridge southwest of Emer Lake, chalcopyrite and pyrite occur in a quartz vein only where it intersects a limestone body. Minor bornite was found at the eastern end of the Emer Ridge.

Four occurrences of magnetite skarn are present along the margins of Bloom Cirque. Very minor chalcopyrite with malachite and azurite occur locally within epidote (diopside garnet) skarn which borders a magnetite skarn bed on the east side of the cirque. The skarn zone strikes roughly east-west, dips north at 8° and has a minimum thickness of 4 m (See photographs on P11 Appendix I). Mineralization within the zone is sparse and erratic.

Local occurrences of magnetic chalcopyrite, galena and sphalerite present in the Raven area are discussed in detail later.

**Intrusive Rocks:** Fracture fillings and minor disseminated chalcopyrite with malachite occur throughout the fine grained phase of the Croydon Creek Pluton (Bloom Creek Diorite). Mineralization, albeit weak, is widespread, strongest in more densely fractured areas, and is accompanied by widespread weak to very strong propylytic alteration. Mineralization extends into the pegmatitic phase on the west side of Bloom Cirque. Elsewhere, rare chalcopyrite was found disseminated in the pegmatite, apparently in lieu of pyrite. Minor pyrite in epidote-quartz-potassium feldspar veins occurs locally in South Sarah Cirque. Disseminated and fracture related pyrite, 3 to 15%, hosted by a hornfelsed diorite subvolcanic, occurs at the north end of East Emer Ridge. The resultant gossan is one in a series of prominent gossans forming the "Raven Trend". *Roughly 2.5 km to the northwest, the Raven gossan is caused by pyritic intrusive rocks and* hornfelsed volcanic rocks.

Minor cobalt bloom was noted on fracture surfaces on the west side of Bloom Cirque.

**Alteration:**

**Takla Gp:** Weak pervasive chloritization is ubiquitous. Locally it is moderate to intense along fractures, within faults, shears and proximal to intrusive bodies. In larger faults, chlorite schist occurs in widths from a few meters to over 20 m.

Pervasive carbonatization is moderate to intense within and along faults and shear zones. Staining indicates dolomite as the dominant carbonate. Discontinuous lenses of calcite with or without dolomite are common within most shear or fault zones. Calcite fracture fillings occur locally throughout the volcanic pile. Weak, pervasive iron carbonate alteration is common in the agglomero-breccia on the west side of South Sarah Cirque.

Epidote alteration is widespread but restricted to margins of intrusive rocks and as selvages along fine fractures. Along Croydon Ridge, epidote is an obvious product of weak to strongly saussuritized, medium to locally course grained, recrystallized volcanics (or intrusive equivalents?).

Evidence of hornfelsing is found in pods, pockets and over broad areas. A close associations with intrusive rocks is not always apparent. Effects of hornfelsing include local pyritization, a coarsening of augite phenocrysts and local recrystallization. Pyritic gossans are more common and larger on the east half of the property. Weak calcsilicate development, possible calcsilicate skarn, and recrystallization occur locally. Calcsilicates include diopside, garnet and epidote in strongly varied proportions. Preservation of primary textures and general weak calcsilicate development suggests the original rock types were calcareous tuffs with limestone lenses and/or calcareous volcanic derived clastic rocks.

Uralization is common on the west half of the property and in particular, along Croydon Ridge. Pyroxene is replaced by hornblende (including richterite) and tremolite-actinolite. In many instances, augite phenocrysts are perfectly pseudomorphed by amphibole which is only apparent in thin section. Hornblende and richterite form pegmatitic aggregates with crystals up to 20 cm long and 2 to 5 cm across. Richterite was identified by Dr. Lee Grout of U.B.C. using X-ray Fluorescence. Apparently, it often forms by hydrothermal alteration of alkaline intrusive rocks under conditions of low temperature and pressure. Along larger shears more finely uralitized volcanic rocks are similar in appearance to serpentinite. Much of the "hornblendite" at the Davie Creek Deposit, described by previous workers, may represent recrystallized and replaced basalt and/or pyroxenite.

Potassium feldspar occurs locally as minor fracture fillings with or without quartz, and is commonly related to felsic dykes, local granitization or other intrusive rocks. At the Raven, it forms rims around sericitized plagioclase in monzonite dykes.

Dark brown to black, secondary biotite masses, 5 to 20% are present at the Lady Diana Showing. Spotty occurrences were noted along Croydon Ridge. On the ridge southwest of Emer Lake, of a fine grained volcanic rock was described in thin section as a meta-diorite with 30% secondary biotite (T.S. 1384-17, Appendix IV).

Weak, pervasive silicification occurs locally along felsic dyke margins, granitized pods and patches and more rarely as fine stringers. Remobilized quartz sweats, lenses and discontinuous veins occur within faults, shears and along bedding planes. Larger veins have been traced intermittently for over 200 m. Veins commonly exhibit strong pinch and swell.

**Intrusive Rocks:** Intrusive rocks are variably fresh to weakly, altered and locally strong to intensely altered.

Chloritization is weak to locally intense, occurring pervasively and along fractures, shears, faults and dykes. It most commonly forms at the expense of hornblende. Biotite of the Kliyul Creek Pluton, is weakly chloritized.

As in Takla Gp. rocks, dolomite alteration is commonly moderate to strong along shears and faults. Pervasive calcite forms locally with the breakdown of hornblende and plagioclase, often along, or proximal to, fine fractures. Intense dolomitic alteration is present over a broad area at the head of Bloom Cirque.

Pervasive epidotization is weak along fractures, dykes and near Takla Gp. contacts. Volcanic fragments and matrix of the hybridized pegmatoid, often show intense, pervasive, but often fracture-related epidote alteration (see photographs P8, Appendix I). Massive epidote occurs locally as fracture fillings. The most significant occurrence is within Bloom Cirque Diorite, where epidote is found as a result of widespread, pervasive, weak to moderate saussurition, and as massive fracture fillings in areas of intense brittle fracturing (see photograph P-11, Appendix I).

Potassium feldspar is sparse, occurring as stringers and fracture fillings with or without bull quartz. It is present in South Sarah Cirque, Bloom Cirque and as scattered minor occurrences on the west half of the property. Clots occur in the granitized/hybridized contact areas between Takla Gp. rocks and intrusive bodies. Moderate to intense potassium alteration is present at the Davie Creek Deposit along stringers, veins, granophyre "dykes" and is locally pervasive. The biotite core and potassium feldspar margins (potassic zonation) of the Kliyul Creek Pluton is likely a primary feature related to the volcanic contact.

Secondary biotite was observed replacing severely chloritized hornblende in a dacite dyke along Croydon Ridge.

Throughout Bloom Cirque Diorite, weak to moderate sericite is commonly present due to plagioclase saussuritization. Along the brecciated contact in South Sarah Cirque, sericite has intensely replaced the intrusive matrix and volcanic fragments (see photograph P-9, Appendix I). Moderate sericite occurs on the north slope of Raven Knoll and locally on East Emer Ridge. Sericitization is rare and commonly weaker on the west half of the property. Strong alteration is reported in a latite dyke along Porphyry Ridge.

Silicification is commonly weak but locally moderate, occurring pervasively along intrusive margins and as local stringers or fine fracture fillings. Minor stringers are scattered throughout Bloom Cirque and as a finely sheeted parallel vein system and a weak vein stockwork over a broad area in the headwall of South Sarah Cirque. Quartz occurs locally as veins and lenses in faults and shears. Most are discontinuous, pinch and swell and are traced intermittently for a maximum of two hundred metres. Veins are fewer and smaller on the east half of the property.

Clay alteration is absent on the west half of the property. At the head of Bloom Cirque, a pyritic diorite dyke is moderately altered. On East Emer Ridge a quartz eye, plagioclase "quartz diorite" porphyry dyke shows weak, pervasive clay alteration.

On the west half of the property, magnetite commonly forms at the expense of hornblende. Pyrite locally replaces hornblende in a small quartz diorite body at the head of Porphyry Creek.

**1990 RESULTS**

Au and Cu analytical results for all sample media are plotted on Figures 9a to d. Geochemical response of soil appears to closely follow mineralization, alteration and lithological changes. Soil data interpretation and geochemical plots of ph and 30 elements for the east half, west half and Raven area are presented and discussed in the geochemical reports by Stan Hoffman (1990). Although local values for some elements are suspect, the soil survey is considered to be of high quality. Six major anomalies have been identified for one or more of Au, Cu, Ag, Pb, Zn, Cd, Mo, W, K and Bi. Anomalies are large and exhibit a high degree of contrast with background. Boundaries are poorly defined due to the nature of contour sampling. Major areas of interest as outlined by soil geochemistry are:

a) Bloom Cirque Cu
b) Raven Au, Cu
c) North Sarah Cirque (East Emer Ridge)
d) South Sarah Cirque (western headwall)
e) Porphyry Creek Au
f) Porphyry Creek (Davie Creek Mo)

Soil response indicates Kliyul Creek Pluton has a unique signature with high Ba, Sr, La and low Ca, Mg, V.

Cr and Ni values over Croydon Creek Ultramafics Stock are more typical of mafic volcanic rocks. Hoffman postulates high dilution due to glacial effects. It is also probable rock compositions are more "gabbroic" than "ultramafic". Cr and Ni response may be used to adjust extrapolated intrusive/volcanic contacts on the north side of Porphyry Creek. High Ni, reflecting mafic volcanic bedrock, appears to be controlling Pb, As and Zn distribution.

Co is enhanced across the entire survey area while Ag and As are more common on the east half. Ag is weak with enhanced values ranging from 2 to 4 ppm. On the east half of the property As background is 25 ppm compared to 12 ppm in the west.

Sr distribution is believed to reflect bedrock lithology. The downslope dispersion limits of 300 to 400 m noted at the south end of Bloom Cirque may be useful as a guide in evaluating element dispersal elsewhere. Hoffman recommends reanalysing these samples to eliminate the possibility of a false pattern created by analytical inconsistencies.

Strong B, often accompanied by anomalous Au values occurs in rock samples on the west half of the property. In some samples the equivalent of 20% tourmaline would be required to yield sufficient B. Reanalysis by atomic absorption found many high values to be incorrect. Test tube contamination postulated by Hoffman was ruled out by the laboratory based on the erratic values being produced. Instead, interference by sulphur is suspected.

Selected samples with 3 to 9 ppm Hg and all samples with +10 ppm Hg were reanalysed by atomic absorption. Reproduction of results was erratic.

Analytical results with reference to known mineralization for the east and west half of the property are presented in the following section. Raven Grid area is discussed in Raven Detail (this report). The property has been divided into 15 anomalous areas as depicted in Figure 9e. Significant soil response is summarized for each area. Boundaries are loosely based on topographic and geological parameters. Soil survey plots for selected elements showing anomalous rock sample locations are in Appendix VIII. Table 3 lists elemental threshold values for soil and talus fine samples for both the reconnassaince and the Raven Grid survey.

TABLE 3. THRESHOLD VALUES FOR SOIL AND TALUS FINES

(Note: Au as ppb. Fe, Ca and Mg as %. All other elements as ppm)

| *REGIONAL SURVEY* | | | | *RAVEN GRID* | | |
|---|---|---|---|---|---|---|
| Element | Soil | Talus Fines | | Element | Soil | Talus Fines |
| Au | 50 | 50 | | Au | 75 | 110 |
| Ag | 1.1 | 1.3 | | Ag | 1.4 | 1.5 |
| As | 25 | 40 | | As | 30 | 45 |
| Sb | 10 | 10 | | Sb | 8 | 8 |
| Bi | 8 | 8 | | Bi | 5 | 6 |
| Cu | 250 | 650 | | Cu | 250 | 400 |
| Pb | 25 | 25 | | Pb | 30 | 30 |
| Zn | 140 | 175 | | Zn | 130 | 150 |
| Cd | 4 | 4 | | Cd | 3 | 3 |
| Mo | 11 | 11 | | Mo | 16 | 12 |
| W | 10 | 10 | | W | 7 | 8 |
| Fe | 6.2 | 7.3 | | Fe | 7.5 | 8.5 |
| Mn | 1350 | 1800 | | Mn | 1000 | 1400 |
| Co | 28 | 50 | | Co | 30 | 50 |
| Ni | 70 | 85 | | Ni | 30 | 50 |
| Cr | 120 | 100 | | Cr | 55 | 95 |
| V | 140 | 160 | | V | 165 | 150 |
| Ba | 210 | 250 | | Ba | 190 | 215 |
| Sr | 100 | 150 | | Sr | 110 | 150 |
| Ca | 0.8 | 1.0 | | Ca | 0.75 | 1.3 |
| Mg | 2.1 | 2.2 | | Mg | 1.8 | 2.5 |
| Al | 4.0 | 4.2 | | Al | 4.8 | 5.2 |
| K | 0.17 | 0.39 | | K | 0.13 | 0.25 |
| Tl | 0.23 | 0.15 | | Tl | 0.23 | 0.25 |
| P | 0.14 | 0.20 | | P | 0.17 | 0.12 |
| La | 12 | 12 | | | | |

*From Hoffman 1990*

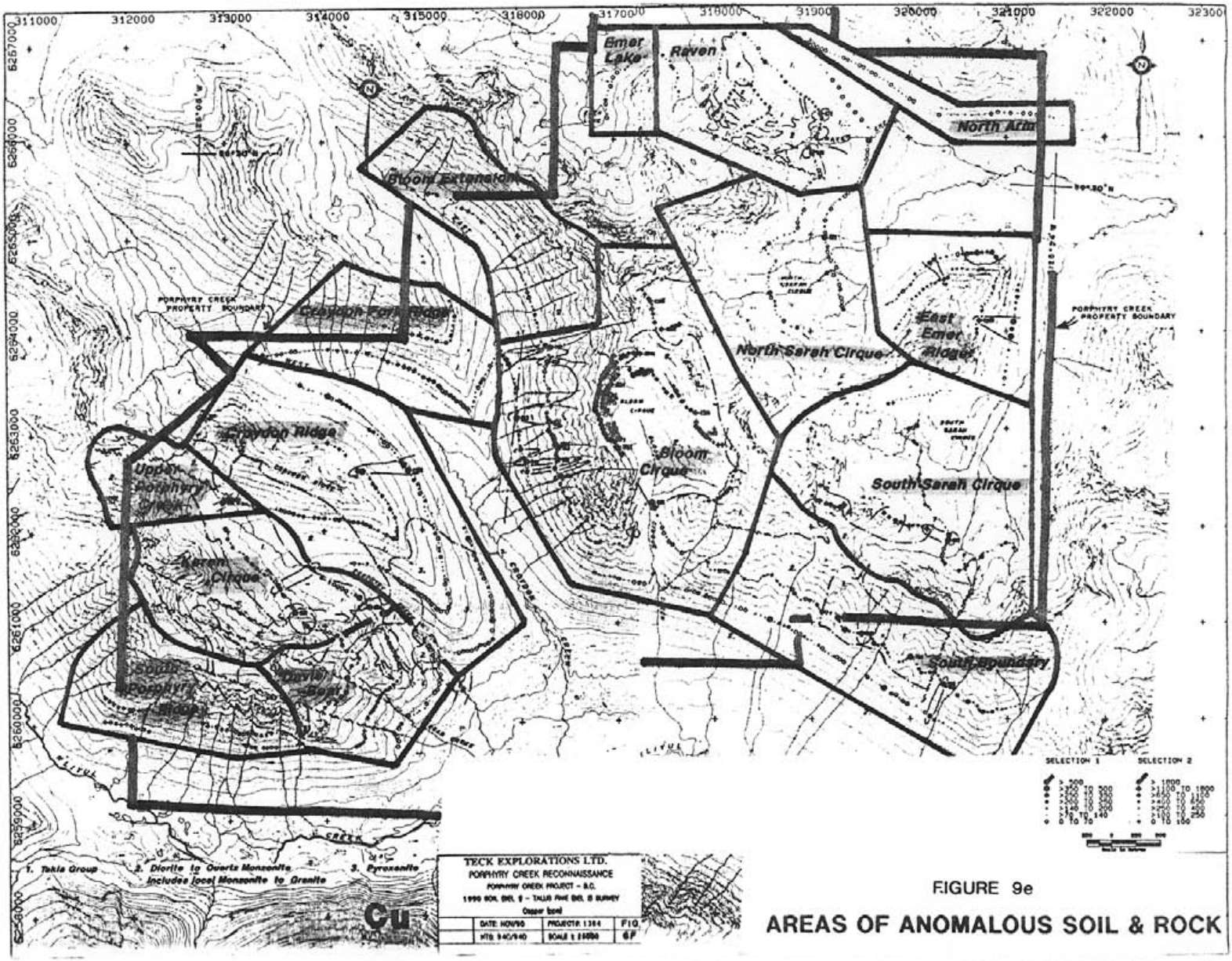



FIGURE 9e

**AREAS OF ANOMALOUS SOIL & ROCK**

**West Half - Lithogeochemistry and Soil Response:**

A large portion of rock samples have very high grade or strongly anomalous Au and Cu. Majority of samples represent selected grabs or rough chips from quartz veins and/or mineralized shear or fault zones. Results for Au and Cu analyses are shown on Figures 9a and 9b. Approximately 64 rock samples have +500 ppb Au of which 47 have over 1 g/t with 13 of +15 g/t Au. Highest Au values are from 60 to 157 g/t. About 66 rock samples returned +850 ppm Cu with 28 having +1% Cu. Maximum Cu values range from 3 to 6%. Anomalous Cu and Au are often, but not always coincident.

Locally, veins and shears exhibit enhanced Ag, Bi, Mo, Sb and Co, Enhancement in one or more if these elements is common with the presence of visible sulphides or Cu, Fe and Mn oxides. There is no uniform preference of element enhancement to a particular strike direction or host rock. Kliyul Creek Pluton and northerly trending monzonite/granodiorite dykes are barren of economic mineralization. Footwall mineralization is common but weakly developed adjacent to some dykes.

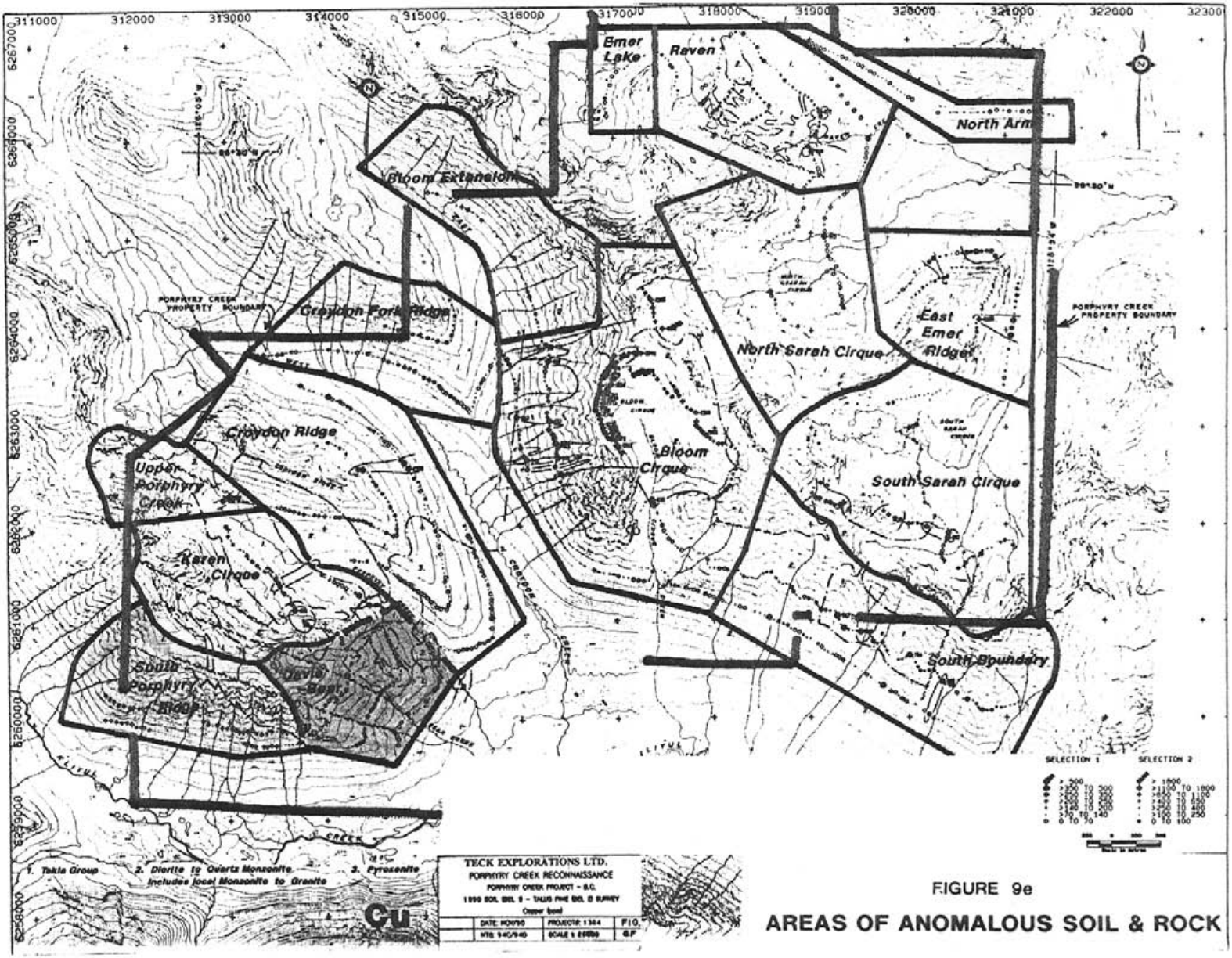



FIGURE 9e

**AREAS OF ANOMALOUS SOIL & ROCK**

## 1. South Porphyry Ridge

Soil sampling covers an area of extremely rugged slopes at an elevation below known mineralization. Due to a gap in sample coverage, soil data does not apply to below the west half of the Lady Diana Showing. Soil samples generally do not reflect bedrock mineralization, partly due to sample distribution. Pb values remain unexplained Sr, La and Ba anomalies are attributed to a high background of the Kliyul Creek Pluton.

A narrow quartz vein with rare galena from the Lady Diana Showing, returned exceptional Au (15500 ppb), Ag (214.7 ppm) and Pb (18439 ppm), with enhanced values in W and Bi. Samples of biotized volcanic rocks with pyrite and/or chalcopyrite, more typical of the showing, exhibit erratic Au (maximum 3900 ppb) and Cu (26980 ppm) but are commonly enriched with Ag (3.4 to 44.8 ppm). Several other samples are weakly enriched in one or more of Ag, As, Co, W, Bi. Elsewhere several quartz veins have elevated Mo (193 ppm) and/or Bi (14 ppm). Trace element geochemistry is summarized in Table 4.

TABLE 4. LITHOGEOCHEMISTRY - SOUTH PORPHYRY RIDGE - Lady Diana Showing

(Note: Au as ppb, all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 40 | 2.8 | | | | | | | | | - 1% py, q vein 30 cm (M133) |
| 15500 | 214.7 | 894 | | | | | | 87 | 16439 Pb, 108W | - rare 2% ga, q vein 10 cm (A382) |
| | | | | | | | | 20 | | - tr py, q vein along bedding (M52) |
| 200 | 4.8 | 5544 | | | | | | | | - 2% py, 2% cp; calcite, epidote stringer zones in volcaniclastic (M134) |
| 550 | 17.4 | 15510 | | | | | | | | - same as M134 (M135) |
| 40 | 4.8 | 2527 | | | | | | | | - py, mal, cp; argillaceous sediment (A383) |
| 980 | 17.5 | 12853 | | | | | | | | - 2% py, 1% cp, bio; lim fracture in volcaniclastic (M53) |
| 610 | 6.8 | 8959 | | | | | | | | - 2% py, 2% cp trace mal, similar to M53 (M54) |
| 950 | 16.1 | 8381 | | | | | | | | - similar to M54 (M55) |
| 800 | 15.0 | 9380 | | | | | | | | - 2% py, 2% cp, bio; bleached, lim. andesite (M120) |
| 180 | 4.8 | 2162 | | | | | | | | - same as M120 (M121) |
| 540 | 13.2 | 10700 | | | | | | | | - same as M120 (M123) |
| 2580 | 17.8 | 11030 | | | | | | | | - same as M120 (M124) |
| | | 365 | | | | | | | | - same as M120 (M125) |
| 3900 | 18.5 | 13670 | | | | | | | | - same as M120 (M126) |
| 2480 | 44.8 | 26980 | | | | | | | | - same as M120 (M127) |
| | | 103 | | | | | | | | - same as M120 but less altered (M128) |
| | | | | | | | | 12 | | - pink border phase Kliyul Creek Pluton (M121) |
| | | 134 | | | | | 21 | 11 | | - < 5% py, limonitic argillite (M56) |
| | 3.0 | 980 | | | | 189 | | | 15W | - 10% to 20% py, actinolite, andesite ? (M129) |
| | | | | | | | | 28 | 11W | - bleached pyritic stringer zones in volcaniclastic at intrusive contact (M131) |
| 240 | 3.4 | 1981 | | | | | | | | - 1% py, trace cp, mal; epidote bio stringers |
| | | | | | | | | | | OTHERS: |
| 30 | | 44 | 25 | | | | | 14 | | - q vein 15 cm (A385) |
| 30 | | 84 | 193 | | | | | 14 | | - q vein 50 cm (A386) |
| 20 | | | 37 | | | | | | | - trace py; q vein 10 cm; volcanic (R171) |
| | | | | | | | | | 15W | - trace py; lim. q vein; granodiorite (M50) |
| | | | | | | | | | 15W | - intensely chloritized volcanic adjacent to silicified altered dyke of R137 with 52 Cu (R136) |

## 2. Davie - Bear Creeks

Au soil anomalies over the Davie Creek Stock and downslope along Porphyry Creek have not been explained by bedrock sampling. This is significant as previous workers have not adequately explored the Au potential of the Davie Creek Porphyry System. Anomalous Cu in soils southeast and above Davie Creek Stock have not been explained by rock geochemistry. Strongly anomalous soils (+5000 ppm Cu) were found in this area by previous surveys but they were not fully evaluated. Coincident Ag and Pb anomalies above Bear Creek are downslope from galena in quartz veins but source for the Zn anomaly is not known. Strong Mo occurs over and beyond the Mo deposit of the Davie Creek Stock. Soils with coincident, anomalous W, Mo, Ba, Sr and Mg above the Davie Creek Stock have not been explained in bedrock sampling but are probably due to scheelite and/or powellite mineralization in carbonate (quartz?) stringers and veins. Strong K is above and coincident with the Davie Creek Stock. Weak to moderately anomalous Cr above Bear Creek probably represents mafic volcanic hybridization with intrusive rocks.

Included in this area are roughly 45 rock samples from the eastern end of Porphyry Ridge above Davie and Bear Creeks. Seven samples returned high Au values ranging from 600 ppb to 34.97 g/t Au. A total of 23 had +500 ppm Cu with a maximum of 3.08% Cu. Majority of samples were very weakly mineralized, narrow quartz veins through diorite. The best Au value of 34.97 g/t, from pyritic quartz float with trace galena, was accompanied by 311.0 ppm Ag, 2294 ppm Cu, 4081 ppm Pb, 55 ppm Sb and 98 ppm Bi (A4). Other veins exhibit local enhancement in Au, Ag, Mo, Pb and Bi. In one sample pyritic footwall diorite with trace chalcopyrite returned 1260 ppb Au, 62.6 ppm Ag, 10.8% Cu and 3311 ppm Zn (R131). Other shear zones and altered intrusive rocks exhibit erratic enhancement in As, Sb and W. Local increases in Ni and Co in "sheared or serpentinized diorite" may represent a shear coincident with a mafic dyke, xenolith or pendant (M19, M45). Similarly, "hornfelsed diorite" of R142 may represent a hybridized zone at the volcanic/intrusive contact. Trace element lithogeochemistry is summarized on Table 5.

TABLE 5. LITHOGEOCHEMISTRY- DAVIE, BEAR CREEK

(Note: Au as ppb, all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 2.2 | 1456 | | | | | | | | - minor mal; q vein 30 cm, diorite (R136) |
| 1640 | 3.7 | 655 | | | | | | | | - trace py, mal; q vein 20 cm; shear in diorite (M17) |
| 3155 | 6.6 | 800 | | | | | | | | - trace cp, q vein; shear in diorite (M18) |
| 20 | | 156 | | | | | | 10 | | - trace py, q talus (R130) |
| 1260 | 62.6 | 108083 | | | 3311 | | | | | - 1% py, trace cp; Footwall to R130 chloritic diorite (R131) |
| 180 | 7.1 | 1166 | | | | | | 26 | | - minor mal; q vein and sheared diorite (R177) |
| 20 | | 44 | | | | | | 19 | | - rare hem, q vein (A356) |
| 50 | | 1145 | | | | | | 22 | | - trace cp, mal; q feldspar vein 50 cm (A357) |
| | | 35 | | | | | | 27 | | - trace py, q vein (R178) |
| | | | | | | | | 11 | | - q vein 50 cm (R151) |
| 50 | | 33 | | | | | 24 | | | - 8% py, 2% mag; carb. altered? at R151 (R152) |
| 220 | 6.4 | 630 | | | | | | | | - trace py, q vein 1m in 10 m wide shear (M144) |
| 2020 | 19.2 | 501 | 96 | | | | | 60 | 460 Pb | - trace py, mo?, lim, q vein 30 cm (M42) |
| 900 | 2.0 | 474 | 36 | | | | | | | - gossanous q vein 50 cm, sheared diorite (R135) |
| 140 | 5.4 | 32 | | | | | | | 138Pb | - 2% py, trace cp; q float (R 1) |
| 330 | 5.4 | 120 | | | | | | | 376Pb | - q vein 15 cm in shear (R167) |
| 49500 | 311.0 | 2294 | | | | | | 98 | 4061Pb 55Sb | - 3% py, trace ga; rusty q float? (A 4) |
| | | 66 | | | | | | | 20Sb | - rare py, q vein 5 cm; granitic or gabbroic host (A 3) |
| 4700 | 24.4 | 30648 | | | 915 | | 27 | | | - mag, mal, azurite, trace py, cp; chl q carb. shear (R134) |
| | | 48 | | 361 | | | 42 | | 12W | - trace py serpentinized?, shear in altered diorite (M19) |
| 40 | | 678 | | | | | | | 12Sb | - lim, shear 25 cm (A360) |
| 110 | 4.7 | 327 | | | | | | | | - 7% py, trace cp; K-feld altered monzonite (R13) |
| 190 | | 751 | | 235 | | 105 | | | | - 5 to 10% py, shear; diorite (M45) |
| | | 32 | | | | | | | 757Ba 13W | - 5% py, 5% mag, silicified shear (M46) |
| 20 | | 181 | | | | | | 12 | | - weak K-feld alteration, strongly bleached diorite dyke (R132) |
| 20 | | 235 | | | | | | | 20W | - hanging wall to R132 (R133) |
| 690 | 7.3 | 6531 | | 243 | | 133 | 21 | | | - 2% py, weakly hornfelsed diorite (R142) |
| | | 157 | | | | | 30 | | | - 1% py, actinolitic (uralitized?) volcanic (R143) |
| | | | | 232 | | | 22 | | | - very fine grained massive actinolite + recrystallized hornblendite? (R145) |

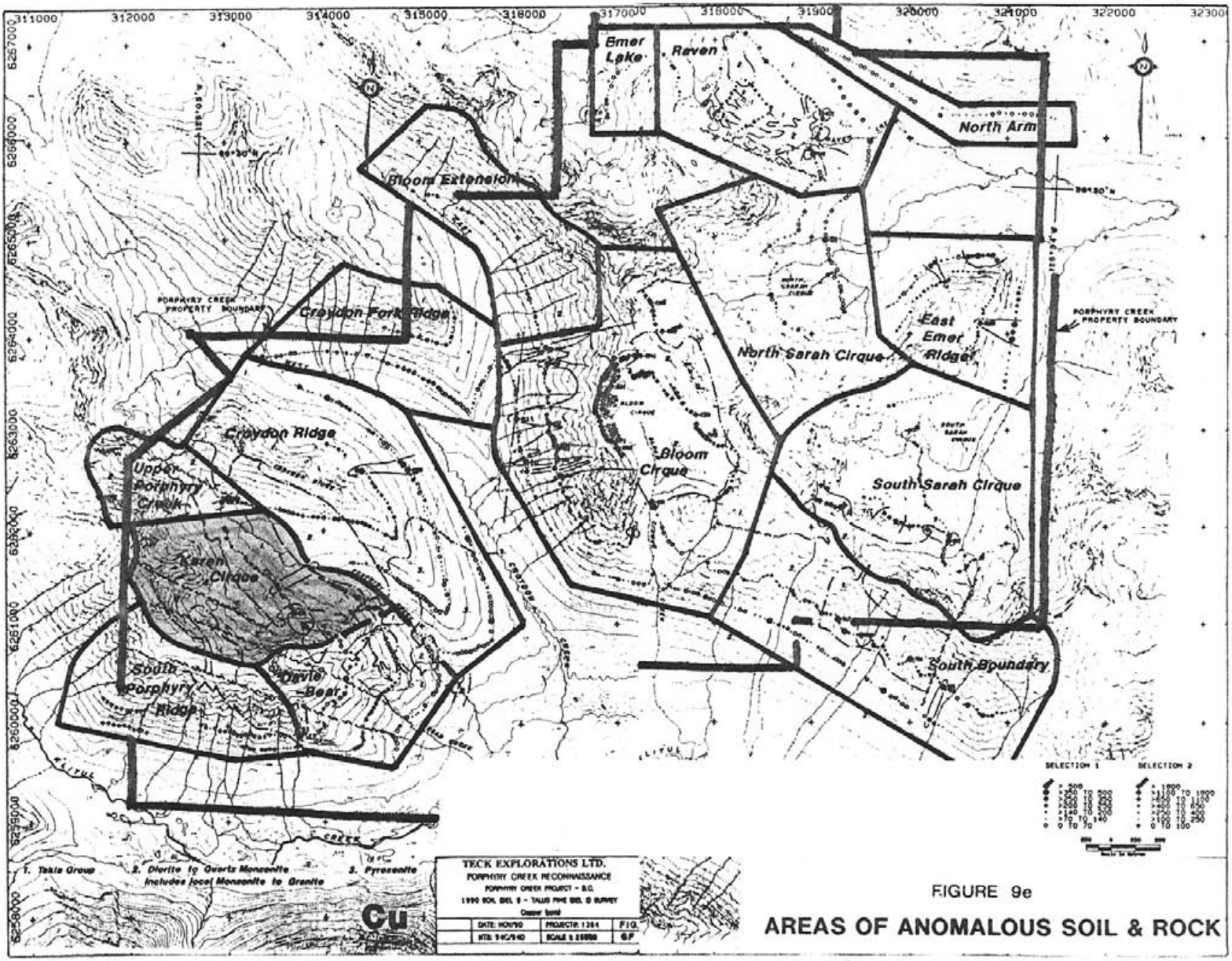



FIGURE 9e

**AREAS OF ANOMALOUS SOIL & ROCK**

### 3. Karen Cirque

A soil line along the 1700m contour traverses the entire area across the mouth of the cirque, at an elevation below the cirque bottom. A second line at 1500m asl covers the eastern half of the area sampled by the upper line.

Majority of bedrock samples are from +300m upslope from the nearest soil line. The upper soil line is consistently moderate to strongly anomalous in Au. Anomalous values range from 90 to 250 ppb with a high of 1360 ppb Au. Ag is only present in the immediate vicinity of Karen Creek although rocks with enhanced Ag are scattered throughout the area. Anomalous Cu can be related to bedrock mineralization only in 2 localities where rock samples are less than 100m upslope from the soil line. Cu response may be negatively affected by acidic soil conditions present to the northwest. Ni is anomalous in soils proximal to a volcanic pendant south of Karen Creek. All other anomalies cannot be directly associated with known mineralization. At present, evidence does not negate the possibility that anomalous Au is due to mechanical dispersion from the large number of mineralized quartz veins present in Karen Cirque. Soil anomalies on the lower lines have not been evaluated by prospecting or bedrock sampling.

Majority of samples are of weakly mineralized quartz as veins or talus, within intrusive rocks. A high proportion of samples returned moderate to strongly anomalous Au. More than 30 samples have +500 ppb and most are +1g/t with 10 of +10g/t Au. Scattered values of moderate to strong Cu occur throughout the cirque. More than 25 have +500 ppm Cu, with most running +1000 ppm. Maximum value for Cu is 4.25%. Other trace element response is erratic but is locally very strong. Many samples exhibit Ag enrichment and the better values are associated with visible sulfide mineralization. Values in quartz veins ranged from 2.7 to 30.5 ppm with highs of 72.0 and 84.5 ppm Ag. An exceptional value of 239.4ppm Ag with strong Au, Cu, Pb, Zn and Bi was from rusty quartz talus with less than 5% malachite and chalcopyrite (A370). Values for shears and altered intrusive range from 9.2 to 30.0 ppm Ag. Bi is locally moderate to strong in quartz with maximum values of 62, 181 and 238 ppm Bi. It is very rarely present in other sample types. As is generally rare and weak but 63 and 127 ppm are present in 2 samples. Enhancement in Pb, Zn, Sb or W is rare. Local Ni and Co are commonly associated with mafic volcanic rocks. In two localities proximal to Karen Creek Fault, significant Hg occurs in subsidiary structures. In sheared quartz with strong Au and weak Ag and Bi, 3500ppb Hg is present south of the fault (R154). The massive sulfide pod, at a fault intersection north of Karen Creek Fault (800m east of R154) returned 4730ppb Hg with strong Au, Ag, Pb, Zn, Cd and 881ppm Sb (M136). Both samples are within 100m of Karen Creek Fault. Trace element lithogeochemistry is summarized on Table 6.

## TABLE 6. LITHOGEOCHEMISTRY- KAREN CIRQUE

(Note: Au, Hg as ppb, all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 10000 | 12.4 | 27 | | | | | | 19 | 3500Hg | - yellow ochre, sheared q vein (R154) |
| 1440 | 1.8 | 172 | | | | | 127 | | 216Pb | - limonite, wallrock to R154 (R155) |
| 230 | | 484 | | | 854 | | 83 | | | - trace mal, azurite cp, wallrock to R154; diorite (R156) |
| 80800 | 84.5 | 3840 | | | | | | 82 | | - 2% cp, minor mal; q vein (A315) |
| 3800 | | 470 | | | | | | 18 | | - very minor py; q vein 1 m (A316) |
| | | 267 | | | | | | 14 | | - trace py, cp; q vein 10 cm; xenolithic diorite (S164) |
| 18000 | 25.4 | 182 | | | | | | 19 | | - q vein; weakly py diorite (S173) |
| 41800 | 72.8 | 18275 | | | | | | 27 | | - 2% py, 12% cp, trace cov, hem; q vein; pyritic volcanic; same vein as S173, S175 (S174) |
| 14000 | 20.0 | 3387 | | | | | | 21 | | - trace py, cp; q vein (S175) |
| 370 | 1.8 | 35 | | | | | | 10 | | - q vein 20 cm + 10 cm chlorite carbonate altered selvage; diorite (M22) |
| 810 | 8.3 | 38 | | | | | | 23 | | - q vein; diorite 2% py (S36) |
| 1840 | 5.8 | 48 | | | | | | | | - bull q vein 50 cm; diorite (M33) |
| 1580 | 14.8 | 16440 | | | | | | | | - mal, lim., trace cp; q vein; xeno. diorite (M35) |
| 1880 | 38.8 | 48800 | | | | | | | | - 1% py, trace cp, q vein 5 cm, diorite (M142) |
| 140 | 1.5 | 95 | | | | | | 181 | 180W | - weakly pyritic q vein (A373) |
| 126000 | 238.4 | 12340 | | | 2888 | | | 328 | 1000Pb 23W | - < 5% mal, cp; rusty q talus (A370) |
| 230 | 24.0 | 30010 | | | 778 | | | | | - rare py; q (A371) |
| 880 | 21.3 | 34770 | | | 828 | 173 | | | 105Pb | - selected 5% cp, mal, q sweat in greenstone (A367) |
| 70 | | | 22 | | | | | 32 | | - rare py; q vein 10 cm (A365) |
| 130 | | 30 | 28 | | | | | | | - q vein 10 cm; granodiorite 5% py (A362) |
| 4400 | 10.8 | 95 | 188 | | | | | | | - frothy yellow q talus (A322) |
| 3300 | 10.9 | 232 | 70 | | | | | | | - orange frothy q talus (A323) |
| 1280 | 17.5 | 1400 | 24 | | | | | | | - q vein (S178) |
| 2000 | 28.8 | 288 | 34 | | | | | | | - trace cp; large q vein; diorite (M27) |
| 888 | 3.4 | 34 | 43 | | | | | | | - 2% py, q vein 30 cm, sheared diorite (M24) |
| 1100 | 6.1 | 4784 | | | | | | | | - wallrock to M27; diorite (M28) |
| 7300 | 72.0 | 66321 | | | | 156 | | | 108b | - trace py, 3% cp; q talus (S179) |
| 30 | 2.7 | 2738 | | | | | | | | - rare cp; q carb. vein 4 cm (A323) |

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4700 | 8.1 | 11250 | | 136 | | | 31 | | | - 5% cp, mal, carbonate vein 50 cm (A403) |
| | | 119 | | | | | | | 15W | - 20 cm carb stringer zone in 2 m wide shear (R128) |
| 170 | 19.8 | 1084 | | | | | | | 851Pb | - trace cp, py, q K-feld vein 10 cm; diorite (M136) |
| 1000 | 9.2 | 1779 | | | | | | | | - 2% py, 5% cp sericite, silica altered granodiorite vein and dyke, shear (R152) |
| 10400 | 30.0 | 670 | | | | | | | | - 10% py stringers, possible V.Q., lim mal, altered diorite (M32) |
| 30 | | 308 | | | | | 21 | | | - lim shear; diorite (M23) |
| 3400 | 11.8 | 80 | | | | | | | 435Pb | - 5% py, lim shear 1 m, diorite (M141) |
| 570 | 11.3 | 27106 | | | 857 | | | | | - 2% mal, pyritic shear (M29) |
| 7800 | 8.0 | 3750 | 220 | | 588 | | | | | - 10 to 20% py; strongly sheared diorite (A324) |
| | | | | | | | | 28 | | - rusty slightly sheared diorite (A364) |
| 80 | 4.1 | 4888 | | | | | | | | - minor 10% cp in feldspar, in shear; diorite (A369) |
| 85000 | 176.4 | 14810 | | | 3144 | | | 220 | 163b 1088Pb | - cp, gal, py, high grade q? talus (A366) |
| 153000 | 180.8 | 13530 | 20 | | 8056 | | | 283 | 15826Pb 29W 375b | - very selected A366 (A366B) |
| 20 | | | | | | | | 10 | | - lim. fract., trace mag, py shear, granodiorite (R159) |
| 1080 | 16.8 | 34531 | | | 807 | 522 | | | | - 5% py, 5% cp, carbonate shear 10 cm; granodiorite (R160) |
| 940 | 8.8 | 18572 | | | | | | | | - 10% py, 3% cp; sericitized diorite dyke (R188) |
| 120 | 4.9 | 8910 | | 561 | | | | | | - trace cp; amphibolite (M143) |
| | 3.8 | 4107 | | | | | | | | - 2% py, 1% cp, lim. mal, fracture; diorite (M138) |
| | | 35 | | | | | 28 | | | - moderate chlorite mag. alteration of hornblende, trace py (M21) |
| 800 | 7.5 | 14327 | | | | | | | | - 10% py, sericitized granodiorite vein and diorite (R163) |
| 180 | | 1348 | | | | | | | 123b 14W | - shear adjacent to R163 (R165) |
| 1040 | 14.9 | 19936 | | | 554 | | | | | - mal. on diorite (A315) |
| | | | | | | | | 11 | | - lim. fract. chilled margin on diorite subvolcanic (R127) |
| 280 | 3.8 | 23180 | 171 | 1070 | | 1772 | 138 | | | - py, mag, massive sulfide grade; diorite (A326) |
| 29000 | 282.2 | 40880 | | | 52230 | | 21 | | 28280Pb 732Cd 881Sb 4730 Hg | - 10% py, 10% cp, 10% ga, 10% sph, with q at fault intersection (M139) |
| 120 | 8.8 | 140 | | | | | | | 287Pb | - lamprophyre 50% diorite, 50% lim. (M137) |

## 4. Upper Porphyry Creek

Few soil samples were collected from the south side of the creek. On the north side, the strong Au anomaly (110 to 260ppb) may be attributed to mineralized quartz vein(s) 200m upslope. Sufficient mineralization occurs at the head of the creek to explain Cu in soils. Ag is present in 12 rock samples in the saddle area but is not found in the soils collected 400 to 500m downslope. Sb, As and Bi occur in rock at the saddle but only As is found in soil. Anomalous Fe and Zn are not explained by current bedrock sampling and coincident, albeit weak to moderate Mn, may indicate scavenging. Anomalous Ni and Cr in soils indicate the presence of mafic volcanic rocks. Source for the Ba soil anomaly remains unexplained. Limits for downslope dispersion is not known and care must be taken in assigning a bedrock source for most of these soil anomalies.

Most of the 34 samples collected were of quartz with or without weak pyrite and/or chalcopyrite. Geochemical response is erratic. Stronger Au values range from 650 to 25000 ppb with 8 samples returning +1 g/t. Cu of +500 ppm is present in 11 samples with maximum values of 1.6% and 6.6% Cu. Local enhancement occurs in one or more of Mo, Sb, As, Bi and rare Zn and W. Enhanced Ag values occur in 15 samples. Ag ranges from 3.6 to 20.5 ppm with local highs of 82.4, 72.0 and 46.1 ppm. Locally elevated Ni or Co probably represents contamination by volcanic wallrock. Anomalous trace element geochemistry is on Table 7.

TABLE 7. LITHOGEOCHEMISTRY- UPPER PORPHYRY CREEK

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 650 | 15.2 | 18337 | | | | | | | | - 2% py, 1% cp, q vein 60 cm through volcanics and diorite (S142) |
| 6300 | 13.3 | 123 | 150 | | | 148 | | | | - 5% py, 1% cp, 1 m SE end of S142 vein (S143) |
| 20 | | 73 | | | | 411 | | | 10Sb | - 1% py 20 cm, NW end S142 vein (S144) |
| 270 | 14.6 | 6473 | | | | | | | | - q grab across gouge zone; volcanics (S151) |
| 60 | 3.6 | 3469 | | | | | | | | - 1 to 2% py, 1 to 2% cp, q vein 40 cm, epidote altered diorite (S153) |
| 9100 | 20.5 | 1436 | | | | | | 25 | | - trace py, cp; q vein 10 cm, shear with quartz diorite dyke (S147) |
| 7500 | 7.8 | | | | | | | 30 | | - 3% py, q (carb.) vein, shear 10 cm (S149) |
| 13000 | 82.4 | 1255 | | | | | | 496 | 728Pb | - 25% py, 2% cp 8 cm, S148 vein (S150) |
| 170 | 1.8 | 2016 | 46 | | | | 33 | 16 | 17Sb | - q vein, shear volc/intrusive contact (S159) |
| 440 | 8.4 | 1157 | | | | | 66 | 15 | 19Sb | - 2% py, 70 cm, same as S159 (S161) |
| 1060 | 1.8 | 221 | 590 | | | | 163 | 12 | 15Sb | - 2% py, q vein; quartz diorite-diorite (S162) |
| 250 | 17.8 | 28422 | | | 796 | | 27 | 16 | 102Pb | - trace py, cp, cov., q vein 80 cm, shear xenolithic diorite (S163) |
| 2700 | 3.6 | 99 | 24 | | | | | 16 | | - 1% py, q vein 10 cm, shear; volcanics (S166) |
| 25000 | 46.1 | 23 | 69 | | | | | 29 | | - trace py, q vein 80 cm, shear (S146) |
| | | 586 | | 103 | | | | 15 | | - trace py, q vein 20 cm, shear volcanic/intrusive contact (S158) |
| 11800 | 4.6 | 1277 | 23 | | | 257 | 39 | | 100W | - 3% py, q float, diorite (S170) |
| 20 | | 87 | 24 | | | | 23 | | | - q vein 60 cm, shear; volcanic/intrusive contact (S160) |
| 130 | | 85 | | | | | 46 | | | - trace py, hem, K-feld, dyke (S156) |
| 360 | 4.0 | | | | | | | | 15Sb | - 2% py, trace cp, q vein 50 cm, shear; volcanic (S155) |
| 40 | | | | | | | 31 | | 12Sb | - trace py, q vein 10 cm, shear; volcanics |
| 7200 | 72.0 | 66321 | | | | 155 | | | 10Sb | - trace py, 3% cp, q float; diorite (S178) |
| 2900 | 10.8 | | | | 679 | | | | | - 4 to 8% py, q vein 1.8 m, shear; volcanics (S152) |
| 40 | | 220 | | | | | | | 10W | - trace py, cp q shear 1.2 m (S167) |

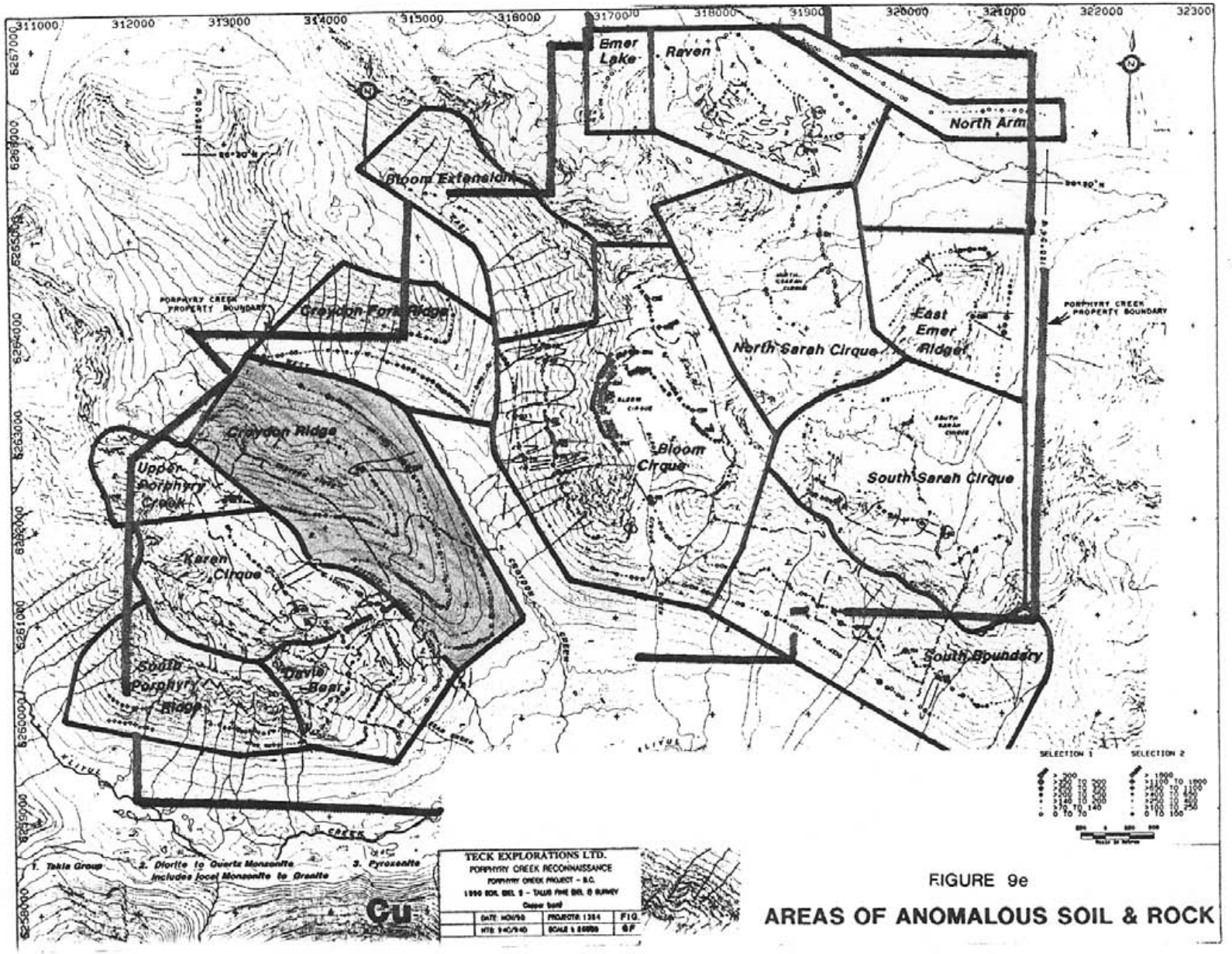



FIGURE 9e

**AREAS OF ANOMALOUS SOIL & ROCK**

## 5. Croydon Ridge

Majority of rock samples with trace element enhancement are from the west half of the ridge where soil was not sampled. High As in soils at the Upper West Croydon Creek Anomaly are 750m downslope from rock samples with elevated As values. Most rock samples represent discontinuous quartz veins and shears through volcanic rocks. Rock samples with elevated trace elements are presented on Table 8, on the following page.

## 6. Croydon Fork Ridge

Rock sampling is restricted to 7 samples collected from the east end of the ridge. Spotty, strong Pb anomalies in the centre of the lower line, are 500m downslope from three rock samples with enhanced Pb. Samples with enhanced trace elements are listed below.

TABLE 9. LITHOGEOCHEMISTRY– CROYDON FORK RIDGE

| Ag | Cu | Bi | | DESCRIPTION |
|---|---|---|---|---|
| 4.1 | 23 | 14 | 146 Pb | - trace py, q vein, shear (S183) |
| 5.6 | | 15 | 390 Pb | - same vein as S183 (S184) |
| 1.6 | | | 105 Pb | - trace py, q vein (S186) |
| | 80 | | 15 Sb | - weak py, strong epidote along shear contact (S181) |

TABLE 8. LITHOGEOCHEMISTRY - CROYDON RIDGE

(Note: Au as ppb, all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 2320 | 4.2 | 45 | | | | | | | | - 2% cp, mal, q float (S140) |
| 2000 | 5.2 | 47 | | | | | | | | - 2 to 5% py, q vein 10 cm; sheared volc. (G103) |
| 260 | 2.7 | 963 | | | | | | | | - 5% cc, 2 - 5% mo, 10% cp; q veins 5 cm (G114) |
| 2900 | 5.4 | 5678 | | | | | | | | - mal 5 - 8%, az 2 - 3%, cp, cc, q float (G135) |
| 2700 | 43.5 | 38084 | | | | | | | | - 2 to 5% cp, mal, q vein 5 cm selected (A88) |
| 120 | 8.8 | 4560 | | | | | | | | - mal, cp, q vein 10 cm, selected (A103) |
| 20 | 2.6 | 2772 | | | | | | | | - minor cp, mal, q talus (A104) |
| 20 | 2.4 | 2577 | | | | | | | | - rare cp, q vein 25 cm; gabbro (A109) |
| 450 | 3.2 | 1936 | | | | | | | | - minor cp, mal, q vein 25 cm selected (A112) |
| 30 | 2.1 | 1539 | | | | | | | | - minor cp, q vein 25 to 50 cm (A121) |
| 400 | 0.7 | 2145 | | | | | 26 | | 145b | - 5% mal, q vein 18 cm; volcanics (G134) |
| 60 | 0.8 | 214 | | | | | 28 | | 185b | - rare py, q vein 10 - 12 cm (G136) |
| | | | | | | | 24 | | | - q vein 5 cm (G131) |
| | | | | | | | 26 | | | - q vein 3 to 10 cm (G132) |
| | | | | | | | 26 | | | - rare py, q vein 4 to 7 cm (G133) |
| | | | | | | | 20 | 11 | | - q vein 12 cm; volcanic (G137) |
| | | | | | | | 26 | | | - rare cp, q vein 12 cm, shear, volcanic (G97) |
| 1780 | 4.5 | | | | | | | 18 | 135b | - 5% py, q vein; sheared volcanics (G100) |
| | | 116 | | | | | | 12 | | - q vein 15 to 30 cm; volcanic (G119) |
| | | | | | | | | 11 | | - q vein 20 cm; volcanic (G120) |
| 140 | 7.0 | 6402 | | | | | | | | - mal, hem; chlorite calcite veins 5 cm (G108) |
| 160 | | 36 | | | | | | 18 | | - 1% hem; calcite q veins 5 cm (G112) |
| 70 | 5.8 | 246 | | | | | | 727 | | - q vein 15 cm, shear in volcanics (G146) |
| 160 | 101.0 | 16 | 214 | | | | | 276 | 14827Pb | - 2% ga, weak py, q vein 50 cm; volcanics (G153) |
| 210 | 82.5 | 16 | 283 | | | | | 187 | 3510Pb | - 2% py, q vein 20 cm (A114) |
| 40 | 1.5 | | | | | | | | 137Pb | - weak py, q vein 35 to 40 cm, shear (G153) |
| 490 | 3.2 | 43 | | | | | | | | - mag, py; carb vein 15 cm (A110) |
| 280 | 5.8 | 6981 | | | | | | | 165b | - weak py, cp, hem?, diorite wallrock to A110 (A111) |
| | | | 65 | | | 105 | | | 15W | - q carb. vein, 20 cm, unaltized gabbro (A117) |
| 20 | 1.6 | 500 | | | | | 24 | | | - rare py; felsite veinlet; volcanics (G98) |
| 180 | 5.0 | 1146 | | 156 | | 462 | 31 | | | - 10 to 15% py; andesite-dacite sub volc. (G126) |
| 20 | 0.8 | 158 | | | | | 29 | | | - 8 to 15% py; dolomitic volcanic (G138) |
| | | 127 | | | | | 20 | | | - 25% py; hornfelsed volcanic (G140) |
| | | 146 | | | | | 37 | | | - rare py; hornfelsed volcanic (G141) |
| 50 | 1.1 | 406 | | | | | | | | - trace to 5% py; hornfelsed volcanic (G144) |
| | | | | | | | | | 175b | - intensely sheared volcanics (G107B) |
| 200 | | 611 | | 301 | | | 41 | | 422Cr | - 15 to 25% py; volcanics (G142) |
| 70 | | 76 | | | | | 28 | | | - 3 to 8% py; hornfelsed volcanic, calcsilicate (G139) |
| | | 41 | | | | | | | 100La | - q (calcite) lense, shear; volcanic (G123) |

**East Half - Lithogeochemistry and Soil Response:**

Results for Au are much less spectacular than on the west half, reflecting fewer quartz vein/shear samples. Only 20 Au values are greater than 500 ppb (excluding Croydon Mine Dump), 12 have +1 g/t and only 2 have +10 g/t Au. Maximum value for Au in rock is 13.71 g/t. Anomalous Au soil values are more widespread than predicted by lithogeochemistry. It is strongest in a broad area over Raven and present in a smaller area at the North end of East Emer Ridge (East Emer Anomaly). Scattered Au values occur on the west side of South Sarah Cirque. Threshold for Au in soils is 50 ppb.

About 90 rock samples have +850 ppm Cu with 17 over 1%. Maximum Cu values range from 3 to 6%. A strong Cu response in rock and soils occurs at Bloom Cirque and along the western half of the South Sarah Cirque. Very few rock samples were collected in the Raven area mainly due to the difficulty in observing mineralization in the poorly exposed, gossanous rubble. Majority of samples with interesting Cu values contained visible Cu mineralization, mainly as chalcopyrite and/or malachite.

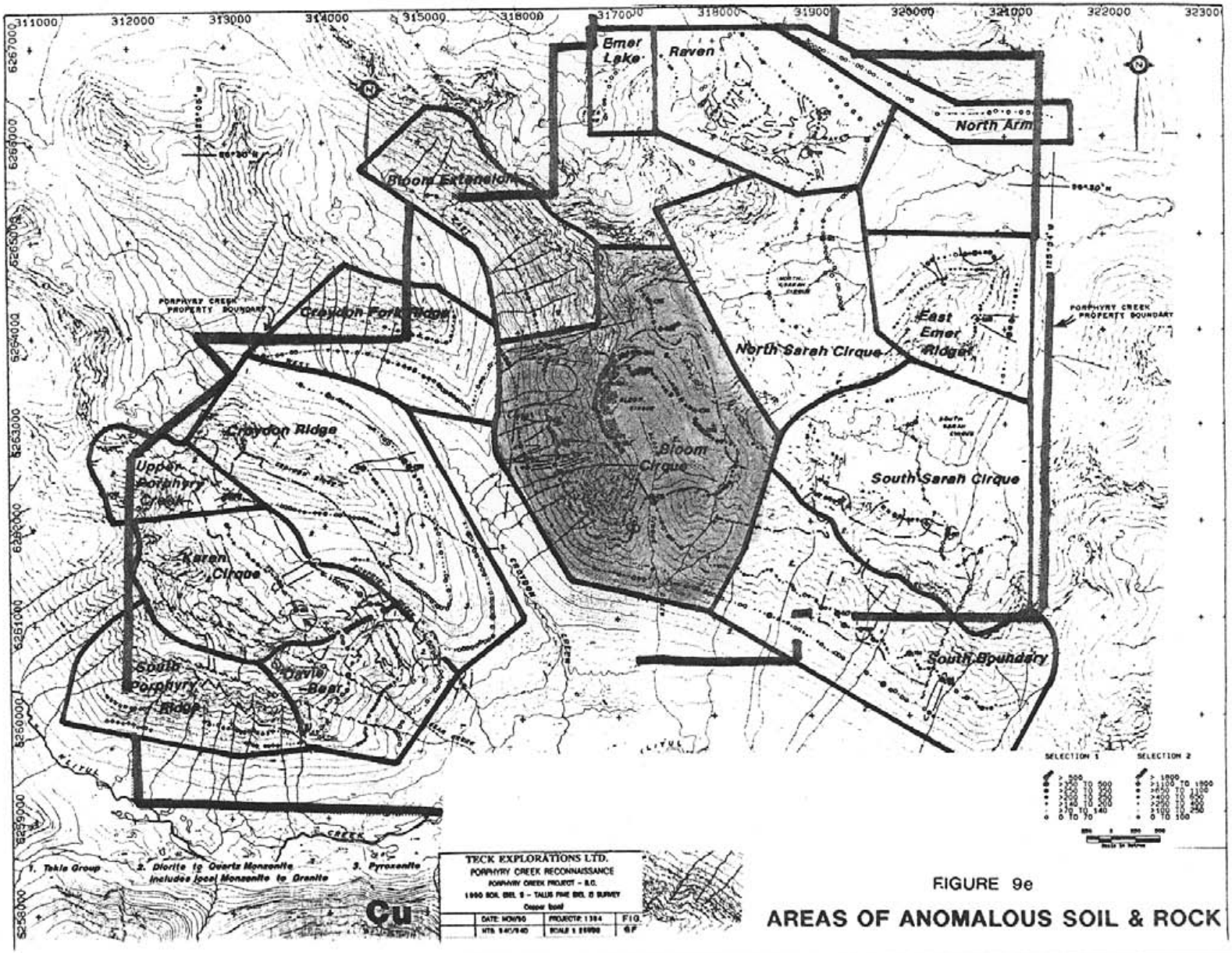



FIGURE 9e

**AREAS OF ANOMALOUS SOIL & ROCK**

## 1. Bloom Cirque

Soil geochemistry is slightly different from east to west and from north to south. The latter correlates with lithological differences - fine diorite to quartz diorite (north) verses a pegmatic, xenolithic diorite (south). Soil response is tabulated on the following page.

Mineralization is commonly related to fracturing. Zones vary from a few centimetres to several metres wide. Fracture density varies from sparse to intense. Alteration and mineralization increases with the degree of fracturing. K enhancement occurs throughout the cirque but is strongest in fine diorite on the west side. Roughly 29 rock samples had 0.1 to 0.2% K and 9 ranged from 0.21 to 0.43% K. The highest values of 0.56 and 0.53% K were from strongly altered diorite with minor quartz stringers and weak disseminated and fracture controlled Cu mineralization (G418, 419).

Correlation of soil and rock anomalous in Cu and Au is high although a 2080 ppb Au and neighbouring 560 ppb Au in soils on the east side remain unexplained. Ag is strong in soils over fine diorite in the west, but it is rarely enhanced in rock. Anomalous Ag in soils over the pegmatitic diorite on the west side correlate with bedrock mineralization. Sb in soil and rock are partly coincident on the west side. High soil values of Zn, Pb, Mo and Ba occurring on the west side are not predicted by lithogeochemistry although high Pb and Ba are found in S193. Soil response of Mn is high and scavaging may explain enhancement of other elements. Minor cobalt bloom is present in the vicinity of Cu soil anomalies on the west side. In the southwest, several rock samples returned 12 to 32 Bi and soil response was also strong. Anomalous Bi in pegmatitic diorite on the west side (S497, 506, 508) has not been tested by soils. Rock with anomalous Mo (G431) and Ni, Co (A335) are associated with soil anomalies, but most of the anomalous rock values in the north are in areas lacking soil samples. Clusters of coincident Ni and Cr are coincident with mafic volcanic rocks.

## a) East Bloom

Obvious mineralization is more restricted on the east half of the cirque and consequently fewer samples were collected. Au response is more erratic and values are commonly less than 50 ppb. Spotty highs of 600 to 800 ppb Au occur. Maximum Au is 1.37 and 2.88 g/t. Few samples returned +500 ppm Cu. Higher values tend to be from the head of the cirque where one sample returned 1.65% Cu.

Other trace elements were found to be more commonly enhanced in samples from the east side and are tabulated below.

TABLE 10. LITHOGEOCHEMISTRY - EAST BLOOM

(Note: Au as ppb; all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 2.3 | 13142 | | | 333 | | 28 | | | - felsic intrusive (G362) |
| 250 | 4.8 | 8799 | | | | | | | | - felsic intrusive (G445) |
| 1280 | 6.0 | 16480 | | | | | | | | - trace py, 2% cp; felsic intrusive (G426) |
| 40 | 4.0 | 106 | 23 | | | | | 32 | | - very weak py, lim., hem., in q vein; within altered quartz diorite (S550) |
| 650 | 3.0 | 4104 | | 234 | | 148 | 30 | | | - 5x10 m gossan, azurite, mal; rare cp (A339) |
| 110 | 2.7 | 3201 | | | | 249 | | | | - 10% py; diorite (A337) |
| 250 | 5.0 | 3284 | | 159 | | 209 | | | | - 5% py, weak cp, mal (A344) |
| 150 | | 3335 | 46 | | | | | | | - trace Cu, strong to intensely silicified diorite (G450) |
| 80 | | 826 | 11 | | | | | | | - hanging wall to G450 (G451) |
| | | | 603 | | | | | 11 | | - Mn, trace py in q vein; diorite (S551) |
| | | 315 | | | | | | 12 | | - 15% py; augite feldspar andesite porphyry (S551) |
| | | 597 | | | | | | 10 | | - 2% py, azurite; basalt (A355) |
| | | 800 | | | | | | 14 | | - very minor Cu; feldspar(?) rock (A341) |
| | | 503 | | | | | | 15 | | - minor mal; mod to strongly altered diorite (G458) |
| 100 | | 1981 | | 138 | | 496 | 140 | | 15 W | - 25% py, 75% mag; massive (A340) |
| 130 | 1.8 | 3372 | 10 | | | | 3236, 92 | | 14 W, 16 Sb | - minor azurite, cp, mal; mag epidote (diopside garnet) skarn zone (G409,410 411) |
| | | | | 144 | | | | | | - hornfelsed volcanic (block ?) (G417) |
| | | 230 | | | | | 35 | | | - 5 to 10% py; volcanic (G416) |

## b) West Bloom

Au response is weak but fairly consistent, with many samples ranging from 40 to 60 ppb and local highs of 100 to 290 ppb Au. Weak Cu mineralization is widespread. Majority of samples returned +1000 ppm Cu and two had 1.69 and 2.64% Cu. Bi values of 12 to 21 ppm occur in 7 samples of fine diorite with weak Cu mineralization in fine fractures or rarely in quartz stringers.

Other trace elements of interest are tabulated below:

TABLE 11. LITHOGEOCHEMISTRY- WEST BLOOM

(Note: Au as ppb; all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 290 | 5.8 | 5849 | | | | | | | | - trace Cu, fractures; mod. altered fine diorite (S486) |
| 110 | 63.4 | 16880 | | | 369 | | | 161 | 561Pb | - (?) float, selected high grade Cu grab (A328) |
| | | | | | | | | 12 to 21 | | - 7 samples, weak Cu, fractures; fine diorite, rarely in quartz stringers |
| 30 | | 2113 | | | | | | 13 | | - narrow q vein; pegmatoid (S497) |
| | | 235 | | | | | | 17, 23 | | - intrusive stockwork; pegmatoid (S506, S508) |
| 70 | 4.2 | 4849 | 35 | | | | | 15 | | - 5% cp, lim., epidote, calcite fractures; pegmatoid 066 °/ 18W, (S504) |
| 80 | 5.4 | 7188 | 22 | | | | | 10 | | - same vein as S504 (S505) |
| 350 | 3.5 | 7865 | 348 | | | | | | | - py, cp, mal. calcite veins; pegmatoid (S499) |
| 170 | 2.7 | 7505 | 59 | | | | | | | - cp, mal, ep, calcite fractures; pegmatoid (S500) |
| 20 | | 526 | 23 | | | | | | | - trace cp, mal, py, epidote fractures; fine diorite (S539) |
| 180 | 4.0 | 26446 | 58 | | 620 | | | | | - (?) selected high grade Cu grab (A330) |
| | 2.7 | 266 | 21 | | | | | | 27Sb | - mod. lim, trace py, shear in volcanics (S192) |
| | | 541 | | | | | | | 10Sb | - mal, lim. in q carbonate vein; fine diorite (S194) |
| | | 52 | | | | | | | 4573Mn 128Pb 1268a 18Sb | - strong Mn, trace py, mod. hem. in a carbonate talus (S193) |
| 50 | | 952 | | | | | 33 | | | - intensely altered (epidote, silica) pyritic volcanics, 10% mag (S510) |
| 1020 | 13.9 | 6727 | | 271 | | 685 | 52 | | 16W | - 65 to 70% py, 10 mag; massive in volcanics (S512) |
| | | 186 | | | | | 30 | 11 | | - trace cp, py; granodiorite/ felsic dyke (S533) |

### c) North Bloom

Relatively few samples were taken from the north end of the cirque. Many represent selected high grade grabs. Most returned +50 ppb Au and maximum values range from 1.65 to 3.60 and 10.63 g/t Au. Strong Cu response (+2% Cu) occurs in samples with +10% total sulphides as pyrite and chalcopyrite. The distinctive quartz eye dacite porphyry sill returned 245 ppm Sr, 628 ppm Ba and 0.29% K.

Other trace elements of interest are listed on Table 12 below.

TABLE 12. LITHOGEOCHEMISTRY- NORTH BLOOM

(Note: Au as ppb, all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 9100 | 35.3 | 55260 | | 537 | 1436 | 561 | | 11 | | - 75% py, 25% cp, massive lenses amphibolite (A346) |
| 2260 | 11.1 | 38230 | | 116 | 981 | 213 | | | | - 10% cp, 5% py; carbonate talus (A345) |
| 790 | 14.7 | 36640 | | 138 | 826 | | | | 135b | - 10% cp, mal; amphibolite (A347) |
| 60 | | 458 | | 234 | | 132 | | | | - pyritic volcanic (A335) |
| 1160 | 11.1 | 20910 | | 493 | 558 | 249 | 30 | | | - (?) selected high grade Cu grab (A378) |
| 70 | | 1058 | 26 | 461 | | 122 | | | | - 20% py, amphibolite (A352) |
| 30 | | 2563 | | | | 181 | | | | - 3% azurite, mal; carbonate veins (A350) |
| 20 | | 158 | 24 | | | | | | | - trace py in q stockwork; diorite (G431) |
| 220 | | 557 | | | | | | 10 | | - trace cp, 4 cm q vein float (G428) |
| 710 | 2.7 | 4635 | | | | | 36 | | 115b | - 5% cp + mal; mag band volcanics (A349) |
| | | 63 | | | | | 32 | | 185b 14W | - azurite, mag pod; volcanics (A348) |
| | | 212 | | | | | 30 | | 135b | - mag, massive; volcanics (A380) |

### d) Bloom Extension

Soil response of Cr and Ni is indicative of mafic volcanic rocks. Care must be taken in the interpretation of results from along the west flank of Bloom Cirque due to the presence of thick (?), broad fans of debris from higher elevations. Rock samples were not collected from along the possible northwest extension of Bloom Cirque Diorite.

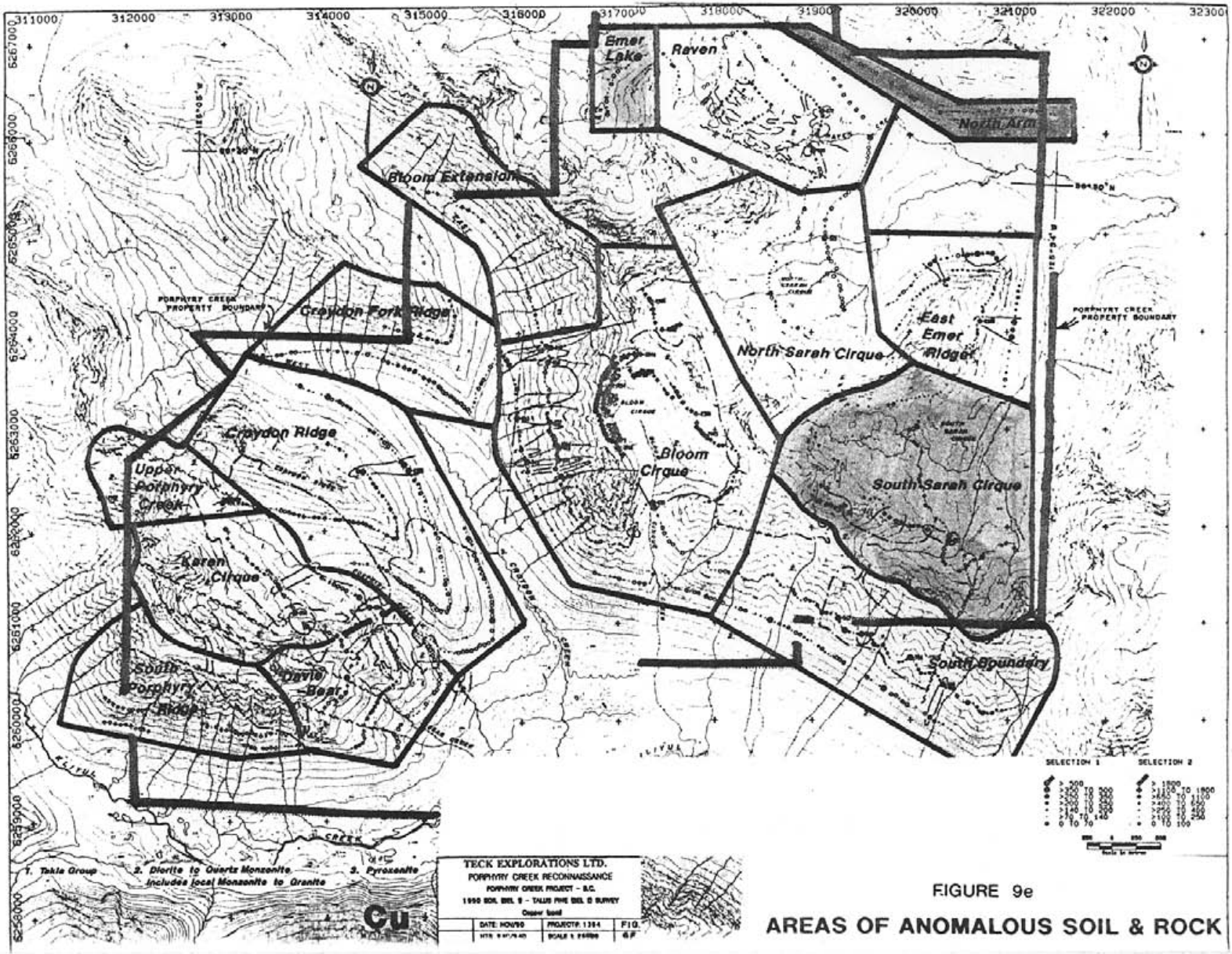



FIGURE 9e

**AREAS OF ANOMALOUS SOIL & ROCK**

## 2. South Sarah Cirque Anomalies

Soil sampling was hampered by large blocky talus. Contour lines were chosen to allow ease of sampling. Soil collection is not precluded as a possible follow-up method in selected areas. Only the south and western slopes were sampled.

Maximum Au is 4.53 g/t but mineralization is very sparse. Cu is common, particularly in the west and south. Maximum Cu is 6.06%. Elevated values for other trace elements are presented on Table 13. Samples A406, 407 are from a carbonate vein which returned 16000 ppb Hg.

Correlation of rock and soil geochemistry is difficult due to sample distribution. Three samples with 13 to 17 ppm Bi (A415 to 17) are from slopes roughly 500 m upstream from a strong Bi soil anomaly. Strong Ba in R540 is upslope from the Ba soil anomaly along East Emer Ridge. Rocks with 120 and 180 ppb Au (A411, 412) are in the immediate vicinity of a 100 to 200 ppb soil anomaly.

TABLE 13. LITHOGEOCHEMISTRY - SOUTH SARAH CIRQUE

(Note: Au and Hg as ppb, all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Bi | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 13500 | 8.0 | 3952 | | | | | | | | - trace cp, q calcite sweat in major shear; volcanics (R542) |
| | | 1810, 1520 | | | | | | 13, 15 | | - weak Cu stain, diorite (A416, 417) |
| | | 2142 | | | | | | 17 | | - weak cp, mal; q talus (A415) |
| 70 | | | | | | | | 10 | | - chlorite, epidote, K-feld fractures; quartz diorite (G434) |
| | | 101 | | | | | | 10 | | - 1% py; monzonite dyke (R473) |
| 50 | 1.8 | 579 | | 142 | | | 58 | | 19W | - trace py, cov.?; semimass. mag. float; volcanic? (R535) |
| | | 2170 | | | | | | 12 | | - 2% cp, strong mal on fract., weak py; diorite (R536) |
| | | | | 374 | | | 36 | | | - chl schist wallrock to R471; volcanic (R472) |
| | | 387 | | | | | 32 | | | - q carb shear, 4m wide volcanic (R529) |
| | | 273 | | 108 | | | | | | - 5% py; amphibolite (R533) |
| | | 100 | | | | | 28 | | 2473Mn, 129b | - trace py; volcanic (R474) |
| | | 88 | | | | | | | 1435Ba | - quartz carbonate shear; volcanics (R540) |
| 820 | 8.0 | 3564 | | 273 | 441 | | 248 | | 16Sb | - minor mal, azurite shear; volcanics (G412) |
| | 0.4 | 247 | | | | | 25 | | | - 15% py, fracture zone; volcanics (G413) |
| 30 | | 235 | | | | | 39 | | | - 5 to 10% py near shear; volcanics (G414) |
| 950 | 33.2 | 22015 | | | | | | | | - 2% mal and cp, q; shear (A152) |
| 210 | 78.4 | 60542 | | | 563 | | | | 470Pb 10W | - 25% cp, mal, in 2 q stringers (A413) |
| 1400 | 7.5 | 7528 | | | | | 28 | | | - cp, calcite vein; volcanics (A406) |
| 2700 | 25.2 | 10206 | | 857 | 1204 | 229 | 298 | | 32845b, 16000Hg | - cp, calcite vein; volcanics (A407) |
| 350 | 8.8 | 4954 | | 274 | | 148 | 43 | | 465b | - mal, cp, carbonate; volcanic (A408) |
| 120 | 15.0 | 4272 | | | | | | | | - cp; calcite talus (A411) |
| | | 2148 | | | | 442 | 692 | | 145b 22W | - po, py fairly massive pod 1 m X 4 m (A405) |
| 180 | 8.8 | 5225 | | | | | | | | - weak Cu stain; monzonite talus (A412) |

### 3. South Boundary Anomaly

Soils collected from the outer flanks of the south headwall of South Sarah Cirque were anomalous in a number of elements. The strong K anomaly shown in the report by Hoffman (1990), is false and *represents a decimal point error* in the data. The string of high values on the lower line should be multiplied by 0.1 to correct the error.

Very few samples were collected in this area and most are from along the ridgetop more than 500 m upslope. Andesite feldspar augite porphyry with trace pyrite and strong manganese staining returned 88 ppm Mo, *100 ppm Co, 57 ppm Ag, 28% Fe, 14 ppm Sb, 2403 ppm Cu, 230 ppb Au and 2.3 ppm Ag (S555).* It was taken 100 m upslope of the western half of the soil anomaly. With the exception of weak Cu mineralization, ridge samples are geochemically uninteresting.

### 4. North Arm Anomaly

North of Raven Creek, a single soil line along the 1700 m contour returned anomalous soil but the hillside was not examined.

### 5. Emer Lake Anomaly

East of Emer Lake is a small string of anomalous soils which have not been tested by bedrock sampling. Local quartz and/or carbonate veins and shears have been observed in talus and in the cliffs above the area.

On the ridge southeast of Emer Lake, two quartz veins were mineralized (at the intersection with a limestone bed) with 2% pyrite and 1% chalcopyrite. One ran 680 ppb Au, 31.9 ppm Ag, 62 ppm Mo, 56 ppm As with 13 ppm Sb (M110) while the second returned 450 ppb Au with 7.9 ppm Ag (M111). Veins were 20 and 10 cm wide respectively. Quartz carbonate talus with weak pyrite and chalcopyrite ran 80 ppb Au with 8.8 ppm Ag (M112).

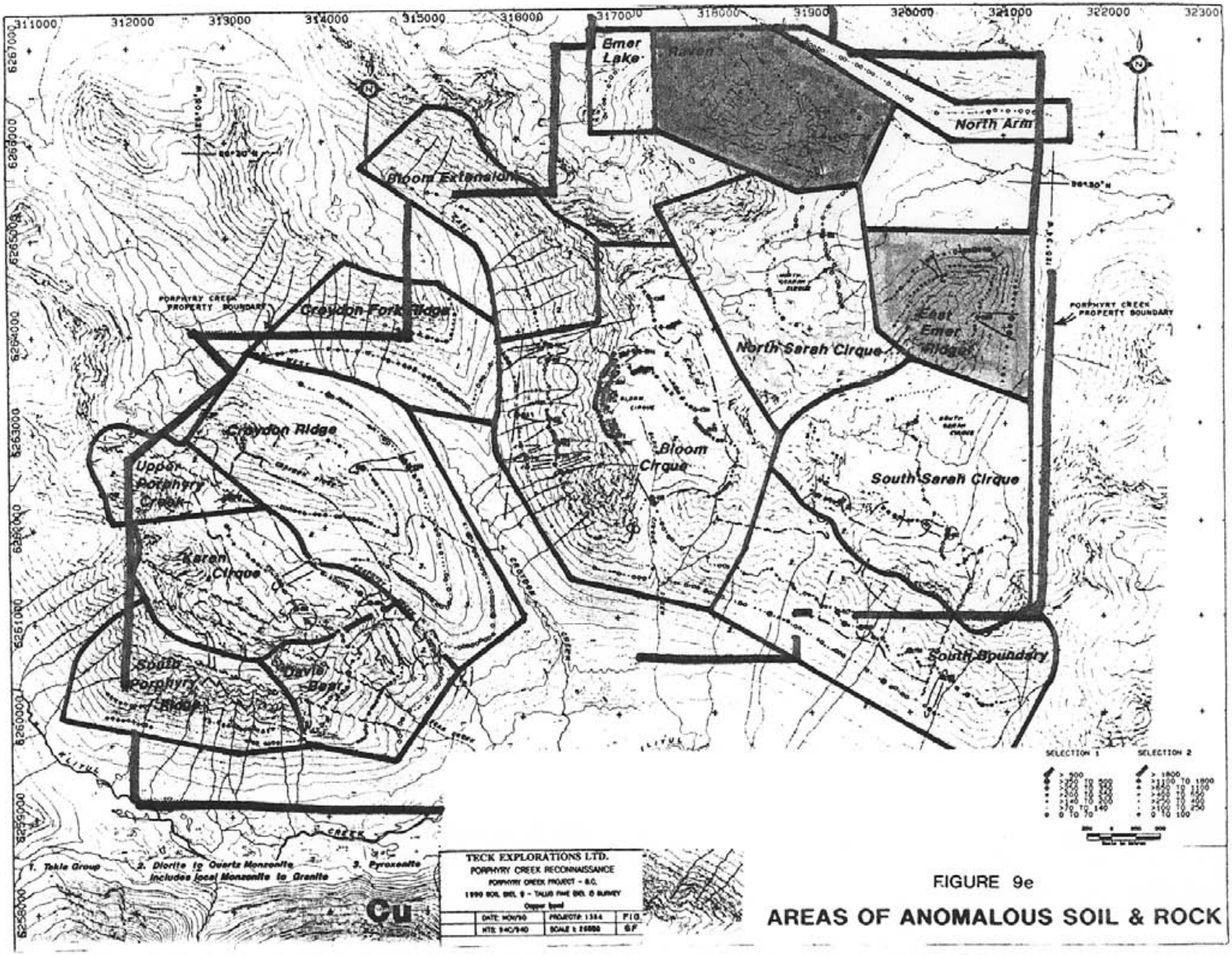



FIGURE 9e

**AREAS OF ANOMALOUS SOIL & ROCK**

## 6. East Emer Ridge Anomaly

At the north end of the ridge anomalous soils occur in the vicinity of the broad gossan. Soil response is similar to that of the Raven. The southernmost Au soil anomaly is in the vicinity of quartz carbonate stringers which returned 1120 ppb Au, 56.3 ppm Ag, 1630 ppm Zn and 23 ppm Sb (R487). The stringers were mineralized with massive clots of pyrite, chalcopyrite, weak malachite, limonite and possible bornite. Soil was not sampled downslope from the 2.5 m wide shear which returned 13500 ppb Au (R542). Numerous quartz calcite stringers and veins in a smaller shear zone within the Ag soil anomaly ran 6.3 ppm Ag (R490). Ten of the 20 rock samples collected showed element enhancement and are tabulated below.

TABLE 14. LITHOGEOCHEMISTRY- EAST EMER RIDGE

(Note: Au as ppb, all other elements as ppm)

| Au | Ag | Cu | Mo | Ni | Zn | Co | As | Sb | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 23 | 66La | - intensely altered q eye dyke; q stockwork in wall rock hosted by volc (R482) |
| | | | | | | | | 12 | 54La | - q eye dyke (R539) |
| 100 | | 876 | | | | | 40 | | | - q fracture fillings, volcanic (R546) |
| | | | | | | | 29 | 22 | | - q calcite vein; volcanic (R538) |
| | | | | | | | 80 | | | - q (calcite) vein; volcanic? shear? (R501) |
| | 6.3 | 147 | | | | | 36 | | | - shear zone (?) (R490) |
| 13500 | 6.0 | 3952 | | 108 | | | | | 235b | - trace cp; 2.5m wide major shear; volcanic (R542) |
| | | 135 | | 240 | | | | | | - 10% py; fracture fillings; subvolcanic? (R484) |
| | | 208 | | | | | | | 115b | - 4% py, q cst; shear; volcanic (R485) |
| 1120 | 56.3 | 64200 | | | 1630 | | | | | - 5% py, trace cp; q calcite stringers; bn?; hb porphyry(?) (R487) |

## 7. North Sarah Cirque

Large areas along the cirque walls were not soil sampled due to anticipated difficulty in sample collection. Soil values are restricted to the western headwall, centre of the cirque and to the East Emer Ridge area to the east. Western headwall samples are considered part of the Bloom Cirque Anomaly.

Sampling is sparse. Very little of interest was noted in the agglomero-breccia in the northwest wall and the central area was not examined. Samples in the southeast headwall (along East Emer Ridge) are more than 1 km beyond, and within a large gap of soil sampling.

A banded quartz vein with 2% pyrite, 1% chalcopyrite and trace galena 250 m upslope from the 1750 m contour in the centre of the cirque ran 140 ppb Au, 5.8 ppm Ag and 123 ppm Pb (M119). Further west a 10 cm wide quartz magnetite stringer zone within a fault through augite andesite porphyry returned 120 ppb Au, 37.8 ppm Ag with 35300 ppm Cu. This sample (M163) is above a large gap in upper soil line and is roughly 1 km west of the middle soil line. In the south, and over 1 km from the nearest soil line, a carbonate altered shear with weak quartz, trace pyrite and 1% chalcopyrite ran 60 ppb Au, 6.9 ppm Ag and 10490 ppm Cu (R494).

## 8. Raven

Soil response is presented in "Raven Detail" (this report) and is thoroughly discussed by Hoffman (1990). Grid soil anomalies are much more spectacular than initially anticipated from contour soil sampling.

**La - A Possible Indicator of Mineralization**

As previously stated, mineralization on the property is confined to rocks of the Takla Gp. and Croydon Creek Pluton. Although absent from within the Kliyul Creek Pluton and monzonite dykes, significant mineralization and alteration is present locally at their contacts. Potassic alteration as secondary biotite, potassium feldspar and sericite is of particular importance. Emplacement of the Kliyul Creek Pluton postdates mineralization but appears to have been influential during at least part of the mineralizing event. The unique geochemical signature of the pluton may be useful in detecting and understanding alteration, mineralization or elevated geochemical values elsewhere on the property. Although sample results are generally lower than crustal averages, soil geochemistry indicates the pluton is enriched in Sr, Ba, La and depleted in Ca and Mg. Whole rock analysis of one sample has determined it to be a quartz monzonite enriched in Ba, $Fe^{3+}$ and low in K, Si and Sr (R172). Due to complex geochemistry and lithologies, Ca and Mg are not considered. Constraints of analytical methods ie. partial digestion, limit the use of K results.

For reference, average content of La, Sr and Ba in ppm for the major rock types are as follows:

| | Mafic | Intermediate | Felsic | Limestone |
|---|---|---|---|---|
| Sr | 300 | 500 | 340 | 1200 |
| Ba | 250 | 500 | 600 | 100 |
| La | 6.1 | 31 | 55 | 9 - 23 |

According to Hoffman (1990), lithology controls distribution of Sr in soil. From the summary of Sr and Ca lithogeochemistry (Table 15), it is evident that high Sr is strongly associated with high Ca and may be a better indicator for the presence of carbonate and/or carbonate alteration.

The summary of Ba lithogeochemistry (Table 16) shows enhanced Ba is not restricted to a particular rock type and is not always accompanied by enhanced La. Both Ba and Sr may substitute for Ca. Ba can substitute into calcite, potassium feldspar micas and apatite. It may be present in Fe, Mn and carbonate precipitates but it has low mobility in the secondary environment. Ba lithogeochemistry is further complicated by the possibility of inaccurate results due to incomplete digestion.

Presence of La is therefore considered to be the best indicator element for intrusive activity, alteration and mineralization which may be associated with the Kliyul Creek Pluton. Enrichment in Sr and Ba is considered additional support for the correlation. Lithogeochemistry for La is summarized on Table 17. La has a high primary mobility concentrating in large stage granitic melts, pegmatites and is highly concentrated in some alkalic rocks including carbonatites. It may substitute in potassium feldspar, sphene, pyrochlore, apatite and fluorite. In soil, it is associated with limonite and clays. Values of +10 ppm La in rock and +9 ppm La in soil are considered significant on the property. Geochemistry of samples G149,

G430, R169, R482 and R439 closely matches that of the Kliyul Creek Pluton. Distribution of significant La in soils and rocks is shown of Figure 9f. It is interesting and significant to note that majority of anomalous samples are from areas already deemed geochemically interesting.

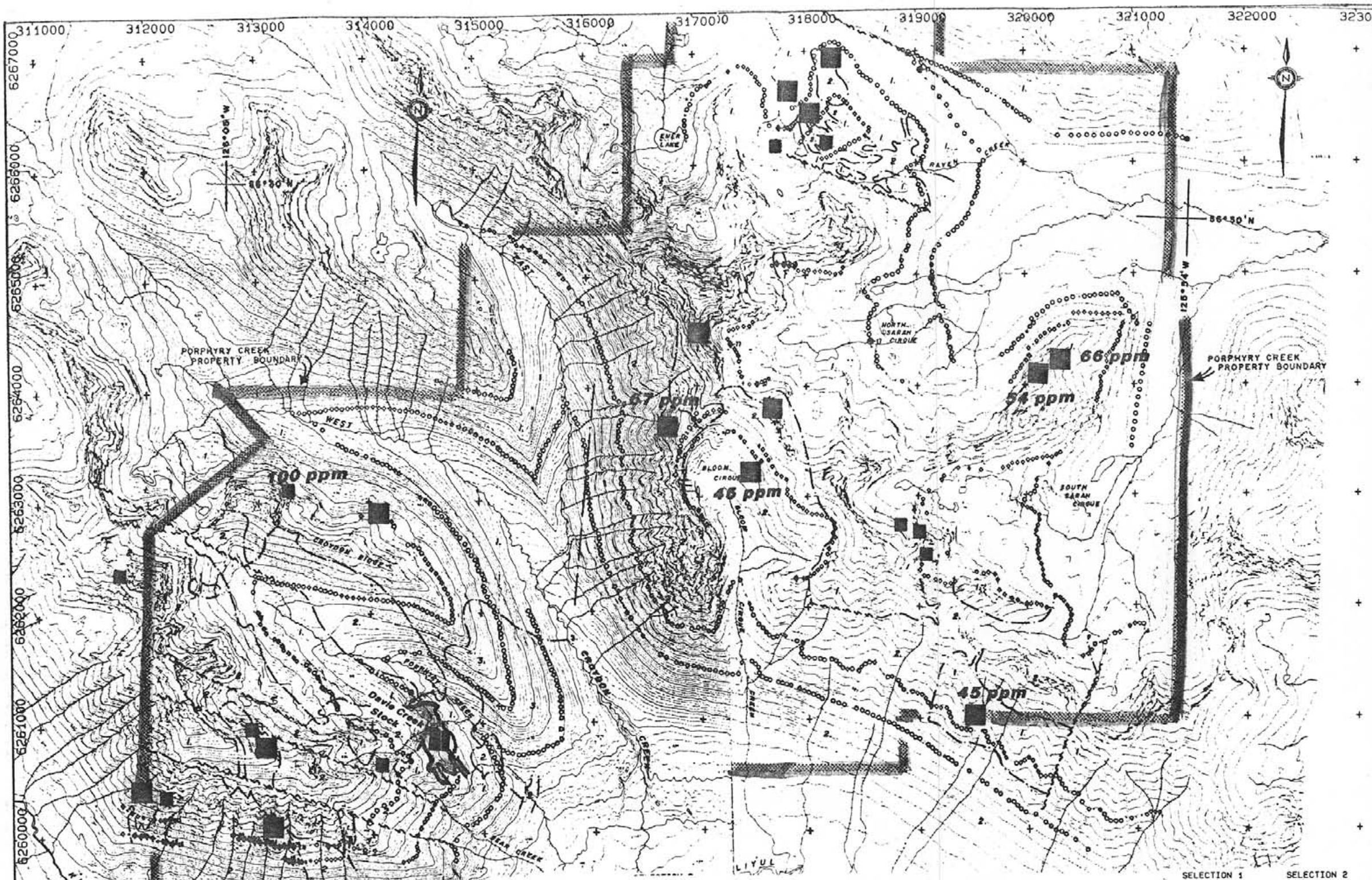
At the Davie Creek Stock the geochemical signature of potassically enriched mineralized zones is similar to the Kliyul Creek Pluton. Results for all samples collected from DDH 82-6 are summarized below on Table 18. Whole rock analysis of sample 1354 closely matches a quartz diorite composition with $Fe^{3+}$ enrichment.

Samples are too few to provide conclusive correlations but altered rocks exhibit enhancement in Mo, As, Sb and Bi. The possibility of anomalous Au and Cu in the perimeter has not been tested.

TABLE 18. DAVIE CREEK STOCK LITHOGEOCHEMISTRY

(Note: Au as ppb; Mg and Cu as %, all other elements as ppm)

| SAMPLE | La | Sr | Ba | Ca | Mg | Au | Ag | Cu | Mo | As | Sb | Bi | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 414 | 2 | 67 | 36 | 2.22 | 0.57 | 5 | 0.8 | 236 | 329 | 25 | 15 | 17 | "Hornblendite" weak carbonate |
| 448.5 | 37 | 169 | 165 | 1.65 | 0.34 | 5 | 0.4 | 50 | 825 | 27 | 16 | 14 | "Granodiorite" strong K-feldspar |
| 471.3 | 33 | 469 | 302 | 1.11 | 0.34 | 5 | 0.3 | 34 | 203 | 18 | 12 | 16 | "Granodiorite" q flooded fracture zone, local K-feld. carbonate pods |
| 499.8 | 43 | 100 | 260 | 0.96 | 0.70 | 5 | 0.3 | 28 | 896 | 13 | 17 | 16 | "Granodiorite"weak to mod. altered |
| 512 | 15 | 200 | 88 | 1.87 | 0.13 | 5 | 0.4 | 20 | 333 | 31 | 28 | 20 | "Granodiorite"K-feld and q 20% py minor fluorite |
| 1354 | 47 | 169 | 30 | 1.16 | 1.05 | 5 | 0.2 | 72 | 279 | 8 | 4 | 8 | "Granodiorite"fresh |




*Values of 25 ppm or greater are highlighted*

FIGURE 9f

# SUMMARY OF LA IN SOILS & ROCK

To accompany report by L. Grexton and P. Roberts.

Table 15

TABLE 16. Sr and Ca LITHOGEOCHEMISTRY

(Note: Sr, Ca as ppm. Only Sr > = 100 and/or Ca > = 10 are shown)

| SAMPLE | Sr | Ca | DESCRIPTION |
|---|---|---|---|
| G 106 | 240 | 11.25 | - chlorite calcite veins, volcanic |
| 107 | 405 | 15.57 | - calcite q veins; volcanic |
| 108 | 83 | 29.88 | - sheared volcanic |
| 111 | 387 | 13.14 | - calcite veins, volcanic |
| 122 | 335 | 18.36 | - q epidote calcite veins; volcanic |
| 156 | 221 | 15.86 | - q epidote calcite veins |
| 157 | 153 | 16.38 | - q epidote calcite veins |
| 158 | 176 | 14.67 | - q calcite vein |
| 297 | 845 | 16.15 | - calcite breccia; intrusive |
| 299 | 207 | 1.70 | - q feld. stringers, rare epidote; intrusive |
| 424 | 253 | 1.82 | - intense epidote altered, q stringers; intrusive |
| 430 | 245 | 1.80 | - weakly rusty, dolomitic q-eye dacite dyke |
| R 144 | 387 | 22.46 | - q veins, actinolite altered; volcanic |
| 153 | 270 | 8.76 | - q stringers, shear, actinolite, weak carbonate |
| 203 | 222 | 10.10 | - siderite, dolomite, calcite altered; intrusive |
| 477 | 102 | 12.37 | - weak to moderate carbonate; shear; volcanic |
| 491 | 127 | 11.35 | - q vein, moderate carbonate; volcanic |
| 494 | 32 | 11.21 | - carbonate altered, shear; volcanic |
| 496 | 212 | 8.02 | - weak to moderate carbonate altered; shear; volcanic |
| 502 | 248 | 14.82 | - strong carbonate fractures, fault; calcite, dolomite; volcanic |
| 521 | 333 | 2.02 | - strong epidote, biotite, moderate K alteration; monzonite |
| 543 | 88 | 10.92 | - q vein in epidote, chlorite altered volcanic |
| 550 | 258 | 21.31 | - calcite, dolomite, q; shear; epidote altered volcanic |
| A 96 | 212 | 22.88 | - rusty pyroxenite |
| 110 | 342 | 13.13 | - calcareous; volcanic ? |
| 118 | 180 | 11.54 | - q carbonate vein |
| 137 | 140 | 27.35 | - carbonate vein |
| 152 | 90 | 18.99 | - calcite talus |
| 327 | 367 | 13.07 | - q carbonate greenstone shear in diorite |
| 350 | 236 | 12.58 | - carbonate vein |
| 353 | 79 | 26.35 | - carbonate talus |
| 397 | 240 | 13.09 | - q carbonate talus |
| 400 | 262 | 4.72 | - q vein |
| 406 | 80 | 24.87 | - calcite vein |
| 411 | 237 | 22.24 | - calcite talus |
| M 36 | 227 | 8.45 | - silicified breccia vein, dolomite, calcite |
| 41 | 141 | 10.81 | - strongly silicified shear |
| 47 | 215 | 3.89 | - epidote q vein; altered diorite |
| 55 | 254 | 1.04 | - epidote, limonite; fractures; volcaniclastic |
| 99 | 123 | 12.24 | - q carbonate, shear; limonite |
| 103 | 67 | 10.34 | - q carbonate stringers; in ? volcanic |
| 105 | 137 | 12.87 | - intense q carbonate altered, strong limonite; volcanic |
| 109 | 109 | 12.19 | - intense q carbonate altered; volcanic |
| 114 | 72 | 16.19 | - moderate q carbonate epidote stringers; fault gouge |
| S 138 | 301 | 27.63 | - calcite veins; diorite |
| 139 | 261 | 9.52 | - calcite q veins; volc./intrusive contact |
| 179 | 192 | 12.26 | - q vein with acid dyke; moderate epidote, chlorite; weak carbonate |
| 191 | 103 | 11.11 | - weak carbonate altered, moderate epidote, limonite; strong q, shear |
| 481 | 99 | 10.09 | - weak carbonate altered; shear; limonite |
| 483 | 79 | 10.44 | - moderate carbonate altered; shear; limonite |
| 486 | 41 | 17.17 | - q stringers; strong limonite |
| 503 | 247 | 2.64 | - moderate epidote calcite fractures; moderate limonite; pegmatitic diorite |
| 507 | 201 | 16.86 | - moderate to strong epidote, calcite fractures; limonite; pegmatitic diorite |
| 516 | 336 | 9.80 | - weak q carbonate stringers; quartz diorite |

## TABLE 16. Ba LITHOGEOCHEMISTRY

(Note: Ba, Sr, La as ppm. Mg, Ca as %. Only Ba > = 500 shown)

| SAMPLE | Ba | Sr | Ca | Mg | La | DESCRIPTION |
|---|---|---|---|---|---|---|
| G 136 | 1683 | 155 | 3.89 | 0.58 | | - q calcite vein; volcanic |
| 143 | 945 | 147 | 5.14 | 1.44 | | - hornfelsed volcanic |
| 430 | 628 | 245 | 1.80 | 0.13 | | - carbonate alt. q eye dacite dyke |
| R 127 | 644 | 83 | 2.98 | 0.33 | 11 | - diorite/subvolcanic, fault |
| 159 | 572 | 61 | 2.09 | 0.47 | 16 | - weak carbonate, clay alt. granodiorite dyke |
| 181 | 816 | 32 | 7.78 | 1.10 | | - intensely carbonate alt. shear; q eye porphyry |
| 490 | 595 | 127 | 11.35 | 1.66 | | - carbonate shear, hornfelsed volcanic ? |
| 539 | 1102 | 47 | 1.59 | 0.09 | 54 | - biotite q eye dyke |
| 540 | 1435 | 92 | 6.54 | 1.41 | | - q carbonate shear |
| 550 | 1506 | 258 | 21.31 | 1.12 | 16 | - calcite q dolomite shear |
| M 37 | 1367 | 81 | 2.54 | 0.11 | 13 | - bleached epidote rich xenolithic diorite |
| 105 | 1846 | 137 | 12.87 | 4.10 | | - q carbonate altered, volcanic |
| S 148 | 1241 | 129 | 4.63 | 0.85 | | - q vein; volcanic |
| 175 | 805 | 19 | 0.23 | 0.26 | | - q vein, diorite |
| 188 | 1349 | 82 | 2.05 | 0.07 | 45 | - carbonate, silica altered, diorite dyke |
| 193 | 1228 | 14 | 6.06 | 0.15 | | - q carbonate talus |
| 481 | 642 | 99 | 10.09 | 1.85 | | - q stringers, weak carbonate shear; volcanic |
| 515 | 1620 | 86 | 3.58 | 0.37 | 67 | - moderate carbonate, silica, K altered dacite feld. porphyry dyke |

## TABLE 17. La LITHOGEOCHEMISTRY

(Note: Ba, Sr, La, Bi, Sb as ppm. Ca, Mg as %. Only La >= 10 ppm are listed)

| SAMPLE | La | Sr | Ba | Ca | Mg | Bi | Sb | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| G 149 | 28 | 34 | 31 | | | 28 | | - hornblende dacite dyke |
| 430 | 70 | 240 | 628 | 1.80 | 0.13 | | | - quartz eye dacite dyke |
| 461 | 11 | | | | | | | - carbonate, chlorite altered diorite |
| R 152 | 13 | | | | | | 16 | - carbonate, chlorite, sericite, actinolite |
| 159 | 16 | | 572 | | | 16 | | - carbonate, chlorite, sericite; granodiorite dyke |
| 169 | 25 | 39 | 92 | 0.43 | 0.40 | | | - K-feld, actinolite; granodiorite |
| 172 | 30 | 39 | 154 | 0.43 | 0.32 | | | - Klyul Creek Pluton; fresh |
| 173 | 11 | 8 | 169 | 0.05 | 0.09 | | | - q vein; granodiorite |
| 473 | 10 | 58 | 55 | 1.00 | 1.12 | 10 | | - chlorite schist; wallrock to monzonite dyke |
| 474 | 10 | | | | | | | - hornblende, plag. volc. porph; epidote, calcite |
| 482 | 88 | 52 | 352 | 1.14 | 0.26 | 23 | | - carbonate, sericite; q biotite plag. dyke |
| 504 | 12 | | | | | | | - K-feld, epidote, sericite; monzonite dyke |
| 506 | 14 | | | | | | | - volcanic; contact with epidote alt. diorite |
| 517 | 12 | 54 | 36 | 1.43 | 1.36 | 13 | | - biotite monzonite dyke |
| 520 | 13 | 51 | 256 | 1.37 | 1.28 | | | - biotite monzonite dyke |
| 521 | 13 | 333 | 20 | 2.02 | 0.98 | 14 | | - K-feld; biotite monzonite dyke |
| 539 | 54 | 47 | 1102 | 1.59 | 0.09 | | | - biotite quartz eye dyke |
| 550 | 16 | 258 | 1506 | 21.31 | 1.12 | | | - calcite, q, dolomite; shear; volcanic |
| A 400 | 11 | 262 | | | | | | - q vein |
| 405 | 11 | | | | | | 14 | - massive po pod |
| 406 | 12 | | | | | | | - calcite vein |
| 411 | 11 | | | | | | | - monzonite talus |
| M 34 | 13 | | | | | | 11 | - monzonite dyke |
| 37 | 13 | 81 | 1367 | 2.54 | 1.16 | | | - bleached epidote rich xenolithic diorite |
| 173 | 10 | 84 | 148 | 1.07 | 0.73 | | 11 | - epidote; mod. K (?) alt.; volcanic |
| S 555 | 46 | 7 | 55 | 0.04 | 0.80 | | 14 | - py, Mn stringers, limonite; volcanic |

## RAVEN DETAIL

The Raven Showing was selected for detailed follow-up work based upon significant contour soil geochemical values. Subdued topography and proximity to the 1990 base camp allowed for quick and accurate grid construction. Approximately 1175 soil samples were collected, (including 170 reconnaissance contour samples) along 100 m spaced, picketed grid lines at 25 m station intervals. Portions of the two baselines were also sampled at 25 m intervals. The Raven area is discussed in the report by Stan Hoffman (1990). Geology, sample locations and analytical results for Au and Cu are plotted on Figures 10 a, b, c and d.

### Geology:

The showing is located within an area of subdued topography, bounded on the north and south by parallel northwest trending faults located approximately 1200 metres apart. Geology at 1:5000 scale is shown on Figure 10a. Photographs of the Raven (P-6) are in Appendix I.

Upper Triassic Takla Gp. andesitic, volcanic sequence is intruded by hornblende diorite which, in hand sample, is locally very similar to hornblende diorite at the head of Karen Creek. Variation exists within the Raven diorite as is evident from thin section 1384-11 which represents a small northwest trending dyke on Raven Knoll. Multiple diorite intrusions are likely in this area. More detailed mapping is required to confirm this.

Later stage, northeast trending monzonite dyke occurrences cross-cut volcanc-diorite contacts. Although of limited surface exposure, these widely spaced dykes, along with float of similar material found north of Raven Knoll, suggest a monzonite stock of significant dimensions may exist at depth beneath the immediate area.

The andesite is typical Takla Gp. pyroxene porphyry and is variably altered. Much of the area surrounding the immediate zone of interest is comprised of fresh flows with intercalated agglomero-breccia volcanics as described in more detail in Appendix V. Talus of this unit occurs within the western and southern grid boundaries, but does not display significant alteration or mineralization. Laminated ash tuff is widespread to the north and intercalated with the pyroxene porphyry within the central portion of the grid area. Occasionally interbedding is seen on a scale of a few centimetres in float only.

The tuff in the northern grid area is relatively fresh and monotonous, with a bedding attitude of approximately 100°/30°N. Pyritic fractures with minor limonite persist locally. Significant mineralization or alteration was not recognized in this area.

In the central portion of the grid area, on the north spur, a diorite occurrence of unknown dimensions is located near to where pyroxene andesite porphyry comes in contact with a northwest trending tuff sequence. This area appears significantly shattered with local weak sericite alteration. Significance of the alteration zone is not apparent, although anomalous gold geochemical results, from down-slope, suggest local mineralization is possibly associated with this zone. Soil sampling was not extended to cover the top of the knoll due to the lack of fine material available.

Fine to medium-grained hornblende diorite is found as an elongate, northwest trending body paralleling Raven Fault. It has (mapped) peripheral dimensions of 1400 x 400 m, with numerous elongate volcanic pendants, or possibly vertical screens, and a complex surface expression. Drilling by UMEX Ltd. in 1972 indicates a very irregular, apparently sheeted, structure at depth. Andesite and diorite zones, 20 - 30 ft thick, occur in the upper 200 ft. Repeated intersections of 30 - 80 ft thick volcanic screens were made in the lower 300 ft. of drill hole DDH 72-10. Details are sketchy, but evidently an extremely complex relationship exists between the host andesite and diorite beyond a simple contact.

Due to the high contact surface area between the andesite and diorite, pyritic hornfelsing, with strong limonite weathering at the surface, is widespread. Volcanic bodies within the diorite and also peripheral to the known intrusive occurrences, display strong propylitic alteration.

The UMEX drill log reports fresh diorite throughout the drill interval. The 1990 mapping indicates rocks are in general fresher in the vicinity where drilling was undertaken than upslope towards the knoll. It is quite possible the drill collars are located peripheral to the strongest alteration zone which is more closely associated with the knoll and the immediate surrounding area. Based on the relationship between floodplain and drainage, Hoffman (1990) concludes that drilling tested a false anomaly of hydrologically transported Cu.

**Structure:**

The Emer Fault to the north of the mapping limit, and the Raven Fault to the south, appear to be strong regional features. Exposure is poor over the mapped portion of the ground, but local topography, combined with a few outcrops of chlorite schist, indicate the structures are 10 to 30 m wide.

Large blocky talus obscures bedrock along Raven Fault. Very minor exposure has been examined south of the fault, but the alteration to the north appears to be almost certainly fault bounded.

To the north, significant alteration terminates south of a clustering of outcrops near Emer Fault. This area appears to have undergone slumping, possibly along preexisting faults subsidiary to Emer Fault.

Numerous orange carbonate altered shears exist in the southwest portion of the grid area. Minor similar structures exist in the north central portion of the grid in the slump area. Minor galena and sphalerite is associated to the north (90-R-516-R).

On a larger scale, the northwest trending Raven Fault or a related subparallel structure may trend to the southeast crossing through the north end of East Emer Ridge. Similar widespread pyritic hornfelsing occurs there, accompanied by base-metal mineralized shears, anomalous gold and copper.

**Mineralization:**

A total of 35 rock and 1175 soil samples were collected from the immediate Raven Grid Area. The majority of rock samples represent typical low grade copper and base metal mineralization found on the property. A few were taken as blind grab samples in the early stages of investigation.

Copper mineralization occurs as minute disseminated chalcopyrite blebs within most monzonite porphyry dyke occurrences and locally within diorite and andesite found on the northwest flank of Raven Knoll. Host monzonite is generally fresh, but locally may display weak to moderate surface weathering. No chalcopyrite was noted in strongly weathered or leached rock. Malachite is virtually non-existent. It was found associated with one narrow, mineralized quartz vein. The most significant style of copper mineralization was found in several locations within the northern grid area. Chalcopyrite occurs with magnetite, pyrrhotite and pyrite as fracture-controlled blebs and pods up to 2 mm thick within recrystallized ash to crystal tuff. Vein selvages of pale green epidote/albite occur up to 1 cm wide in several samples. Mineralized fractures are closely spaced from 1 to 4 cm apart in fist-sized fragments. Larger pieces were not found so the true density is not known. These copper-rich fragment occurrences extend over a strike length of 600 - 700 m. The source area is not known, but the fragments appear to be local in origin. A very significant gold soil trend parallels this zone, 200 - 300 m south, indicating possible nearby gold/copper zonation in bedrock.

Galena and sphalerite are found in significant concentrations in outcrop at three localities. Near 102W/53+50N and 98+50W/51+25N, galena, sphalerite, and chalcopyrite are associated with limy shear zones. *Massive calcite and dolomite fragments up to 10 cm thick occur within greenschist.* These two occurrences are likely related to the Raven Fault or associated subsidiary shears. Minor galena was found disseminated in a narrow quartz vein with trace chalcopyrite and malachite near 95W/52+25N. Galena and sphalerite occur in carbonate altered boulders near 96W/63+00N. These boulders are up to 80 cm across and are found in a large frost boil located over a shear trend.

None of the base metal occurrences contain associated gold. While these showings are not in themselves large enough to be of economic grade, they may indicate the presence of:

1. Volcanogenic massive sulphides nearby.
2. Structurally-controlled base metal mineralization peripheral to a Cu-Au or Au porphyry system (which would be concurrent with a porphyry style model of mineralization).

Soil sampling led to the discovery of interesting elemental zonation and associations not previously recognized in the Raven Area. It is evident that low grade, multi-element zonation is present on a broad scale. Soil geochemistry is presented and discussed in detail in the accompanying report by Dr. S.J. Hoffman, 1990.

**Alteration:**

Widespread disseminated, fine grained pyrite accompanies propylitic alteration and local hornfelsing of the volcanics. Hornblende diorite displays weak pervasive propylitic alteration, and weak sericite development. The mafic component varies from 15 - 20% to 50% hornblende which may be moderately to strongly pseudomorphed by felted chlorite and granular epidote. Alteration is more evident between Raven Knoll and the prominent northeast-trending monzonite dyke to the southeast, coincident with copper and molybdenum geochemically enhanced soils.

Plagioclase dominates the felsic component and in thin section 1384-11 is relatively fresh with minor epidote dusting and associated rare quartz. A second lithological type in the same sample, displays stronger sericite and carbonate alteration along with complete alteration of the mafic component. Minor potassium feldspar occurs in the groundmass. Hairline microfractures contain epidote, potassium feldspar, sericite and minor quartz.

A very strongly bleached, sericite alteration zone outcrops in the northern slope of Raven Knoll at approximately 1900 m elevation. Exposure is limited. One speck of visible gold was possibly recognized. This sample did not return an anomalous gold value but subsequent soil sampling of the grid-area confirmed an elevated geochemical response for gold downslope of this area on both sides of this north trending spur.

Within 100 to 200 metres to the southeast of this sericite alteration zone, very little outcrop occurs. Predominantly finely laminated ash tuff occurs with lesser pyroxene basalt porphyry to the west. Contacts are not apparent. This particular area displays the most intensly shattered volcanics recognized on the property. Strong secondary epidote and chlorite within microfractures of a crackle-breccia aspect typify this area. Due to the lack of exposure, it is difficult to reliably distinguish between real hydrothermal alteration and simple weathering and frost-heave effects.

In a saddle between Raven Knoll and Raven Fault, a very strongly gossanous area approximately 150 x 50 metres exists as felsenmeer with minor small outcrops. Associated with the gossan are limy tuffs with strong galena and sphalerite, disseminated and as clumps, in sheared massive grey calcite with minor dolomite. Near the eastern perimeter of this gossan, numerous quartz blocks and local stockwork occur. These are essentially barren of mineralization with the exception of trace pyrite. Numerous slab-like blocks of ferricrete cemented, angular rock fragments are found locally and east along the banks of Raven Creek. Mapping in 1971 identified this tectonic breccia, however this origin is doubtful. Weak silicified breccia over 1 - 4 cm exists near rare quartz veins within Raven Creek, but it is very minor and of unknown significance.

**1990 Soil Survey:**

A variety of factors such as structure, lithology, alteration haloes, topography and metal associations are reflected in the elemental distribution and defined anomalous zones. Cu and Au values are plotted on Figures 10c and d. Figure 10e is a compilation of soil geochemistry. Threshold values are listed on Table 3.

There appears to be a distinct relationship between enhanced metal concentrations associated with dykes on the west side of Raven Knoll and the diorite stock emplaced in the south central portion of the grid area. Although blocky talus obscures much of the Raven Fault making examination difficult, it is apparent that the fault has played a role in focusing diorite emplacement. Efforts should concentrate in further outlining areas of known surficial mineralization in addition to investigating possible deeper sources with a porphyry style model in mind. Mineralization is widespead, found in both country and intrusive hosts. The property's potential cannot be over emphasized based upon these preliminary results.

**Au:** Gold is enhanced on the NW to N flanking slopes of Raven Knoll. Diorite of unspecified dimensions intrudes Takla volcanic rocks with local bleaching sericite alteration and rare pimary (cumulate?) banding occuring within the intrusion at one locality. Local float of monzonite with disseminated chalcopyrite has been found. Au is also enhanced along an E - NE trend east of the knoll associated with volcanic rocks locally intruded by diorite dykes up to 20 m wide. Associated pyritic contact halos and sheared contacts are evident. This area outlines the approximate northern contact of the main diorite stock.

**Ag:** Silver primarily occurs on the NW slope of Raven Knoll, near a known monzonite dyke occurrence, peripheral to Au and local multi-element basemetal anomalies. Diorite dykes are also prevalent but exposure is limited. Several spot anomalies exist in areas of no outcrop exposure in addition to the main diorite stock anomaly.

**As:** Arsenic is found peripheral to the main Au anomaly and more clearly spatially associated with basemetal accumulations. The area of the main diorite stock is highlighted in addition to the slope and grassy area west of Raven Knoll. The knoll was not soil sampled so the two zones could conceivably be linked. The anomalous area on the south side of North Arm has not been explained due to poor exposure.

**Sb:** Antimony closely parallels Ag occurrences with enhanced values associated with diorite and monzonite on the west flank of the knoll. It appears associated with a ferricrete occurrence south of the knoll. Local quartz stockwork and veins exist that have not been thoroughly sampled. Spot highs seem associated with the break in slope surrounding the knoll.

**Bi:** There are four areas of interest. Bi correlates with the known northern limit of diorite/monzonite float occurrence. There is no outcrop to confirm a relationship exists here. There is enhanced Bi in an area of elevated As, Ag, Sb values near the largest monzonite dyke in the centre of the main diorite stock. Local multisample highs exist within the NE portion of the grid, no outcrop exists to confirm an association with monzonite. A multi-element weak enhancement exists on the NW flank of the knoll, indicating a possible extension to the known limit of monzonite exposure.

**Cu:** Copper is asociated primarily with the main diorite stock. Several anomalies, to the immediate north of the main zone in an area of no rock exposure, may indicate diorite with associated Cu in bedrock. Several anomalous samples west of the knoll seem to confirm that areas of intrusive/volcanic contact exhibit greatest Cu potential. Cu is weakly enhanced over the main Au anomaly where a background of 75 ppm exists.

**Pb:** Lead in soils defines two 1500 X 400 m NW trending belts separated by a central 300 m wide zone of barren ground. The enriched band to the south corresponds with the southern portion of the main Cu anomaly. Pb is found enhanced on both sides of the Raven Fault. The western slope of Raven Knoll is moderately anomalous and may reflect continued extension from the main diorite intrusion. The linear belt in the north is interrupted by a conspicuously barren area that is coincident with the main Au anomaly. Much of the northern area is underlain by volcanic rocks.

**Zn:** Zinc is highly anomalous over a broad area to the west and south of Raven Knoll, coinciding with the southern half of the Au anomaly, the western margin of Cu, part of As, Ag, and Sb and peripheral to Pb. It is only weakly enhanced in areas downhill of the several known galena occurrences. A weakly anomalous belt of spotty highs parallels Emer Fault along the North Arm Raven Creek. Zn is likely widely detected due to the scavenging properties of Mn.

**Cd:** Cadmium is found central to the main Zn anomaly but most closely resembles the main Ag anomaly which coincides with strong As, Sb, Cu and Pb. It appears associated with diorite/monzonite intrusions in contact with the volcanics.

**Mo:** Molybdenum is outlined over the diorite stock correlating well with Cu, Fe, K, Ba and P. A second E - W trending anomalous zone is apparent across the north slope of the knoll. Most rock samples collected from within the Mo anomalous area returned elevated MoS2 concentrations, especially ones taken from quartz veins or that are weakly siliceous.

**W:** Tungsten displays an odd geochemical distribution and cannot be considered to reliably define W - bearing targets. A sampling artifact is possible.

**Fe:** A 700 m wide gossan of anomalous Fe concentration extends the full 1.6 km grid width across the southern half of the Raven Grid. This is bounded only by the Raven Fault in the south and interrupted by the unsampled peak of Raven Knoll. Fe ranges from 10 - 17%, corresponding closely with the pyritic hornfels halo associated with the diorite intrusion. Diorite contains 1 - 2% fine-grained pyrite locally. Ubiquituous limonite fracture staining exists. The volcanic rocks within the area outlined by high Fe values, are the primary source of Fe. Locally, ferricrete cements felsenmeer south of the knoll and along the upper banks of Raven Creek. the volcanic rocks on the northern half of the grid are primarily rust-free with only trace pyrite.

**Mn:** Manganese is concentrated on the south and west flanks of Raven Knoll extending partway over the Cu - Mo zone. It most closely resembles Zn distribution. Ni, Ba, Sr, Ca, As, Co and enhanced ph coincide, cross-cutting known lithologies.

**Co:** Typically Co is scavenged by Mn. A close parallel between the two anomaly pattern exists.

**Ni:** Nickel is scattered throughout the area primarily underlain by fresh volcanics. A conspicuous low exists over the main Cu - Mo enriched stock.

**Cr:** Chromium is enhanced only along the western margin of the grid. Amphibolite has been mapped in outcrop exposed along two drainage cuts. Presumably, enhanced mafic-related metals such as Cr and Ni are reflecting compositional differences in local volcanics. Very little outcrop occurs in this area of grassy rolling hills.

**V:** Vanadium is widely dispersed and shows no clear relationship with known geology. A cluster of high values at the headwater of Raven Creek may be related to local abundant ferricrete.

**Ba:** The highest Ba values were returned from a Pb - Zn bearing carbonate shear spatially associated with a narrow monzonite dyke in the SW corner of the grid. It is likely replacing fault related carbonate. Ba is more widespread where it overlies the main Cu - Mo enhanced diorite stock. A strong association with Ni, Zn and Sr along North Arm Raven Creek has not been explained geologically. The area remains unmapped. On the advice of Dr. Hoffman, all samples with +399 ppm Ba were reanalysed by atomic absorption to test for barite. Reanalyses confirmed the earlier ICP results and the preesence of barite is unlikely.

**Sr:** Strontium is widespread over the grid area. It locally parallels other distribution patterns such as those of Ni, Zn and Ba along North Arm, the Cu - Mo diorite stock and portions of the Au trend. Overall it most closely parallels Ca but only away from the Cu - Mo zone. Overall the stock Ca is low and Sr is high.

**Ca**: The main Ca soil anomaly trends NW through the central portion of the grid over an elongate area 300 m X 1400 m. It coincides with the northern end of the NE trending Au anomaly and with distinct lows of Zn, Fe, Mn, Co and Mg. It possibly reflects bedrock lithology but little exposure exists in the area to confirm this. Low Ca values coincide with the diorite stock.

**ph**: ph varies widely within the grid area and is not seen to distinctly reflect bedorck lithology. Alkaline values coincide with high As, Zn, Mn, Co and Ni in particular.

**Al**: Aluminum distribution is widespread and crosses all lithologies. No clear relationship with other elements is evident, although Mg, Ni, Zn and Cr anomalies coincide with Al on the western portion of the grid.

**K**: Potassium clearly outlines the main Cu - Mo diorite stock. Only a few isolated anomalies exist beyond this area. Few rock samples were collected from this immediate area. High K values returned from lines 97W and 98W on the south flank of the knoll may reflect diorite dykes trending away from the main body. Diorite on the north flank of the knoll is not reflected by K suggesting that the diorite is much less prevalent than currently believed or else a separate K-rich phase exists only within or associated with the main stock. Multiple intrusions may exist here at depth. K is presumably reflecting secondary alteration and not primary lithologies.

**Ti**: Titanium is weakly to moderately enhanced over the main diorite stock as well over the main Au anomaly. It is widespread across areas of relatively low elevation. Areas of secondary enhancement are likely being highlighted.

**P**: Phosphorous is primarily concentrated over the main diorite stock as well being associated with dykes west and north of Raven Knoll.

The soil survey has clearly been successful in outlining areas within Raven Grid that deserve further examination. More detailed mapping is needed to follow up results obtained from the current program. Detailed geophysical work will likely aid in defining potential mineralized targets. Chip sampling may also aid in further definition of areas of interest but due to the thick gossanous surface, true metal concentrations or styles of mineralization cannot be determined without sampling fresh rock. There appear to be distinct metallogical zonations and associations that are described in more detail by Hoffman (1990).

**Lithogeochemistry:**

Forty one rock samples were collected from the Raven Grid and immediate surrounding area. They are representative of lithological units, with or without visible mineralization, as well as specific styles of mineralization encountered. Four were sent for thin section analysis.

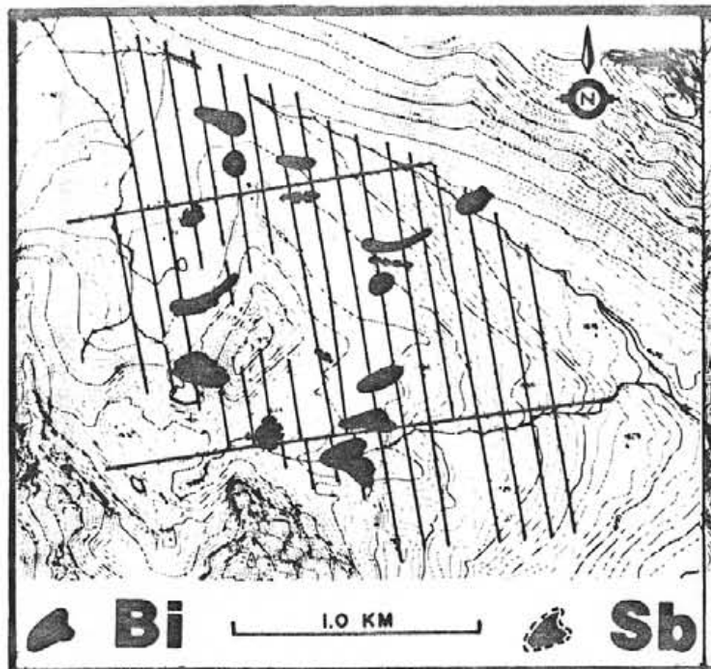
Most samples returned results lower than soil threshold values indicated for background or near background concentrations of metals and pathfinder elements. Only five samples returned significantly anomalous multi-element values. Analytical results for Cu and Au are plotted on Figures 10 c and d.

**Au:** Seven samples >100 ppb Au, three are above soil threshold. R524R returned 1040 ppb Au which is lower than several high soil results returned from a calcite, dolomite, quartz shear with minor chalcopyrite. Significant galena, sphalerite occurs locally within this NW trending shear. No rocks from within the main Au soil anomaly trend returned significant Au valves. The source remains unknown.

**Ag:** Two samples returned significant Ag values, one from within the main Ag soil anomaly on the west-facing slope of Raven Knoll. A strongly limonitic pyritic andesite/diorite contact immediately upslope from the main Ag soil anomaly returned 4.2 ppm Ag with associated 120 ppb Au. This value is comparable to a high Ag soil anomaly. The most significant anomaly of 22.1 ppm Ag, local trace chalcopyrite, malachite in quartz (A145R) is not reflected in the soil results. A few samples 100 m away returned 2 ppm Ag.

**As:** Four samples returned interesting As values. Pyritic andesite sampled in the area west of Raven Knoll returned 46 ppm As in one sample. The rock samples taken don't reflect the much higher As values generally returned in soils. Either secondary enrichment has taken place, or more likely, the source has not been found. Sample R552R returned 203 ppm As. This is probably the singularly most interesting rock sample from the grid area and represents relatively fresh rock from the north bank of Raven Creek in the vicinity of the large multi-element geochemical anomaly. Sample R512R returned 438 ppm As from a contact between rusty and fresh pyroxene porphyry. Sample R524R returned 235 As along with 3070 ppm Pb, 16240 ppm Zn, 103 ppm Cd, 5635 ppm Mn, 1382 ppm Ba.

**Cu:** Four samples returned Cu values greater than threshold for soil, three are equivalent to moderate soil anomalies. Sample R550R, a footwall shear to a monzonite dyke in the SW corner of the grid (R550) returned 463 ppm Cu, 10219 ppm Pb, 1506 ppm Ba. Quartz talus (R145) returned 529 ppm Cu, 100 ppb Au, 202 ppm Pb, 55 ppb Mo, and 22.1 ppm Ag. Sample R552R from Raven Creek returned 730 ppm Cu, 130 ppb Au, 157 ppm Mo, 203 ppm As, 53 ppm W. From a contact between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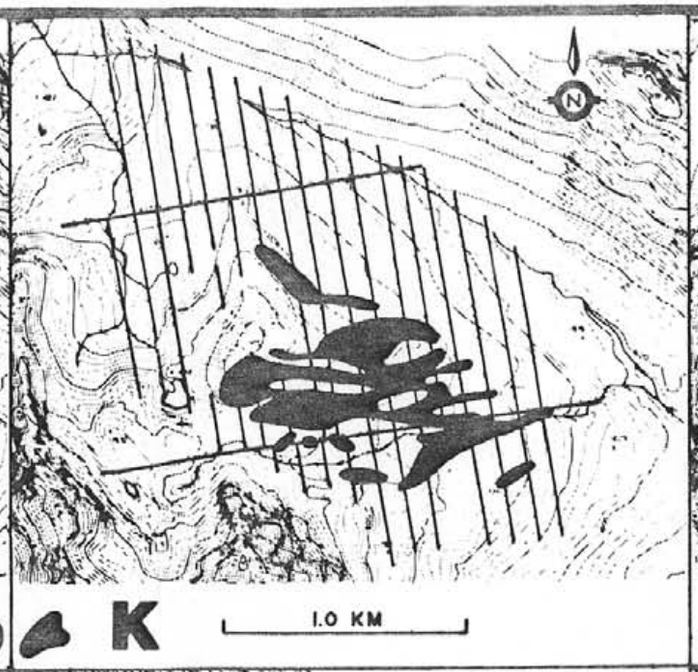
Sb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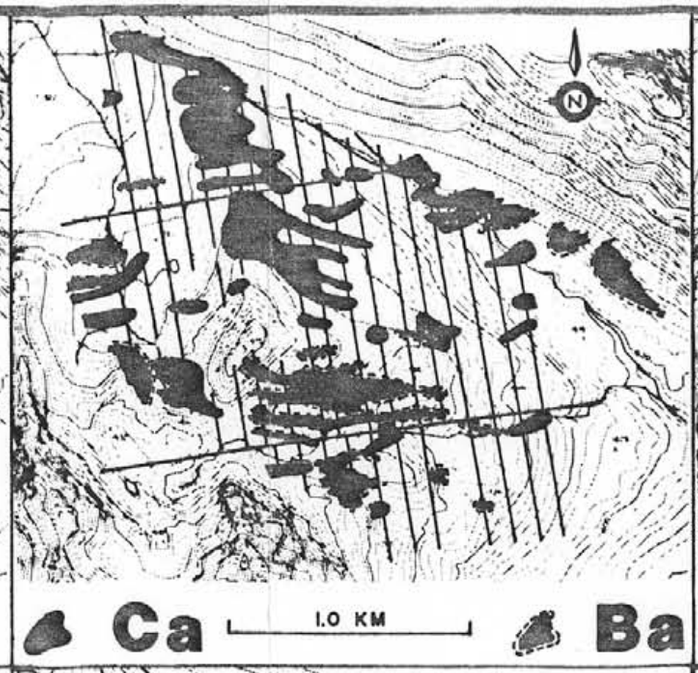
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Ba


Sr
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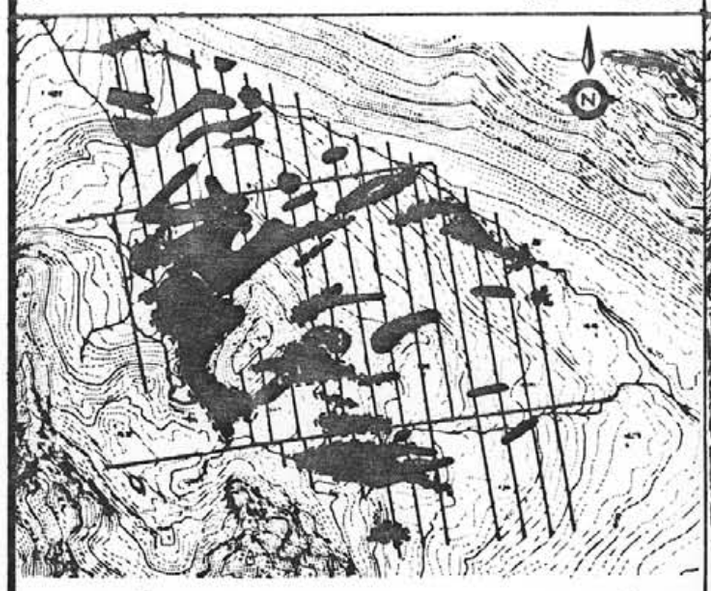
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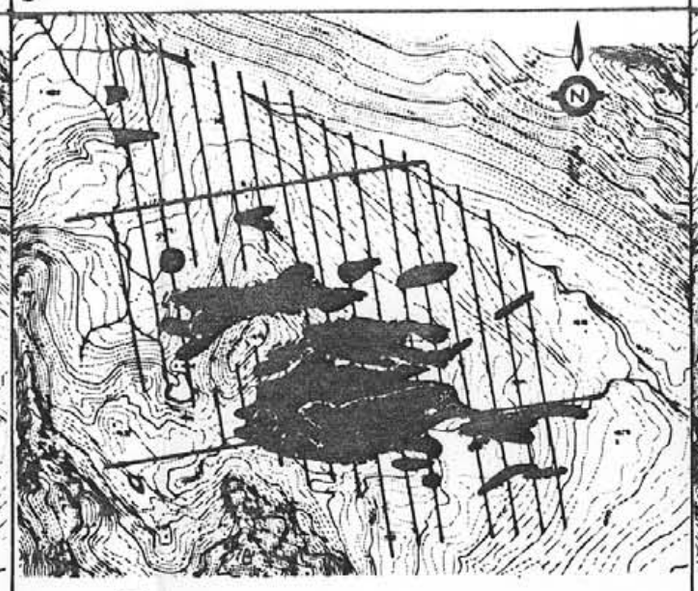
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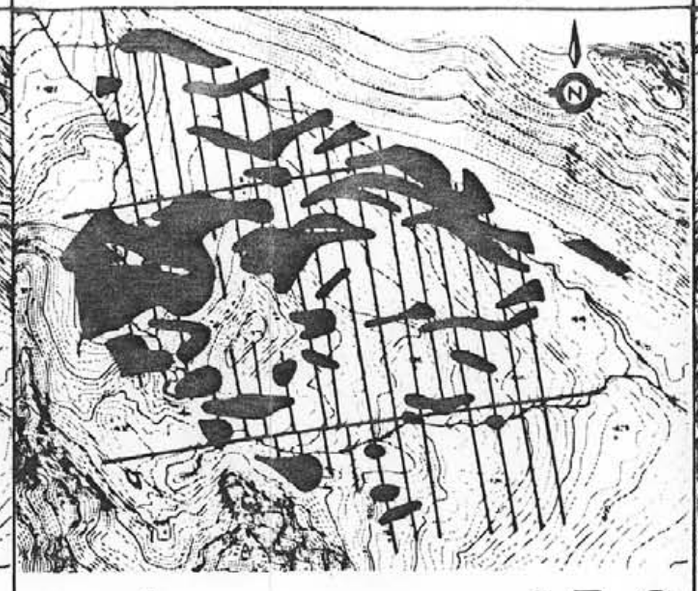
Mo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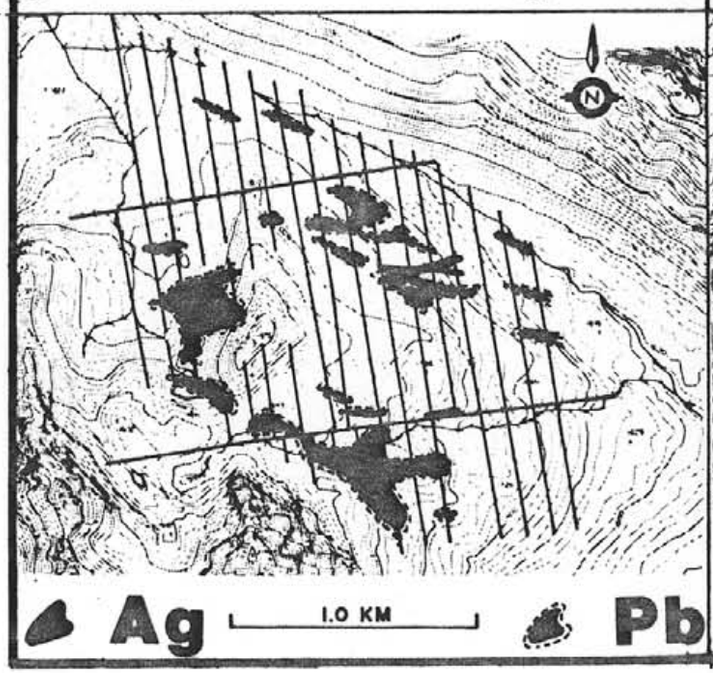
1.0 KM
+5.3


Mg
1.0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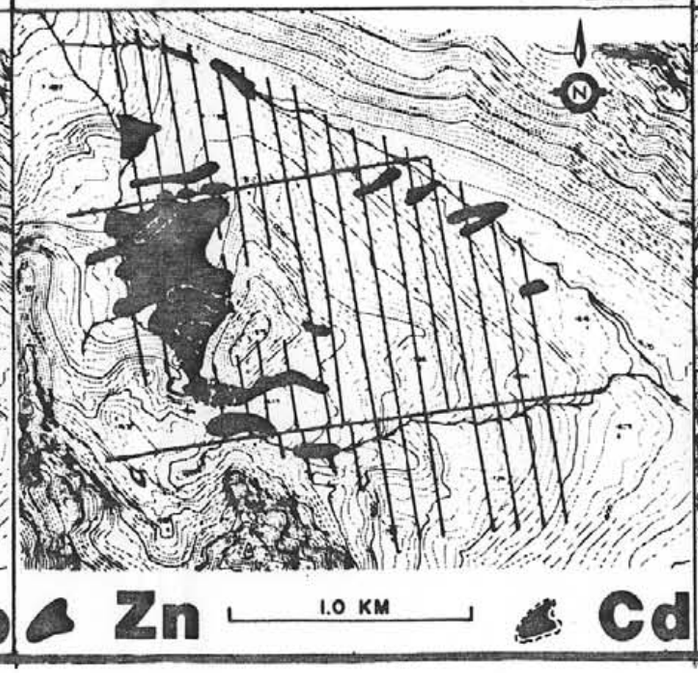
Pb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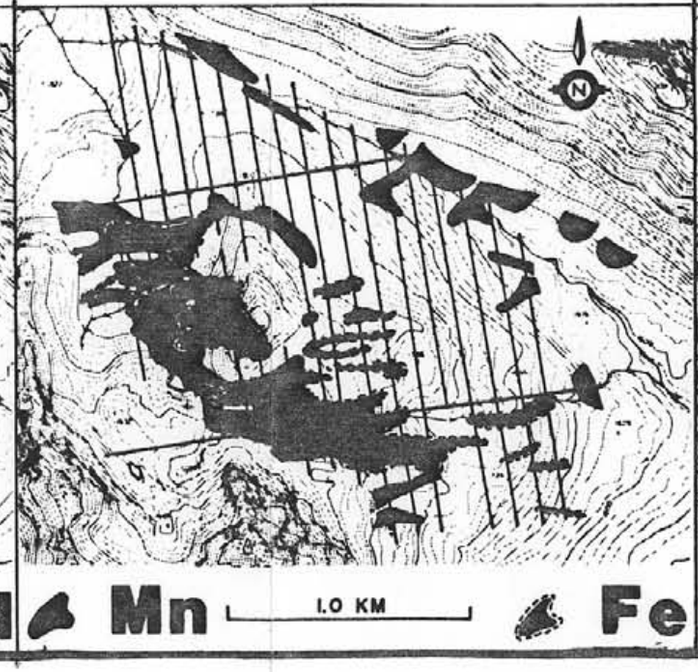
Cd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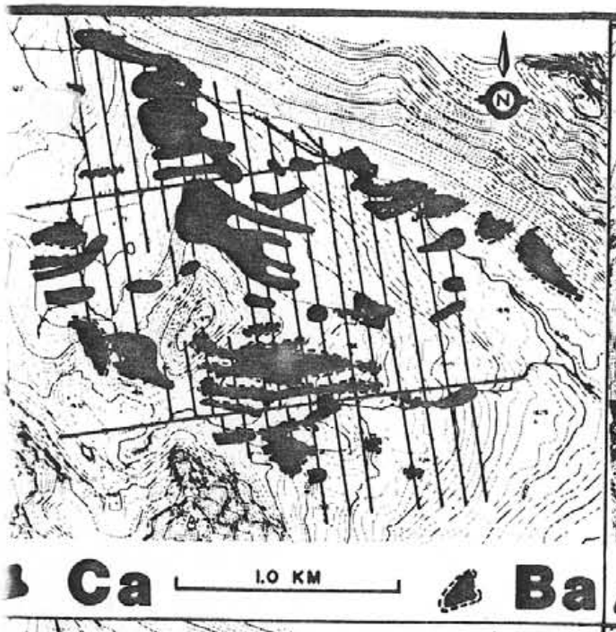
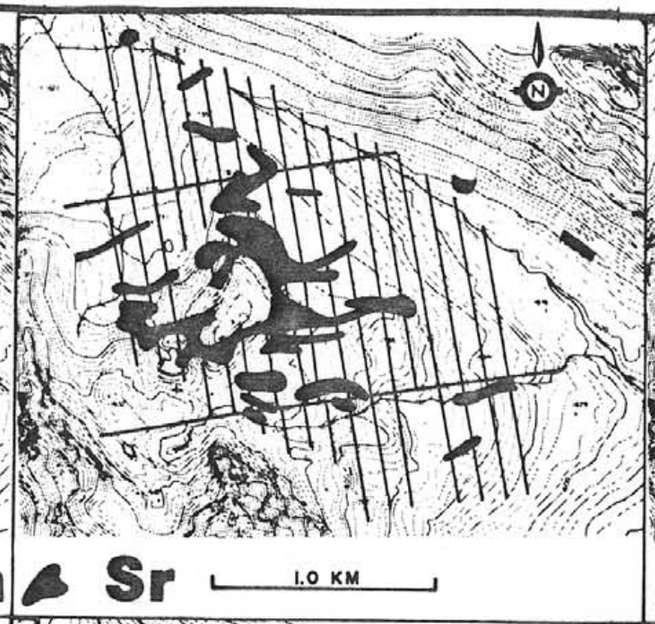
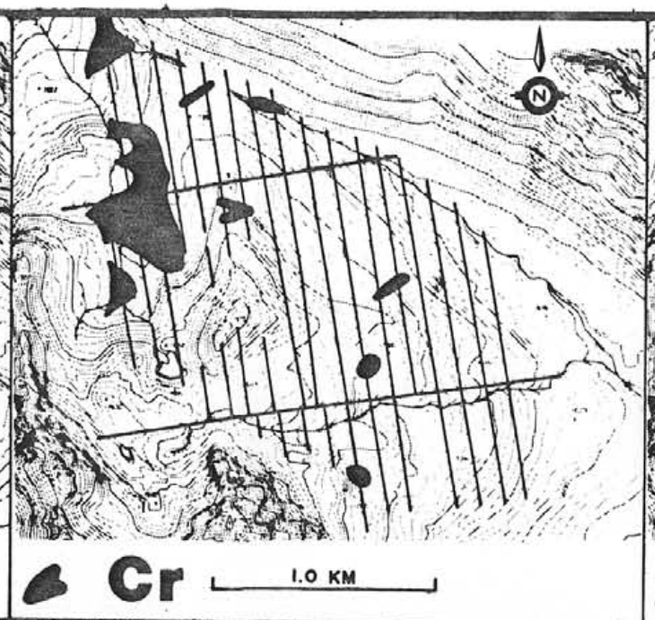
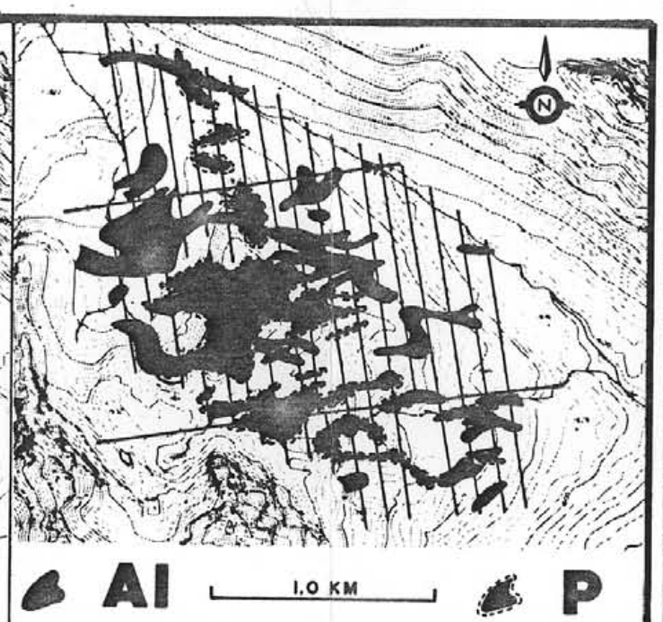
Fe

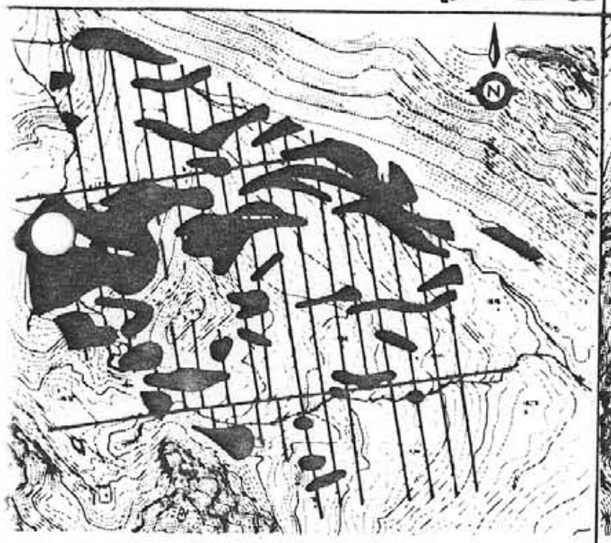

La
1.0 K

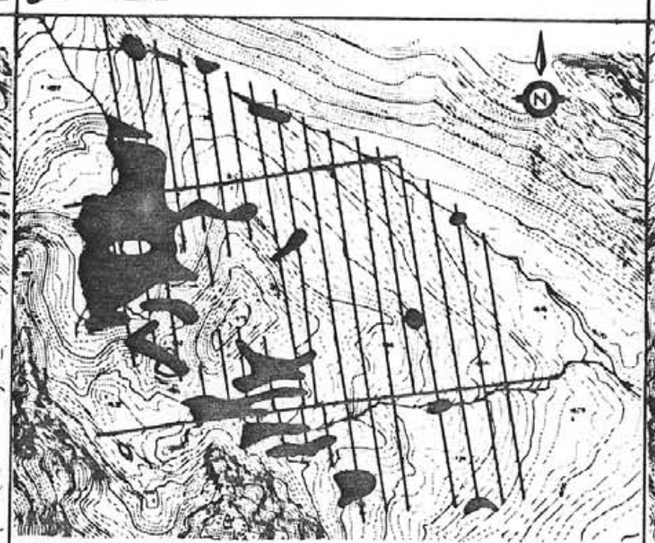


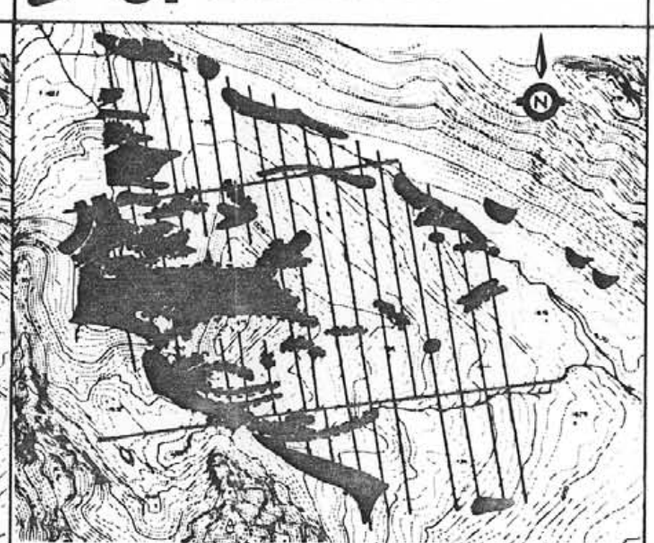



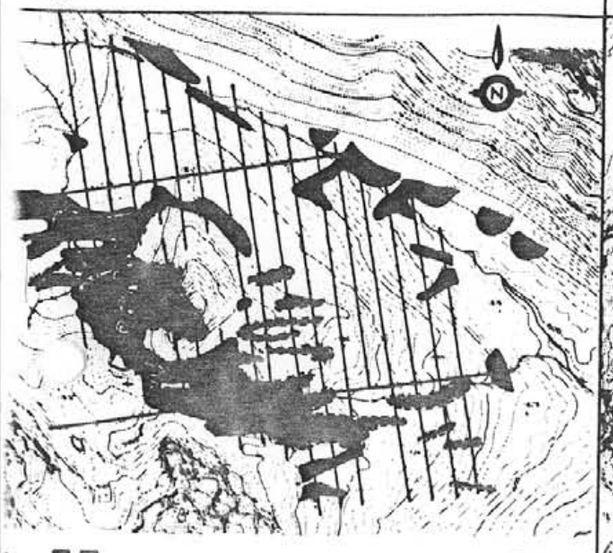



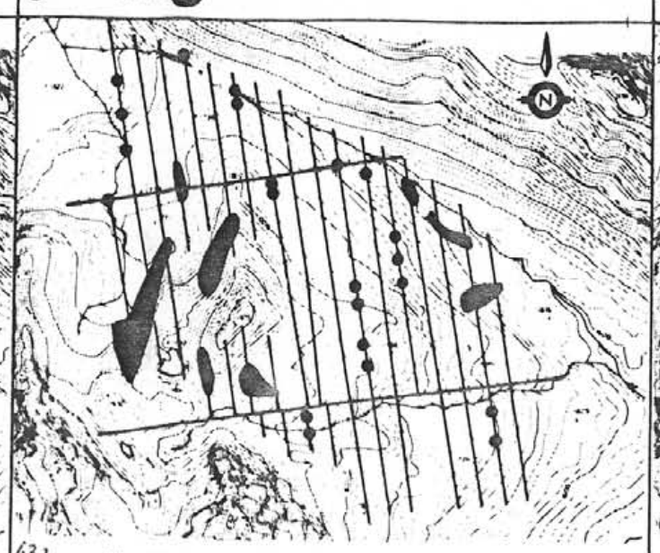





*All data except La, from Hoffman 1990.*

FIGURE 10e

TECK EXPLORATIONS LTD.

PORPHYRY CREEK PROJECT 1384

**RAVEN GRID**

# ANOMALY SUMMARY SOIL GEOCHEMISTRY

To accompany report by L. Grexton and P. Roberts, October 1990

NTS 94G/5,12

diorite and propylitically altered andesite, R553R returned 2217 ppm Cu, the best copper mineralization discovered. Only background Cu values were returned in soils from this area. R553R represents chalcopyrite, pyrrhotite, magnetite as weakly banded to multiphase fracture-filling up to 2 mm wide. This style of mineralization was found in several float blocks within the northern part of the grid.

**Pb**: Four samples returned Pb values of significance. A145R is equivalent to a weak to moderate soil anomaly, with 202 ppm Pb from quartz talus associated with 100 ppm Au, 22.1 ppm Ag, 529 ppm Ca, 55 ppm Mo. The other three are highgrade samples from galena, sphalerite, chalcopyrite, pyrite mineralized carbonate quartz shears. A monzonite dyke footwall shear returned 10224 ppm Pb with 463 ppm Cu (R550R). No soil anomaly is associated with mineralization in this area (L102W,52 + 75N). R516R returned 4086 ppm Pb with strong Zn in quartz carbonate (local?) float blocks from the northwestern grid area where a local weak soil anomaly exists downhill to the north. R524R returned 3070 ppm Pb with 16240 ppm Zn, 103 ppm Cd, 1382 ppm Ba.

**Zn**: Three samples with anomalous Zn concentrations were collected. R516R with 17620 ppm Zn, 4086 ppm Pb, 177 ppm Cd and 33 ppm Sb represents quartz, carbonate altered frost heave boulders from the northern portion of the Raven grid. R518R from a limonitic shear within aphanitic dark green andesite returned 1080 ppm Zn along with 557 ppm Ba and 360 ppm Au. Sphalerite was not observed. This represents a possible source area for the large Zn soil anomaly immediately down slope, R524R returned 16240 ppm Zn along with anomalous Pb, As, Cd, Mn and Ba.

**Mo**: Five samples are significantly anomalous in Mo. Four of these are from within the area represented by Cu - Mo in soils. A134R returned 42 ppm Mo from quartz talus. A145R returned 55 ppm Mo with 100 ppb Au, 22.1 ppm Ag, 529 ppm Ca, 202 ppm Pb and 53 ppm W from quartz talus. R552R returned 157 ppm Mo from a hornblende diorite/pyritic andesite contact from within Raven Creek. R525R returned 89 ppm Mo from milky white quartz felsenmeer. Attached wallrock vestiges indicates diorite host. R507R collected from the southern spur of Raven Knoll is from beyond the main Mo soil anomaly but may indicate a source area for Mo in soils on the west side of Raven Knoll. This sample is from a very rusty quartz sericite clay alteration zone 20 cm wide from within a NW trending plagioclase porphyry diorite dyke.

**W**: One sample, R552R returned 53 ppm W which is considered highly anomalous within the Raven Creek area. No soils returned greater than 2 ppm.

**Ba:** Five samples, R505R, 506R, 507R, 518R, 522R returned elevated Ba results from 355 - 678 ppm which are equivalent to anomalous soil values. Two samples are clearly anomalous for rocks. R524R returned 1382 ppm Ba along with highly anomalous Pb, Zn values. R550R returned 1506 ppm Ba with strong Pb, Zn, Cu locally occurring in a carbonate shear.

For many elements, rock samples generally returned values lower than expected. Strong surface leaching likely partially responsible. More detailed surface sampling may help further define anomalous zones as well as find new sources for metals such as Zn that have not been fully explained. Until fresh rock is excavated and pits are dug in overburden covered areas can anomalous zones be considered to be properly sampled.

## STATEMENT OF COSTS

**FIELD WORK** (June 25 - September 27, 1990):

| | |
|---|---|
| Equipment and Supplies | $26,163.48 |
| Drafting | 7,061.97 |
| Aircraft Charter | |
| Fixed-Wing | 6,499.41 |
| Helicopter | 70,348.64 |
| Expediting | 3,374.76 |
| Radio, Telephone, Fax | 7,687.06 |
| Assay, Analyses | 32,106.62 |
| Groceries, Meals | 10,355.41 |
| Truck Rental, Fuel, Maintenance | 10,501.26 |
| Salaries | 89,635.00 |
| Shipping | 1,518.61 |
| | $265,252.22 |

**REPORT PREPARATION** (September 28, 1990 - March 31, 1991):

| | |
|---|---|
| Salaries | $40,649.40 |
| Drafting | 4,857.94 |
| Reproductions | 4,931.96 |
| | $50,439.30 |

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# APPENDIX III

***Detailed Rock Unit Descriptions***

WEST HALF

Kliyul Creek Pluton

QUARTZ DIORITE TO GRANODIORITE COMPOSITION — Porphyry Ridge (South Side)

- light grey, medium-grained, non-magnetic, noncalcareous
- equigranular intergrown plagioclase, quartz, K-spar, biotite, fresh
- body is zoned with increasing K-spar, decreasing biotite toward northern contact with volcanics; grain size decreases toward contact.

**MAFIC MINERALS:**

biotite:
- 3 - 5%, black ± chl intergrowths 2 - 3 mm across as thin books, as foliated pockets interstitial to plagioclase, intergrown with quartz, fresh, primary.

**FELSIC MINERALS:**

plagioclase:
- 57%, light grey, 0.5 - 3.0 mm subhedral grains, fresh to weak replacement by elongate coarse sericite flakes.

K-spar:
- 8 - 10% - varies, increases towards margin, pale pinkish orange, 0.5 - 3.0 m sporadic grains, irregular segregations, Perthitic, fresh occasional c.g. K-spar veinlets.

quartz:
- 28% anhedral grains 0.5 - 3.0mm to locally ≥0.5 mm quartz phenocrysts in slightly finer grained matrix.

muscovite:
- 2% - rare, grades from 1 - 2 mm to sericite-size.
- establishes rock as belonging to trondhjemite class.

**MINERALIZATION:**
- trace pyrite locally.

**ALTERATION:**
- biotite variably altered to chl. K-spar - locally remobilized into c.g. equigranular veinlets.

**VEINS:**
- locally sheeted fracture cleavage but generally massive.
- no significant quartz veins or other mineralized structures.

**WEATHERING:**
- very thin pale orange crust; smooth, minor lichen locally, very similar to fresh surface.

**COMMENTS:**
- see also thin section report 90-R-172-R (T.S. 1384-7) whole rock analysis also. Border phase, 90-M-121-WR.

FINE-GRAINED QUARTZ DIORITE

**Biotite alteration zone near Kliyul Creek Pluton.**

- mottled medium to dark green, fine grained, highly fractured, recrystallized, rock, part of hornfels aureole surrounding Kliyul Creek Pluton. This unit was mapped as belonging to Volcanic Suite. See thin section 1384 - 6 (90-R-168R).

**MAFIC MINERALS:**

biotite: - 10% strongly concentrated around epidote clumps and as meshwork aggregates of small euhedral crystals, locally intergrown with epidote and hornblende. Weakly altered to chlorite, rutile.

hornblende: - 6% occurs as aggregate crystals rimming epidote clumps, recrystallized acircular needle clusters x-cut local fabric.

epidote: - 30% subprismatic clumps 0.1 to several mm across of aggregate grains, grades to coarse grained aggregates locally.

**FELSIC MINERALS:**

plagioclase: - 40% aggregates of subhedral 0.1 - 1.0 mm grains, grades to interstitial felsite.

quartz: - 15% irregular equant grains isolated or in polygranular patches - pale sky blue - opalescent? in character.

**MINERALIZATION:**

- pyrite trace, fine grained

**ALTERATION:**

- this sample is strongly epidotized with minor chlorite associated. In handspecimen and thin sections, obvious unusual meshwork fabric is developed. The T.S. report indicates "obvious igneous origin", however this is not at all evident in the field.
- sample was collected because of its unusual texture and quartz content and appeared to be quite restricted in extent. Nearby a strong dark purple-hued (biotite?) volcanic? was more prevalent.
- true extent and importance unknown.
- biotite alteration is strong due to Kliyul Creek Pluton and related to biotite of the Lady Diana Showing.

**WEATHERING:**

- occurs on a steep slope with moderate rock failure, fairly fresh, strong lichen cover mimics rock texture making mapping difficult.

**COMMENTS:**

- little is known of this unit or its extent. Possibly of intrusive origin but likely recrystallized, hornfelsed volcanic.

Croydon Pluton

HORNBLENDE SYENODIORITE — Porphyry Creek Ridge

- medium grained grey green, strong mafic/felsic segregation; equigranular subhedral, crystals 0.5 - 5.0 mm across; weak preferential fabric locally developed - related to flow emplacement; relatively fresh, particularly the mafic component.
- weakly magnetic, noncalcareous.

**MAFIC MINERALS:**

hornblende:
- 30% dark green, ragged irregular grains, clumps, occasionally incorporates plagioclase, fresh with local chlorite and minor epidote alteration.
- local chlorite, epidote as anastomosing microfractures.

**FELSIC MINERALS:**

plagioclase:
- 40% 0.5 - 4.0 mm closely packed subhedral prismatic grains, weak prefered orientation, weak to moderate saussuritization as dustings of sericite and epidote.

K-spar:
- 15 - 20% interstitial to plagioclase and hornblende crystals, slightly coarser than associated quartz.

quartz:
- 3 - 5% as interstital microgranular grains associated with interstitial K-spar.

**MINERALIZATION:**
- pyrite trace to 1%, few samples of this unit taken, but generally poorly mineralized. Well mineralized structures and quartz veins common.

**ALTERATION:**
- 10% saussurite, 3% chlorite, 3% epidote associated with plagioclase alteration.
- horblende fairly fresh.

**WEATHERING:**
- generally fresh; may have abundant lichen locally.

**COMMENTS:**
- highly variable unit, gradational to intrusive breccia, hornblendite, appinite, and various other previously mapped and described subunits.

MONZONITE (LATITE PORPHYRY DYKES)

South of South Bear Creek Fault adjacent to Kliyul Creek Pluton along northeast contact

- pale grey, medium-grained, conspicuous plagioclase phenocrysts up to 0.5cm make up 10-20% of rock; may show concentric zonation, overgrowths.
- porphyritic with microgranular intergrowths of plagioclase, K-spar.
- fresh.

**MAFIC MINERALS:**

hornblende: - 10 - 30%, may be altered to chlorite, epidote, and calcite, local magnetite, of fresh to strongly altered.

biotite: - 2 - 3%, strongly altered to chlorite.

**FELSIC MINERALS:**

plagioclase: - 40 - 50%, grey, 0.5 - 4.0 mm phenocrysts 15% by volume, 0.01 - 0.2 mm as microgranular intergrowths with K-spar weakly altered to epidote locally.

K-spar: - 30%, 0.01 - 0.2 mm anhedral crystals intergrown with plagioclase, may be locally fibrous rimming plagioclase.

**MINERALIZATION:** - trace to 1% pyrite locally 10%, generally enriched along mafic/felsic margins where >25% hornblende.

**ALTERATION:** - hornblende variably altered to chlorite, epidote, calcite, locally weak magnetite as fine-grained crystals within hornblende. Plagioclase may be dusted with sericite, epidote. Zoned plagioclase crystals may show internal alteration with preserved outer shells.

**WEATHERING:** - relatively fresh, rough surface with thin bleached crust.

**COMMENTS:** - likely local heat source for Po in adjacent volcanics; may be responsible for K-spar/biotite alteration along Kliyul Pluton/Takla Volcanic contact.

GRANOPHYRIC QUARTZ MONZONITE PORPHYRY (DYKES - NNE - STEEP)

Either side of North Bear Creek fault, small exposure north of Karen fault, on Porphyry Ridge.

- mottled creamy white green to pale to medium orange, dark hematite-red in granophyre locally; aphanitic to fine grained porphyry to nearly equigranular. Locally very grungy, strongly altered to moderately fresh.
- host to amygdaloidal basalt dykes.

**MAFIC MINERALS:**
- 8 - 10% completely altered to irregular clumps of chlorite and epidote, with or without carbonate - hornblende and lesser biotite likely primary mafics.

**FELSIC MINERALS:**

plagioclase:
- 20 - 30% as 0.5 - 4.5 mm subhedral phenocrysts strongly saussuritizied or as sericite, clay, epidote pseudomorphs.

K-spar:
- 15 - 30% mainly as granophyre component
- fresh, blocky anhedral grains to microgranular aggregates, may be rimmed by granophyre, minor intergrown chlorite, sericite.

quartz:
- 10% 0.05 - 0.2 mm, granular component of granophyre, or as pockets of anhedral secondary blebs.

carbonate:
- trace - 2% - alteration product of hornblende.
- rare irregular pockets coarse-grained, sparry calcite.

**MINERALIZATION:**
- minor disseminated cpy in occurrence that butts against North Bear Creek Fault. Mineralization is likely related to the main fault, occurring within microfractures.
- locally; footwall structural-related on Porphyry Ridge.
- near Karen Fault, barren; occasional trace pyrite

**WEATHERING:**
- often very crumbly, thin bleached crust.

**COMMENTS:**
- dykes predate NW trending faults, offsets could conceivably be used to determine fault dispacements. T.S. 1384-14 samples R-127R, R-132-12.

Croydon Creek Pluton

**QUARTZ DIORITE**

**Head of Porphyry Creek in saddle and along Croydon Ridge**

- *medium grey green, fine to medium grained, hypidiomorphic granular commonly subporphyrytic (hornblende), non-magnetic varies locally to strongly (patchy) magnetic; spotty, weakly calcareous.*

**MAFIC MINERALS:** hornblende: - 40%, dark green, fine to medium grained locally medium to coarse grained, subhedral to euhedral, varies to 75% (crowded).

**FELSIC MINERALS:** quartz: - anhedral, maxmium 10%, generally not readily apparent in finer grained sections.

feldspar/ quartz: - mixed, bulk of rock, interstitial to hornblende.

**MINERALIZATION:**
- pyrite trace disseminated; locally as 1 to 2% on hornblende.
- magnetite varies 0 to 3%, very fine grained, disseminated locally 10%.

**ALTERATION:**
- hornblende commonly weak pervasive chloritization. Feldspar weak to moderate saussuritization commonly strongest along calcareous fracture fillings. Pyrite locally replacing hornblende.

**WEATHERS:**
- blocky, smooth, dark grey, moderate lichen cover.

**COMMENTS:**
- pyrite growth on hornblende implies introduction of S.
- minor limonite fractures.
- appearance in cliff in Shell Cirque is suggestive of a sill (?).

## Dykes

**FELDSPAR QUARTZ DIORITE PORPHYRY DYKE** **Croydon Ridge**

- medium greenish grey, fine to very fine grained, porphyrytic; weakly calcareous around mafic minerals.

**MAFIC MINERALS:** hornblende: - 25 to 30%, medium to dark green, subhedral to euhedral, elongated, somewhat decussate.

**FELSIC MINERALS:** plagioclase: - 2 to 5%, light greenish, fine grained, 1.5 to 3.5 mm, anhedral to subhedral, hazy grain boundaries.

quartz/ feldspar: - very fine grained, interstitial to hornblende

**MINERALIZATION:** - pyrite rare, very fine grained, disseminated.

**ALTERATION:** - hornblende moderate, pervasive chloritization, plagioclase.

**WEATHERS:** - small angular, blocky cobbles with pinkish (dolomitic?) hue.

**COMMENTS:** - 15m wide, 092°/70° S, contacts distinct to sharp.

**QUARTZ DIORITE DYKE** **Croydon Ridge**

- medium greenish grey, fine grained, equigranular to weakly porphyrytic, hypidiomorphic-granular.

**MAFIC MINERALS:** hornblende: - 25%, fine to medium grained, 1 mm to 2.5 mm subhedral and some anhedral aggregates.

**FELSIC MINERALS:** quartz: - 10%, anhedral white.

feldspar: - bulk of rock, fine grained, anhedral interstitial to hornblende, probably mixed with some quartz.

**COMMENTS:** - mafic content variable, either somewhat poorly differentiated or erratic occurrence of large volcanic, strongly digested, fragments.
- poorly documented.

HORNBLENDE DACITE (dyke?) **Croydon Ridge**

- medium pinkish green, porphyry to subvolcanic, nonmagnetic.

**MAFIC MINERALS:** hornblende: - 10 to 15%, subhedral and anhedral.

**MATRIX:** - pinkish to greenish very fine grained to aphanitic, felsic.

**ALTERATION:**
- hornblende weak to moderately chloritized, pervasive.
- commonly altered to hematite as rare very fine disseminations, most as distinct pink hue.

**COMMENTS:**
- minimum 1 m wide.
- very fine calcareous fracture fillings common (G144R).

**ANDESITE - DACITE (subvolcanic) DYKE** **Croydon Ridge**

- medium greenish grey, very fine grained to aphanitic, subporphyrytic.

**MAFIC MINERALS:** hornblende: - < 10%, very fine elongated, deccusate, subhedral to euhedral.

**FELSIC MINERALS:** feldspar: - 3 to 5%, 2 mm maximum, hazy margins.

**MATRIX:** - medium to light grey, forms bulk of rock.

**COMMENTS:** - minimum 6 m wide.

HORNBLENDE FELDSPAR DACITE PORPHYRY DYKE — Croydon Ridge

- light to medium greenish grey, very fine grained, porphyrytic moderately well fractured, fairly fresh, nonmagnetic, strongly calcareous.

**MAFIC MINERALS:** hornblende: - 25%, very fine grained, subdecussate, thin elongated grains, 3 mm.

**FELSIC MINERALS:** plagioclase: - 2% pale greenish, 3 to 4 mm, anhedral weakly hazy margins.

**MATRIX:** - bulk of rock, white to pale greenish, siliceous.

**MINERALIZATION:** - pyrite trace, disseminated, very fine grained, weak to moderately rusty.

**COMMENTS:** - strongly sheared Fw in volcanics (2 m wide), moderately sheared HW (maximum about 40 cm wide).

DACITE DYKE — Croydon Ridge

- light grey, weakly magnetic, weakly calcareous (along hairline fractures).

**MAFIC MINERALS:** biotite: - 8%, very fine grained.
hornblende: - ?, remnant.

**MATRIX:** - quartz-feldspar (felsic) mixture; very fine grained to aphanitic.

**MINERALIZATION:** - magnetite 2%, very fine grained, disseminated.

**ALTERATION:** - chloritized biotite replaces intensely chloritized hornblende.

**WEATHERS:** - medium greyish brown, finely blocky.

**COMMENTS:** - 080°/ steep S.

GRANODIORITE DYKE — Croydon Ridge

- light grey, fine to medium grained, spotty weakly magnetic.

**MAFIC MINERALS:** biotite: - 20%, fine to medium grained aggregates.
hornblende: - remnant.

**FELSIC MINERALS:** feldspar: - 30%, anhedral to subhedral locally euhedral.

**ALTERATION:**
- biotite replacing moderately to intensely chloritized hornblende.
- weak epidote (saussuritization) spotty.

**COMMENTS:**
- contact distinct, fining.
- related to Dacite dyke with biotite with respect to time of emplacement and parent (?).

HORNBLENDE BIOTITE DACITE DYKE — Croydon Ridge

- light grey, weak to moderately calcareous, weak to moderately magnetic.

**MAFIC MINERALS:** biotite: - very fine grained, dark brown, fresh, secondary.
hornblende: - remnants only, total mafics < 12%.

**MATRIX:** - medium to light greyish green, siliceous; indistinct feldspar.

**MINERALIZATION:** - pyrite 2 to 3%, extremely fine grained, disseminated.

**ALTERATION:**
- hornblende intensely chloritized and removed, replaced by biotite and calcite.
- feldspar possible clay alteration (?).

**COMMENTS:** - calcareous fracture fillings; in shear 030°/70° SE.

Takla Group

PYROXENE BASALT PORPHYRY

Porphyry Ridge
Emer Last Ridge, North
and South Sarah Cirques

- widespread occurrence.
- variable medium to dark chlorite/epidote green; aphanitic to fine grained matrix host pale yellow-green subhedral plagioclase phenocrysts with lesser medium to coarse grained euhedral pyroxene phenocrysts, generally fresh, may be weakly propylitically altered, pyroxene may be replaced by hornblende locally magnetic; noncalcareous.

**MAFIC MINERALS:**

pyroxene: - 30%, 0.5 - 10.0mm, subhedral to euhedral, occassionally broken phenocrysts, may be pseudomorphed by finer grained aggregates of hornblende; crystals are often more prominent on the weathered surface.

biotite: - local, secondary; 5 - 20%, related to Kliyul Pluton contact metamorphism.

**FELSIC MINERALS:**

plagioclase: - 15 - 60% (depending on degree of alteration) found as fine grained anhedral phenocrysts moderately to strongly epidotized, also as aphanitic groundmass component along with minor quartz.

quartz: - 4 - 5% as densely packed micrograins in groundmass.

carbonate: - may occur locally in microfractures as late alteration by product.

**MINERALIZATION:**

- pyrite trace to 2% fine grained disseminated euhedral.
- chalcopyrite local, usually with malachite, azurite; fault and fracture related, rarely disseminated often associated with calcite and/or quartz stringers. Often found within the footwall wallrock to intrusive dykes.

**ALTERATION:**

- widespread greenschist facies alteration on a regional scale with local variability in degree of saussuritization and propylitization.
- fine grained hornblende aggregates replace pyroxene phenocrysts with weak to moderate chlorite developed.
- epidote strongly replaces plagioclase phenos, also may be found within hornblende pseudomorphs.
- magnetite is also weakly developed as 0.01 - 0.1 mm grains in hornblende and freely within the groundmass.
- large scale faults are commonplace (Bear Creek faults, Karen Fault) with strong chlorite schist developed over 2 - 40 metre widths. Carbonate commonly associated as sweats within foliation pockets. Widespread fracturing, jointing likely related to larger structures.
- local hornfelsing due to stock emplacement with associated biotite alteration, pyrite nodules, fracture, filling as alteration products.
- K-spar locally found as narrow 2 - 4 cm syenite stringers and sub-paralleling dyke swarms.

WEATHERS:

- rough pitted surface pale grey-green groundmass with prominent fine to coarse grained mafic phenocrysts. Smaller plagioclase phenocrysts often more evident moderate to strong spotty lichen cover.
- limonite generally absent or very local, weak.

COMMENTS:

- fairly hard, massive unit, mostly seen as talus to felsenmeer fragments over wide area; likely flow-related but no internal flow-fabric. Bed thicknesses are unknown as is top direction.
- locally cut by NW trending amygdaloidal dark grey to black basalt dykes 20 - 80 cm.
- calcium - quartz amygdules.
- locally seen interbedded on 5 - 10 cm scale with tuff.

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**TUFF, ARGILLITE - LIMESTONE SERIES** **Porphyry Ridge**

**TUFF:**
- pale to medium green aphanitic to very fine grained massive non-porphyritic to well laminated with 1 - 10 mm scale beds. Weak to moderate saussuritization, generally fresh to thin grey-green weathered surface. Calcareous laminae recessive.

**ARGILLITE:**
- aphanitic, black may show moderate-strong parting, poorly bedded, uniform, fractured, no apparent significant alteration, comprises 10 - 70 % of unit at Cu, Ag, Au Lady Diana Showing. Grades into limestone, ash tuff. 5 - 8% pyrite as clots, stringer manganese locally pale to dark grey, silty.

**LIMESTONE:**
- finely banded to interbanded with black argillite on mm scale locally swirled, fossiliferous at one locality near 1708 m knoll near Bear Creek. Beds vary from few cm to approximately 5 m in thickness. Trace to 1% fine grained pyrite may be altered to calcium silicates. Garnet - calcite - epidote - pyroxene.

**MAFIC MINERALS:**
- very fine grained, difficult to discern components.

hornblende:
- rare visible phenocrysts, 5 - 10% locally.

biotite:
- common fine grained alteration product of tuff near Lady Diana Showing alongside Kliyul Creek Pluton.

**FELSIC MINERALS:** plagioclase:
- 50%, as both fine grained phaneritic crystals, groundmass component. 10% < 2mm ghost. Plagioclase phenocrysts at Lady Diana Showing.

**MINERALIZATION:**
- strong, Cu, Au mineralization at Lady Diana Showing between Kliyul Creek Pluton to south and South Bear Creek Fault to north. Host rocks moderately K strong hornfelsed, with fracture controlled pyrite, chalcopyrite, combined < 5%, trace bornite.
- *metallics show moderate correlation with strong epidote alteration.*

**ALTERATION:**
- tuff - variably propyllitically altered with fracture-related epidote selvages, ubiquitous chlorite, clinozoisite occasionally found in quartz sweats, may be *hornfelsed to very hard, massive rock variably silicified.*
- limestone - massive, recrystallized bands show minor plastic deformation where thinly interbedded with argillite local calc-silicate (red garnet, pale green epidote with diopside) alteration.

**WEATHERING:**
- tuff - pale green on surface, may be entirely covered by lichen.
- limestone - shows characteristic prominent/recessive interbedded laminae on surface, very rough pale to medium grey resistent sandy or silty clots, disrupted bedding fragments may protrude, *minor limonite stain.*
- argillite - very fresh, may have fracture related limonite stain.

COMMENTS: - units are of minor importance on Porphyry Creek property. The Lady Diana Showing, although well mineralized, is on steep terrain, and of limited extent. The adjacent Soup property has discrete skarn replacement of limey tuff beds on-strike with the Porphyry Creek occurrence. Mineralization occurs along post-skarn fault structures unrelated to skarn mineralization. Tuff locally interbedded on 5 - 10 cm scale with pyroxene porphyry. Seen in float only on Porphyry Ridge.

Takla Group

ANDESITE - BASALT AGGLOMERATE — Croydon Ridge

- medium brownish green.

**MATRIX:** - 75%, near aphanitic medium green, chloritic with vague flow(?) laminae.

**FRAGMENTS:** - andesite to dacite hornblende/augite porphyry, 8 X 15 cm maximum, well rounded and as classic bombs.

**MINERALIZATION:** - none noted.

**ALTERATION:** - matrix shows weak to moderate hornfelsing with local laminae 1 cm wide of biotite hornfels.

**WEATHERS:** - smooth surface, fragments readily apparent only on weathered surface.

**COMMENTS:**
- only noted in one location, E of Croy, south and vertically above (?) the calcsilicate. Appears to be overlain by medium green semimassive, moderately to strongly calcareous and moderately magnetic fresh blocky.
- andesite tuff having a maximum thickness of 3 m and weathering dark greenish grey to black.
- agglomerate very limited in extent, may be reflection of ability to recognise fragments in beds dipping into the hillside.

Takla Group

## HORNBLENDE AUGITE ANDESITE - BASALT PORPHYRY — Croydon Ridge

- medium to dark green; very fine grained, weakly to strongly porphyritic
- nonmagnetic to spotty moderately magnetic; weakly to moderately calcareous, varies -fairly fresh to locally moderately chloritized; spotty weak alteration of various types, locally subvolcanic (?)

**MAFIC MINERALS:**

- hornblende: - 5%, dark green, subhedral, locally euhedral maximum 3 to 4 mm long, locally replaces augite.
- augite: - 5%, dark green - black - brown, anhedral to euhedral 1 to 2 mm across.
- biotite: - 2 - 5% to 10% max; most less; dark brown books, fine grained, 1 to 2 mm wide x <0.5 mm thick, disseminated, decussate, secondary.

**MATRIX:**

- 85 to 95%, mix of dark green aphanitic material and very fine grained white plagioclase.

**MINERALIZATION:**

- pyrite, chalcopyrite as rare disseminations; spotty strongly gossanous pyritic pods (1 to 2 m), likely due to hornfelsing and local S introduction (?)
- chalcopyrite clots with weak malachite, in calcite ± minor quartz veins
- locally with 2 - 5% hematite and rare molybdenite
- galena as rare fine to coarse aggregates in larger quartz veins
- visible gold, single 1 - 2 mm grain in float; cobble of massive coarsely crystalline brownish calcite with chalcopyrite clots and very weak malachite, north side of Croydon Ridge.

**ALTERATION:**

- local coarsening/recrystallization of augite due to hornfelsing and metasomatism, varies from medium grained to locally pegmatitic richterite (10cm), decussate
- hornblende replaces augite locally; weak to complete, as fibrous intergrowths of olive-light green uralite, areas of most intense alteration often related to strong, steep shears.
- biotite noted occasionally, difficult to see, likely more about than presently known, appears to be growing out of matrix.
- saussuritization of plagioclase; locally weak to moderate, pervasive and along foliation/cleavage and fractures.
- K-feldspar - spotty, generally weak pervasive narrow selvages along fractures, commonly related to felsite - granodiorite veining/dyking/hybridization
- chloritization weakly pervasive, locally strong throughout, intense as greenstone - chlorite schist. Moderate to strong along shears and faults, maximum about 2m wide foliated Fw commonly wider than Hw.
- carbonate weak to strong as Fe-dolomite and calcite, various shades of orange-brown gossan associated with most shears.
- silicification - sparse to rare; pervasive along felsic dykes/veins; as minor discontinuous lenses maximum about 2 m, within centre of many shears; with calcite chalcopyrite minor malachite in narrow (2 to 12 cm) veins but fairly continuous (maximum 60 m) along bedding planes.

**VEINS:**

- as mentioned, commonly associated with obvious structures, narrow discontinuous, strong pinch and swell, maximum 2 to 3 m wide most less than 3 to 5 cm, traced intermittently for maximum of 200 - 300 m.
- rare magnetite stringers.

**WEATHERS:**

- rough irregular or smooth surface, dark grey to black, uralitized varieties commonly lighter (dusty) green, fine to coarsely rough surface depending on grain size; smooth surface types tend to be blocky.

**COMMENTS:**

- Highly varied assemblage, in part reflecting primary compositions (ie. originally only hornblende or only augite or both), and in part complicated by overprinting of hornfelsing and metasomatic processes. Metamorphic processes produce local medium grained to pegmatitic phases which may be monomineralic as massive amphibole/uralite, or fine to coarse grained epidiorite. Apparently original flows and tuffs varied from intermediate to ultramafic composition. Further complications arise locally due to presence of felsic to (likely) ultramafic dykes and sills.

**Takla Group**

EPIDIORITE — **Croydon Ridge**

- dark greenish grey, locally strong mottled appearance.
- very fine to medium grained; equigranular locally porphyritic
- patchy weak to moderate magnetite.

**MAFIC MINERALS:** hornblende: - 40% total but likely augite is also present, dark green, fine to medium grained, locally as subhedral phenocrysts (in finer grained varieties) maximum 4 mm long, appears to be fresh.

**FELSIC MINERALS:** plagioclase: - 40% white to greenish yellow, anhedral to euhedral, commonly interstitial to mafic minerals.

**MINERALIZATION:**
- minor disseminated magnetite fine, anhedral grains commonly associated with mafic minerals, max 2%, spotty.
- very rare pyrite, disseminated.

**ALTERATION:**
- saussuratization of plagioclase moderate, pervasive; <u>almost</u> "characteristic"

**WEATHERING:**
- dark grey to black, similar to volcanic rocks

**COMMENTS:**
- weak to strong textural variability vertically and horizontally. Unit boundaries arbitrary. Difficult to distinguish from surrounding volcanics when looking at an exposure from 10 m away.

**Takla Group**

**AUGITE ANDESITE - BASALT PORPHYRY** **Croydon Ridge**

- dark green grey to black, weak to strongly porphyrytic, varies from nonmagnetic to moderately magnetic, generally noncalcareous

**MAFIC MINERALS:** augite: - 2 to 15%, very dark green, fine to medium grained, anhedral to euhedral, fresh (?)

**MATRIX:** - dark green to blackish, aphanitic; bulk of rock

**MINERALIZATION:** - rare disseminated pyrite, chalcopyrite

**ALTERATION:**
- chloritization - local patchy, pervasive; weak to moderate
- biotite local, 2 - 5% max, patchy, fresh, secondary, difficult to see.

**WEATHERS:** - dark greenish black, smooth or rough, weak to strong lichen cover

**COMMENTS:** - overall - fresh; likely a flow; composition ranges basalt to pyroxenite?, interbedded with some volcanic derived sediments.

**Takla Gp.**

**HORNFELSED ANDESITE TUFF (?)** **Croydon Ridge**

- dark green, locally porphyritic, massive, noncalcareous, generally nonmagnetic

**MAFIC MINERALS:** - hornblende phenocrysts 1 to 3%, locally apparent, subhedral, fine grained.

**MINERALIZATION:** pyrite:
- 3 to 15% (locally), very bright, brassy, fine grained, anhedral to subhedral disseminations, rarely as very fine stringers.
- Magnetite locally 15% massive fine grained in vague laminations, as rare occurrences.

**ALTERATION:**
- appears hornfelsed
- patchy pervasive Fe carbonate
- patchy pale to medium green calcsilicate development as vague laminations

**WEATHERS:** - blocky, strong to intensely gossanous, medium to light to dark rusty brown, quite massive in areas of calcsilicate development.

**COMMENT:** - local narrow bed of slightly different composition, doesn't appear to be extensive. Occurs at west end of calcsilicate, abutts large shear. Possibly represents bed receptive to fluids/volatiles migrating within shear.

**Takla Gp.**

**CALCSILICATE** **Croydon Ridge**

- medium pinkish brown to light green to medium green as multicolored bands, lenses, irregular patches and spots noncalcareous, nonmagnetic

**MINERAL ASSEMBLAGE:** - strongly varied mixture garnet, pale diopside and epidote.

**MINERALIZATION:** - only minor pyrite noted in later (quartz) calcite veins running parallel and at angles to bedding, and/or in later shears.

**STRUCTURE:** - strikes roughly parallel to ridge, dips 20° southward (into hill) commonly disrupted by narrow shears.

**WEATHERS:** - smooth, blocky, no lichen cover

**COMMENTS:** - maximum thickness 3 to 8 m bed, traced intermittently for 200m along strike, thickest at western end. Strong color and texture variations likely due to similar variability in primary composition both vertically and horizontally. Primary bedding/laminae preserved. Likely represents strongly calcareous andesite to basalt (?) with narrow limestone lenses, within a pile of weakly to noncalcareous tuffs. Formation of calcsilicate minerals implies escape of $CO_2$.

**Takla Gp.**

**ANDESITE - BASALT AGGLOMERATE** **Croydon Ridge**

- medium brownish green

**MATRIX:** - 75%, near aphanitic medium green, chloritic with vague flow (?) laminae

**FRAGMENTS:** - andesite to dacite hornblende/augite porphyry, 8 x 15 cm maximum, well rounded and as classic bombs

**MINERALIZATION:** - none noted

**ALTERATION:** - matrix shows weak to moderate hornfelsing with local laminae 1cm wide of biotite hornfels.

**WEATHERS:** - smooth surface, fragments readily apparent only on weathered surface.

**COMMENTS:** - only noted in one location, East of Croy claims south and vertically above (?) the calcsilicate. Appears to be overlain by-medium green semimassive, moderately to strongly calcareous and moderately magnetic fresh blocky andesite tuff having a maximum thickness of 3 m and weathering dark greenish grey to black. Agglomerate very limited in extent, may be reflection of ability to recognize fragments in beds dipping into the hillside.

**Takla Group (?)**

**AMPHIBOLITE** **Bear Creek Area; Croydon Ridge**

- Medium to dark green to greyish green, decussate, fine grained to pegmatitic hypidiomorphic granular texture commonly strong magnetic, non calcareous

**MAFIC MINERALS:** amphibole: - 30 - 90% dominantly as hornblende probably local actinolite, subhedral to euhedral, decussate locally strongly felted, crystals 1 mm to 2 cm wide and from 1 cm to 5 cm long.

**FELSIC MINERALS:** plagioclase: - 30 to 35%, anhedral, white to greenish, intersitial to amphibole.

**METALLICS:** magnetite: - 10 to 15%, very fine to medium grained, disseminated and anhedral masses, very fresh

**ALTERATION:**
- plagioclase weakly saussuratized
- hornblende chloritized, weak, pervasive; some may represent totally replace proxene; locally altered to actinolite or tremolite

**COMMENTS:**
- may represent altered mafic-ultramafic volcanics or in part, a pyroxenite or an altered replaced pyroxenite or periodotite
- termed Hornblendite by Bema, locally as Appinite by earlier workers.
- See Thin Section 1384-22

EAST HALF

Croydon Creek Pluton

**BLOOM CIRQUE DIORITE - QUARTZ DIORITE** **Emer Claims**

- Light grey to white to green, fine grained varies to very fine grained equigranular, hypidiomorphic granular, commonly weakly to nonmagnetic, typically noncalcareous.

**MAFIC MINERALS:**
- hornblende: - 10 to 25%, medium to dark green, fine grained, subhedral to euhedral, maximum 1.5 mm long and as anhedral aggregates.

**FELSIC MINERALS:**
- feldspar: - 40% (?) white to buff most as anhedral aggregates locally mixed with quartz, more rarely as anhedral phenocrysts with distinct to hazy margins.
- quartz: - when present 10%, clear-white anhedral aggregates intermixed with feldspar.

**MINERALIZATION:**
- pyrite: - trace to 1%, very fine grained disseminated and as very fine grained aggregates, commonly weakly oxidized locally as fracture fillings in moderate to strongly fractured along ridge around north end of Bloom Cirque.
- chalcopyrite: - locally trace to 1%, as fine fracture fillings and very fine grained, disseminated in areas of saussuration and moderate to strong fracturing.
- often, but not always associated with weak malachite
- magnetite: - when present, 2 to 5%, very fine grained, anhedral to subhedral, disseminated.

**ALTERATION:**
- saussuritization:- more or less ubiquitous but with varying degrees of intensity
- silicification: - local, minor, as above mentioned stringers
- K-feld: - locally associated with quartz, and as fine stringers along ridge near common boundary of Emer 1 and 2
- sericitization: - intensely altered contact (breccia) phase along ridge of Emer 1, likely fairly ubiquitous possible product of saussuritization

**VEINS:**
- very fine quartz stringers locally present in Bloom Cirque, locally with fine poddy chalcopyrite
- sheeted, parallel quart stringer zones with/without K-feld, vertical, in zones +50 wide (southwest side of Emer 1)
- weak, quartz - (± K-feld), stockwork locally developed in vicinity of the sheeted quartz stringers

**WEATHERS:**
- buff to light grey to greenish, commonly small angular weak to strongly blocky, little or nil lichen

**COMMENTS:**
- except for obvious alteration effects, unit appears fairly uniform in composition and texture
- locally cut by pegmatoid phase of Croydon Creek Pluton
- contact with volcanics weakly hybridized/breccia due to presence of variably assimilated volcanic fragments
- contact with pegmatoid somewhat confused ie. some case is possible fault contact; others is a brecciated contact with fragments of diorite in pegmatoid and pegmatoid in diorite; often is obscured so no relationship can be inferred.

Croyden Creek Pluton

HORNBLENDE DIORITE PEGMATOID — Emer Claims

- strongly mottled black-dark green - buff, coarse grained to pegmatic, equigranular along North side of Kliyul Creek, highly varied everywhere else, noncalcareous, fresh

**MAFIC MINERALS:** hornblende - 50 to 80%, coarse grained to pegmatic (+25 cm long), subhedral to euhedral

**FELSIC MINERALS:** plagioclase - 20 to 50%, anhedral aggregates, interstitial to hornblende, white to buff

quartz - rarely apparent, as one or two anhedral medium to course grains caught up in plagioclase, only observed in equigranular variety

**MINERALIZATION:** - generally nil; magnetite uncertain may have forgotten to note it; locally xenoliths with minor chalcopyrite

**VEINS:** - locally cut by felsite veins of diorite (?) composition commonly fine to medium grained, equigranular

**ALTERATION:** - local xenoliths of volcanics and/or ultramafic (Croydon Creek Pluton) variably altered to hornblende forming fine to pegmatitic subhedral to euhedral aggregates
- ultramafic xenoliths locally have felted texture along Croydon Creek

**WEATHERS:** - rough surface to highly irregular; from rounded "Flintstones" to strongly coarse blocky; light mottled to dark brownish black; commonly weak to nil lichen

**COMMENTS:** - locally cut by Croydon Creek fine grained, leucocratic dykes
- contact with Croydon Creek Pluton fine diorite - confused as previously stated
- contact with Croydon Creek Ultramafic Stock not observed directly, appears hybridized with variably assimilated pyroxenite fragments included in pegmatoid

DIORITE PORPHYRY East Emer Ridge

- mottled pale to medium grey with 0.3 - 6.0 mm dark grey hornblende phenocrysts as distinct phenocrysts 10 - 15% by volume
- weak to moderately hornfelsed, pyritized with 2 - 3 mm white to limonite weathered surface.

**MAFIC MINERALS:** hornblende
- 15% 0.3 - 6.0 mm phenocrysts, 8 to 10% groundmass.
- fresh olive brown - dark greygreen, phenocrysts vary from fresh to containing intergrown actinolite or 100% actinolite plus chlorite.

**FELSIC MINERALS:** plagioclase
- 40% as felsite groundmass, few zoned phenocrysts, strongly altered to fine-grained epidote and/or sericite. The groundmass contains specks of epidote, amphibole chlorite.

quartz
- 1 to 2% scattered irregular grains

**MINERALIZATION:** pyrite
- 2 to 5% disseminated very fine grained, likely related to hornfelsing event (possibly indicates larger pyritic halo peripheral to nearby intrusion).
- rare pyrite fracture-filling.

**ALTERATION:**
- actinolite, chlorite replaces hornblende partially to fully.
- widespread hornfelsing has produced a significant pyrite content leading to widespread bright orange limonite surface coating.
- plagioclase strongly altered to fine grained epidote and sericite.

**VEINS/STRUCTURES**
- local NW trending carbonate altered shears and minor quartz veins with significant Cu, Au mineralization locally.

**WEATHERING:**
- strong limonite surface coatings, clay altered crust up to 5 mm thick, plag phenocrysts visible within weathered crust. Minor lichen cover.

**COMMENTS:**
- unit is locally widespread in talus, minor local subcrop. Contour soil geochem results along with a few significant rock samples indicate local mineralized structures.
- northeastern portion of the Emer East Ridge lies along trend with the Raven showing, however more detailed mapping and prospecting is required to establish if a relationship exists between these areas or if there is potential for a separate mineralizing system here.
- Thin Section 1384-9 (90-R-488-R)

HORNBLENDE PLAGIOCLASE DIORITE — Northwest End of East Emer Ridge

- pale to medium mottled grey
- fine to medium grained, highly variable porphyritic texture, appears to grade into nearby diorite porphyry of subvolcanic aspect. Locally weak to moderately hornfelsed.
- Cut by numerous plagioclase porphyry dykes, carbonate, limonite shears

**MAFIC MINERALS:** hornblende - 30 to 40% euhedral fine grained needles distributed, homogenous rock relatively fresh in hand specimens.

**FELSIC MINERALS:** plagioclase - 50% fine-grained principally as groundmass with 10 to 15% 0.5-1.5 mm phenocrysts, locally altered to clay, sericite, epidote, carbonate.

**MINERALIZATION:** - contains trace amounts of fine-grained pyrite, locally 1 to 2%.

**ALTERATION:** - 5 to 10% epidote as microfracture-filling, weakly pervasive, trace sericite clinozosite, abundant limonite locally, likely "bleeding" from adjacent pyritized diorite porphyry subvolcanic, locally pyrite limonitic. Unit is only exposed over steep near-vertical rock face resulting in limonite dips, runoff stain, locally moderate to strong fine-grained yellow-encrusting material coats, weathered fractures 10% calcite, minor clay, sericite.

**WEATHERING:** - strongly fractured with limonitic shears, steep, mobile rock, little weathered crust.

**COMMENTS:** - likely related to hornfelsed diorite porphyry subvolcanic. Numerous carbonate shears, augite porphyry dykes

DYKES East Emer Ridge

1. NNE trending porphyritic plagioclase diorite dyke.
2. NW trending quartz "eye" porphyritic quartz diorite
   - cuts porphyritic plagioclase diorite dyke (above) at right angle, both steeply dipping.
3. NNW to NE fine-grained andesite dykes cuts 1. above or is hosted by 1. above, unsure of extent beyond host dyke, steep, difficult to map. Of little importance.
4. Pyroxenite a 1 x 2 m occurrence of unknown extent or significance.

- Several generations of intrusive dykes are found in this area. Generally poor exposure, although 1. and 2. above are very prominent - visible from the air. Numerous minor pyroxene porphyry, plagioclase porphyry and carbonaceous shears are found locally disrupted, discontinuous and untraceable for more than several metres. Locally very fractured, rusty,, crumbly.

**1.** mottled pale grey medium grained plagioclase phenocrysts, relatively fresh.

**MAFIC MINERALS:** - fine grained < 1.0 mm aggregate clusters within groundmass, likely hornblende, are phenocrysts.

**FELSIC MINERALS:** - plagioclase 60%, 40% as medium grained subhedral phenocrysts, relatively fresh looking.

**MINERALIZATION:** - barren, limonite stain locally from other units.

**ALTERATION:** - very weak overall, no thin sections of this unit , minor epidote locally.

**WEATHERS:** - pitted olive green to white with orange carbonate?/clay spots where plagioclase phenocrysts once existed.

**2.** quartz diorite porphyry - wide spread occurrence on Emer claim, several occurrences north of Bloom Cirque.

**MAFIC MINERALS:**
- hornblende - 5 to 10% fine grained poorly preserved xls on north facing slope, on faulted-off section on SE facing slope, fresher with biotite.
- biotite - 20% only recognized in fresher rocks on SE facing slope.

**FELSIC MINERALS:**
- plagioclase - 20% weakly altered to epidote, abundant clay, minor dolomite, trace calcite.
- quartz - 20% as distinct "quartz eyes" phenocrysts 1-5 mm single crystals sub-euhedral.

**MINERALIZATION:** - moderately to strongly altered to clay, carbonate, abundant orange to pink colour from Fe-carbonate, limonite rock extremely grungy, breaks easily to relatively competent. Biotite moderately fresh to 100% replacement by yellow grungy clay, local quartz carbonate stockwork (apparently barren).

**WEATHERS:** - mottled greyish orange to pinkish orange, pervasive, no fresh rocks.

**COMMENTS:** - This unit has been recognized over wide areas of the Emer claims. It does not appear to be related to mineralization systems specifically, but is spatially associated locally.

LEUCO GRABBO DYKE East Ridge south end Bloom Cirque

- medium greenish grey, fine to medium grained, equigranular, hypidiomorphic granular, locally glomeroporphyrtic hornblende
- Weakly magnetic; weak to very weak pervasively calcareous

**MAFIC MINERALS:** Hornblende: - 20%, dark green to black, subhedral to euhedral, and in aggregates, fine to very fine grained maximum 2 mm.

**FELSIC MINERALS:** Feldspar: - 15%, locally 20%, milky clear, anhedral and 40% white, anhedral aggregates

**MINERALIZATION:**
Pyrite: - trace very fine grained, disseminated, weakly limonitic, commonly associated with hornblende
Magnetite: - trace to 1% very fine grained, commonly associated with hornblende
- minor very fine epidote stringers

**WEATHERS:** - light grey weak to moderate lichen, rough, blocky

**COMMENTS:**
- forms matrix in breccia along Croydon Creek Pluton margins at west end of this ridge
- whole rock sample G 293 indicates unit is a Fe, Na-rich, Mg, Ca-deficient equivalent to a Ba salt
- originally described as a possible Granodiorite

PLAGIOCLASE "GRANODIORITE" DYKE — Ridge at South End of Bloom Cirque

- medium to dark greenish grey, very fine grained, finely porphyritic nonmagnetic, noncalcareous

**MATRIX:**
- Silceous, very fine grained to near aphanitic
- quartz 20% anhedral; hornblende 25% anhedral to subhedral; plagioclase 20%, anhedral, plag/feld maximum 15%

**FELSIC MINERALS:**
- Plagioclase 2 to 3%, anhedral to subhedral aggregates and single crystals maximum 1.5 cm long; grain boundaries indistinct to vague, appear to be weakly overgrowing matrix

**MINERALIZATION:**

Pyrite: - trace, very fine-grained; seen as limonitic spots on hornblende and rare very fine grained brassy disseminations

Hematite: - very weak, disseminated

Magnetite: - 1 to 2%, patchy, very fine grained disseminated

**ALTERATION:**
- weak S introduction (pyrite on hornblende)
- hornblende weak to very weakly chloritized
- plagioclase in matrix weak to locally strongly saussuritized

**COMMENTS:**
- Whole Rock Analysis (G 294) shows a composition as a slight Si deficient Andesite
- identical in appearance to the monzonite porphyry dykes found in the Porphyry Creek and Soup areas.

MONZONITE PORPHYRY

**Raven Grid - Area**
**Ridge saddle between North**
**Sarah Cirque, South Sarah Cirque**

- mottled grey to pale orange, medium grained to granophyric near dyke margins. Similar to monzonite from Porphyry Creek Ridge except this is less saussuritized, contains less plagioclase, more K-spar, which also occurs here as phenocrysts, and hosts minor disseminated cp blebs. See T.S. 1384-8, 1384-10, 1384-12, 1384-13.

**MAFIC MINERALS:**

Biotite: - 7 to 10% may be very fresh to strongly chloritized with associated rutile, evenly distributed throughout.

Hornblende: - 0.5 to 3.0 mm strongly altered to chlorite with carbonate

**FELSIC MINERALS:**

Plagioclase: - elongate 0.5 to 2.5 mm variably phenocrysts sericitized, may display K-spar overgrowth.

K-spar: - 25 to 30% groundmass 2 to 5% phenocrysts to 10 mm maximum with included plagioclase. Also replacement and overgrowth of plagioclase. Groundmass is blocky aggregate of K-spar and minor quartz.

Quartz: - accessory, 4 to 5% restricted to groundmass

Sericite: - 6% as plagioclase alteration product.

**MINERALIZATION:** - In Raven Grid-Area, minor disseminated chalcopyrite, microfracture controlled. Also find chalcopyrite weakly enhanced within nearby diorite and andesite host rock; locally 1% pyrite.

**ALTERATION:** - plagioclase pervasively altered to sericite, rimmed by K-spar overgrowth, mafics are variably altered, biotite to chlorite, hornblende to chlorite, carbonate and trace magnetite.

**WEATHERING:** - thin surface crust over grey rock may be stained pale pinkish-orange making it very similar to pinkish orange. May lead to confusion since it looks very similar to K-spar alteration.

DACITE QUARTZ EYE PORPHYRY

**East side Bloom Cirque, head of North Sarah Cirque**

- pinkish to orangish brown, strong to weakly porphyritic, nonmagnetic non to weakly calcareous, 1 to 3 m wide

**MAFIC MINERALS:** Biotite: - 2 to 10% indistinct, strongly removed

**FELSIC MINERALS:** Quartz: - 5 to 25%, clear, anhedral to subhedral phenocrysts, 2 mm to 4 mm across, locally broken in weakly "foliated/sheared" varieties

**MATRIX:**
- variable hard to crumbly, siliceous, forms bulk of rock, little discernable due to colour/staining

**ALTERATION:**
- weak carbonate (dolomite) alteration, pervasive
- biotite severely removed/replaced, commonly silvery green

**COMMENT:**
- no metals observed
- very distinct unit, visible from long distance, see photographs P-7
- general trend east northeast dipping steep south (Bloom Cirque) and as a sill? (north ridge)
- disrupted by later faults & shears
- appears to correlate with dykes on East Emer Ridge
- may be of some value in sorting out major fault movements
- Thin Section 1384-5; Whole Rock G430 analyses indicates composition equivalent to Fe-rich quartz diorite

PYROXENITE (DYKES) **Raven Map area East Emer Ridge.**

- Dark green coarse-grained equigranular massive pyroxene crystal aggregate.

**MAFIC MINERALS:** - 95 - 100% massive pyroxene crystals - 4.0 - 8.0 mm across, appear slightly mottled, partially replaced by chlorite, degree of alteration unknown.

**MINERALIZATION:** - No associated mineralization recognized.

**ALTERATION:** - Appear slightly mottled, no thin sections prepared, likely weak secondary partial replacement, overall appears fresh on hand sample scale.

**WEATHERS:** - Small occurrences appear fresh, limonite bleeds from host rock, strong lichen cover.

**COMMENTS:** - significance unknown, may be related to small ultramafic stock or possibly recrystallized, partial melt residue. Regional government aeromagnetic map shows strong response over Croydon Ultramafic body on west half of property. No similar scale magnetic anomaly is outlined on the east half of the property.

Takla Group

HORNBLENDE ANDESITE PORPHYRY

On East Emer Ridge and near contact with hornblende microdiorite/diorite near South Sarah Cirque.

- In many respects identical to pyroxene porphyry except phenocrysts are comprised of hornblende rather than pyroxene.
- Fine grained hornblende plagioclase phenocrysts in pale (to very dark) green, aphanitic groundmass, homogenous relatively fresh, local strong fracture-controlled limonite, weakly magnetic, 2 - 3% magnetic locally.

**MAFIC MINERALS:** Hornblende: - 15 - 40%, dark green to black 0.5 - 1.0 mm crystals, disseminated.

**FELSIC MINERALS:** Plagioclase: - 20 - 40% as cloudy grey 1.0 mm euhedral phenocrysts interspersed with hornblende phenocrysts, cloudy pale bluish-grey.

Calcite: - 10%, locally, with or without dolomite, concentrated in fractures and shears along East Emer Ridge.

**MINERALIZATION:** Pyrite; highly variable from trace to 10% locally, clumps, and disseminated, commonly 3 - 5% often with strong limonite fracture coatings, small shears, fractures may have very minor chalcopyrite, malachite.

**ALTERATION:** Generally fresh with moderate to strong limonite stain, local epidote, carbonate fracture controlled, ubiquitous chlorite with rare visible sericite.

**WEATHERING:** Strong lichen cover locally, true extent of this unit is unknown, locally in fault contact with pyroxene porphyry, also appears gradational in places, the similarity in outward appearances between units makes mapping difficult.

Takla Group

AGGLOMERATE (unit 1 agg)

Ridge between North Sarah/South Sarah Cirques
- Basin south of Raven Grid

- mixed fragmental - possibly autobrecciated submarine flows?
- highly variable vesicular/amygdaloida pillow fragments 1 mm - 200 m, supported in a similar matrix of brecciated dark green to black andesite-basalt, occasional maroon subvolcanic porphyry clasts, very rare intrusive fragments
- generally quite fresh, local strong lichen cover
- moderately magnetic

**MAFIC MINERALS:** - Rock is generally aphanitic, occasionally found small 1 - 2 mm partially digested mafic crystals of unknown composition, groundmass dark purplish black to dark chlorite-green. Pervasive chlorite, carbonate alteration. Dark purple to black mafic rich scoriaceous cusps with or without jasper between original pillow fragments (not matrix to pillows).

**FELSIC MINERALS:** plagioclase - groundmass component possibly responsible for calcite amygdules. In dark maroon fragments, 1 - 3 mm phaneritic crystals evident to 15 to 20% locally fresh, euhedral. The matrix is strongly epidotized with locally massive secondary epidote, minor chlorite weathered surfaces have weak clay alteration.

calcite: - secondary precipitate in vesicles, cavities, coats fractures occasionally, with rare quartz.- locally glomeroporphyritic 1 x 3 mm blades in dark maroon fragments.

**MINERALIZATION:** - no associated metallics or mineralization

**ALTERATION:**
- Volcanic fragments are generally moderately pervasively altered with chlorite, epidote, cardote, carbonate precipitating in vesicles. Chlorite and epidote also occur as 1 - 2 mm meshwork blebs and may be pseudomorphing original mafic phenocrysts.
- Matrix - mottled pale to dark green with very strong pervasive epidote alteration, locally 100% chlorite is moderate to strongly developed.
- most conspicuous feature is bright hematite-red jasper amygdules, of very limited occurrence but locally comprise 15% of select rock fragments.

**WEATHERS:** - Generally fresh with local dark grey pocked surfaces, was generally seen on ridge tops or on steep mobile slopes, ie. fresh rock with little lichen.

**COMMENTS:**

Unit conspicuously separates pyroxene porphyry flows from laminated ash tuff/limestone occurrences. In plan-view, this unit, between the North and South Sarah Cirques, extends for 600 m x 150-200 m before being buried by talus/ It could conceivably be used as a pseudo-marker horizon, regionally within the Takla Group. It is spatial associated with weak chalcopyrite-mineralized faults and quartz veins within the Sarah prospect.

No thin sections were prepared from this unit.

Several fault-bounded blocks of unknown extent are located on the East Emer Ridge. Northeast of the highest peak.

Takla Group

TAKLA VOLCANICS — **Intercalated laminated ash tuff with minor agglomerate, limestone and pyroxene porphyry flows** — Emer Claims

- A 100 - 300 m wide belt extends from the ridge separating North and South Sarah Cirques towards the northwest with occurrences mapped on the ridge south of Emer Lake. It's regional extent is unknown. It is in contact with Croyden Pluton to the west.
- Typically pale epidote green very well bedded on mm to metre scale, broken and disrupted by numerous faults over strike length of several km maximum.
- Bedding typically oriented 080°/10-35° NNW.

**MAFIC MINERALS:** - rare phenocrysts in fine grained crystal tuff beds of unknown composition, strongly chloritized

**FELSIC MINERALS:** plagioclase - dominant constituent but very rarely identifiable - aphanitic to very fine-grained crystals

**MINERALIZATION:** - hosts small local mineralized structures, faults, shears, very few quartz veins.

**ALTERATION:** - strong pervasive chlorite, epidote, minor calcite on fract surfaces, interbedded with pyroxene porphyry

**VEINS:** - minor quartz veins, sporadic weak mineralization.

**LIMESTONE:** - bedded ash tuff unit is characterized by local interbedded silty limestone horizons over about 100 m vertical interval, very silty horizons indicate bedding 030°/20 - 30° NW, strongly fractured, strongly recrystallized, no fossils found near Sarah prospect, however, south of Emer Lake camp, several unidentified corals and crinoid stems, likely Upper Triassic in age were discovered in better preserved horizons of similar rocks.

**WEATHERS:** Strongly fractures scattered tuff numerous small faults and shears, thin weathered surfaces, moderate lichen cover.

**COMMENTS:** This unit is in intrusive contact with Croyden Pluton to the east along the headwall of Bloom Cirque, picked up trend along Ridge south of Emer Lake, along ridge north along East Croydon Creek. Not associated with any important mineralized areas. Local mineralization structures may x-cut this unit.

**Takla Group**

**ANDESITE-BASALT AGGLOMERATE/BRECCIA** **West Side North Sarah Cirque**

- medium to dark green to brownish, massive, weak to moderately magnetic, weak to noncalcareous, locally vesicular, dominantly matrix supported, thickly bedded

**MATRIX:**
- 35 to 75%, medium to dark green to brownish green; locally vesicular; varied non to strongly porphyritic with max. 15% augite phenocrysts as fine to course grained, subhedral to euhedral maximum 3 mm across

**FRAGMENTS:**
- 25 to 75%, moderately well rounded to angular, characteristic "bombs" observed sporadically; varies from subangular dominant to subrounded dominant; compositionally similar to matrix, virtually invisible on fresh surface, commonly readily apparent on weathered surface, augite phenocrysts 5 to 15%, anhedral to euhedral, 1 mm to 1.5 cm; commonly weakly calcareous, weakly to moderately magnetic, magnetite
- one fragment of medium grained quartz diorite noted, well rounded

magnetite - trace to 2% disseminated locally apparent fine to very fine grained, anhedral

**ALTERATION:**
- weak to pervasive Fe-carbonate common, in part responsible for brownish coloration, strong along shears
- epidote local, weak, fracture filling and pervasive fracture related.
- chloritization weak pervasive, common

**Takla Group**

**HORNBLENDE ANDESITE SUBVOLCANIC - MICRODIORITE** **Bloom Cirque along ridge to SE**

- very dark greenish grey, near aphanitic to very fine grained, weakly porphyritic (feldspar, augite); nonmagnetic, weakly calcareous along fractures

**MAFIC MINERALS:**
Hornblende: - 5%, fine to medium grained, subhedral to euhedral
Augite: - 25%, fine to medium grained, subhedral to anhedral

**FELSIC MINERALS:** Feldspar: - 20%, white, very fine grained, subhedral to anhedral

**MATRIX:** - very dark green, aphanitic to very fine grained

**WEATHERS:** - dark green, rough irregular to blocky

Takla Group

DIOPSIDE GARNET EPIDOTE AND EPIDOTE MAGNETITE SKARN Ridge east side Bloom Cirque

- strongly bedded, striking approximately EW dipping 8°N, total 4 m thick in several zones (max.)

| | | |
|---|---|---|
| **MINERALOGY:** | Garnet: | - medium reddish brown, very fine grained, granular, 0 to 35% |
| | Diopside: | - patchy, dark green |
| | Epidote: | - 25 to 85%, massive, aphanitic |
| **METALLICS & OXIDES:** | Chalcopyrite | - trace, anhedral to subhedral, disseminated |
| | Pyrite | - trace anhedral to subhedral, disseminated |
| | Magnetite | - spotty, very fine grained, anhedral masses in epidote rich sections, massive black, aggregates in magnetite skarn beds/lenses |
| **WEATHERS:** | - smooth blocky, no or very little lichen | |
| **COMMENT:** | - magnetite - epidote bed 2 m thick<br>- magnetite beds 20 cm to 80 cm thick<br>- garnet-epidote with chalcopyrite maximum 50 cm thick<br>- see photograph P-11<br>- local discontinuous occurrences of poddy (?) magnetite skarn (?) north of Bloom Cirque | |

# APPENDIX IV

***Thin Section Report***

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Job #54

September 13th, 1990

## A PETROGRAPHIC STUDY OF ROCK SAMPLES FROM THE PORPHYRY CREEK PROPERTY (PROJECT P.O. 1384)

### INTRODUCTION

22 samples, designated as follows, were prepared as conventional thin sections.

| Thin Section No. | Field Number |
|---|---|
| 1384- 1 | PORPH 1 |
| 2 | EMER 1 |
| 3 | EMER 200 |
| 4 | EMER G.435 |
| 5 | EMER G.430 |
| 6 | PORPH R.168 |
| 7 | PORPH R.172 |
| 8 | PORPH R.471 |
| 9 | PORPH R.488 |
| 10 | PORPH R.504 |
| 11 | PORPH R.511 |
| 12 | PORPH R.517 |
| 13 | PORPH R.525A |
| 14 | PORPH M.34 |
| 15 | PORPH M.21 |
| 16 | PORPH M.21B |
| 17 | PORPH M.117 |
| 18 | PORPH TR 10 |
| 19 | EMER Bx |
| 20 | EMER UM |
| 21 | PORPH Dfp |
| 22 | PORPH Amph |




### SUMMARY

This suite consists entirely of igneous rocks. These include a few relatively coarse-grained varieties, of typical intrusive aspect, as well as a majority of finer, often porphyritic rocks which are probably dykes and/or border phases. There are also examples of hybridization (physical intermixing of two different phases), and of apparent thermal modification (hornfelsing) of one intrusive phase by another - attesting to a complex geological history.

A remarkably wide range of rock compositions is represented, from ultramafics to highly siliceous granitoids. The suite includes quartz-poor rocks of the diorite-monzonite clan, as well as more quartzose variants.

In view of the diversity of lithotypes, grouping of these rocks is difficult. Only a few of them are clearly assignable to the same geologic unit on the basis of their petrography. The possible kinship of others may be apparent from a knowledge of their field characteristics and spatial relationships.


### A. ULTRAMAFICS:

**i) Pyroxenite:** Samples 1 and 3. These rocks consist essentially of medium-grained aggregates of clinopyroxene. Sample 3 includes some accessory hornblende. Both rocks show partial intergranular and/or fracture-controlled alteration to tremolite-actinolite.

**ii) Peridotite:** Sample 20. This rock consists predominantly of partially serpentinized olivine with abundant secondary magnetite. Local concentrations of hornblende and pyroxene may be xenolithic.

**iii) Hornblendite:** See G: Hybrid rocks.

### B. DIORITES

**i) Potassic diorite:** Sample 15. This is a medium-grained, non-porphyritic rock of plutonic aspect. It consists predominantly of plagioclase and hornblende. Rather abundant accessory K-spar and minor quartz occur in interstitial mode.

**ii) Melanodiorite porphyry:** Sample 2. This rock consists of abundant phenocrysts of hornblende and minor pyroxene in a groundmass of microgranular plagioclase. Its prominent porphyritic texture and mafic-rich composition suggest that it may be a form of lamprophyre.

**iii) Diorite porphyry:** Samples 9 and 21. These rocks are essentially free of quartz and K-feldspar. Sample 9 contains hornblende and lesser plagioclase phenocrysts in a fine-grained feldspathic groundmass; it contains notable amounts of accessory pyrite. Sample 21 is leucocratic, and consists of sparse plagioclase phenocrysts in a somewhat altered plagioclase groundmass.

iv) **Diorite-granodiorite porphyry:** Samples 4 and 11. These rocks differ from the previous group in containing significant proportions of accessory quartz and K-feldspar. Sample 4 consists of plagioclase phenocrysts in a granular matrix of hornblende and plagioclase, with interstitial K-spar and quartz. Sample 11 consists of abundant phenocrysts of plagioclase and accessory altered mafics, in a microgranular matrix of plagioclase and epidote; it embraces a contact between two variants (one more potassic and siliceous than the other).

**C. SYENITE:** Sample 18. This is a fine-grained, aplitic-textured rock consisting essentially of monomineralic K-feldspar.

**D. MONZONITES**

i) **Monzonite porphyry:** Samples 8, 10, 12 and 13. These four samples are of closely similar type, and almost certainly represent the same unit. They consist of phenocrysts of plagioclase, minor K-spar and various, more or less altered, mafics in a microgranular, leucocratic groundmass of K-feldspar with minor accessory quartz and granophyre.

ii) **Quartz monzonite porphyry:** Sample 14. This rock is clearly a variant of the previous group, differing principally in the higher proportion of quartz and granophyre in the groundmass. The plagioclase phenocrysts are strongly saussuritized.

**E. QUARTZOSE ROCKS**

i) **Quartz diorite (trondhjemite):** Sample 7. This is a medium-grained, non-porphyritic rock of plutonic aspect. It is a leucocratic aggregate of plagioclase and quartz, with minor K-feldspar and biotite.

ii) **Quartz-feldspar porphyry:** Sample 5. This is a leucocratic rock of similar composition to Sample 7 (though devoid of K-spar), but prominently porphyritic, with quartz and plagioclase phenocrysts in a minutely felsitic groundmass.

iii) **Alaskite:** Sample 16. This is a strikingly leucocratic, clumpy-textured granitoid, of plutonic aspect. It is an intergrowth of K-feldspar, quartz and plagioclase.

**F. HORNFELSED ROCKS(?):** Samples 6 and 17. These rocks probably originated as quartz diorite to diorite. They contain abundant secondary-type biotite, and (in #6) granular epidote, intergrown with strikingly fresh, microgranular plagioclase, of more or less strongly recrystallized appearance. They are tentatively classified as thermally modified country rocks from a contact aureole.



**G. HYBRID ROCKS:** Samples 19 and 22. Sample 19 is a somewhat quartzose, porphyritic monzonite with angular xenoliths of hornblendite. Accessory hornblende in the monzonitic host may be partly derived by assimilation of xenolithic material. Sample 22 is an essentially monomineralic aggregate of actinolitized hornblende, probably representing an ultramafic differentiate. It is cut by vein-like bodies of medium-grained, quartz-free monzonite, showing strong, localized marginal epidotization. These two rocks may be related - differing essentially in the relative proportions and mode of intermingling of the same two components.

Individual petrographic descriptions are attached. Please refer to these for details of relative styles and intensities of alteration, etc.

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(929-5867)

**Thin Section 1384-2 (EMER 1)** **PORPHYRITIC MELANODIORITE**

Estimated mode

| | |
|---|---|
| Plagioclase | 27 |
| Saussurite | 8 |
| Pyroxene | 5 |
| Hornblende | 60 |
| Opaques | trace |

This is a mafic-rich rock of prominently porphyritic aspect.

It is of simple composition, consisting essentially of plagioclase and strongly pleochroic (yellow-green) hornblende.

The hornblende show a bimodal size distribution. It includes a proportion of obvious euhedral phenocrysts, 1 - 6mm in size, but much of it is in the form of semi-coalescent clumps of smaller, stumpy, subhedral grains, 0.1 - 0.7mm in size.

Some of the coarser phenocrysts have relict cores of colourless clinopyroxene, and others consist of compact clumps of hornblende showing crudely pseudomorphous outlines of pyroxene. It seems that the mafics in this rock partly originated as pyroxene, which was modified to hornblende by magmatic reaction. The finer-grained hornblende aggregates may represent a later stage of primary crystallization.

The plagioclase forms a matrix of distinctive, equigranular texture, consisting of an aggregate of stumpy subhedral-euhedral grains, 0.03 - 0.1mm in size. These have a composition of andesine (about $An_{45}$). The plagioclase shows patchy saussuritization (alteration to minutely felted sericite and cryptocrystalline epidote) which is locally strong, and obscures the equigranular fabric.

This rock has the textural aspect of a minor intrusive of dioritic affinities. Its mafic-rich composition places it in the class of the appinites. Alternatively, it may be a form of lamprophyre (spessartite).

**Thin Section 1384-1 (PORPH 1)** **PYROXENITE**

Estimated mode

| | |
|---|---|
| Clinopyroxene | 82 |
| Hornblende | 3 |
| Tremolite | 13 |
| Carbonate | 1 |
| Opaques | 1 |
| Sphene | trace |

This rock is an essentially monomineralic pyroxenite, made up of an aggregate of subhedral grains of pale-coloured clinopyroxene, 1 - 5mm in size.

The pyroxene shows minor patchy and peripheral modification to a light olive-coloured amphibole which, in turn, is largely altered to colourless, fibro-acicular tremolite, flecked with fine-grained secondary opaques. The tremolite/opaques assemblage forms a semi-continuous, intergranular network throughout the pyroxene aggregate, and also occurs as scattered, more concentrated pockets - probably representing the complete alteration of selected grains of primary silicates.

A prominent vein-like zone, 4 - 5mm in thickness, crosses the sectioned area. This is composed of bladed tremolite with minor intergrown pockets and threads of carbonate. It is devoid of opaques, but includes rare, tiny grains of sphene. This feature appears to represent a zone of shearing and more intense alteration.

**Thin Section 1384-3 (EMER 200)  PYROXENITE**

Estimated mode

| | |
|---|---|
| Clinopyroxene | 67 |
| Hornblende | 16 |
| Actinolite | 12 |
| Chlorite | 2 |
| Epidote | 1 |
| Tremolite | 1 |
| Carbonate | trace |
| Opaques | 1 |

This is another ultramafic rock, of similar macroscopic aspect to 1384-1.

In thin section the resemblance is confirmed, though some differences can be seen. Compared with Sample 1, this rock is somewhat finer-grained, and the pyroxene shows a higher degree of conversion to hornblende, and exhibits localized alteration of a type not seen in the other sample.

It consists essentially of an anhedral aggregate of colourless clinopyroxene, of grain size 0.5 - 2.5mm.

Amphibole is a major accessory. It apparently includes two generations of somewhat different composition. One is a rather pale olive-brown hornblende, which occurs as scattered clumps of grains of similar size to the pyroxene, and as small flecks and intergranular selvedges throughout the pyroxene aggregate. The other is a pale green variety (actinolite) which forms networks of concordant and cleavage-controlled hairline veinlets throughout the pyroxene. Where these veinlets cross areas of hornblende they are often infilled by carbonate.

A few localized clumps (totally replaced primary grains?) are composed of minutely felted chlorite studded with tiny euhedra of epidote, or of fibrous tremolite.

Opaques are a minor accessory, as randomly disseminated, equant/skeletal grains 0.02 - 0.5mm in size. The coarsest of these tend to be associated with hornblende.

**Thin Section 1384-4 (EMER G.435)  FINE-GRAINED DIORITE**

Estimated mode

| | |
|---|---|
| Plagioclase | 45 |
| K-feldspar | 10 |
| Quartz | 7 |
| Saussurite | 10 |
| Hornblende | 25 |
| Pyroxene | 1 |
| Apatite | trace |
| Opaques | 2 |

This is another rather microgranular, weakly porphyritic rock composed predominantly of plagioclase and hornblende. It is texturally somewhat similar to 1384-2, but is of considerably more felsic composition.

Plagioclase forms a few euhedral phenocrysts, 1 - 3mm in size. These are set in a blocky, granular matrix, of grain size 0.1 - 0.7mm, composed predominantly of subhedral plagioclase with intergrown, individual, similar-sized grains of olive-green hornblende.

K-feldspar is a prominent accessory, as a network of interstitial clumps and partial rims to plagioclase grains. Fine-grained quartz is also a component of this interstitial assemblage, as well as forming rare phenocryst-like clumps 0.5 - 1.0mm in size.

Other, more minor accessories are tiny granules of pyroxene intergrown with the hornblende (generally in a peripheral relation); traces of apatite as scattered, minute euhedra; and rather evenly disseminated opaques as sub-equant grains 0.05 - 0.5mm in size.

This rock has the composition of diorite approaching granodiorite.

**Thin Section 1384-5 (EMER G.430) QUARTZ FELDSPAR PORPHYRY**

Estimated mode

| | |
|---|---|
| Phenocrysts | |
| Quartz | 12 |
| Plagioclase | 22 |
| Sericite | 6 |
| Altered biotite | 5 |
| Opaques | trace |
| Groundmass | |
| Plagioclase | 44 |
| Sericite | 5 |
| Carbonate | 6 |

Macroscopic examination of the stained off-cut clearly indicates that this sample is a felsic porphryry, composed of phenocrysts of quartz, plagioclase and altered biotite in a groundmass of weakly potassic felsite.

Phenocrysts, 0.5 - 5.0mm in size, make up about 45% of the rock. They consist predominantly of plagioclase - generally poorly twinned, but apparently of oligoclase-andesine composition - and typically aggregated as clumps of prismatic subhedra. The plagioclase phenocrysts show pervasive alteration (locally strong) to minutely fine-grained sericite.

Quartz phenocrysts are typically coarse, monocrystalline grains (occasionally polygranular), showing equant/sub-rounded form, modified by embayments and inclusions of the matrix.

The mafic phenocrysts clearly originated as euhedral biotite. They are now totally pseudomorphed by lamellar intergrowths of sericite, micron-sized rutile, limonite and carbonate.

The groundmass is an evenly felsitic, mafic-free aggregate of feldspars (plagioclase plus possible minor K-spar), of grain size 5 - 30 microns. It is rather sparsely speckled throughout with tiny flecks and small clumps of sericite and fine-grained carbonate. The groundmass shows local development of spherulitic texture.

This is a typical quartz feldspar porphyry of dacitic composition.

**Thin Section 1384-6 (PORPH R.168)**
**HORNFELSED(?) FINE-GRAINED QUARTZ DIORITE**

Estimated mode

| | |
|---|---|
| Plagioclase | 38 |
| Quartz | 16 |
| Biotite | 8 |
| Chlorite | 1 |
| Hornblende | 6 |
| Epidote | 30 |
| Sphene) | 1 |
| Rutile) | |
| Opaques | trace |

This is a fine-grained, quartzo-feldspathic rock of somewhat heterogenous texture. It shows strong epidotization.

This rock lacks the obvious porphyritic character of many of the samples of the suite, and in thin section - though clearly of igneous origin - has a somewhat recrystallized appearance, suggestive of extensive deuteric modification (or possibly the thermal effect of contact with an adjacent later intrusive).

It consists predominantly of a diffuse-margined aggregate of subhedral plagioclase, of grain size 0.1 - 1.0mm, which grades to an interstitial phase of minutely felsitic texture.

Quartz is an abundant accessory, as irregular-equant, polygranular patches of similar grain size to the plagioclase. The quartz segregations, like the plagioclase, tend to show diffuse outlines, gradational to the felsitic interstitial phase (which may also include a component of fine-grained quartz) - in the manner of a partially recrystallized rock.

Mafics consist of epidote, biotite and hornblende. These show distinctive textural relationships of uncertain origin. The epidote forms sub-prismatic clumps, from 0.1 to several mm in size, made up of compact aggregates of tiny granules, 10 - 30 microns in size. Some of the larger patches grade to cores of coarser-grained, prismatic aggregate texture. Epidote also concentrates as a veniform segregation with intergrown quartz.

In one part of the slide (a xenolith?) the epidote is particularly abundant, and in this same area it is associated with blue-green hornblende. The latter forms random or sheaf-like aggregates of acicular grains, mainly in peripheral relation to the epidote clumps.

The principal mafic in the remainder of the slide is biotite (strongly pleochroic from straw colour to dark olive-brown). This occurs concentrated in rimming relationship to the epidote clumps, as felted or meshwork aggregates of tiny, well-formed flakes (of secondary aspect). There are also some irregular patches

Thin Section 1384-6 cont.

composed essentially of biotite with minor intergrown epidote and hornblende. Hornblende, in this portion of the slide, occurs as scattered sheafs of bladed/acicular crystals of porphyroblastic habit, cutting across the quartzo-feldspathic matrix grain fabric.

In a few areas the biotite is altered to chlorite with intergrown flecks of sphene/rutile.

The epidote/hornblende and epidote/biotite clumps have somewhat the aspect of pseudomorphs (after some original mafic?), and some of the quartz may be of introduced or redistributed nature. Secondary processes of one sort of another have clearly been important in the formation of this rock.

**Thin Section 1384-7 (PORPH R.172)**
**QUARTZ DIORITE (TRONDHJEMITE)**

**Estimated mode**

| | |
|---|---|
| Quartz | 28 |
| Plagioclase | 57 |
| Sericite | 2 |
| K-feldspar | 8 |
| Biotite | 3 |
| Muscovite | 2 |
| Chlorite | trace |
| Epidote | trace |
| Sphene | trace |
| Apatite | trace |
| Opaques | trace |

This is a fresh, medium-grained, leucocratic intrusive, composed largely of plagioclase and quartz.

It consists of an intergrowth, on the scale 0.5 - 3.0mm, of subhedral plagioclase and anhedral quartz. The latter occurs as angular pockets, interstitial to the plagioclase aggregate, and as prominent segregations up to several mm in size (see stained off-cut).

The plagioclase is generally fresh, but occasional crystals show replacement by meshworks of elongate, rather coarse flakes of sericite.

Perthitic K-feldspar is the principal accessory, as sporadic grains and small, irregular/elongate segregations, of similar size to the plagioclase. It is totally fresh.

Biotite (occasionally chloritized) and muscovite are the other accessories, as foliaceous pockets interstitial to the plagioclase and sometimes intergrown with quartz. Some biotite flakes are also seen included within plagioclase.

Sphene is a minor but prominent accessory, as sparsely scattered, rather coarse, wedge-shaped crystals.

The quartz-rich character of this rock, and the prevalence of micas rather than hornblende, puts it in the trondhjemitic class of quartz-rich diorites.

**Thin Section 1384-8 (PORPH R.471)  MONZONITE PORPHYRY**

Estimated mode

| | |
|---|---|
| **Phenocrysts** | |
| K-feldspar | 5 |
| Plagioclase | 40 |
| Saussurite | 6 |
| Pyroxene | 4 |
| Amphibole | 2 |
| Biotite | 2 |
| Chlorite | 2 |
| Epidote | 1 |
| Apatite | trace |
| Sphene | trace |
| **Groundmass** | |
| K-feldspar | 32 |
| Quartz | 6 |

This is the first example of a lithotype which is quite widely represented within the suite. It is a leucocratic, somewhat quartzose monzonite, consisting essentially of abundant phenocrysts of plagioclase, and occasional K-feldspar, in a microgranular matrix composed of K-spar and accessory quartz.

Phenocrysts range in size from 0.3 - 3.0mm. They consist predominantly of subhedral plagioclase, typically showing rather even pervasive saussuritization (in the form of a brownish turbidity superimposed by minute flecks of sericite and cryptocrystalline epidote). The occasional coarse phenocrysts of perthitic K-spar are fresh.

The mafics are also of phenocrystic habit - though generally smaller than the feldspars. The commonest type consists of euhedral-subhedral grains of fresh, pale green clinopyroxene. Other forms of mafics include individual flakes of fresh biotite, biotite totally altered to chlorite and fine-grained sphene, and actinolitic amphibole as peripheral modifications of pyroxene. Chlorite (after biotite?) is also seen in peripheral intergrowth with some pyroxene grains. Epidote is an associate of some of the more altered mafics.

The groundmass consists of a blocky microgranular aggregate of fresh K-felspar, of grain size 0.05 - 0.2mm. Accessory quartz, of similar size, occurs sporadically intergrown. There are also traces of more intimate (granophyric) intergrowth of the quartz and K-spar.

This lithotype has the textural aspect of a dyke rock or fine-grained intrusive border phase.

**Thin Section 1384-9 (PORPH R.468)  DIORITE PORPHYRY**

Estimated mode

| | |
|---|---|
| **Phenocrysts** | |
| Plagioclase | 10 |
| Sericite | 7 |
| Epidote | 4 |
| Amphibole | 14 |
| Chlorite | 3 |
| Sphene) Rutile) | 2 |
| Pyrite | 2 |
| **Groundmass** | |
| Plagioclase | 40 |
| Epidote | 7 |
| Amphibole | 8 |
| Chlorite | 2 |
| Quartz | 1 |

This is another rather fine-grained porphyritic rock. It is of dioritic composition, and has a rather heterogenous texture, partly resulting from pervasive alteration.

Phenocrysts range from 0.3 - 6.0mm in size. They are principally hornblende plus lesser plagioclase.

Some of the mafic phenocrysts consist of fresh, olive-brown hornblende. Others have intergrown pale green, actinolitic amphibole (possibly secondary after original pyroxene). Still others consist of actinolite alone, or actinolite partially to completely pseudomorphed by felted chlorite.

Pyrite is a prominent accessory, randomly disseminated as angular/irregular and skeletal clumps, 0.05 - 0.5mm in size - typically intergrown with, or mantled by, epidote.

A few phenocrysts of plagioclase are seen. These are generally strongly altered, either to fine-grained epidote or (in the case of one or two prominent larger phenocrysts) to pseudomorphs of meshwork sericite.

The groundmass is a felsitic to microgranular aggregate of plagioclase, of grain size 10 - 200 microns. It is abundantly speckled with fine-grained epidote, amphibole and chlorite. These intimately intergrown accessories render the groundmass cloudy and texturally diffuse.

Rare accessory quartz occurs as scattered, small, irregular grains.

**Thin Section 1384-10 (PORPH R.504)  MONZONITE PORPHYRY**

Estimated mode

| | |
|---|---|
| **Phenocrysts** | |
| K-feldspar | 5 |
| Plagioclase | 38 |
| Sericite | 6 |
| Biotite | 6 |
| Amphibole | 1 |
| Chlorite | 2 |
| Carbonate | 2 |
| Epidote | trace |
| Apatite | trace |
| Opaques) Rutile) | trace |
| **Groundmass** | |
| K-feldspar | 30 |
| Plagioclase | 5 |
| Quartz | 4 |
| Chlorite) Biotite) | 1 |
| Opaques | trace |

Comparison of the stained off-cuts shows that this is a very similar rock to Sample 1384-8.

Phenocrysts consist principally of abundant, elongate, prismatic grains of plagioclase, 0.5 - 2.5mm in size. These show varying degrees of pervasive, minutely fine-grained sericitization.

The slide includes one large euhedral phenocryst (8mm in size) of fresh K-feldspar, with included small grains of plagioclase. K-spar also forms partial replacements or overgrowths on a few of the plagioclase phenocrysts.

The minor mafic phenocrysts show a highly variable degree of alteration. They include completely fresh, brown biotite; biotite totally pseudomorphed by chlorite and rutile; and amphibole - typically strongly altered to chlorite and carbonate.

The groundmass consists of a blocky aggregate, of grain size 20 - 100 microns, composed of K-feldspar and minor accessory quartz, plus scattered, tiny, sub-phenocrysts of sericitized plagioclase.

Traces of tiny intergrown flecks of mafics and minute granules of opaques are also present.

**Thin Section 1384-11 (PORPH R.511)  MICRODIORITE**

Estimated mode

| | |
|---|---|
| Plagioclase | 66 |
| K-feldspar | 5 |
| Quartz | 4 |
| Sericite | 3 |
| Chlorite | 11 |
| Epidote | 11 |
| Carbonate | trace |
| Sphene | trace |
| Apatite | trace |
| Opaques | trace |

The sectioned portion of this sample embraces the contact between two generally similar - but recognizably different - lithotypes.

Both variants are phenocryst-rich, porphyritic rocks of dioritic composition. They differ in that one has a rather higher content of mafics and a non-potassic interstitial phase, whilst the other has slightly coarser plagioclase phenocrysts than the first, less mafics, and an interstitial phase which includes some K-spar.

Both variants show partial preferred orientation of elongate mafic phenocrysts parallel to the contact, presumably related to flow in a crystal mush.

The non-potassic variant consists of abundant euhedral-subhedral phenocrysts of plagioclase, 0.15 - 2.5mm in size, plus totally altered mafic phenocrysts of similar size, pseudomorphed by felted chlorite and granular epidote. The plagioclase phenocrysts are sharply defined and essentially fresh, but for an overall turbidity and rare dustings of epidote. The phenocrysts are set in an evenly microgranular groundmass of plagioclase, of grain size 10 - 70 microns, liberally speckled with tiny granules of epidote. Traces of quartz are seen as rare pockets associated with epidote clumps.

The other variant has close-packed plagioclase phenocrysts ranging up to 6.0mm in size. These tend to show slightly stronger pervasive alteration (to fine-grained sericite and/or carbonate). Mafics show complete alteration, as in the other variant, though chlorite is strongly predominant over epidote in the resultant pseudomorphs. The groundmass is of identical textural character to that in the other variant, but is devoid of intergrown fine-grained epidote. The stained off-cut indicates that it includes a component of K-spar and, in thin section, it can be seen also to contain minor quartz.

The rock is cut by a system of sub-parallel hairline veinlets or microfractures. These are mostly infilled by epidote, except in one case by K-feldspar, sericite and minor quartz.

**Thin Section 1384-12 (PORPH R.517) MONZONITE PORPHYRY**

Estimated mode

| | |
|---|---|
| **Phenocrysts** | |
| Plagioclase | 44 |
| Sericite | 2 |
| K-feldspar | 5 |
| Chlorite | 5 |
| Carbonate | 2 |
| Rutile | 2 |
| Opaques | trace |
| **Groundmass** | |
| K-feldspar | 30 |
| Quartz) | 8 |
| Granophyre) | |
| Chlorite | 1 |
| Carbonate | 1 |

This rock is readily recognizable, from the stained off-cut, as being of similar type to Samples 8 and 10.

Phenocrysts make up about 60% of the rock. They consist predominantly of sharply euhedral plagioclase crystals, 0.5 - 3.0mm in size, fresh but for occasional light dustings of sericite. They show incipient preferred orientation. Occasional phenocrysts of K-feldspar are also present; these attain sizes of 5.0mm or more.

Mafic phenocrysts are of a similar size range to the plagioclase, but are less abundant. They are totally altered - in the majority of cases to pseudomorphs of chlorite with lamellar biotite. There are also less abundant mafics consisting of intergrowths of chlorite and carbonate; these probably represent original hornblende.

The groundmass is a relatively coarse, blocky, granular aggregate of K-feldspar, 0.05 - 0.2mm in size. Accessory quartz occurs randomly intergrown and, more intimately, in the form of granophyre - which makes up as much as 20% of the groundmass, interstitial to the stumpy subhedra of K-spar. Small flecks of chlorite and carbonate are minor accessories.

This is a somewhat quartzose monzonite of minor intrusive aspect.

**Thin Section 1384-13 (PORPH R.525A) MONZONITE PORPHYRY**

Estimated mode

| | |
|---|---|
| **Phenocrysts** | |
| Plagioclase | 46 |
| Sericite | 6 |
| K-feldspar | 2 |
| Chlorite | 7 |
| Carbonate | 2 |
| Rutile) | 2 |
| Opaques) | |
| Apatite | trace |
| **Groundmass** | |
| K-feldspar | 25 |
| Quartz) | 8 |
| Granophyre) | |
| Chlorite | 1 |
| Carbonate | 1 |

This rock is, in all essential respects, identical to Sample 1384-12 (q.v.).

It differs principally in that the plagioclase phenocrysts show a slightly stronger degree of pervasive sericitization.

The sectioned portion does not include any of the coarser phenocrysts of K-spar noted in earlier examples of this lithotype, and no tendency for preferred orientation of the plagioclase phenocrysts is recognizable.

Opaques (Fe-Ti oxides?) are slightly more abundant than in Sample 12. They consist of small, equant/skeletal grains and grain clusters, closely associated with altered mafic phenocrysts.

**Thin Section 1384-14 (PORPH M.34)**
**GRANOPHYRIC QUARTZ MONZONITE PORPHYRY**

Estimated mode

| | |
|---|---|
| **Phenocrysts** | |
| Plagioclase | 17 |
| Saussurite | 25 |
| Chlorite | 5 |
| Epidote | 3 |
| Carbonate | trace |
| Sphene | trace |
| Opaques | trace |
| Apatite | trace |
| **Groundmass** | |
| K-feldspar | 16 |
| Granophyre | 24 |
| Quartz | 8 |
| Epidote | 1 |
| Carbonate | 1 |

It is apparent from the stained off-cut that this rock is made up of much the same components as the quartzose monzonites of the suite. It differs from that lithotype in that the plagioclase phenocrysts are somewhat larger, though less abundant. They do not show a distinct white etch, and are clearly strongly altered.

In thin section this impression is confirmed. Plagioclase phenocrysts range in size from 0.5 - 4.5mm, and show strong saussuritization. In some cases this consists of a more or less dense dissemination of tiny epidote granules, and in others of pervasive replacement by minutely felted sericite. Examples are also seen of more or less complete conversion to pseudomorphs of intimately intergrown sericite, clays and sub-opaque, cryptocrystalline epidote.

Mafics are also completely altered, to irregular/sub-prismatic clumps, 0.2 - 1.5mm in size, composed of chlorite and granular epidote in various proportions, occasionally with carbonate. Lamellar pseudomorphs recognizable as original biotite are rare, and the predominant primary mafic was probably hornblende. The rock contains a few prominent grains of well-crystallized sphene.

The groundmass is distinctive for its high content of granophyre. It consists predominantly of a blocky aggregate, of grain size 0.05 - 0. 2mm, in which quartz is an abundant component. Granophyre (feathery micro-intergrowths of quartz and K-spar) is prominent; it makes up some 50% of the groundmass, as sub-radiate clumps and irregular masses, alternating with, and enveloping, K-spar and quartz grains.

The rock contains rare, irregular pockets of coarse, sparry carbonate of uncertain origin.



This lithotype clearly represents a more silicic variant of the monzonite porphyries of the suite.

**Thin Section 1384-15 (PORPH M.21) DIORITE**

Estimated mode

| | |
|---|---|
| Plagioclase | 40 |
| Saussurite | 10 |
| K-feldspar | 18 |
| Quartz | 3 |
| Hornblende | 22 |
| Chlorite | 3 |
| Epidote | 3 |
| Apatite | trace |
| Sphene | trace |
| Opaques | 1 |

This quartz-poor, somewhat potassic, feldspathic rock is one of the few non-porphyritic lithotypes of the suite. It is distinctive for its relatively high content of fresh mafics.

It consists predominantly of plagioclase as close-packed, subhedral prismatic grains, 0.5 - 4.0mm in size, showing a distinct preferred orientation - presumably related to flow during implacement. The plagioclase shows notably even, weak to moderate, pervasive saussuritization in the form of dustings of fine-grained sericite and epidote.

Hornblende forms generally ragged, irregular grains and clumps. sporadically intergrown throughout the plagioclase aggregate, and sometimes incorporating plagioclase crystals. It is fresh but for local alteration to chlorite and rare epidote.

K-feldspar, and minor quartz, form an interstitial phase filling angular interstices between the close-packed crystal mush of plagioclase and hornblende. The quartz is generally rather fine-grained, microgranular, but the K-spar is coarser - as evidenced by the fact that adjacent, semi-connected pockets often show optical continuity.

Well-crystallized sphene is a prominent trace accessory. Opaques are apparently magnetite, as equant/skeletal grains, 0.1 - 0.5mm in size, closely associated with the hornblende.

The end of the slide is cut by a system of anastomosing, epidote-filled microfractures with adjacent chloritization.

**Thin Section 1384-16 (PORPH M.21B) ALASKITE**

Estimated mode

| | |
|---|---|
| K-feldspar | 40 |
| Plagioclase | 24 |
| Quartz | 35 |
| Sericite | 1 |
| Chlorite | trace |
| Opaques | trace |
| Limonite | trace |

This is a notably leucocratic, quartz-rich granitoid.

It has a grain size range of 0.4 - 4.0mm, and consists of subhedral plagioclase grains scattered through a relatively coarser intergrowth of perthitic K-feldspar and anhedral quartz.

The plagioclase is fresh but for mild, patchy, argillic turbidity and occasional sericitic flecking. The K-spar is totally fresh.

The quartz in this rock shows a strong tendency to form clumpy segregations up to 5 or 10mm in size. These show strain polarization and crenulate grain boundaries (probably just an effect of the normal crystallization process, as the rock shows no sign of deformation or recrystallization).

Mafics are extremely sparse, being confined to a few small clumps and tiny intergranular shreds of chloritized biotite.

The rock is cut by a few discontinuous hairline fractures, infilled by limonite.

**Thin Section 1384-17 (PORPH M.117) HORNFELS (META-DIORITE)**

Estimated mode

| | |
|---|---|
| Plagioclase | 58 |
| Quartz | 6 |
| Biotite | 30 |
| Chlorite | 3 |
| Hornblende | 1 |
| Epidote | 1 |
| Apatite | trace |
| Sphene | trace |
| Opaques | 1 |

This sample is a fine-grained feldspathic rock of apparent igneous origin. It is distinguished from others of the suite by its notably high content of secondary-type biotite, and by a texture which may be indicative of extensive recrystallization. Sample 1384-6 shows certain similarities.

The rock consists predominantly of plagioclase. Rare remnants are distinguishable of a blocky, igneous-type aggregate, composed of subhedra, 0.5 - 2.0mm in size, but, for the most part, the plagioclase is in the form of a minutely felsitic, diffuse-margined matrix of grain size 10 - 30 microns. This has a totally recrystallized (granoblastic) appearance. It is strikingly free of pervasive alteration.

The mafic component is fresh, straw-coloured to dark olive-brown biotite, as meshwork aggregates of well-formed individual flakes, 20 - 150 microns in size. The biotite concentrates as semi-continuous networks and irregular to sub-prismatic clumps, 0.5 - 2.0mm in size, which possibly represent a totally recrystallized mafic component in an original diorite. The distribution of the biotite outlines a blocky texture of presumed relict primary origin, in which the areas of microgranular plagioclase between the biotite segregations represent original coarse plagioclase subhedra, now recrystallized.

A minor proportion of the biotite occurs in dispersed form, as tiny flecks intergrown throughout the recrystallized plagioclase.

Chlorite, epidote and sphene are minor accessories of some of the biotite clumps. A few of the latter also include euhedral grains of plagioclase, somewhat coarser than the prevalent felsitic matrix.

Quartz is a significant accessory, occurring as occasional augen-like clumps to 1.0mm in size, and as randomly-disseminated, smaller grains and pockety segregations in the granoblastic plagioclase matrix.

One end of the sectioned area incorporate a sub-angular patch, some 5 -10mm in size, which shows distinctive mineralogy, and possibly represents an altered, partially assimilated xenolith. In this area biotite is minor, and the mafic clumps consist of epidote and



chlorite, plus acicular grains of hornblende of porphyroblastic aspect.

The mafic clumps in this area often contain clusters of opaques - apparently mainly pyrite. Pyrite is also seen in the host lithotype as rare disseminated individuals, to 0.5mm in size, within biotite clumps.

The totally non-foliated, evenly recrystallized fabric of this rock, its mineralogy (rich in secondary biotite), and the freshness of its components, are strongly characteristic of a hornfels - in this case probably derived from an original diorite.

**Thin Section 1384-18 (PORPH TR 10) MICRO-SYENITE**

Estimated mode

| | |
|---|---|
| K-feldspar | 92 |
| Biotite) | 1 |
| Chlorite) | |
| Actinolite | 1 |
| Sphene | trace |
| Carbonate | 5 |
| Epidote | 1 |
| Opaques | trace |

This sample represents another igneous rock type in this varied suite. As is abundantly apparent from the stained off-cut, it consists almost entirely of K-feldspar.

In thin section the latter is found to occur as an even, anhedral mosaic of grain size 0.05 - 0.5mm. This is of primary, unrecrystallized appearance, and is fresh but for a mild, brownish turbidity.

Mafics are extremely minor, and consist of sparsely scattered small clumps and shreds of partially chloritized biotite and actinolitized, carbonated hornblende. Tiny disseminated granules of sphene are also present.

The K-spar aggregate is cut by a network of hairline veinlets and intergranular pockets of carbonate. There are also rare epidote-filled micro-fractures.

This rock is totally free of quartz and plagioclase, and is of alkali syenite composition. Its saccharoidal texture is similar to that of an aplite, and it is probably a dyke.

**Thin Section 1384-19 (EMER Bx)**
**SILICEOUS MONZONITE WITH AMPHIBOLITE INCLUSIONS**

Estimated mode

| | |
|---|---|
| Plagioclase | 35 |
| Saussurite | 5 |
| K-feldspar | 28 |
| Quartz | 7 |
| Hornblende | 25 |
| Epidote | 1 |
| Sphene | trace |
| Opaques | 1 |

This sample is a fine-grained monzonitic intrusive containing scattered, sharply defined inclusions (of xenolithic aspect) up to 4 cm in size, composed of a dark, crystalline material.

The host rock is found, in thin section, to exhibit a sub-porphyritic texture, with coarser prismatic subhedra, up to 3.0mm in size, scattered through a predominant aggregate in the size range 0.2 - 1.0mm.

The coarser grains are principally plagioclase (plus occasional K-spar). The matrix consists of intergrown K-feldspar, quartz and plagioclase.

The plagioclase shows weak to moderate pervasive saussuritization (alteration to fine-grained epidote and sericite). The K-spar shows a faint overall brownish turbidity.

Mafics are rather evenly scattered, small, irregular grains, 0.2 - 1.0mm in size (rarely euhedra or polygranular clumps to 2. 0mm) of olive-green hornblende, intergranular to the feldspars. The hornblende is fresh but for minor patches of epidote. The latter is often associated with included clusters of equant opaques (apparently magnetite) and traces of sphene.

The slide includes several areas of the dark, xenolithic(?) phase, ranging in size from 5 - 12mm. These are found to consist of monomineralic aggregates of rather coarse, subhedral-anhedral amphibole, of grain size 0.3 - 3.0mm. This is olive-green hornblende of identical appearance to the apparently primary hornblende in the host rock, but showing local modification to a paler green, actinolitic(?) variety. Some of the amphibolitic patches contain patches of granular epidote and opaques - again similar to those in the host phase. Some of the xenoliths are fringed by zones of partial assimilation(?) in which the massive hornblende appears fragmented, and grades to the smaller, primary-appearing clumps seen throughout the host rock.

The nature of these amphibolite inclusions or segregations is uncertain. Possibly they represent a product of primary segregation process in the magma chamber, fragmented and incorporated in the

Thin Section 1384-19 cont.

still fluid intrusive. The lack of reaction effects suggests a close genetic relationship between "fragments" and matrix.

**Thin Section 1384-20 (EMER UM)** **SERPENTINIZED PERIDOTITE**

Estimated mode

| | |
|---|---|
| Olivine | 30 |
| Serpentine | 22 |
| Pyroxene | 1 |
| Hornblende | 12 |
| Talc | 5 |
| Carbonate | 1 |
| Opaques | 29 |

This dark, rather featureless rock is found, in thin section, to be a strongly altered ultramafic which was originally composed predominantly of an aggregate of olivine, of grain size 0.5 - 2.0mm.

The rock is now extensively altered to serpentine and abundant secondary magnetite, but small remnants of olivine survive throughout. Groups of these show optical continuity, indicating the scale of the primary granularity.

The bulk of the sectioned area shows a cellular texture consisting of remnants of olivine, partially serpentinized olivine, or totally serpentinized olivine, separated by close-spaced networks of secondary magnetite. The latter is in the form of micron-sized granules, segregating to compact clumps and veinlets.

The slide includes several mineralogically distinct areas of uncertain origin.

One side consists of a selvedge (vein? contact?) of fresh, olive-green hornblende, as a monomineralic aggregate of grain size 0.2 - 1.0mm. This is separated from the serpentinized olivine area by a thin reaction zone composed predominantly of minutely felted talc. This contains small unreplaced remnants of hornblende.

A small area about 3mm in size, within the serpentinized rock adjacent to the hornblende, is composed of fresh clinopyroxene with interstitial hornblende. This has the aspect of a xenolith.

A diffuse, vein-like zone crosses the serpentinized area. This is composed essentially of minutely felted serpentine with streaks and patches of talc and carbonate, but only minor development of the fine-grained opaques which permeate the bulk of the rock.

Thin Section 1384-22 (PORPH Amph.)
AMPHIBOLITE WITH MONZONITE VEINS

Estimated mode

| | |
|---|---|
| Host rock | |
| Amphibole | 57 |
| Epidote | trace |
| Chlorite | 2 |
| Carbonate | 6 |
| Opaques | 1 |
| Intrusive vein | |
| Plagioclase | 13 |
| K-feldspar | 10 |
| Sericite | 2 |
| Epidote | 8 |
| Carbonate | 1 |

This sample appears to represent a zone of intermingling of monzonite and amphibolite. In the sectioned area the ultramafic rock predominates and acts as host to a vein-like body of monzonite. The latter shows clearly invasive contacts, and incorporates remnants of the amphibolite (see stained off-cut).

The ultramafic phase is an essentially monomineralic, anhedral aggregate of amphibole, of grain size 0.5 - 4.0mm. The amphibole is predominantly a pale green variety, possibly of actinolitic composition. It appears to be a modification of a primary, pale olive-coloured variety (presumably hornblende), which survives as sporadic small remnant patches and flecks.

Minor chlorite, sometimes with granules of epidote and lamellar wisps of rutile, occurs as small equant patches interstitial to the amphibole. These are probably pseudomorphs of original accessory biotite. Small, randomly disseminated, ragged/skeletal grains of opaques are another minor constituent.

The amphibolite shows partial alteration to carbonate via a network of intergranular veinlets. Carbonate also locally extends along amphibole cleavages and forms diffuse, patchy or streaky replacements.

The monzonite area consists of an anhedral aggregate of plagioclase and K-feldspar, of grain size 0.3 - 3.0mm. The plagioclase shows irregularly developed saussuritization, in the form of fine-grained flecks of sericite and more or less abundant granules of epidote. The latter tends to concentrate near the contacts with the amphibolite, where it forms extensive, compact, essentially monomineralic patches.

The contacts of the monzonite with the amphibolite wall rock, and the included amphibolite fragments, are irregular but sharp. The only reaction effect appears to be an enhanced development of carbonate alteration immediately at the contact.

Thin Section 1384-21 (PORPH Dfp) DIORITE PORPHYRY

Estimated mode

| | |
|---|---|
| Phenocrysts | |
| Plagioclase | 26 |
| Sericite | 4 |
| Chlorite | 2 |
| Carbonate | 1 |
| Sphene) Rutile) | trace |
| Apatite | trace |
| Groundmass | |
| Plagioclase | 43 |
| Sericite | 15 |
| Carbonate | 4 |
| Biotite) Chlorite) | 4 |
| Opaques) Rutile) | 1 |

This is a porphyry of similar textural appearance to several others of the suite, but of distinctive composition. It is a leucodiorite, devoid of both quartz and K-feldspar, and low in mafics. The groundmass shows rather strong pervasive alteration.

Phenocrysts are relatively sparse, making up about 1/3 of the rock. They consist predominantly of plagioclase, as euhedral to subhedral grains 0.3 - 3.0mm in size, sometimes aggregated as clumps. They show a rather even, light, pervasive speckling of sericite plus rare flecks of carbonate.

Rare mafic phenocrysts, to 1.0mm in size, are totally altered and now consist of chlorite with lamellar rutile (after biotite?) or chlorite with carbonate (after hornblende?).

The groundmass is a felsitic/microgranular aggregate of plagioclase, of grain size 10 - 100 microns. Small intergrown flecks of partially chloritized biotite, and sparsely disseminated specks of rutile and opaques, are the only primary accessories.

A rather even speckling of randomly-oriented sericite and small, diffuse clumps of minutely fine-grained carbonate is superimposed on the groundmass. This alteration tends to partially obscure both the grain fabric of the groundmass plagioclase and the outlines of the phenocrysts (which are altered in like manner).

Thin Section 1384-22 cont.

Small apophyses of monzonite and/or carbonate alteration penetrate the amphibolite as offshoots of the main monzonite body.