Province of British Columbia
Ministry of Energy, Mines and
Petroleum Resources
Hon. Jack Davis, Minister

MINERAL RESOURCES DIVISION
Geological Survey Branch

GEOLOGY, LITHOGEOCHEMISTRY AND MINERALIZATION IN THE BUCK CREEK AREA, BRITISH COLUMBIA

By B.N. Church and J.J. Barakso

PAPER 1990-2

Province of British Columbia
Ministry of Energy, Mines and
Petroleum Resources
Hon. Jack Davis, Minister

MINERAL RESOURCES DIVISION
Geological Survey Branch

GEOLOGY, LITHOGEOCHEMISTRY AND MINERALIZATION IN THE BUCK CREEK AREA, BRITISH COLUMBIA

By B.N. Church and J.J. Barakso

PAPER 1990-2

MINERAL RESOURCES DIVISION
Geological Survey Branch

Canadian Cataloguing in Publication Data

Church, B.N.
Geology, lithogeochemistry and mineralization in the Buck Creek area, British Columbia

(Paper, ISSN 0226-9430 ; 1990-2)

Bibliography: p.
ISBN 0-7718-8657-8

1. Geology — British Columbia — Buck Creek Region (Bulkley-Nechako) 2. Geology, Economic — British Columbia — Buck Creek Region (Bulkley-Nechako) I. Barakso, J.J. II. British Columbia. Geological Survey Branch. III. Title. IV. Series: Paper (British Columbia. Ministry of Energy, Mines and Petroleum Resources); 1990-2.

QE187.C58 1990 557.11'2 C88-092130-7

VICTORIA
BRITISH COLUMBIA
CANADA
March 1990

Frontispiece: Panoramic view of open-pit operations at the Equity Silver mine, July 1984.

- ADDENDUM -

For convenience the lithogeochemical data listed in Table A.1 is provided in the file labelled "Back Ck. sdf" in flat ASCll format on a 5 1/4 inch DSDD floppy diskette in the pocket of this report.

Data format:

	Field	Type	Width	Col.
1.	SAMP NAME	Char	3	1-3
2.	SAMP NUM	Char	5	4-8
3.	UTM ZONE	Num	2	9-10
4.	EASTING	Num	6	11-16
5.	NORTHING	Num	7	17-24
6.	GEOL. CODE	Char	2	25-26
	ASSAYS	Num	5	27-131

Elements:				Dec
7.	Ag ppm	Num	5	1
8.	As ppm	Num	5	
9.	Au pp	Num	5	
10.	Ba ppm	Num	5	
11.	Ca ppm	Num	5	
12.	Cd ppm	Num	5	
13.	Co ppm	Num	5	
14.	Cu ppm	Num	5	
15.	F ppm	Num	5	
16.	Fe ppm	Num	5	
17.	Hg ppb	Num	5	1
18.	K ppm	Num	5	
19.	Mg ppm	Num	5	
20.	Mn ppm	Num	5	
21.	Mo ppm	Num	5	
22.	Na ppm	Num	5	
23.	Ni ppm	Num	5	
24.	Pb ppm	Num	5	
25.	Sn ppm	Num	5	
26.	Sr ppm	Num	5	
27.	Zn ppm	Num	5	

FOREWORD

This paper, focusing on the geology and metallogeny of the Upper Cretaceous and Tertiary volcanic rocks of the Buck Creek basin southeast of Houston in central British Columbia, is largely based on field mapping completed during the period 1969 to 1976. Much of the material has been published previously by B.N. Church, mostly in summary reports in annual editions of Geology, Exploration and Mining in British Columbia for the years in which the work was done. The geological interpretations presented at that time are supplemented by the inclusion of extensive lithogeochemical data.

Much work has been done in the Buck Creek area since the field research behind this report was completed. The Equity Silver orebodies at Sam Goosly Lake will soon be entering their second decade of open-pit production with the feasibility of an underground mining operation under investigation; the Silver Queen veins supported production briefly in 1972-73 and have recently been the target of an extensive underground exploration program which has added significantly to reserves. The geological staff at Equity published a paper on the mine geology in Economic Geology in 1984 and more recent work in the Babine and Telkwa ranges, by Don MacIntyre of this Ministry, has added greatly to understanding of the Jurassic and Lower Cretaceous stratigraphy which forms the basement to the Buck Creek area.

Although much of the content of this report is dated, it draws together under a single cover research results previously fragmented through the literature and in unpublished files.

W.R. Smyth, Chief Geologist
Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources

TABLE OF CONTENTS

	Page
FOREWORD	V
SUMMARY	VI
CHAPTER 1 — INTRODUCTION	1
Physiography and Glaciation	1
Mining Activity	1
Acknowledgments	2
CHAPTER 2 — GENERAL GEOLOGY	3
Hazelton Group	3
Maxan Lake Formation	3
Telkwa Formation	3
Skeena Group	6
Francois Lake Group	8
Acidic Volcanics	10
Tip Top Hill Formation	11
Burns Lake Formation	11
Goosly Lake Formation	11
Buck Creek Formation	12
Fenton Creek Volcanics	12
Plateau Basalts	12
Poplar Buttes Volcanics	12
Igneous Intrusions	13
Topley Intrusions	13
Bulkley Intrusions	14
Nanika Intrusions	15
Goosly Intrusions	15
CHAPTER 3 — STRUCTURAL GEOLOGY	17
CHAPTER 4 — LITHOGEOCHEMISTRY	19
Sample Collection	19
Methods	19
Data	20
Detailed Study	23
Inter-element Correlations	23
Factor Analysis	23
Cluster Analysis	24
Composition of the Principal Formations	24
Geochemical Maps	26
CHAPTER 5 — ECONOMIC GEOLOGY	29
Mineral Deposits	32
Equity Mine (Sam Goosly)	33
Silver Queen	41
Diamond Belle	47
Bob Creek	49
Dungate Creek	51
Bornite	54
Grouse Mountain	54
Winninyik Hill	58
Apex	59
Irk	59
Boo Mountain	59
Gerow Creek	59
Mona	60
Francois Lake	61
Oakla	61
Gamble	61

	Page
REFERENCES	63
APPENDIX A — LITHOGEOCHEMICAL DATA	65
APPENDIX B — AEROMAGNETIC MAPS	95

TABLES

2.1	Table of formations for the Buck Creek area	4
2.2	Analyses of volcanic rocks	7
2.3	Analyses of igneous intrusions	13
2.4	Radiometric K/Ar dates for the Buck Creek area	14
4.1	Statistics of the analyzed elements	20
4.2	Matrix of correlation coefficients of log values	24
4.3	Results of "R-mode" factor analysis, eigenvalues and varimax matrix for 94 per cent of total variance	25
4.4	Results of cluster analysis for all samples, composition of the main groups	25
4.5	Composition of the Goosly intrusions and Mesozoic host rocks	25
5.1	Assay results from the Equity mine area	35
5.2	Assay results from the Wrinch vein system	46
A.1	Lithogeochemical results	66
A.2	Alteration and mineralization–analysed samples	65

FIGURES

1.	Geology of the Buck Creek Tertiary outlier	(in pocket)
2.	Anomalous silver and arsenic occurrences in the Buck Creek area	(in pocket)
2.1	Composition frequency of Hazelton volcanic rocks in the Telkwa Range and Gerow Creek	6
2.2	Composition frequency of volcanic rocks in the Owen Lake–Goosly Lake area	11
3.1	A comparison of the frequency of fractures and topographic lineaments in the Buck Creek map area	17
3.2	Equal-area plot of slickenside attitudes in the Mine Hill area	18
3.3	Equal-area plot showing bedding attitudes and fracture frequencies on Grouse Mountain	18
4.1	Distribution of lithogeochemical sampling stations in the Buck Creek area	19
4.2	Cumulative frequency plot for arsenic on a normal probability graph; samples from the Equity mine area	20
4.3	Cumulative frequency plot for lead on a normal probability graph; samples from Tertiary country rocks in the Goosly Lake area	21
4.4	Frequency distribution histogram for lead; samples from the Equity mine area	21
4.5	Cumulative frequency plot for nickel on a normal probability graph, samples from the Equity mine area	22
4.6	Frequency distribution diagram for zinc; samples of Tertiary rocks from the Goosly Lake area.	23
4.7	Cumulative frequency plot for zinc; samples from the Silver Queen mine area	23

CHAPTER 1

INTRODUCTION

The Buck Creek area is situated on the Skeena arch in central British Columbia, midway between Prince Rupert and Prince George. The map area covers approximately 3000 square kilometres of rolling terrain bounded by Francois Lake on the south and Highway 17 on the north, between the towns of Houston on the west and Burns Lake on the east, including parts of NTS map sheets 93L, 93E and 93K.

The object of this report is to bring together results of previous geological investigations and some new lithogeochemical data with a view to shedding further light on the genesis of ore deposits in the area. It builds on 1:100000-scale geological mapping of the Buck Creek area completed mainly in the period 1969 to 1972 and on additional information gathered during numerous subsequent visits to the area.

Successive studies show that the area is underlain by sedimentary and volcanic rocks and igneous intrusions of Mesozoic and Tertiary age which host a variety of mineral deposits. The first definitive geological descriptions were by Leach (1907, 1910) on the Hazelton rocks, Kerr (1936) on the mineral deposits of the area, and Lang (1941) and Armstrong (1965) on regional mapping. More recent reports on the regional geology have been published by Church (1973a) Tipper (1976) and Tipper and Richards (1976). Other publications by the authors include Church (1970a) on the Silver Queen mine at Owen Lake, Church (1970b, 1971c) on the Sam Goosly deposit (the Equity mine); Church (1973b) on the Grouse Mountain deposit; Church *et al.* (1976) on the lithogeochemistry of the Owen Lake, Parrott Lakes and Goosly Lake areas; and Church (1985) on the geology and mineralization in the Buck Creek area.

PHYSIOGRAPHY AND GLACIATION

The Buck Creek area is a well-dissected part of the Nechako Plateau straddling the Skeena–Fraser drainage divide. Elevations vary from about 600 metres (1950 feet) on the Bulkley River at Houston and 715 metres (2350 feet) on Francois Lake, to 1625 metres (5330 feet) at the summit east of the Equity minesite, near the centre of the map area.

The topography and drainage patterns have been greatly modified by Pleistocene glaciation. In general, high ridges and summits have been bevelled and smoothed, and valleys widened by the advance of regional ice sheets and smaller valley glaciers.

The direction of last advance of the Wisconsin (Fraser) Cordilleran ice sheet, as determined from glacial striae measurements, was easterly, averaging 085°. Granite boulder erratics found scattered across the west part of the map area were probably plucked and ice-rafted from the high mountain ranges to the west. Final retreat of the ice left the area strewn with gravel and clay. Drainage resulting from the ablation is responsible for fluvial sands such as found along the Bulkley River, and esker deposits at Burns Lake and near lower Parrott Lake.

Physiographic evidence shows that both Owen Lake and Goosly Lake were once much larger than at present. Ancestral Owen Lake was ponded between a retreating valley glacier on the north and a thick terminal moraine on the south. Meltwater entering this lake from the east, mainly from Wrinch Creek, built an outwash fan which now forms a distinctive broad bench, causing a conspicuous large bend in the present outline of Owen Lake. Breaching and downcutting of the terminal moraine at the south end of the lake resulted in drainage of the meltwaters and erosion along th valley between Owen Lake and Francois Lake.

The eventual withdrawal of ice from Owen valley at the end of the glacial period caused a reversal in local water flow from the Fraser River system via Francois Lake on the south, to the present course, flowing northerly to the Bulkley and Skeena river systems. In recent times, alluvial fans spread across the valley floor at the mouth of Emil Creek and Okusyelda Creek, near the north end of Owen Lake. Growth of these fans dammed Owen Creek from time to time and raised Owen Lake to its present level.

Ancestral Goosly Lake is believed to have extended about 6.5 kilometres west and 3 kilometres east beyond its present limits, covering a broad flat section of the main valley. Meltwater streams entered this body of water from the east, more or less parallel to the present drainage, and from the north along Klo Creek. The lake drained southward from an outlet located about 2.5 kilometres southwest of the present mouth of Klo Creek, the outflow eroding a deep channel in older glacial outwash en route to Parrott Creek. Later melting of an ice dam at the west end of the lake allowed the water to escape along the present course of Buck Creek, the southern outlet being abandoned. Goosly Lake was reduced to its present level following erosion of a canyon through a section of basaltic lava on Buck Creek, near the margin of the former lake.

In general the area contains expanses of glacial till and fluvioglacial sediments, which are local hindrances to prospecting and mine development. Thicknesses of this material in excess of 20 metres are not uncommon.

MINING ACTIVITY

Prior to 1905, native Indians reportedly recovered a small amount of placer gold from Bob Creek, near its confluence with Buck Creek, 10.6 kilometres south of Houston. Subsequently, lode sulphides were discovered and explored on Grouse Mountain, 19 kilometres north of Houston, in the period 1915 to 1929, and at Owen Lake, 35 kilometres south of Houston, from 1912 to 1923. Further intermittent exploration at Owen Lake finally led to production from the Silver Queen mine in 1972 amounting to 190 676 tonnes of ore

CHAPTER 2

GENERAL GEOLOGY

Eighteen geological units are mapped in the Buck Creek area (Table 2.1; Figure 1, in pocket). They include a wide variety of Mesozoic and Tertiary strata that have undergone multiple episodes of faulting and igneous intrusion.

The relative stratigraphic position and age of these rocks were generally decided by the rules of superposition of beds, degree of regional metamorphism and cutting relationships of the igneous intrusions. Fossil evidence and radiometric dates provide some local control. The placement of geological contacts is based on detailed mapping in the vicinity of the principal mines and exploration prospects, and more than 3000 outcrop control stations scattered throughout the area.

This report retains the names "Topley", "Bulkley", "Nanika" and "Goosly" for the principal igneous intrusions, and the established names of the major stratigraphic divisions such as "Hazelton" and "Skeena" for Jurassic and Early Cretaceous .formations, respectively, from previous geological usage. The informal name "Francois Lake group" is newly applied to the succession of Late Cretaceous and Early Tertiary beds that underlie much of the Buck Creek map area. This replaces "Endako Group" mapped in the eastern part of the area (NTS 93K) by Armstrong (1965)–a name also adopted by Church (1970a, b) during mapping to the west (NTS 93L), but subsequently abandoned to avoid ambiguity in the light of new radiometric dates (Church, 1973a) showing the rocks to be older than the "Oligocene and younger" limit assigned to the Endako Group by Armstrong (*see* Table 2.4). The name "Ootsa" is retained informally for an Upper Cretaceous rhyolite formation mapped by Duffell (1959) on the north shore of Francois Lake (NTS 93E) and similar units identified just to the northwest near Owen Lake, by Church (1970a, page 123). "Ootsa" is not used in Armstrong's nomenclature nor elsewhere by the present authors because it is uncertain that this unit is coextensive with basal acidic volcanic rocks in the Francois Lake group exposed throughout the Buck Creek area (*see* section on "Acidic Volcanics" in this chapter).

The term "plateau basalts", adopted in this report, is generally used in reference to thin, near-horizontally bedded Miocene (and younger) basalts found throughout south-central British Columbia. The term fits, in part, Armstrong's (1965) "Oligocene and younger" definition of the Endako Group and Mathew's (1989) description of the Chilcotin Group.

HAZELTON GROUP

The oldest stratigraphic units are assigned to the Hazelton Group. They consist of an assemblage of mostly gently dipping resistant lavas and pyroclastic rocks (Units 1 and 2, Figure 1) and interbedded and basal sedimentary rocks (Unit 0) exposed mainly in the north, northwest and east marginal parts of the map area, as well as in several small windows formed by erosion of the Tertiary cover rocks. On Grouse Mountain, west of McQuarrie Lake just northwest of the map area, three divisions are recognized in the Hazelton (Church, 1973b). These comprise a lower assemblage of reddish lavas and tuffs (Unit 1), overlain by fossiliferous argillite, quartzite and tuff, and upper volcanic rocks (Unit 2) similar to the lower assemblage but containing some conspicuous rhyolite flows. Elsewhere in the Buck Creek map area the upper volcanic rocks rest, without intervening sedimentary beds and without much distinction, on the lower volcanic unit. Units 1 and 2 are thought to correspond respectively to the "Howson subaerial facies" and "Bear Lake subaerial facies" of the Telkwa Formation described by Tipper and Richards (1976). In more specific terms the volcanic and sedimentary rocks of Unit 2 are believed to unconformably overlie the Telkwa Formation (Unit 1) of Sinemurian age (MacIntyre *et al.*, 1987).

MAXAN LAKE FORMATION

The informally named Maxan Lake formation (Unit 0) is the oldest known fossiliferous sedimentary unit within the map area. These rocks probably correlate with the lowest part of the Telkwa Formation. The unit is exposed approximately 5 kilometres east of the north end of Maxan Lake. These rocks are mostly poorly exposed, flaggy bedded, brown mudstones and sandstones. The total thickness and contact relationships of the unit are uncertain other than that the beds appear to be in fault contact with a massive section of Hazelton volcanic rocks (Unit 2) lying adjacent to the northeast. Also, the unit is unconformably overlain by Tertiary lavas to the south and southeast and faulted against the same rocks on the northwest.

The fossil content of the Maxan Lake formation includes carbonaceous plant remains, corals, brachiopods, gastropods and pelecypods. Among the suite of pelecypod shells *Jaworskiella siemonmulleri*, *Welya acutiplicata* and *Welya bodenbenderi* (Plate 2.1; GSC Catalog No. C-103718) have been specifically identified by T.P. Poulton of the Geological Survey of Canada who has suggested a late Sinemurian age for the assemblage.

A basal chert-pebble conglomerate exposed on the north shore of Francois Lake contains *Weyla* fragments and may represent the main body of Maxan Lake formation within the map area. The absence of granitic clasts supports the fossil evidence suggesting an Early Jurassic age. Younger sedimentary rocks in this area locally contain fragments of the Topley and younger granitic plutons. These rocks are tentatively inferred to be Skeena Group and ambiguously assigned the symbol "Unit 3/0" on Figure 1.

TELKWA FORMATION

The Telkwa Formation (Unit 1) is primarily volcanic, consisting of massive maroon and grey breccia and tuff deposits interbedded with a few greenish lava flows. A

TABLE 2.1
TABLE OF FORMATIONS FOR THE BUCK CREEK AREA

AGE (Ma)	BEDDED ROCKS	STRATIGRAPHIC THICKNESS (IN METRES)	IGNEOUS INTRUSIONS
MIOCENE 21.4 ± 1.1	**POPLAR BUTTES FORMATION:** Columnar olivine basalt	60-90	Feeder dikes to Poplar Buttes basalt
	(major unconformity)		
FRANCOIS LAKE GROUP **EOCENE** 48.2 ± 1.6	**BUCK CREEK FORMATION** PARROTT MOUNTAIN MEMBER: Mainly andesitic breccia	~100	Feeder dikes to Buck Creek formation including diabase and a variety of microporphyry and fine grained types
	SWANS LAKE MEMBER: Mainly basaltic lava HOUSTON MEMBER: Aphanitic andesite and dacite lavas and volcanic breccia, minor basalt	~300	Quartz porphyry dikes cutting Goosly stock
48.7 to 54.3	**GOOSLY LAKE FORMATION:** Mainly andesite and trachyandesite lavas with bladed feldspar phenocrysts	500 ±	**GOOSLY INTRUSIONS:** Syenomonzonite-gabbro bodies; including stocks in the Parrott Lake and Goosly Lake area
	BURNS LAKE FORMATION: Conglomerate, sandstone and shale		
	(unconformity)		**NANIKA INTRUSIONS:** Granitic stock west of Equity mine and quartz feldspar porphyry at Dungate Creek
57.0 to 62.7	TCHESINKUT RHYOLITE?	100?	
	(unconformity)		
UPPER CRETACEOUS			**BULKLEY INTRUSIONS**
75.5 to 77.1	**TIP TOP HILL FORMATION:** Mainly biotite-hornblende andesite and andesitic dacite lavas and pyroclastic rocks	~500	Mine Hill microdiorite sills and dikes
78.1 to 80.6	Acidic volcanic rocks, mainly rhyolite lava in the Bob Creek and Bulkley Lake areas possibly related quartz porphyry-intrusions on Okusyelda Hill	100?	Basic and intermediate stocks at Bob Creek and Tsichgass Lake Biotite-plagioclase porphyry stock at Duck Lake and related dikes in the Owen Lake and Bob Creek area
	(major unconformity)		
LOWER CRETACEOUS	**SKEENA GROUP?** A mixed assemblage of chert-pebble and polymictic conglomerate, sandstone and felsic volcanic fragmental rocks; shale and massive rhyolite lava form local deposits; includes conglomerate with some weyla-bearing fragments	~750	
	(major unconformity)		
JURASSIC	**HAZELTON GROUP** Undivided fine-grained dacitic andesite, rhyolite and basaltic lavas, volcaniclastic rocks and dikes	?	**TOPLEY INTRUSIONS:** includes the granitic bodies at Topley and near Burns Lake
	TELKWA FORMATION: includes maroon tuff and tuff breccia	?	
	MAXAN LAKE FORMATION: Weyla-bearing brown sandstones; may also chert-pebble conglomerate and associated beds assigned to the Skeena Group	?	

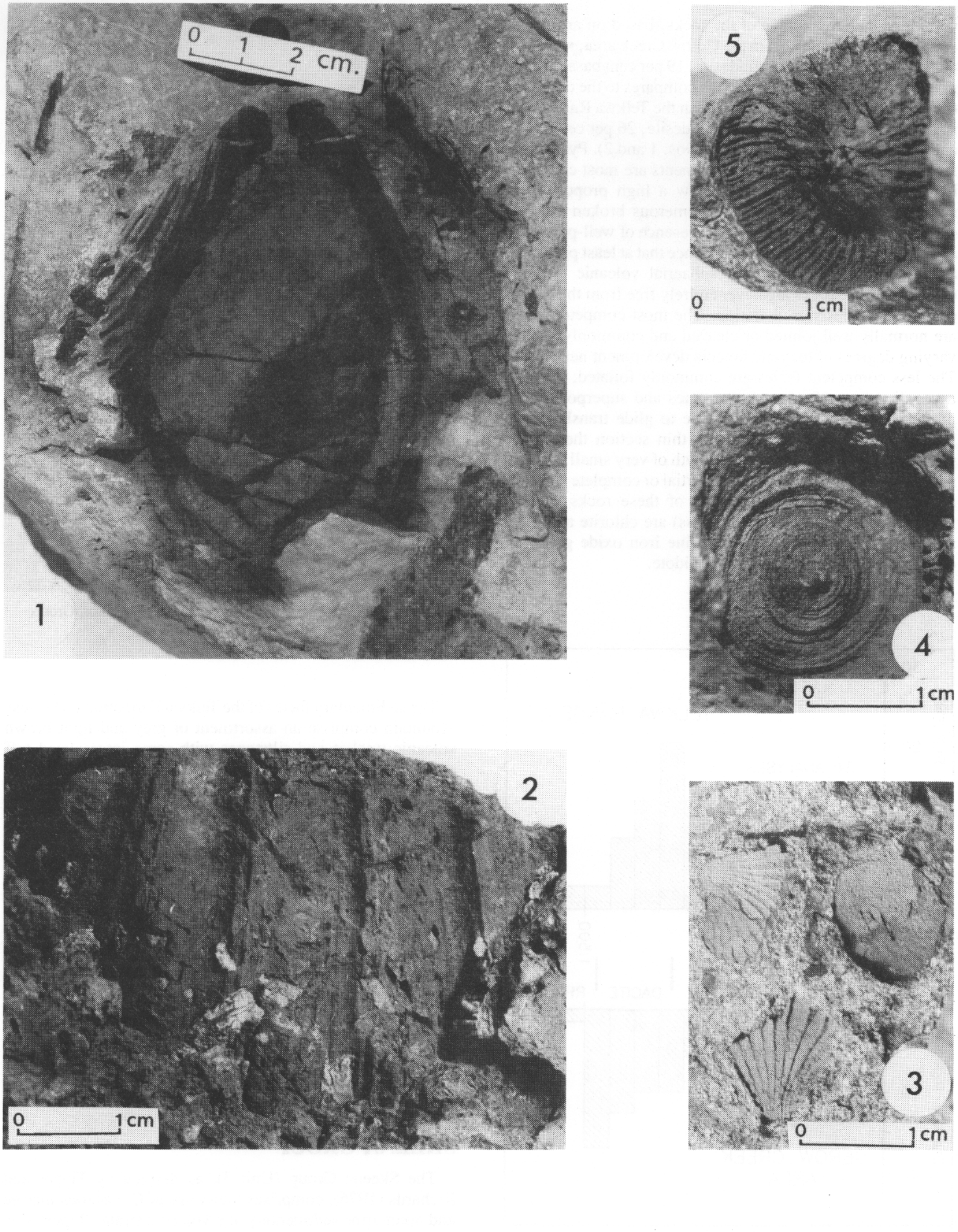


Plate 2.1. Fossil collection from the Maxan Lake formation, 4 kilometres northeast of Maxan Lake (Late Sinemurian): (1) *Jaworskiella*?, (2) *Weyla acutiplicata*, (3) Rhynchonellid brachiopods, (4) and (5) corals (identifications by T.P. Poulton, GSC, cat. G103718).

compositional breakdown of the rocks, based on arc-fusion analysis of 43 samples from the Gerow Creek area, shows 40 per cent dacite, 30 per cent andesite, 19 per cent basalt and 11 per cent rhyolite (Figure 2.1). This compares to the composition of the Hazelton volcanic rocks in the Telkwa Range, that is 28 per cent dacite, 40 per cent andesite, 26 per cent basalt and 6 per cent rhyolite (Table 2.2, Nos. 1 and 2). Pyroclastic material predominates. Lithic fragments are most common, however, petrographic studies show a high proportion of shardy dust in some rocks and numerous broken feldspar crystals in others (Plate 2.2). The presence of well-preserved accretionary lapilli is taken as evidence that at least part of the accumulation is the result of subaerial volcanic eruption (Plate 2.3). The rocks are never entirely free from the effects of either cataclasis or alteration. The most competent units are normally well jointed or cleaved and commonly display varying degrees of tectonic breccia development near faults. The less competent facies are commonly foliated; in many cases distortion of primary structures and superposition of preferred fabrics appears to be due to glide translation on incipient subparallel fractures. In thin section these glide planes are often marked by the growth of very small plates of secondary mica. The products of partial or complete degeneration of the primary components of these rocks (mainly feldspar, biotite, pyroxene and glass) are chlorite and other secondary micas, clay minerals, fine iron oxide granules, carbonates and, less commonly, epidote.

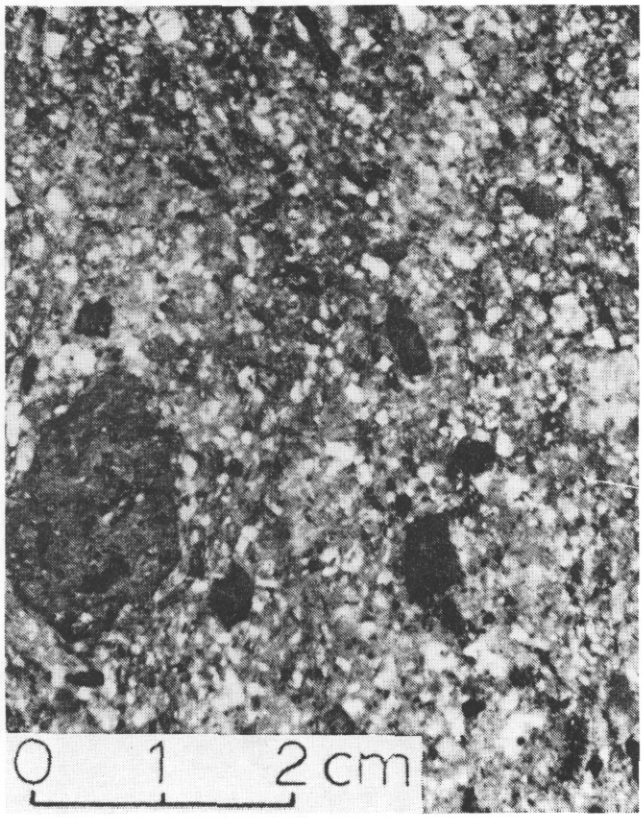


Plate 2.2. Crystal lithic tuff-breccia of the Hazelton Group, Grouse Mountain.

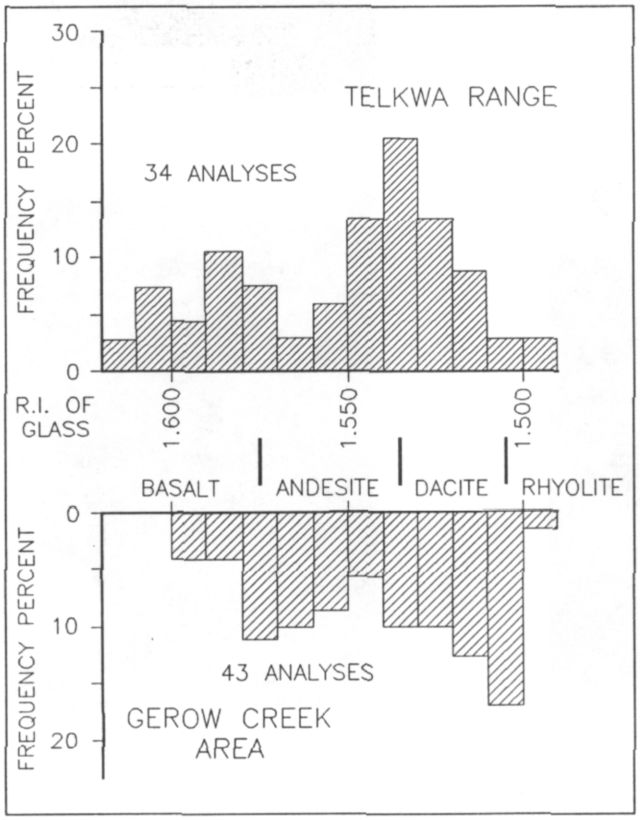


Figure 2.1. Composition frequency of Hazelton volcanic rocks in the Telkwa Range and Gerow Creek area.

The sedimentary facies of the Telkwa Formation on Grouse Mountain comprise an assortment of grey and light brown volcanic wackes and siltstones with some intercalated tuff and breccia lenses. Conglomerates are less common, as are shales and argillites; quartzites, cherts and limy beds are few. This differs from the middle division of the Hazelton type section in the Driftwood Creek area to the north (Hanson and Phemister, 1929) which shows a preponderance of quartzites and dark argillites. The main panel of sedimentary rocks, near Copper Lake on Grouse Mountain, dips gently to the south and appears to pass laterally into massive volcanic formations from which the clastics were probably originally eroded. Thin sections prepared from samples of several sandstone facies show an abundance of volcanic rock fragments mixed with rounded feldspar (often with wormy inclusions), plus a few quartz and chert grains in a clay matrix. Jurassic fossils collected from these rocks include belemnite and *Trigonia* forms and pelecypods tentatively identified as *Gervillia* sp. and *Gryphaea* sp. by the senior author.

SKEENA GROUP

The Skeena Group (Unit 3), as defined by Tipper and Richards (1976), comprises a mixture of Cretaceous marine and nonmarine sedimentary and volcanic strata. Reportedly, the sedimentary rocks are greywackes, shales and conglomerates with local intercalated coal seams. The volcanic facies are varicoloured breccias, tuffs and lava flows.

TABLE 2.2 ANALYSES OF VOLCANIC ROCKS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Oxides recalculated to 100:																		
SiO_2	50.60	60.86	68.10	72.64	76.85	79.50	59.88	64.03	51.68	57.40	57.83	61.06	61.95	55.08	56.29	66.95	78.08	44.00
TiO_2	1.42	1.02	1.02	0.49	0.20	0.10	0.83	0.80	0.91	1.49	1.30	1.30	1.75	1.00	1.64	1.05	0.10	3.01
Al_2O_3	18.10	18.07	19.64	14.59	13.01	11.51	18.20	15.94	16.19	16.20	18.15	16.56	17.16	16.26	15.93	16.69	13.78	15.11
Fe_2O_3	7.44	4.25	1.47	2.17	0.87	0.95	3.87	2.73	1.78	3.64	5.12	4.92	2.37	3.68	5.49	3.01	0.49	5.11
FeO	6.73	3.51	3.91	1.13	0.06	0.04	2.20	3.40	7.60	4.44	1.46	1.34	2.82	5.65	3.79	1.33	0.08	7.90
MnO	0.50	0.14	0.09	0.24	0.03	0.03	0.10	0.06	0.17	0.10	0.08	0.10	0.14	0.15	0.12	0.04	0.04	0.18
MgO	3.46	2.71	1.44	0.72	—	0.37	1.90	2.71	8.88	4.56	3.27	1.72	0.92	6.37	4.65	1.05	0.56	8.62
CaO	5.93	1.78	1.07	1.36	0.41	1.39	6.33	4.88	7.94	5.81	6.40	5.47	4.86	7.59	6.96	3.49	2.32	9.86
Na_2O	4.89	3.23	0.75	0.09	3.21	1.46	4.73	0.18	4.33	3.77	4.27	4.24	3.74	2.87	3.64	3.13	2.94	4.48
K_2O	0.93	4.41	2.51	6.57	5.36	4.65	1.96	4.74	0.52	2.59	2.12	3.29	4.29	1.35	1.49	3.26	1.61	1.73
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Oxides as determined:																		
H_2O+	2.71	2.16	2.80	2.63	0.98	3.36	3.47	2.20	3.46	0.07	1.17	1.20	2.54	1.74	1.46	3.30	9.80	3.63
H_2O-	0.13	0.06	0.22	0.10	0.39	1.71	0.52	0.55	0.76	2.51	1.44	1.21	0.79	0.50	2.01	1.06	5.48	0.44
CO_2	0.01	0.01	0.01	1.47	0.17	0.10	0.01	6.15	1.93	0.04	0.02	0.06	5.50	—	0.07	0.09	0.02	0.01
P_2O_5			0.09	0.17	0.01	0.01	0.27	0.07	0.14	1.29	0.44	0.99	0.45	0.13	1.23	0.61	0.02	0.58
S			0.16	1.42	—	—	—	1.32	—	0.01	0.01	0.01	0.01	0.02	—	—	—	—
Refractive Index	1.587	1.539	1.523	1.505	1.486	1.487	1.543	1.538	1.583	1.561	1.553	1.542	1.538	1.574	1.570	1.523	1.491	1.618
Molecular Norms:																		
Qz	0.1	15.8		41.4	34.4	47.4	9.7	28.0	—	6.6	7.4	11.1	12.5	6.7	9.5	25.7	46.3	—
Or	5.6	26.3		40.3	32.0	28.3	11.6	29.0	3.0	15.3	12.5	19.6	25.6	8.0	8.9	19.5	9.7	10.1
Ne	—	—		—	—		—	—	—	—	—	—	—	—	—	—	—	14.1
Ab	44.4	29.2		0.8	29.1	13.5	42.4	1.7	38.2	33.9	38.3	38.2	33.8	25.9	33.0	28.5	26.9	16.3
An	25.1	8.9		7.0	2.1	7.1	22.6	25.1	22.8	19.7	24.1	16.6	17.5	27.5	22.9	17.6	11.7	15.9
Wo	1.9	—		—	—	—	3.5	—	6.3	3.7	3.1	4.3	2.7	4.1	4.8	—	—	13.0
En	9.7	7.6		2.1	—	1.1	5.2	7.8	5.2	12.6	9.0	4.8	2.6	17.7	13.0	2.9	1.6	—
Fs	3.3	1.1		—	—	—	—	2.3	1.9	2.3	—	—	0.3	4.8	—	—	—	—
Fo	—	—		—	—	—	—	—	14.2	—	—	—	—	—	—	—	—	17.8
Fa	—	—		—	—	—	—	—	5.4	—	—	—	—	—	—	—	—	3.3
Il	2.0	1.4		0.7	0.3	0.1	1.2	1.2	1.2	2.1	1.8	1.8	2.5	1.4	2.3	1.5	0.1	4.2
Mt	7.9	4.5		1.7	—	—	3.4	3.0	1.8	3.8	0.7	0.4	2.5	3.9	5.4	0.9	—	5.3
He	—	—		0.5	0.8	0.8	0.4	—	—	—	3.1	3.2	—	—	0.2	1.5	0.4	—
Cor	—	5.2		5.5	1.3	1.7	—	1.9	—	—	—	—	—	—	—	1.9	3.3	—

Key to analyses:

1. Amygdaloidal basalt, Hazelton Group, Telkwa Range (Church, 1970c, No. 1 on page 88).
2. Dacitic andesite tuff, Hazelton Group, Telkwa Range (Church, 1970c, No. 2 on page 88).
3. Altered dacitic tuff, hostrocks, Equity mine.
4. Rhyolite breccia, Ootsa volcanics, Bob Creek canyon (Church, 1986, No. 2 on page 121).
5. Rhyolite tuff, Ootsa volcanics, Francois Lake (Church, 1973a, No. 1 on page 356).
6. Rhyolite, Tschesinkut Lake (Church, 1973a, No. 2 on page 356).
7. Andesite lava, Tip Top Hill formation, Klo Creek (Church, 1971a, No. 8 on page 124).
8. Andesite breccia, Tip Top Hill formation, Owen Lake (Church, 1973c, No. 1 on page 369).
9. Basalt lava, Goosly Lake formation, Goosly area (Church, 1971a, No. 5 on page 124).
10. Trachyandesite breccia, Goosly Lake formation, Francois Lake, 4 kilometres east of Colleymount.
11. Andesite lava, Goosly Lake formation, Goosly Area (Church, 1970b, No. 3 on page 148).
12. Bladed porphyry lava, Goosly Lake formation, northeast of Klo Lake.
13. Trachytic lava, Goosly Lake formation, Goosly area (Church, 1971a, No. 7 on page 124).
14. Basaltic breccia, Buck Creek formation, Dungate Creek (Church, 1973, No. 3 on page 356).
15. Basaltic andesite lava, Swans Lake member, Buck Creek formation (Church, 1973, No. 5 on page 356).
16. Dacite lava, Parrott Mountain member, Buck Creek formation (Church 1973, No. 4 on page 356).
17. Rhyolite obsidian, Fenton Creek volcanics (Church, 1973, No. 1 on page 376).
18. Poplar Buttes basalt (Church, 1971a, No. 11 on page 124).

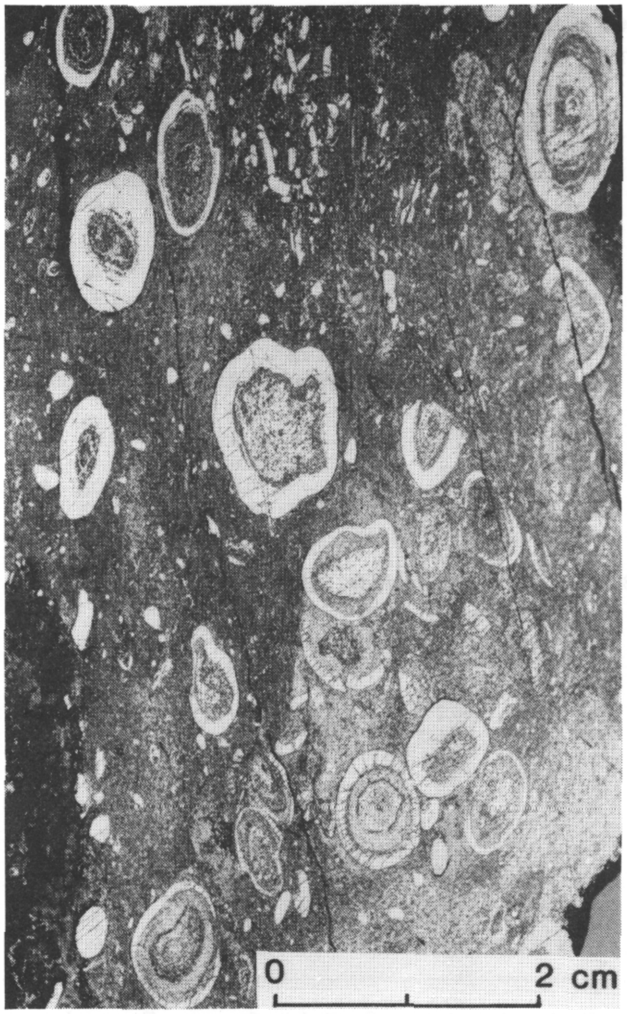


Plate 2.3. Accretionary lapilli elongated parallel to foliation, Hazelton Group on Grouse Mountain.

Within the Buck Creek map area, similar rocks (without coal) identified by Tipper and Richards (Unit 3), are exposed in a series of small windows in the Tertiary and Late Cretaceous covering formations. These exposures extend from the centre of the map area, near Goosly Lake, southeast for about 30 kilometres to the north shore of Francois Lake. A drill-hole cross-section at the Equity mine, northeast of Goosly Lake, shows a sequence of steep, westerly dipping beds 750 metres thick. At the top of the section, the beds are soft, grey tuffs and lapilli tuffs with a few bands of laminar-bedded tuffaceous argillite and chert-pebble conglomerate. The central part of the section shows a progressive downward increase in the volume of tuff breccia and coarse volcanic debris. Near the middle of the sequence the fragments are mainly aphanitic dacite, with some microporphyritic feldspathic admixtures. Local deposits of rhyolite breccia and what appear to be thin, welded rhyolite ash-flow units are also present. In the lower part of the section, dacitic tuff-breccia with some intercalated chert-pebble conglomerate overlies a tongue-like body of shattered dacitic dust tuff (Table 2.2, No. 3). The base of the section consists of a few hundred metres of well-indurated chert-pebble conglomerate. The apparent source of this chert is the Cache Creek terrain east of Babine Lake.

It is significant that the conglomerates on the north shore of Francois Lake contain a peculiar mixture of fossils that include *Trigonia emoryi* (Early Cretaceous) and *Weyla* sp. (Early Jurassic) (Plate 2.4). As identification of the *Trigonia* by the senior author is not positive, it seems possible that much or all of Unit 3 in the map area is correlative with the Early Jurassic Maxan Lake formation (Unit 0). Alternatively, the *Weyla* remains may represent transported clastic material eroded from a nearby Jurassic terrain. Regionally, chert-pebble conglomerates that have been dated are Early Cretaceous or younger. If the Jurassic fossils are clasts, the conglomerates are younger and may be Skeena Group. If the fossils are in place, then these chert-pebble conglomerates are Jurassic and unlike other dated examples.

There is also some question about the age of black shales and rhyolite exposed locally (Unit 3 on Figure 1) and by drilling on the Gillian claim group 5 kilometres southwest of Goosly Lake. Based on the structural tilting of the black shales, their association with rhyolites and general lithologies, these rocks may correlate in part with the Early Cretaceous Red Rose Formation (Sutherland Brown, 1960), or the Jurassic Ashman and Nilkitkwa formations of the Hazelton Group (MacIntyre *et al.*, 1987); the former correlation is favoured because of the nearby occurrence of Skeena-like Cretaceous rocks at the Equity mine.

FRANCOIS LAKE GROUP

The Late Cretaceous and early Tertiary volcanic and sedimentary rocks, informally named here the Francois Lake group, comprise six principal units with a maximum aggregate thickness of about 1500 metres. At the base there are unnamed felsic volcanic breccias and lavas (possibly equivalent, in part, to the rhyolite formation of the "Ootsa group" exposed south of the map area), followed upward by the Tip Top Hill, Burns Lake, Goosly Lake, Buck Creek and Fenton Creek formations–informal names previously proposed by Church (1971a).

The Francois Lake group represents a close succession of igneous events extending from Late Cretaceous through the Early Tertiary. These events begin at 80.8 Ma and range from 78.1 to 48.2 Ma (*see* Table 2.4). They commonly consist of a volcanic cycle beginning with rhyolite eruptions fed by granitic intrusions, changing to andesitic volcanism, then to mixed felsic and basaltic lava types and corresponding intrusions.

The type area for the Francois Lake group is the Owen Lake–Parrott Lakes–Goosly Lake area mapped by Church (1971a) (*see* Figure 4.2). A stratigraphic cross-section is shown on Figure 1. The following descriptions detail items such as age, petrography, chemistry (major and minor elements), composition frequency and range, thickness where best developed, and distribution.

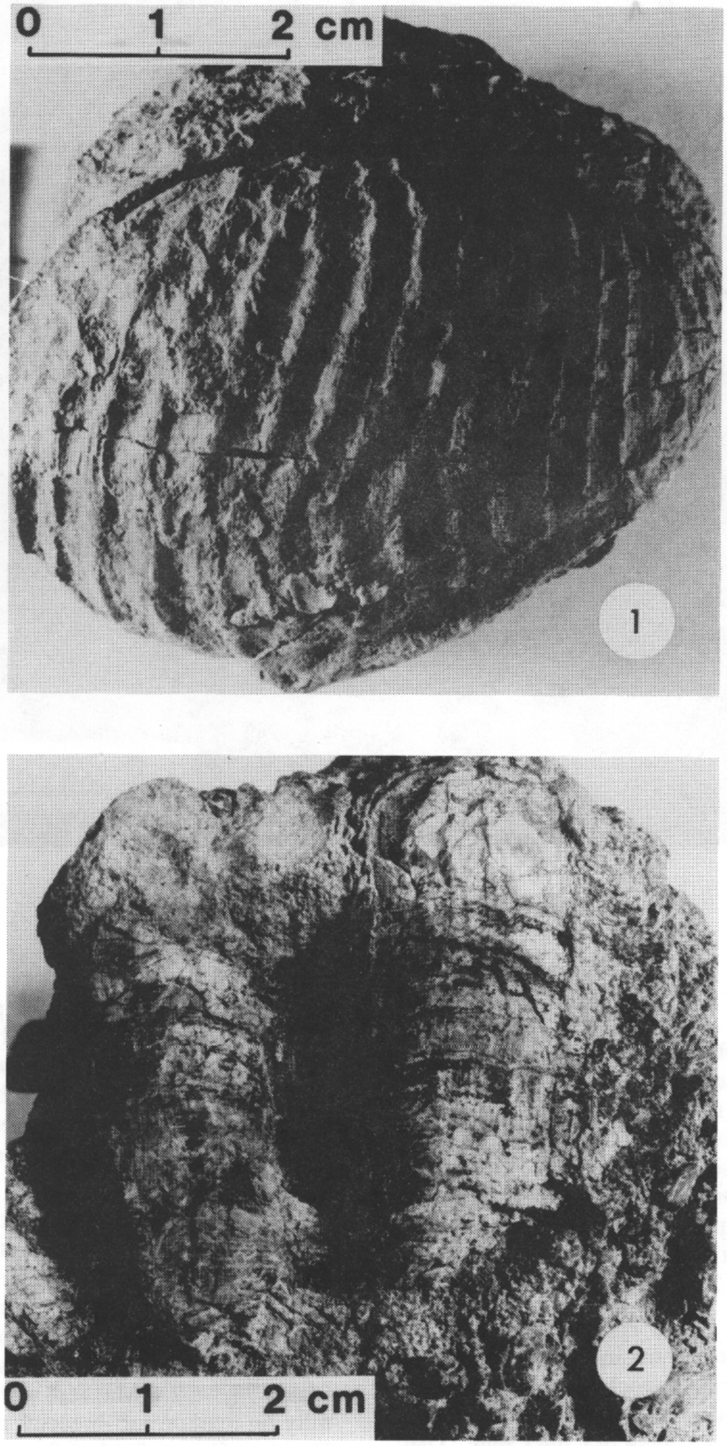


Plate 2.4. Fossil collection from basal conglomerates on north shore of Francois Lake, 7 kilometres southwest of Tchesinkut Lake (Lower Jurassic): (1) Trigonoid, (2) pecten, probably *Weyla* (fossils submitted to the GSC and subsequently misplaced — consequently a catalogue number is not available).

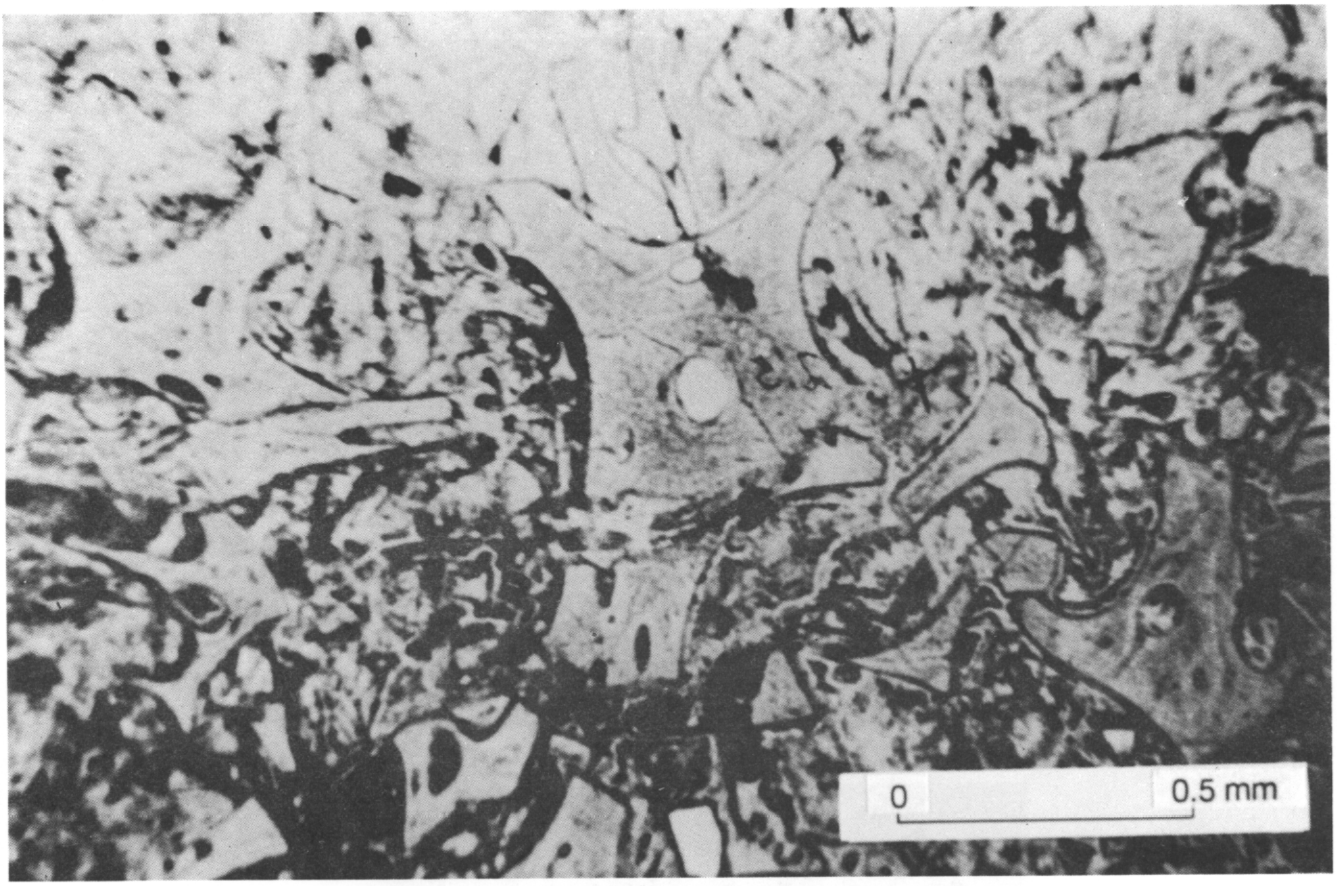


Plate 2.5. Rhyolite tuff south of Bulkley Lake.

Acidic Volcanics

Acidic volcanic rocks (Unit 4) are the basal assemblage of the group in the map area and consist of undivided lava, breccia and tuff of mostly rhyolitic composition, resting unconformably on the Hazelton and granitic rocks. The name "Ootsa" has been applied to similar rocks of Late Cretaceous to early Tertiary age by Duffell (1959) which are best developed in the northeast quadrant of the Whitesail map area, including the northwest shore of Francois Lake in the Buck Creek map area (Table 2.2, No. 5).

In the Owen Lake area, felsic rocks resembling the "Ootsa" volcanics and related intrusions are exposed on Okusyelda Hill. Quartz-bearing pyroclastic rocks are also exposed in Okusyelda Creek and southeast of the Silver Queen mine along much of the course of Cole Creek. They are characterized by an abundance of white porcelaneous fragments and small, corroded quartz crystals seen in thin section.

The dominant phase outcropping along Okusyelda Creek is tuff-breccia with some intercalated accretionary lapilli and thin volcanic sandstone and siltstone layers. These beds dip 25° to 40° to the south.

The rhyolitic and rhyodacitic pyroclastic rocks exposed along Cole Creek are severely altered, the feldspathic and lithic fragments having undergone marked kaolinization. The rocks are enriched in pyrite and normally carry accessory carbonates. Generally quartz is unaffected by the alteration and the original embayed and corroded outlines of the quartz phenocrysts are visible in thin section. The intersections of diamond-drill holes with the top of the felsic volcanics near Cole Creek indicate a gentle northerly dip to the formation.

Elsewhere in the Buck Creek map area, centres of significant volcanism of probable Late Cretaceous (to early Tertiary) age occur near Tchesinkut Lake and south of Bulkley Lake (Plate 2.5). In each case the rhyolite lavas and pyroclastic rocks are exposed adjacent to older formations which the rhyolite apparently also overlies. Near Bob Creek these rocks (dated 78.1 ± 2.8 Ma) rest with apparent angular unconformity on maroon tuff-breccias and intercalated shales of the Hazelton Group (Table 2.2, Nos. 4 to 6).

The distribution of these felsic volcanic centres around the perimeter of the Buck Creek area suggests a caldera structure (Figure 1). However, this speculation is not fully confirmed by field observations. For example, the rock outcrops show no great abundance of ash-flow tuff that would be expected from rapid magma evacuation in an exploding caldera. Less violent events are suggested–perhaps the eruption of massive lava and coarse vent-breccia with tuffaceous admixtures, to form a ring of rhyolitic rocks around the circumference of a gently subsiding volcano-tectonic basin or protocaldera. The timing of these events follow the cycle of development of the Tahtsa Lake cauldron subsidence complex, described by MacIntyre (1985) and centred 80 kilometres to the southwest.

Tip Top Hill Formation

The Tip Top Hill formation (Unit 5), consisting of andesitic lavas and pyroclastic rocks (Church, 1971a), overlies rhyolites in the Owen Lake area. Radiometric analysis of a typical sample of the andesite gives a date of 77.1 ± 2.7 Ma (Table 2.4, No. 17). The relative age and stratigraphic position of this unit resemble "Andesitic Flows (Unit 9)" of the Whitesail–Troitsa Lake map area (*see* Diakow and Mihalynuk, 1987, page 179).

The Tip Top Hill volcanics cover a large area in the west part of the Buck Creek map area, extending in a belt from the Owen Lake area to the north end of upper Parrott Lake and easterly to Goosly Lake. The best-developed section, which is about 500 metres thick, is found on the divide north of Tip Top Hill.

The principal eruptive centre for the Tip Top Hill volcanics appears to be the Mine Hill microdiorite intrusion at the Silver Queen mine just east of Owen Lake. The age and composition of these rocks is similar, and volcaniclastics near the microdiorite are locally coarse, containing markedly angular fragments, suggesting proximity to a volcanic vent (Church, 1970a, Plate VB, page 125). The long axis of the volcanic field, containing the thickest sections, trends northeast through the intervening area between the Silver Queen and Equity mines (*see* Figure 5.2).

The Tip Top Hill rocks are mainly brown volcanic breccias, characteristically charged with small feldspar plates 0.5 to 2 millimetres in length. Generally they also contain scattered hornblende phenocrysts, some of which are as much as 1 centimetre long. In thin section the rocks are found to be merocrystalline with subhedral zoned plagioclase (about 35 per cent) and accessory biotite, pyroxene and hornblende (about 7 per cent combined ferromagnesian minerals) suspended in a fine-grained devitrified matrix. The mean composition of these rocks is between andesite and dacite, as indicated by arc fusion determinations (Figure 2.2) and chemical analysis (Table 2.2, Nos. 7 and 8).

Burns Lake Formation

The name Burns Lake formation (Unit 6) is here applied to the poorly exposed sedimentary rocks underlying the 20 square kilometre area immediately north and east of the town of Burns Lake. These are medium to well-indurated, gently dipping conglomeratic beds which appear to be basal to the Tertiary section. The clasts consist mostly of well-rounded grey chert, black, reddish and grey metaquartzite and white quartz pebbles accompanied by a few boulders of the same composition measuring more than 20 centimetres across. No feldspar is seen in thin section. Although the exact contact relationships are unknown owing to poor exposure, the unit appears to rest unconformably on the Topley granite (Unit A) along its southeast contact, and to be overlain by feldspar porphyry lavas of the Goosly Lake formation (Unit 7). The estimated total thickness of the unit is 50 to 100 metres.

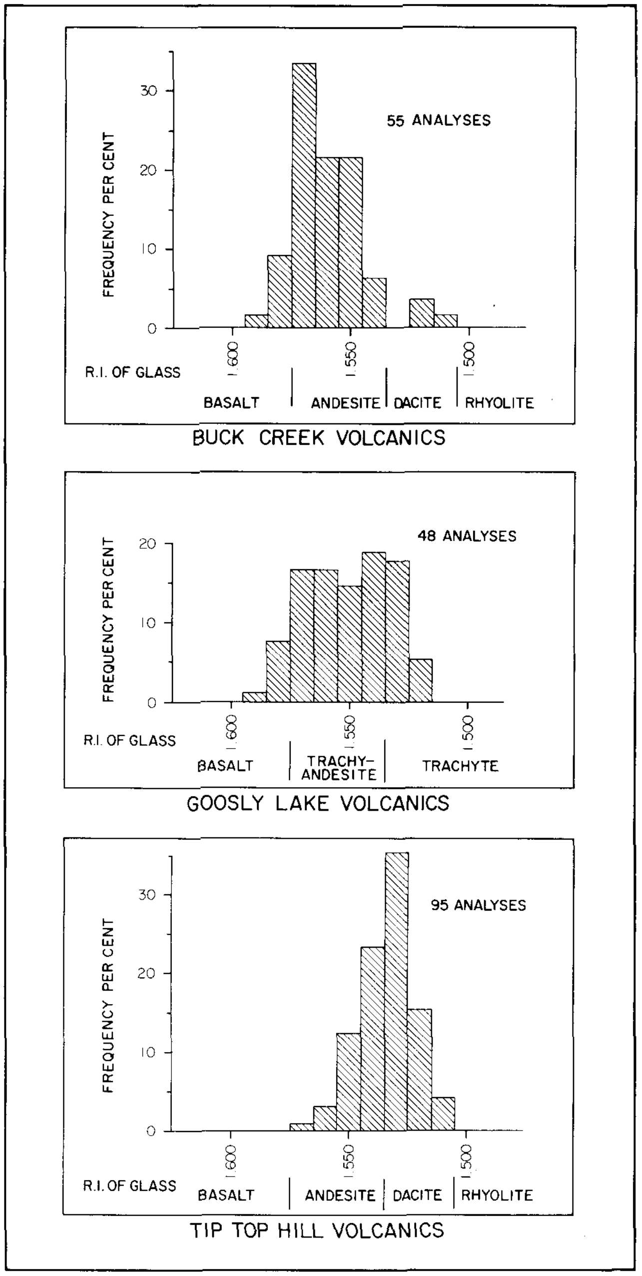


Figure 2.2. Composition frequency of volcanic rocks in the Owen Lake - Goosly Lake area.

Goosly Lake Formation

The Goosly Lake formation (Unit 7), dated 48.8 ± 1.8 Ma, consists mainly of trachyandesite lava with minor amounts of trachyte and basalt (Figure 2.3). These rocks are widely distributed throughout the central and east parts of the map area. The best-developed section, about 500 metres thick, is located south of the southeast end of Goosly Lake. Other thick sections are found northeast of Goosly Lake and north of Parrott Lakes. In some of these areas parts of the sections are unusually massive, consisting of very thick lava flows, sills and possibly discordant intrusions.

Generally the Goosly Lake rocks are light brown or cream coloured and characteristically contain large plagioclase laths or glomerophenocrysts of feldspar measuring up to 1 centimetre across. Thin sections show an average of 15 per cent plagioclase phenocrysts accompanied by accessory diopsidic augite, magnetite, biotite and, less commonly, hornblende. These crystals are normally suspended in a fine-grained feldspathic matrix. Except for a few amygdules, quartz is not readily visible in thin section, although analysis of the typical lava shows more than accessory normative quartz.

Compositional extremes include dark pyroxene-rich basaltic lavas and fine-grained trachyte and pulaskite feeder dikes (Table 2.2, Nos. 9 to 13). The basaltic rocks are locally exposed on slopes 3 kilometres south and 6.5 kilometres southeast of Goosly Lake. The trachyte covers a small area just southwest of the Equity mine.

The principal sources of the Goosly Lake volcanic rocks are three aligned stocks of petrographically similar rock of about the same age, coinciding approximately with the eruptive axis of the older Tip Top Hill volcanics in the area between the Silver Queen and Equity mines. The lavas here appear to flow and fan outward from these centres, reaching the peripheral parts of the basin.

Buck Creek Formation

The Buck Creek formation directly overlies the Goosly Lake volcanic rocks at many localities. The rocks are compositionally diverse and geographically the most widely distributed of all the units in the map area. The formation consists mostly of fine-grained amygdaloidal brown lava although porphyritic lavas and breccia deposits predominate at volcanic centres such as China Nose Mountain in the north and Parrott Mountain in the south. The best exposures are numerous thinly layered lava flows seen on the ridges just southeast of Houston and the section southeast of Maxan Lake (*see* Figure 1).

Three subdivisions of the formation are recognized: the Houston, Parrott Mountain and Swans Lake members.

The Houston member (Unit 8) is most widespread and ranges in composition from dacite to basalt with andesite predominating (Figure 2.3). A sample collected near Buck Creek was dated 48.2 ± 1.6 Ma by K-Ar methods, using a whole-rock sample. Typically, the beds dip gently, capping many of the ridges in the central parts and covering complete sections in peripheral parts of the map area. The same rocks are also found at low elevations adjacent to major easterly and southeasterly trending gravity faults near Buck Creek, west of Goosly Lake and at the east end of the Parrott Lakes. The best-developed section, measuring about 300 metres thick, is exposed along Klo Creek.

The lavas and breccias are mostly aphanitic and medium brown or grey coloured. Thin sections show an average composition of 80 per cent plagioclase microlites, 10 per cent interstitial pyroxene grains, 5 per cent disseminated fine-grained magnetite, and accessory fine-grained biotite and chlorite. Some brown alteration appears to be pseudomorphic after undersaturated mafic minerals, however, chemical analysis of the most basic of these rocks shows accessory levels of normative quartz (*see* Table 2.2, No. 14).

The Parrott Mountain member (Unit 10) is a younger assemblage of petrographically distinctive breccias and lavas surrounding a small volcanic centre south of Tsichgass Lake near the north shore of Francois Lake. These are merocrystalline pyroxene-bearing, plagioclase-rich rocks. Arc-fusion determination of 20 samples shows a refractive index range of 1.520 to 1.536 indicating mainly dacitic composition (Table 2.2, No. 16).

The Swans Lake member (Unit 9) crops out in the north and east parts of the map area. It is mostly massive, brown basaltic lava, 15 to 60 metres thick, overlying the Houston rocks. Arc-fusion analyses of 19 samples indicate a basalt to basaltic andesite composition range with refractive indices falling between 1.564 and 1.584 (Table 2.2, No. 15).

Fenton Creek Volcanics

The Fenton Creek volcanic rocks occur in a small area south of the Morice River beyond the west boundary of the map area (Church, 1973d). These rocks appear to overlie other units of the Francois Lake group, including various phases of the Buck Creek formation. The rocks comprise a volcanic dome, of about 10 square kilometres in areal extent, composed of rhyolite obsidian, quartz-porphyry rhyolite and feldspar-porphyry trachyte flows (Table 2.2, No. 17). Owing to the massive structure of the lava and breccia of the volcanic edifice, there has been no attempt to develop a type section. The age of these rocks indicated by K-Ar analysis is 48.9 ± 1.7 Ma.

The young rhyolite and other felsic dikes at the Equity mine, and the large felsic dike near the main ore zone on Grouse Mountain, are tentatively correlated with the Fenton Creek volcanic event.

PLATEAU BASALTS

In the Fort St. James map area, Armstrong (1965) assigned the name Endako Group to relatively flat-lying Late Oligocene and younger volcanics which include basaltic lava flows and breccias as a major facies. Many of these flat-lying lavas have subsequently been proven to be Eocene age and therefore are not assignable to the Endako Group as defined by Armstrong. In this report these rocks are assigned to the Eocene part of the Francois Lake group. To the southwest, in the Whitesail map area, Duffell (1959) observed volcanic rocks occurring as remnants of what appear to be a continuous sheet of basaltic volcanics which presently caps many of the ridges east of the Coast Mountains. In the Buck Creek map area only a few small outliers of these plateau basalts are present. They are correlated with the plateau basalts of the Chilcotin Group in southwestern British Columbia (Mathews, 1989).

Poplar Buttes Volcanics

The Poplar Buttes volcanic rocks (Unit 11), dated 21.4 ± 1.1 Ma by whole-rock K-Ar analysis, comprise the youngest volcanic unit in the Tertiary sequence. The rocks are typically fine-grained, dark-coloured, columnar basalts

TABLE 2.3 ANALYSES OF IGNEOUS INTRUSIONS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Oxides recalculated to 100:																
SiO_2	51.77	69.29	59.78	67.00	49.12	49.35	51.77	51.84	53.90	54.65	54.79	55.52	56.11	60.69	70.17	75.57
TiO_2	2.76	0.42	0.76	0.67	1.51	1.31	1.42	1.46	1.51	1.88	1.35	1.59	1.35	1.14	0.36	0.26
Al_2O_3	17.32	15.88	18.31	16.20	16.66	16.34	16.68	17.56	17.25	17.57	17.60	17.05	17.63	18.39	16.35	13.91
Fe_2O_3	2.08	2.03	3.20	2.18	2.49	2.35	1.54	2.81	5.31	4.11	3.48	2.35	2.94	2.62	1.41	0.85
FeO	7.14	3.54	2.93	1.58	6.12	7.42	7.60	4.79	2.42	3.75	4.29	4.00	3.46	2.51	0.87	0.43
MnO	0.13	0.67	0.19	0.04	0.20	0.17	0.19	0.14	0.11	0.14	0.14	0.09	0.06	0.06	0.10	0.05
MgO	5.52	1.08	1.44	1.30	6.85	11.93	7.89	5.78	3.85	3.98	4.64	3.53	2.73	1.99	0.72	0.33
CaO	6.96	2.23	6.30	3.30	13.55	6.83	8.11	9.88	7.77	6.25	6.35	8.01	6.51	4.62	0.86	1.85
Na_2O	4.28	0.03	3.73	4.32	3.00	3.62	4.41	4.82	5.08	4.25	3.86	4.93	5.60	4.61	5.60	0.62
K_2O	2.04	4.83	3.36	3.69	0.50	0.68	0.39	0.92	2.80	3.42	3.50	2.93	3.61	3.37	3.56	6.13
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Oxides as determined:																
H_2O+	3.01	2.18	2.28	1.69	2.65	4.27	3.02	4.84	1.10	1.90	1.31	0.83	2.51	1.28	1.07	1.94
H_2O-	0.17	0.14	0.11	0.21	0.90	2.02	0.72	0.51	0.89	0.18	0.37	0.25	0.50	0.23	0.16	0.15
CO_2	3.32	3.98	0.11	0.08	0.69	0.41	5.50	0.60	1.15	0.07	0.01	0.25	0.82	—	1.07	1.61
P_2O_5	0.69	0.22	0.22	0.28	0.28	0.09	0.15	0.18	0.59	0.91	0.71	1.00	2.64	0.60	0.15	0.05
S	0.04	1.09	0.02	—	0.04	0.05	0.24	0.01	0.62	0.40	0.02	0.15	0.09	0.10	0.07	0.53
Molecular norms:																
Qz	—	41.2	10.0	17.9	—	—	—	—	—	0.1	—	—	—	8.0	19.4	42.1
Or	12.0	29.9	20.0	21.7	2.9	3.9	2.3	5.4	16.4	20.1	20.6	17.1	21.0	19.8	20.8	37.3
Ne	—	—	—	—	—	—	—	0.7	1.3	—	—	—	3.1	—	—	—
Ab	38.3	0.3	33.6	38.7	26.9	31.7	39.0	41.5	43.1	38.0	34.5	43.8	44.4	41.2	49.8	5.7
An	21.9	11.6	23.5	13.9	30.5	25.7	24.2	23.2	15.9	18.7	20.3	15.6	12.1	19.4	4.2	9.5
Wo	5.0	—'	3.2	1.0	14.6	2.9	6.2	10.0	8.9	4.9	4.4	9.5	7.9	1.3	—	0
En	3.4	3.1	4.0	3.6	6.0	5.0	6.5	—	—	11.0	11.7	1.4	—	5.5	2.0	0.9
Fs	1.3	3.6	1.2	—	1.8	1.2	2.6	—	—	0.3	2.1	0.3	—	0.5	—	—
Fo	8.8	—	—	—	9.7	20.4	11.2	11.8	7.9	—	0.8	6.2	5.6	—	—	—
Fa	3.3	—	—	—	2.9	5.0	4.5	2.5	—	—	0.1	1.5	1.0	—	—	—
Il	3.8	0.6	1.1	0.9	2.1	1.8	1.9	2.0	2.1	2.6	1.9	2.2	1.9	1.6	0.5	0.4
Mt	2.2	2.2	3.4	2.3	2.6	2.4	1.6	2.9	2.4	4.3	3.6	2.4	3.0	2.7	1.3	0.5
He	—	—	—	—	—	—	—	—	2.0	—	—	—	—	—	0.1	0.3
Cor	—	7.5	—	—	—	—	—	—	—	—	—	—	—	—	1.9	3.3

Key to analyses:
1. Bob Creek gabbro (Church, 1986, No. 4 on page 121).
2. Quartz feldspar porphyry in canyon of Bob Creek (Church, 1986, No. 3 on page 121).
3. Mine Hill microdiorite (Church, 1971a, No. 9 on page 124).
4. Equity granite (Church, 1970b, No. 1 on page 148).
5. Gillian intrusion, gabbroic phase (Church, 1971a, No. 1 on page 124).
6. Gillian melanocratic gabbro, near base of sill, core sample (Church, 1985, No. 2, page 182).
7. Gillian gabbroic chilled selvage of sill, core sample (Church, 1985, No. 3 on page 182).
8. Gillian mesacratic gabbro, upper part of sill, core sample (Church, 1985, No. 5 on page 182).
9. Parrott Lake syenomonzonite stock (Church, 1971a, No. 3 on page 124).
10. Goosly syenomonzonite stock (Church, 1970b, No. 2 on page 148).
11. Goosly syenomonzonite stock (Church, 1985, No. 8 on page 182).
12. Bladed felspar porphyry dike, Silver Queen mine (Church, 1973b, No. 2 on page 402).
13. Bladed felspar porphyry dike, Silver Queen mine (Church, 1971b, No. 1 on page 138).
14. Tablet feldspar porphyry dike, Grouse Mountain (Church, 1973b, No. 3 on page 402).
15. Post-mineralization "latite" dike, east wall at Southern Tail zone, Equity mine.
16. Rhyolite dike cutting main ore zone, Equity mine.

that form a few thick flows having a total thickness ranging from 60 to 90 metres. The only occurrences of this unit within the map area are on the Poplar Buttes centred 9 kilometres northwest of the mouth of the Nadina River, near the west end of Francois Lake.

Microscopic examination of typical Poplar Buttes basalt shows 3 per cent subhedral olivine phenocrysts, usually less than 2 millimetres in diameter, set in a very fine grained matrix composed of about equal parts of plagioclase microlites and granular ferromagnesian minerals. Normative calculations based on chemical analyses show 14.2 per cent nepheline, however, neither nepheline nor feldspathoids have been found and only a few zeolite-lined gas cavities can be seen in thin section (Table 2.2, No. 18).

IGNEOUS INTRUSIONS

Igneous intrusions in the Buck Creek map area comprise an assemblage of granitic to gabbroic stocks that range from early Mesozoic to early Tertiary age. These are grouped from oldest to youngest according to the scheme: Topley intrusions (Jurassic), Bulkley intrusions (Late Cretaceous), Nanika intrusions and Goosly intrusions (early Tertiary).

TOPLEY INTRUSIONS

The Topley intrusions (Unit A) were first recognized in the Topley area by Hanson and Phemister (1929). They were later correlated with similar granitoids to the east and southeast, in the Fort St. James map area, by Armstrong (1965). Subse-

TABLE 2.4 RADIOMETRIC K/Ar DATES FOR THE BUCK CREEK AREA

No.	Formation	Map Unit	Location Lat.	Location Long.	Material	K Wt.%	Ar^{40} $\times 10^{-6}$cc/g	Ar^{40*} %	Apparent Age Ma	Analyst	Submitter/Publication
1	Poplar Buttes basalt	11	54°03.1′	126°34.8′	whole rock	1.48 ±0.01	1.239	56	21.4±1.1	Harakal (U.B.C.)**	Church/(GEM)†, 1972, page 359
2	Buck Creek andesite	8	54°10.6′	126°30′	whole rock	1.75 ±0.01	3.320	80	48.2±1.6	Harakal (U.B.C.)**	Church/(GEM)†, 1972, page 359
3	Altered host, Main ore zone	3/o	54°11.5′	126°16′	whole rock	3.75	7.132	91.4	48.3±1.7	Harakal (U.B.C.)**	Wetherell/unpublished thesis, 1979
4	Goosly syenomonzonite	F	54°11.5′	126°15.2′	plagioclase	2.45 ±0.01	—	79.9	48.7±1.8	Placer Dev. Ltd.	Cyr *et al.*/Economic Geology, 1984, page 956
5	Goosly Lake volcanics	7	54°10.4′	126°18.1′	whole rock	2.58 ±0.03	4.966	94	48.8±1.8	Harakal (U.B.C.)**	Church/(GEM)†, 1972, page 359
6	Goosly syenomonzonite	F	54°11.4′	126°15.4′	biotite	7.53 ±0.02	14.73	69.1	49.7±3.0	Harakal (U.B.C.)**	Church/(GEM)†, 1972, page 359
7	Parrott Lake syenomonzonite	7	54°07.3′	126°36′	biotite	6.65 ±0.01	13.19	89.1	50.3±1.5	Harakal (U.B.C.)**	Church/(GEM)†, 1972, page 359
8	Altered host, Southern Tail ore zone	3/o	54°11.3′	126°16′	whole rock	4.33 ±0.01	—	97.1	51.7±1.9	Placer Dev. Ltd.	Cyr *et al.*/Economic Geology, 1984, page 956
9	Goosly gabbro-monzonite	F	54°12′	126°15′	biotite conc.	3.087±0.045	6.610	47	54.3±2.2	Geochron	Church-Ney/Geological Fieldwork Paper, 1981-1, page 30
10	Altered host, Main ore zone	3/o	54°11.5′	126°15.9′	sericite	5.240±0.068	11.65	62.4	56.3±1.9	Geochron	Church-Ney/Geological Fieldwork Paper, 1981-1, page 30
11	Granitic stock	E	54°10.5′	126°15′	biotite	7.76	—	—	57.0±2.4	G.S.C.***	Wanless *et al.*/unpublished
12	Granitic stock	E	54°11 ′	126°16.8′	biotite	7.09 ±0.04	16.01	77.1	57.2±2.3	Harakal (U.B.C.)**	Church/(GEM)†, 1972, page 359
13	Altered host, Southern Tail ore zone	3/o	54°11′	126°16′	whole rock	4.79 ±3.5	10.942	93.4	58.1±2.0	Harakal (U.B.C.)**	Wetherell/unpublished thesis, 1979
14	Granitic stock	E	54°11.1′	126°16.8′	biotite	3.95 ±0.15	—	91.5	60.0±3.2	Placer Dev. Ltd.	Cyr *et al.*/Economic Geology, 1984, page 956
15	Granitic stock	E	54°11.2′	126°16.8′	biotite	6.552±0.07	16.24	67	62.7±2.0	Geochron	Church-Ney/Geological Fieldwork Paper, 1981-1, page 30
16	Mine Hill microdiorite	D	54°05.2′	126°42.4′	whole rock	2.99 ±0.02	8.962	92	75.5±2.0	Harakal (U.B.C.)**	Church/(GEM)†, 1972, page 359
17	Tip Top Hill andesite	5	54°10.2′	126°21.4′	whole rock	2.16 ±0.02	6.611	94	77.1±2.7	Harakal (U.B.C.)**	Church/(GEM)†, 1972, page 359
18	Duck Lake granite	C	54°01.5′	126°48.1′	biotite	7.32 ±0.03	22.44	94.9	77.2±2.4	Harakal (U.B.C.)**	Church/Geological Fieldwork Paper, 1986-1 page 123
19	Bob Creek quartz porphyry	C	54°18.1′	126°37.2′	muscovite	8.42 ±0.02	26.099	93.9	78.1±2.8	Harakal (U.B.C.)**	Church/Geological Fieldwork Paper, 1986-1, page 123
20	Bob Creek porphyry dike	C	54°18.5′	126°37′	biotite	6.79 ±9.02	21.739	95.0	80.6±2.8	Harakal (U.B.C.)**	Church/Geological Fieldwork Paper, 1986-1, page 123

*Radiogenic argon
**The University of British Columbia
***Geological Survey of Canada
†Geology, Exploration and Mining in British Columbia
Constants for age calculations are those of Steiger and Jäger 1977; $\lambda_e + \lambda'_e = 0.581 \times 10^{-10}$ yr^{-1}; $K^{40}/K = 1.167 \times 10^{-4}$

quent studies by White *et al.* (1970) and Carter (1981) showed ages, based on numerous K-Ar analyses, ranging from 178 to 133 Ma, indicating multiple intrusive phases of granite, syenite, granodiorite and diorite composition.

In the type area at Topley, and in the east part of the Buck Creek map area near Burns Lake, the unit is massive, pink granite underlying a total area of about 50 square kilometres. Although contacts are not exposed, it is assumed that the Topley bodies intrude the surrounding Hazelton assemblage. The granite is medium to coarse grained with both porphyritic and equigranular phases. The composition is similar to that reported by Armstrong (1965, page 93): quartz, 20.8 to 40.3 per cent; potassium feldspar, 32.6 to 56.2 per cent; plagioclase, 4.6 to 30.1 per cent; plus accessories biotite, hornblende, chlorite and magnetite.

BULKLEY INTRUSIONS

The Bulkley intrusions comprise a variety of small stocks and effusives that are thought to be Late Cretaceous age (Kindle, 1954; Carter, 1981). These include dioritic and gabbroic bodies in the Tsichgass Lake and Bob Creek areas (Unit B), the Duck Lake felsic porphyry bodies (Unit C), and the Mine Hill microdiorite at Owen Lake (Unit D).

The Bob Creek gabbro crops out on the crest of two low hills south of the lower section of Bob Creek. This is an altered, medium to fine-grained stock intruding the Jurassic and, apparently, part of the Upper Cretaceous volcanic section. Normative mineral calculations indicate a quartz deficiency typical of many gabbros (Table 2.3, No. 1). The intrusion is believed to represent an end-phase in the Bulkley felsic/basic eruptive suite.

The Duck Lake bodies are well exposed at many localities near the western edge of the map area. They are biotite feldspar porphyry and quartz biotite feldspar porphyry stocks and dikes which appear to be feeders to the Okusyelda Hill rhyolite and related volcanics. Potassium-argon determinations on biotite from the Duck Lake stock and petrographically similar effusive rocks at Bob Creek yield dates of 78.12.8 and 80.6±2.8 Ma respectively (Table 2.4, Nos. 19 and 20).

The Mine Hill microdiorite (Unit D) is a fine to medium-grained sill-like body exposed in the workings of the Silver

Queen mine 2 kilometres east of Owen Lake. Typically the rock is charged with small plagioclase crystals 1 to 3 millimetres long and contains interstitial pyroxene, biotite and minor quartz in some samples. The intrusion is believed to be a feeder to the Tip Top Hill volcanics which are petrographically and chemically similar (Table 2.3, No. 3). Potassium-argon analysis of these rocks gives an age of 75.5 ± 2.0 Ma, essentially the same as the Tip Top Hill volcanics which are dated 77.1 ± 2.7 Ma.

Nanika Intrusions

The Nanika intrusions (Unit E) are the oldest Tertiary plutonic rocks in the region. Many are copper and molybdenum-bearing porphyries, (Carter, 1981), however, some, such as the Nadina Mountain granite, show little evidence of mineralization.

Only two Nanika-type intrusions are known in the Buck Creek map area. These are small, weakly mineralized stocks located 7 kilometres southeast of Houston near Dungate Creek and adjacent to the waste dump at the Equity mine.

The Equity stock is a microporphyritic granite consisting of rectangular and polygonal crystals of plagioclase, averaging 2 to 4 millimetres in diameter, crowded together and set in a fine-grained matrix of mainly quartz and potassium feldspar. A sample submitted for chemical analysis (Table 2.3, No. 4) shows the following mineralogy: plagioclase phenocrysts, 50 per cent; quartz, 2 per cent; biotite, 2 per cent; potassium feldspar, 1 per cent; in a matrix of quartz, 23 per cent; potassium feldspar, 18 per cent; biotite, 2 per cent; and magnetite, 2 per cent. Potassium-argon analysis of biotite from a sample collected near the centre of the intrusion yielded ages in the range 57.0 ± 2.4 to 62.7 ± 2.0 Ma (Table 2.3, Nos. 11, 12, 14 and 15).

Goosly Intrusions

The Goosly intrusions (Unit F) consist essentially of three stocks ranging in composition from syenomonzonite to gabbro, and aligned along a 250° trend outward from the central part of the map area. These bodies occur at roughly 13-kilometre intervals beginning at the Equity mine, then on the Gillian property about 4 kilometres southwest of Goosly Lake, and again west of upper Parrott Lake. In addition, a number of dikes of the same rock type occur on the same alignment at the Silver Queen mine, 9 kilometres southwest of the Parrott Lake stock.

Petrographically the Goosly intrusions consist of 65 to 80 per cent plagioclase (commonly as large bladed phenocrysts), 5 to 20 per cent augite (small, rounded grains or long, prismatic phenocrysts), and accessory biotite, magnetite and apatite. The leucocratic felsic phases contain abundant interstitial potassium feldspar and some quartz. The dark, basic phases show some enrichment in pyroxene and opaque minerals. The basic phases also contain calcite and chlorite pseudomorphic after olivine and accessory feldspathoids in some samples.

The Goosly intrusions are thought to be an important source of the Goosly Lake volcanic rocks, the line of eruption being roughly coincident with the areas of thick Goosly Lake lavas. Further evidence of a magmatic relationship for the plutonic and volcanic assemblages is supplied from mineralogical and chemical comparisons of these rocks (Table 2.3, Nos. 5 to 13). Also, the K-Ar ages of the plutonic and volcanic rocks are similar at 48.7 and 54.3 Ma respectively (Table 2.4, Nos. 4, 6 and 9).

Among the "lesser igneous intrusions" in the Buck Creek map area, a porphyritic variety of pulaskite is conspicuous near the main ore zone on Grouse Mountain. This is a large dike that intrudes the "Ruby ore zone" and cuts across an adjacent and slightly older Goosly-type bladed-feldspar porphyry body (Plate 2.6). This younger intrusion is typically charged with numerous randomly oriented equant-plagioclase phenocrysts measuring 3 to 8 millimetres in diameter. The large crystals are oscillatory zoned $An_{40/50}$ and set in a matrix composed mostly of smaller crystals of alkali feldspar, some plagioclase and accessory pyroxene, chloritized biotite, quartz, magnetite, and a few grains of apatite and sphene. The rock is probably related to the chemically similar trachytic phases of the Goosly Lake volcanic rocks (Table 2.3, No. 14).

Felsic dikes cutting the ore zone and adjacent syenomonzonite stock at the Equity mine range in age from 48.3 to 49.9 Ma (Cyr *et al.*, 1984). These small intrusions are variously described as having a rhyolite to "latite" composition range (Table 2.3, Nos. 15 and 16) and are comparable in age and chemistry to the Fenton Creek volcanic rocks.

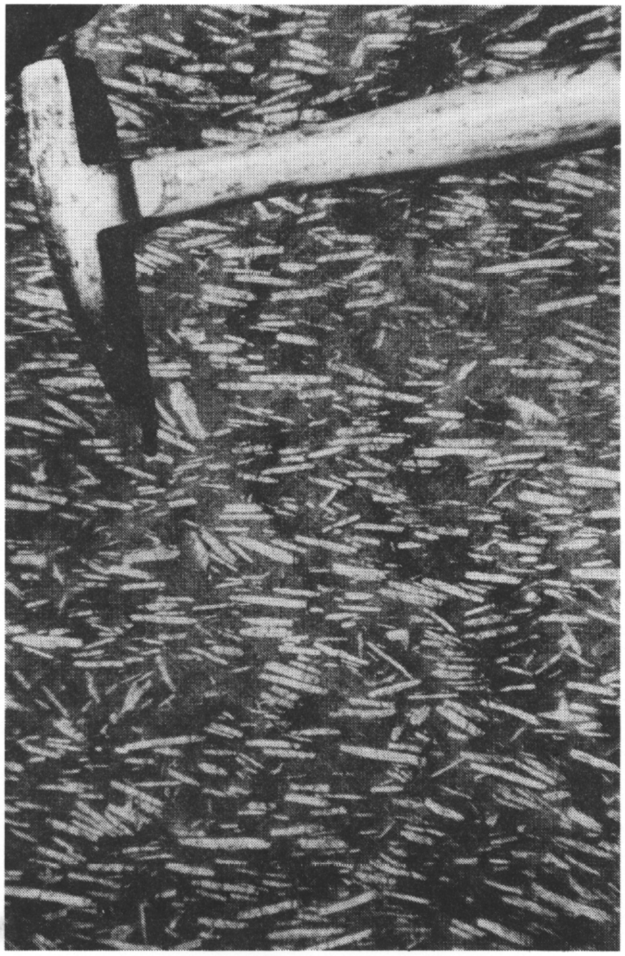


Plate 2.6. Bladed-feldspar porphyry dike (Goosly intrusion), Grouse Mountain.

STRUCTURAL GEOLOGY

The history of deformation is most completely recorded in the oldest rocks. In the Driftwood region, northwest of the Buck Creek map area, the Hazelton beds form a series of shallow-plunging anticlines and synclines. According to Hanson (1924, page 28A): "The sedimentary rocks as a whole have been severely folded and sheared as compared to the overlying volcanic division. During the folding of the assemblages, the volcanic rocks acted in the main as hard, unyielding masses, and the compression was taken up by the intervening sediments". Shear zones cut across the folds striking east and southeast.

Folding of the Hazelton rocks in the Buck Creek area may be similar to the Driftwood area but the details are unknown. Penetrative deformation, possibly related to folding, is manifest by the stretched pyroclastic fragments which commonly distinguish these rocks from younger assemblages. Consistent foliation has not developed because of the original massive nature of these rocks.

Owing to the predominance of lavas and pyroclastic rocks in the Buck Creek Tertiary outlier, bedding attitudes, especially in sequences of layered volcanic breccia, are often unreliable indicators of structural deformation. Initial angles of repose of this material may be as much as 35°. Consequently, knowledge of the structural history, including events such as faulting, tilting and folding of the strata, is fragmentary. Some minor horst and graben development is seen at the margins of the outlier, as in the Burns Lake area, but this shows only local development of clastic wedges adjacent to faults, with no significant fanglomerate deposits or slide breccias.

It is inferred from the few valid measurements of waterlain sedimentary rocks and consideration of the general distribution of the lithological units, that the Tertiary and Late Cretaceous beds are normally gently dipping as a result of gentle downwarping in a broad volcano-tectonic basin. In contrast, the older rocks are more variable in attitude. The chert-pebble conglomerate found in the Equity mine area and on the north shore of Francois Lake certainly displays steep bedding dips, in a few places almost vertical. The interval between deposition of this conglomerate, possibly Lower Cretaceous, and the emplacement of the Upper Cretaceous volcanic rocks was undoubtedly marked by some importar tectonic events.

The more recent history appears to have been one of gentle tilting of fault blocks almost in a random fashion. Here and there Mesozoic rocks are exposed at the base of these blocks, forming a number of small windows in the Upper Cretaceous and Tertiary pile.

The results of a detailed study of the orientations of topographic lineaments in the surrounding region are compatible with the fracture patterns in the Goosly Lake area (Figures 3.1 and 5.5). For example, two strong sets of fractures characterized by the attitudes 050° to 090° vertical and 130° to 170° dipping 70° southwest, are coincident in strike with the principal lineament frequency modes. These directions appear to be subparallel to important faults which define the boundaries of a number of large tilted blocks (Figure 1).

The attitude and frequency of fractures in the Owen Lake area are also shown in Figure 3.1. The strongest joints strike

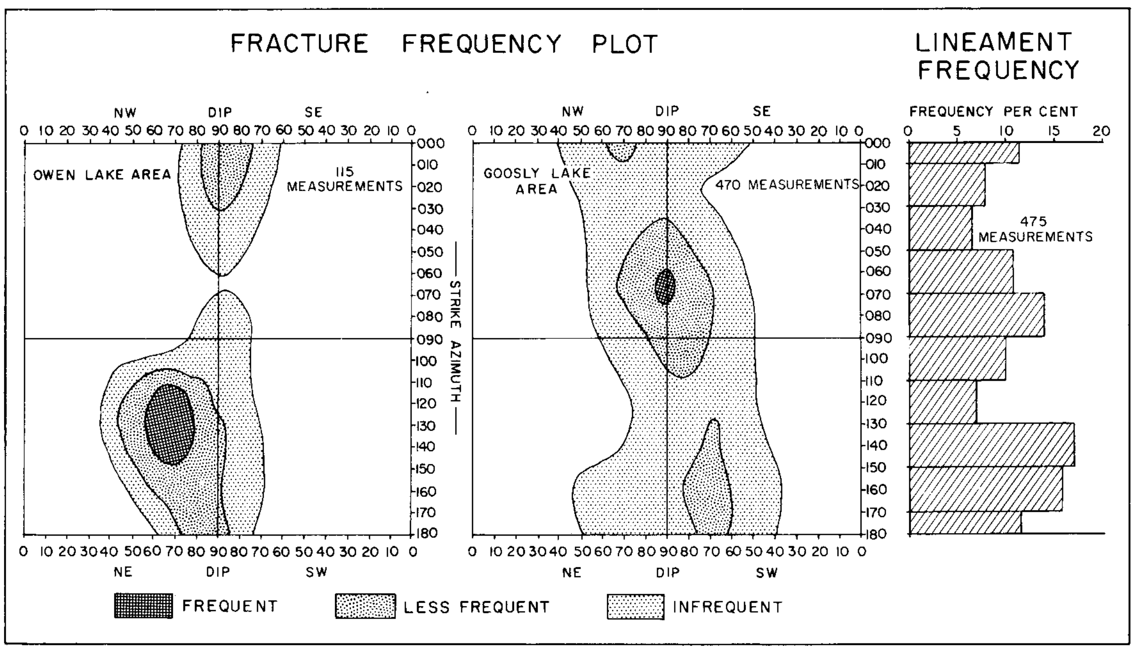


Figure 3.1. A comparison of the frequency of fractures and topographic lineaments in the Buck Creek map area.

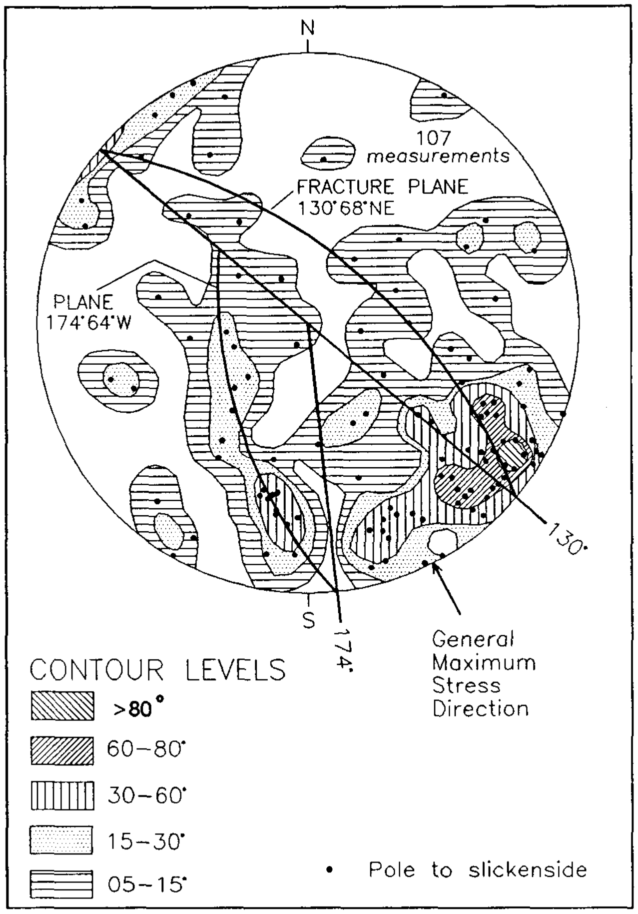


Figure 3.2. Equal-area plot of slickenside attitudes in the Mine Hill area.

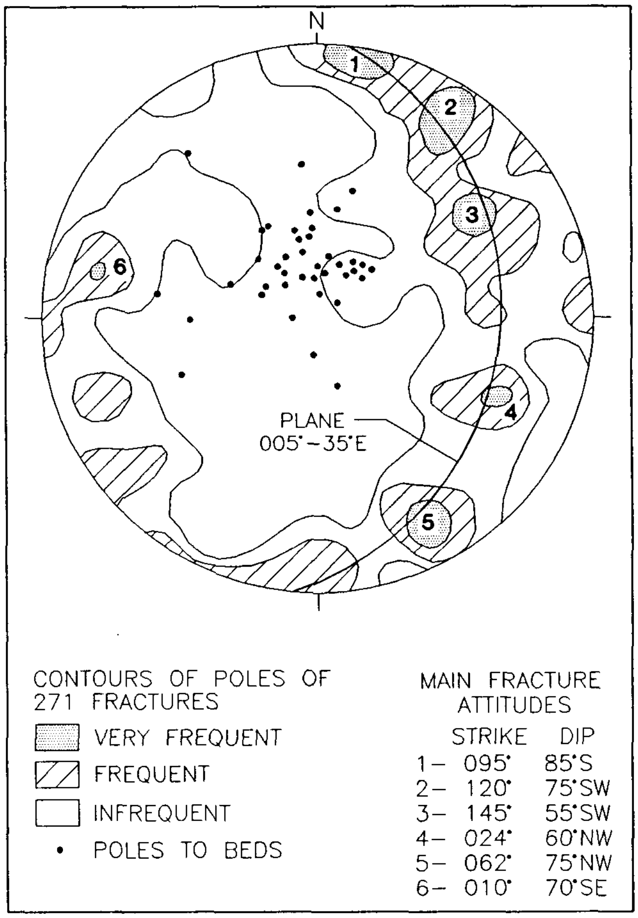


Figure 3.3. Equal-area plot showing bedding attitudes and fracture frequencies on Grouse Mountain.

about 130° and dip 68° northeast. Other strong fractures strike northerly and dip steeply to the east. Weak fractures include cross-joints which strike east and dip steeply, and sheeting which strikes about 050° and dips 25° northwest.

A detailed study of slickensides in the vicinity of Mine Hill reveals the attitude and possible direction of movement on faults and shear planes. An equal-area plot of slickenside directions shows two major clusters; a strong polarization trending 123° and plunging 12° southeast, and a weaker polarization at 190° plunging 30° south (Figure 3.2). The former direction is close to the common fracture direction for the area shown on Figure 3.1. The angular distance between these slickenside poles is 60°. This suggests that the maximum stress axis responsible for these fractures was oriented at approximately 150°. This geometry indicates that the steeply dipping, northerly striking fractures in the Mine Hill area probably have sinistral strike-slip displacement, whereas movement on steep southeasterly striking fractures is dextral; tension fractures are contained between these shears.

On Grouse Mountain, a short distance beyond the northwest corner of the map area (*see* Figure 5.21), several fracture systems have been identified. An equal-area plot of the field data shows that many poles to the joint sets and cleavages lie near the plane of a great circle (Clusters 1 to 5 on Figure 3.3) suggesting development in a common stress field. The related fractures have a wide range of strike directions. The easterly striking fractures commonly dip most steeply, approaching vertical inclinations; the northerly striking fractures have minimum inclinations, dipping westerly, mostly in the range 40° to 50°. A set of steep southeasterly dipping fractures (Cluster 6) is the main exception, lying well off the great circle.

Movement on these fractures is generally slight. Some fissures have simply opened with little or no slip displacement, to accommodate dikes and veins. The favoured direction of dike intrusion is coincident with the northerly striking joint set (Figure 3.3, Cluster 3). Barren quartz veins commonly fill northerly striking fractures (Cluster 6) whereas the sulphide-bearing fissures often strike northeasterly (Cluster 4).

Several important faults have been identified. For example, major northerly trending faults, marked by pronounced topographic lineaments, pass just west of the summit separating the eastern part of Grouse Mountain from the main mass. A wedge of volcanic conglomerate, part of Unit 2, located about 1 kilometre southeast of Coppermine Lake, lies between these faults and has been rotated against the adjacent blocks.

CHAPTER 4

LITHOGEOCHEMISTRY

This chapter provides information on sampling, analytical methods, general statistics and a discussion of the distribution of the elements with examples based on the lithogeochemical data in Appendix A, Table A.1. A detailed evaluation of the data is also provided for the area of mineralized lithologies between Goosly Lake and Owen Lake where sampling of rock outcrops was most detailed. The graphs and plots in this chapter are derived using in-house computer software: "MSCSTATI" for general statistics, providing histograms and cumulative frequency curves; and, "MSCROQMOD" and "MSCQCLUS" for factor and cluster analyses.

SAMPLE COLLECTION

A large collection of rock samples, totalling 1791 hand specimens, resulted from the geological survey of the Buck Creek map area. They provided petrographic information which assisted in assembling the regional geological map.

In 1972, on the initiative of J.J. Barakso (Chief Chemist) and G.C. Waterman (Chief Geologist) of Anaconda American Brass Ltd., samples from the Goosly Lake–Owen Lake sector of the map area were submitted for chemical analyses (Figure 4.1). The program utilized 691 samples comprising the NAD, OL, SG and TS suites listed in Appendix A, Table A.1. These samples provided the ministry with an inventory of lithogeochemical data and Anaconda with valuable information to assist further mineral exploration.

In 1973 a similar program was undertaken with J.W. Murton of City Service Minerals Corporation, covering the eastern and northern parts of the map area. This utilized 740 samples comprising the DKR and OPG suites.

In 1979 an additional investigation, in cooperation with J.M. Kowalchuk (geologist) and P.M.D. Bradshaw (geochemist) of Placer Development Limited, resulted in an additional 360 samples, comprising the G suite, being added to the suite of samples evaluated in this report.

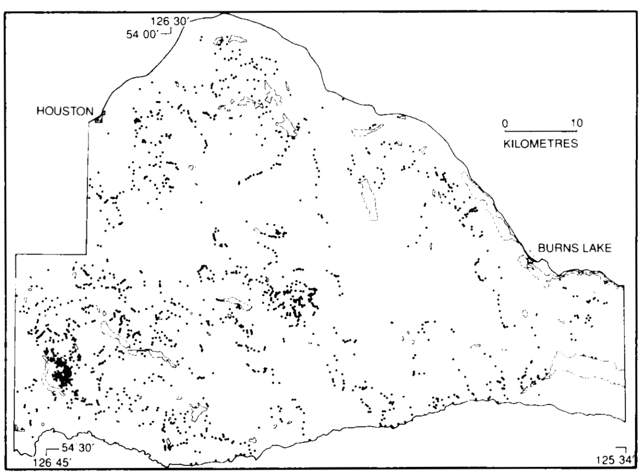


Figure 4.1. Distribution of lithogeochemical sampling stations in the Buck Creek area.

METHODS

Sample preparation followed routine procedures. In each case a hand specimen, containing no less than one textural unit (smallest repeating mineral array) of rock, was pulverized by ceramic milling to less than original grain size. This generally produced several hundred grams of –120 mesh powder.

Analyses were performed using mainly atomic absorption instrumentation. Determinations were made for 21 elements, listed alphabetically in Appendix A, Table A.1, and required more than 30 000 individual tests.

Determination of silver, arsenic, cadmium, cobalt, copper, fluorine, iron, manganese, molybdenum, nickel, lead and zinc required pretreatment of samples using a mixture of nitric and perchloric acid. This achieved 92 to 98 per cent extraction of the total contained metals; residuals remained with light-coloured clays, a small amount of dark opaques and undissolved original minerals.

Sample preparation for barium, strontium, fluorine and tin was more complicated and required fusions and, in some cases, elimination of interfering elements; barium and strontium were analysed by spectrophotometric methods and fluorine by specific ion electrodes. For tin, ammonium iodide digestion was followed by spectrophotometric finishing procedures.

All results are quantitative, having an overall reproducibility of 10 per cent or better relative deviation (C), where $C = 100\ s/x$; "s" being the standard deviation and "x" the average value.

Some general statistics of the elements, based on the data in Table A.1, are listed in Table 4.1. The deviation or "central tendency" of results is expressed in terms of a range, containing, on average, two-thirds of the recorded values for each element. Some trace elements such as copper and manganese comprise several widely separated sample populations. For several elements, such as arsenic, gold and tin, analytical detection limits coincide with the lower limits in the dispersion range precluding detailed statistical analysis. In these cases anomalously low values have been assigned zero in Table A.1 (zero values aligned in rows in the table denote non-availability of samples).

The distribution of sample stations is shown in Figure 4.1. The uneven pattern and large gaps in sampling are partly due to local inaccessibility of bedrock because of gravel and till cover. This has caused difficulties in plotting and contouring metal concentrations across the map area.

TABLE 4.1
STATISTICS OF THE ANALYSED ELEMENTS
(ppm except as noted)

Element	Analyses	Deviation Range	Detection Limits
Ag	1675	0.2 – 1.5	0.1 – 255
As	1776	1 – 7	1 – 1 925
Au	786	5 – 10 ppb	5 – 5 600 ppb
Ba	1498	1 000 – 2 600	32 – 40 800
Ca	1498	2 200 – 16 000	100 – 80 000
Cd	1776	0.3 – 1.2	0.1 – 255
Co	1675	6 – 23	1 – 96
Cu	1776	5 – 35	1 – 64 500
F	1600	170 – 900	8 – 2 700
Fe	952	15 000 – 40 000	1 000 – 50 000
Hg	1249	8 – 40 ppb	5 – 2 000 ppb
K	1498	650 – 3 000	110 – 18 000
Mg	801	1 000 – 1 300	200 – 41 000
Mn	1675	220 – 1 050	20 – 12 500
Mo	1776	1 – 4	1 – 275
Na	1498	400 – 1 100	60 – 16 200
Ni	1675	5 – 50	1 – 300
Pb	1776	7 – 25	2 – 3 900
Sn	884	2 – 5.5	2 – 18
Sr	1506	200 – 1 080	18 – 9 000
Zn	1776	35 – 120	4 – 2 300

DATA

Figure 2 (in pocket) shows the dispersion of anomalous arsenic and silver values across the map area. These are excellent pathfinder elements for locating zones of alteration and ore typical of the Buck Creek area; clusters of anomalous arsenic and silver values, greater than 5 and 2 ppm respectively, coincide with known mineral deposits and prospects.

The following is a general discussion of the elements.

Arsenic: Anomalous levels of arsenic are found in a variety of rock types across the map area (Figure 2). Clusters of high values occur in the Hazelton rocks in the Gerow Creek area, in the vicinity of the Apex prospect near Aitken Creek, and along the valley of Buck Creek between Bob Creek and the Irk prospect. The greatest concentration of anomalous samples occurs in the Upper Cretaceous andesites and rhyolites of the Francois Lake group and the Tertiary and pre-Tertiary formations around the Equity mine. Statistical analysis of arsenic is based on the methods of Rose *et al.* (1979, page 39) using the data generated by Anaconda. The mode for arsenic is estimated to lie between 2.2 and 2.4 ppm, and the minimum threshold (mean plus two standard deviations), from logarithmically transformed values, varies from 5 ppm for country rocks to 21 and 149 ppm for host rocks in the vicinity of the Silver Queen and Equity mines respectively. For small blocks of data such as the samples collected near the Equity mine, there is a straight line log-normal distribution for this element (Figure 4.2).

Barium: A range of barium values, from a few thousand to several thousand parts per million, is characteristic of the Goosly Lake volcanic rocks. In this association barium correlates with potassium. Higher levels of barium may correlate with strontium in some gold-bearing veins (such as sample NAD-1). Barium occurs as barite in the sphalerite-rich veins of the Silver Queen mine (Plate 5.11). Neither barite nor barium are notable in the ore zones of the Equity mine.

Cadmium: This is a good pathfinder element for sulphide mineralization in the Buck Creek area. Anomalous values, in excess of a few parts per million, are found in the Gerow Creek area and at the Silver Queen and Equity mines. At the Silver Queen mine cadmium correlates with silver and zinc in vein samples. At the Equity mine cadmium is generally associated with silver, arsenic, copper and zinc, and locally with arsenic and gold.

Calcium: This is one of the major elements in basic igneous rocks and as such is associated with magnesium and iron. In the veins of the area these elements also occur together in calcite, siderite and ankerite as gangue constituents. Calcium is also manifestly abundant in the carbonates of the propylitic alteration zone at the Silver Queen mine.

Cobalt: The distribution of cobalt is similar to nickel. Both elements show relative abundance in basaltic lavas and gabbroic intrusions. For specific igneous rock suites, such as the Tertiary effusives, which include the Swans Lake basaltic member of the Buck Creek formation and the gabbroic phases of the Goosly intrusions, the distribution of cobalt is approximately log-normal. The estimated mode and threshold are 14 and 35 ppm respectively. For the Upper Cretaceous volcanics of the Francois Lake group, cobalt is generally less abundant, showing a mode of 8 ppm and threshold of 33 ppm.

Copper: This is the most variable of all the elements analysed. The several modes that characterize the distribution of copper range from 7 to 22 ppm; threshold values

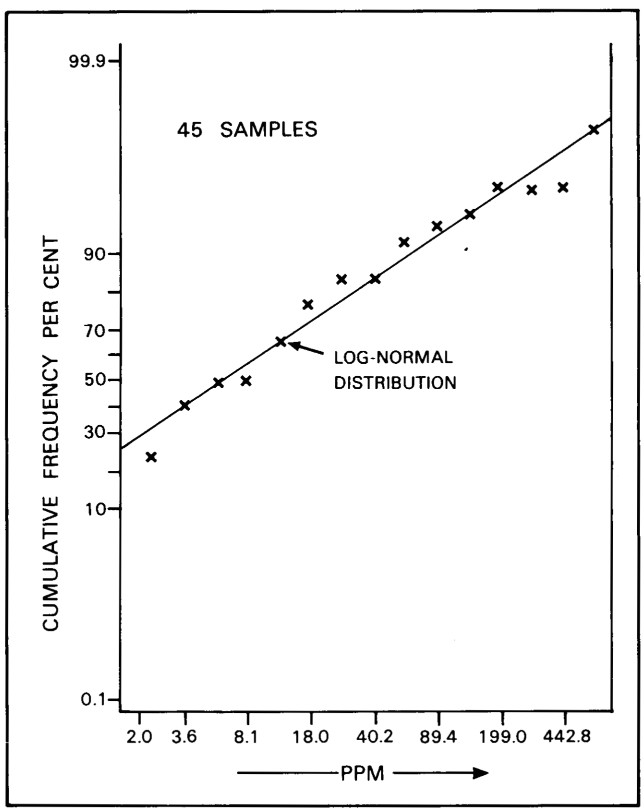


Figure 4.2. Cumulative frequency plot for arsenic on a normal probability graph samples from the Equity mine area.

commonly fall between 50 and 60 ppm. Anomalous copper levels result from a variety of sulphide mineral occurrences. For example, copper in the Hazelton volcanic rocks is often manifest as disseminations and veinlets of chalcocite, bornite, chalcopyrite and pyrite. Copper in association with molybdenum occurs as disseminated chalcopyrite accompanied by pyrite and molybdenite in granite porphyries as at the Dungate Creek prospect. Copper correlating with silver, zinc and lead is found in the chalcopyrite, pyrite, tennantite, sphalerite and galena-bearing quartz veins of the Silver Queen mine. Copper with silver, arsenic and antimony occurs as disseminations, veinlets and lenses of chalcopyrite, pyrite and tetrahedrite at the Equity mine.

Fluorine: This element is ubiquitous in the rocks of the map area and rarely falls below 100 ppm. The Goosly intrusions and Goosly Lake volcanic rocks are slightly enriched in apatite and correspondingly enriched in phosphorous and fluorine. Anomalous fluorine, in excess of several thousands of parts per million, usually indicates the presence of fluorite. An abundance of fluorite exposed on the Mud Lake (Deer) prospect east of Houston is associated with quartz-carbonate veining and sulphide mineralization in Hazelton volcanic rocks. At the Equity mine fluorine is depleted over the ore zone. A weak discontinuous halo rising above 1000 ppm fluorine can be interpreted as surrounding the deposit.

Gold: Relatively few samples have been analysed for gold. These are mainly from the area between Owen Lake and Goosly Lake. Background levels are normally less than 15 ppb; many samples containing as much as 30 ppb show no visible indications of mineralization. At the Silver Queen mine it is not unusual that vein samples with chalcopyrite, sphalerite and galena return gold analyses in the order of a few thousand parts per billion; pyritized samples of altered country rock adjacent the veins may contain gold ranging up to several hundred parts per billion. At the Equity mine, gold ranges from a few hundred to a few thousand parts per billion in the altered country rocks and ore zone. The gold is usually associated with fine-grained sulphides in small cracks within the dacitic host rocks.

Iron: This element, occurring as a major component in magnetite, hornblende and pyroxene, tends to be enriched, together with magnesium and nickel, in basic igneous rocks such as gabbros and basalts. In the mineral deposits, iron is mostly in pyrite and displays some coherence with sphalerite (zinc) and silver in this setting. At the Equity mine specularite and magnetite are present in the ore zone. Hematite is commonly found in fractures throughout the orebody whereas magnetite is concentrated in lenses and pockets nea the contact with the Goosly syenomonzonite stock.

Lead: The source of lead in country rocks is uncertain although it probably occurs mostly in galena and lead-bearing feldspar. The distribution of lead is approximately log-normal (Figure 4.3) with an overall mode at about 12 ppm; this is slightly higher and skewed in mineralized suites (Figure 4.4). Where galena is abundant there is good to fair correlation between lead, zinc and silver.

Magnesium: Magnesium in the country rocks ranges from a few hundred to several thousand parts per million. The good correlation of magnesium with iron, calcium and nickel in the basic igneous rocks is not surprising because of the similar ionic properties of these elements. Similarly, magnesium follows calcium and sodium in the carbonates associated with the hydrothermally altered rocks adjacent to the ore zones.

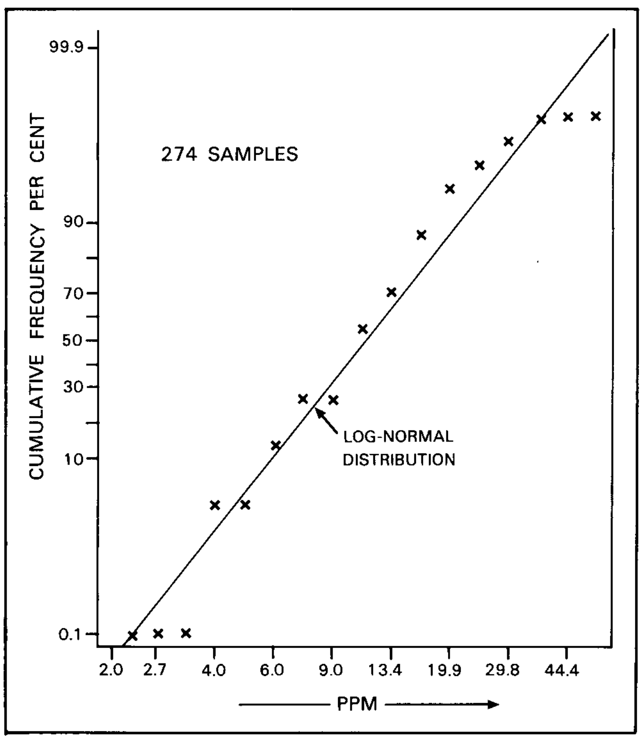


Figure 4.3. Cumulative frequency plot for lead on a normal probability graph; samples from Tertiary country rocks in the Goosly Lake area.

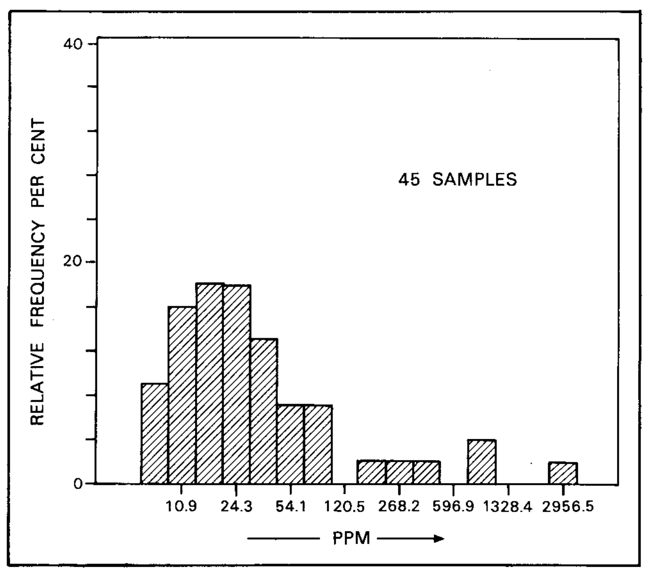


Figure 4.4. Frequency distribution histogram for lead; samples from the Equity mine area.

Manganese: This is the most abundant of the trace elements analysed. The background level of manganese averages several hundred parts per million and ranges to a few thousand parts per million in many of the mineralized areas. Manganese occurs in abundance in the rhodochrosite-bearing veins and oxidized vein cappings at the Silver Queen mine. There is a correlation between high manganese values and zinc and a weaker relationship with lead, cadmium, arsenic and silver.

Mercury: The distribution of mercury in the map area is somewhat erratic — different subareas have different background levels. This trace element is not consistently associated with any particular type of rock, alteration or mineralization. The most common level of mercury is 10 ppb although background in the Silver Queen mine area is several times this value. In the vicinity of Aitken Creek, some samples have coincident anomalous levels of mercury, arsenic, cadmium and copper; elsewhere anomalous mercury coincides locally with high arsenic, lead and zinc values. The mercury-arsenic correlation is the strongest.

Molybdenum: For the most part, the background level of molybdenum is relatively constant at a few parts per million. The several high readings reveal some weak correlations such as molybdenum with arsenic, zinc and copper. The granite porphyry intrusions at Dungate Creek and west of the Equity mine are the source of these metals.

Nickel: The association of nickel with basic igneous rocks is well known. Cobalt and, to some extent, copper share this characteristic. For the Tertiary volcanics and intrusions, which are mostly intermediate and basic in composition, the estimated mode and threshold values for nickel are 18 and 112 ppm respectively. In comparison, the Upper Cretaceous felsic volcanic and associated intrusions have lower nickel values, with a mode at 5 ppm and threshold of 29 ppm. At the Equity mine the distribution of nickel is log-normal (Figure 4.5). In the ore zone, nickel values rise to 300 ppm and coincide with relatively high values of cobalt, copper, arsenic, silver and gold.

Potassium: Among the diverse rocks of the area, potassium is most abundant in rhyolite and granite where it occurs principally in biotite and alkali feldspar. In the altered rocks which host the silver-copper-arsenic ores at the Equity mine, potassium is present in the form of fine-grained sericite; potassium feldspar is an important constituent in the adjacent Goosly syenomonzonite stock where it comprises up to 25 per cent of the rock. A few granite porphyry bodies in the area contain veinlets rich in potassium feldspar and a small amount of pyrite, copper minerals and molybdenite.

Silver: The background for silver is less than 1.5 ppm. Anomalous values in the vicinity of the mines and exploration prospects are greater than 2 ppm and range to more than 250 ppm (Figure 2). The association of anomalous levels of silver with lead, zinc and cadmium is typical of the sphalerite and galena-bearing veins of the Silver Queen mine and many less-developed properties. Similarly, correlation of silver with arsenic, antimony and copper is characteristic of the chalcopyrite-tetrahedrite-rich ores of the Equity mine.

Sodium: The distribution of sodium is similar to the other major elements and usually ranges in abundance from a few

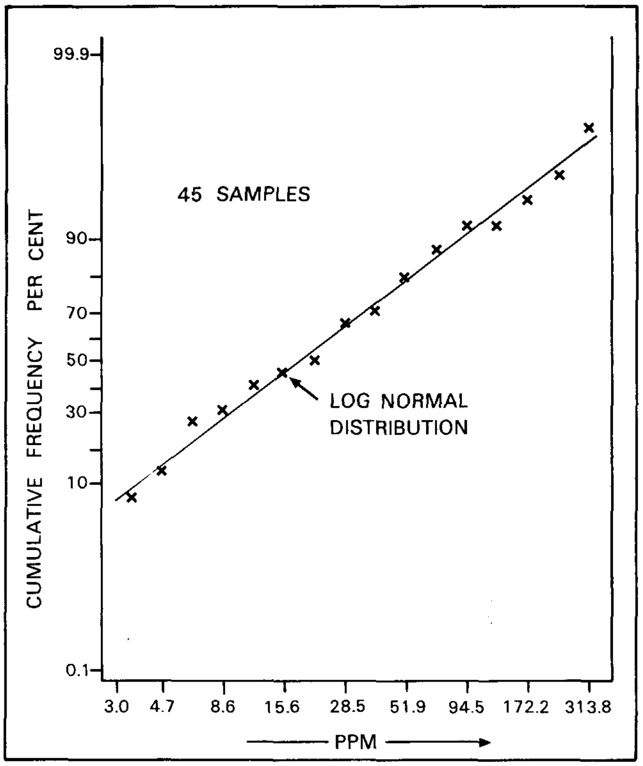


Figure 4.5. Cumulative frequency plot for nickel on a normal probability graph; samples from the Equity mine area.

hundred parts per million to several per cent. Unlike the other elements analysed, however, there is no evident correlation between sodium and the ore minerals. The common association of sodium is with calcium and, to a lesser extent, strontium in plagioclase in igneous rocks. The late-forming fractions of plagioclase tend to be enriched in sodium and strontium. In alkali feldspar, some sodium is associated with the early-forming feldspar fractions together with strontium and barium. The late-forming adularia feldspar of the vein systems would not be expected to carry much sodium, strontium or barium.

Strontium: The behaviour of strontium is similar to barium. Both of these alkali-earth elements tend to accumulate in the late fluids of magmatic sequences. The concentration levels in common rocks range to several thousand parts per million and to several per cent in some vein samples. In vein sample NAD-1 from the Silver Queen mine, strontium (probably occurring as strontianite) and barium (barite) correlate with high gold values. At the Equity mine both strontium and barium are depleted in the principal ore zones. For example, the 300-ppm contour level of strontium encloses a negative anomaly about the Main zone and Southern Tail orebodies. Values of strontium greater than 1000 ppm are usually remote from the orebodies. Barium gives a similar but more diffuse pattern.

Tin: The level of tin determined in the country rocks of the area is commonly less than 6 ppm. Few samples have more than 10 ppm, and most of these are associated with the gold-bearing ores of the Equity mine. The host mineral is unknown

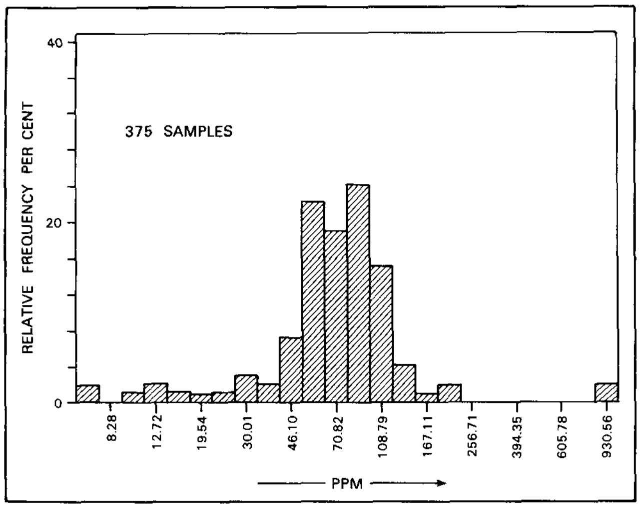


Figure 4.6. Frequency distribution diagram for zinc; samples of Tertiary rocks from the Goosly Lake area.

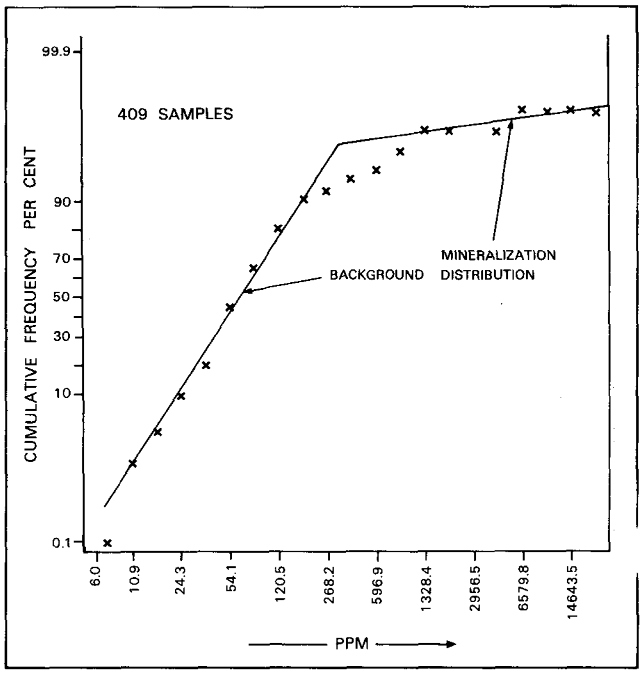


Figure 4.7. Cumulative frequency plot for zinc; samples from the Silver Queen mine area.

but may be a tin sulphosalt such as kylindrite. This would be compatible with the antimony-rich Equity ores.

Zinc: The distribution of zinc is similar to lead; values range widely from less than 100 ppm to more than 2000 ppm. The background mode for zinc, for samples collected from the Tertiary country rocks, is approximately 80 ppm and the threshold is 150 ppm (Figure 4.6). The pattern is different in the Equity mine area, the mode is lower and the threshold higher, 40 and 400 ppm respectively. Samples collected from the vicinity of the Silver Queen mine show a polymodal distribution, a background pattern overprinted by the effects of mineralization (Figure 4.7). For most of the mineralized rocks of the area zinc shows a good positive correlation with cadmium, silver, lead and, to a lesser degree, copper.

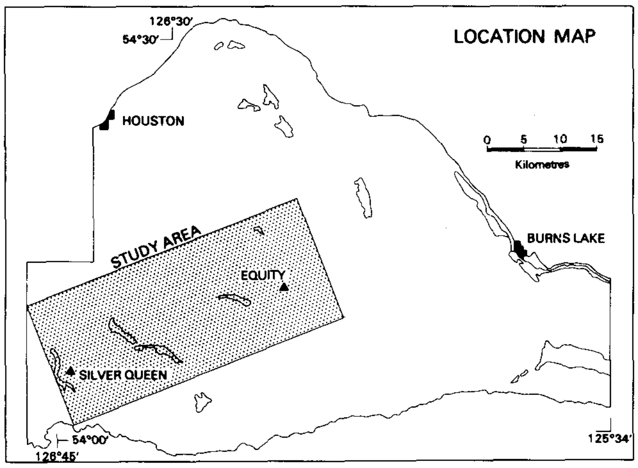


Figure 4.8. Location of the detailed lithogeochemical study area.

DETAILED STUDY

A detailed study has been undertaken in the type area of the main formations and in the belt of principal mineralization inclusive of the Equity and Silver Queen mines (Figure 4.8). Here the dispersion of metals in the country rocks on either side of a line of Tertiary intrusions suggests that these igneous bodies may be genetically related to known vein deposits, sulphide replacements and disseminations (Church *et al.*, 1976). These interpretations, based on data from 12 pathfinder elements and 853 samples, result from a variety of statistical procedures including correlation of the elements, factor analyses, cluster analyses and computer-assisted contouring of element concentrations.

INTER-ELEMENT CORRELATIONS

To test the behavioural coherence of the elements, a product-moment correlation matrix was computed using log-transformed values (Table 4.2). Of the 55 pairs of elements generated from the original data, three have positive correlations above 0.6. These are Zn-Cd, Ni-Co and Pb-Ag.

The Zn-Cd and Pb-Ag correlations, and a more general interdependence between these and As-Hg, are not surprising, the six elements together being commonly related to sulphide mineralization. Nickel and cobalt correlate strongly but have relatively weak cross-correlations with other metals. It is assumed from this that these elements are concentrated primarily in ferromagnesian silicate minerals rather than sulphide phases. Copper shows moderate correlation with nickel and cobalt and weaker correlation with lead, zinc, arsenic and cadmium.

FACTOR ANALYSIS

The correlation test and cumulative frequency plots (*e.g.* Figure 4.7) suggest that the geochemical expression is composite, the effects of mineralization being locally superimposed on the original composition of the rocks. This interpretation is supported by factor analysis.

In this instance, the "R-mode" factor analysis was employed, which compares the variables (elements) within samples. The variables were grouped and weighted according to variance similarities and loaded into factors, each factor accounting for a percentage of the total sample variance. The matrix of correlation coefficients (Table 4.2) was input to an algorithm from which factors were extracted.

The results of the calculations are given in Table 4.3. Nine factors account for 94 per cent of the variance in the correlation data; the first two factors alone are responsible for 50.3 per cent. The most significant factor, No. 1, is considered to best express the effects of mineralization. This factor is strongly weighted in favour of lead and silver, and less strongly with arsenic and cadmium. The second most important factor, No. 2, is thought to reflect the contribution of primary rock chemistry. This factor is dominated by nickel and cobalt, and influenced in a minor way by copper and iron. These elements are known to accumulate in basic igneous rocks. The remaining weaker factors, Nos. 3 to 7, are each dominated by one element only, these being manganese, molybdenum, mercury, arsenic and copper, in decreasing order of importance. The weakest factors, Nos. 8 and 9, account for only 6.8 per cent of the total variance. Factor 8 has strong negative copper and iron loadings and is interpreted to reflect the chalcopyrite-rich mineralization of the Equity mine. Factor 9 has strong zinc and cadmium loadings, perhaps reflecting the sphalerite-rich mineralization found in the veins at the Silver Queen mine.

The additional operation to test matrix isotropy, known as promax oblique rotation of the matrix (K Min = 2), had little effect, comparing the results with the varimax rotation. The only noticeable change was in Factor 8, where copper loading was reduced.

Cluster Analysis

Cluster analysis goes a step beyond the previous test by achieving statistical partitioning of the data. The rock samples rather than the separate chemical elements are treated and grouped according to their relative similarities. The calculations, based on factoring, produce a graphical plot that is easy to evaluate.

The procedure is described in detail by Parks (1966, 1970). A Q-mode principal-components analysis is performed on the matrix of correlation coefficients and distance function values. Factor scores are computed by "Harmon's short regression square root method" and normalized. Each sample is then compared to all other samples on the basis of these scores, to achieve clustering. The result is presented as a dendrogram. The samples are listed in groups according to similarities, the groups being joined in broad associations by an array of stems; long stems indicating large differences. The abscissa on the dendrogram is the value of the distance function, ranging from 0.0 (total similarity) to ± 1.0 (total dissimilarity).

Figure 4.9 is an example of a dendrogram representing samples from the Goosly area. Several groups of samples are readily identified by different average chemical compositions. Unmineralized country rocks (No. 1), slightly mineralized hostrocks (Nos. 2 and 3) and ore (No. 4) are clearly separated.

The result of cluster analysis of the entire suite of samples from the Goosly–Owen Lake area is summarized in Table 4.4. Four main groups are defined — the Equity-type mineralization, Silver Queen mineralization, average country rock, and country rock with low metal background.

The mineralized samples are mostly from the vicinity of the two deposits and have Cu:Pb:Zn ratios similar to the corresponding ores. Equity mineralization is copper rich, with above average silver, nickel and cobalt. Silver Queen mineralization is comparatively zinc rich, with high cadmium and mercury.

The country rocks are Tertiary and Mesozoic igneous and sedimentary formations. For the most part, cluster analysis has not been successful in separating these because the elements analysed are not entirely suitable for the purpose. However, the samples with the lowest overall values, group No. 1, are generally the most siliceous rocks — rhyolites, dacites and granitic intrusions. Other rock types can be recognized, but are poorly defined.

Composition of the Principal Formations

Analyses of the Goosly syenomonzonite-gabbro intrusions and the main hostrock formations are given in Table 4.5 as modes and threshold values.

TABLE 4.2 MATRIX OF CORRELATION COEFFICIENTS OF LOG VALUES (N = 853)

	Mo	Cu	Pb	Zn	Ni	Co	Ag	Fe	Hg	As	Mn	Cd
Mo	1.000											
Cu	0.128	1.000										
Pb	0.174	0.252	1.000									
Zn	0.173	0.308	0.468	1.000								
Ni	– .128	0.478	0.054	0.024	1.000							
Co	0.216	0.474	0.185	0.215	0.677	1.000						
Ag	0.260	0.387	0.602	0.375	0.186	0.272	1.000					
Fe	– .187	0.221	– .144	0.236	0.286	0.440	– .031	1.000				
Hg	0.200	0.087	0.377	0.221	– .201	– .043	0.220	– .119	1.000			
As	0.248	0.296	0.450	0.331	– .045	0.027	0.438	– .070	0.378	1.000		
Mn	– .074	0.016	0.174	0.495	0.049	0.282	0.074	0.389	– .008	–0.045	1.000	
Cd	0.310	0.349	0.542	0.707	0.163	0.344	0.547	0.122	0.169	0.326	0.374	1.000

TABLE 4.3
RESULTS OF 'R' MODE FACTOR ANALYSIS EIGEN VALUES AND VARIMAX MATRIX FOR 94 PER CENT OF TOTAL VARIANCE

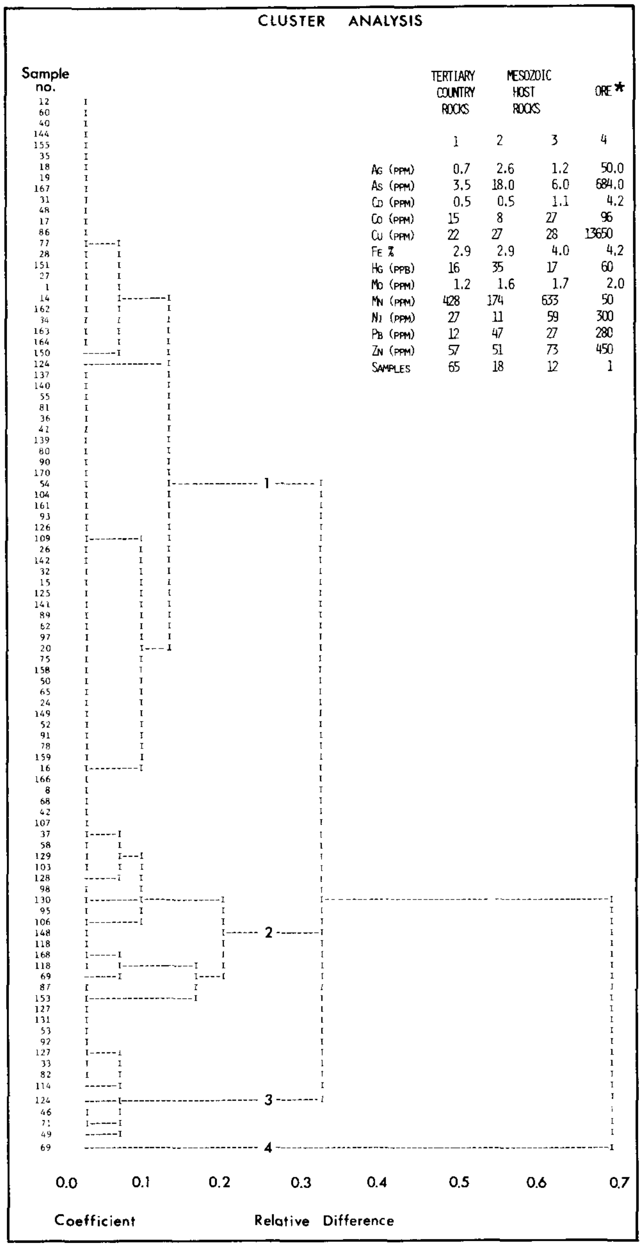
Factor	1	2	3	4	5	6	7	8	9
Eigenvalue	3.79	2.25	1.47	.94	.83	.67	.52	.44	.37
Per Cent	31.6	18.7	12.2	7.8	6.9	5.6	4.3	3.7	3.1
Cumulative Per Cent	31.6	50.3	62.5	70.4	77.3	82.9	87.2	90.9	94.0
Sum of Squares	1.516	1.756	1.039	1.112	1.085	1.004	.926	1.052	1.791
.974 LOG Mo	.095	.009	– .048	.957	– .085	– .093	– .033	.012	.137
.983 LOG Cu	.166	.347	– .035	.044	– .047	– .134	– .879	– .808	.179
.824 LOG Pb	.665	.130	.123	– .042	– .314	– .231	0.46	.216	.384
.900 LOG Zn	.125	– .026	.272	.036	– .114	– .150	– .157	– .133	.855
.926 LOG Ni	.053	.909	– .068	– .171	.134	.017	– .202	– .501	.037
.919 LOG Co	.136	.828	.203	.263	– .020	.027	– .136	– .275	.094
.932 LOG Ag	.894	.088	– .021	.143	– .028	– .150	– .197	– .030	.204
.978 LOG Fe	– .066	.229	.184	– .115	.042	0.19	– 0.69	– .925	.109
.978 LOG Hg	.122	– .105	0.015	.088	– .955	– .150	– .039	.032	.090
.995 LOG As	.239	– .037	– .048	.106	– .176	– .921	– .122	.020	.170
.985 LOG Mn	.033	.066	.923	– .052	.014	.048	.036	– .184	.294
.887 LOG Cd	.353	.169	.105	.192	– .021	– .070	– .067	– .024	.822

TABLE 4.4
RESULTS OF CLUSTER ANALYSIS FOR ALL SAMPLES, COMPOSITION OF MAIN GROUPS

	Country Rocks Background		Mineralized Rocks	
	Low	Average	Silver Queen	Goosly
	1	2	3	4
Ag (ppm)	0.5	0.8	3.0	10.5
As (ppm)	3	2	33	37
Cd (ppm)	3.0	0.6	57.0	3.0
Co (ppm)	2	14	14	85
Cu (ppm)	5	17	52	1808
Fe %	0.6	2.7	2.0	1.5
Hg (ppb)	17	11	111	24
Mo (ppm)	1.2	1.1	2.0	1.4
Mn (ppm)	104	505	516	250
Ni (ppm)	5	15	7	273
Pb (ppm)	12	14	193	138
Zn (ppm)	25	61	4751	379
Samples	33	816	7	2

TABLE 4.5
COMPOSITION OF THE GOOSLY INTRUSIONS AND MESOZOIC HOSTROCKS

	Average Country Rock	Tertiary Intrusions		Hostrocks			
				U. Cretaceous		M. Mesozoic	
	1	2		3		4	
		Mode	Thresh.+	Mode	Thresh.+	Mode	Thresh.+
Ag (ppm)	0.8	0.8	2.5	0.6	2.5	1.1	19.0
As (ppm)	2	2	13	2	21	4	149
Cd (ppm)	0.6	0.6	1.7	0.5	4.4	0.8	6.0
Co (ppm)	14	21	55	9	33	15	63
Cu (ppm)	17	34	225	12	61	10	1304
Fe %	2.7	3.0	7.3	3.6	7.2	1.7	4.5
Hg (ppb)	11	10	20	11	96	12	95
Mo* (ppm)	1.1	<1.0		1 1		1.2	
Mn (ppm)	505	460	881	735	4498	376	2118
Ni (ppm)	15	46	115	6	29	16	190
Pb (ppm)	14	20	40	12	71	20	391
Zn (ppm)	61	60	128	54	560	49	392
Samples	816	29		409		45	



	TERTIARY COUNTRY ROCKS	MESOZOIC HOST ROCKS		ORE*
	1	2	3	4
Ag (ppm)	0.7	2.6	1.2	50.0
As (ppm)	3.5	18.0	6.0	684.0
Cd (ppm)	0.5	0.5	1.1	4.2
Co (ppm)	15	8	27	96
Cu (ppm)	22	27	28	13650
Fe %	2.9	2.9	4.0	4.2
Hg (ppb)	16	35	17	60
Mo (ppm)	1.2	1.6	1.7	2.0
Mn (ppm)	428	174	633	50
Ni (ppm)	27	11	59	300
Pb (ppm)	12	47	27	280
Zn (ppm)	57	51	73	450
Samples	65	18	12	1

Figure 4.9. Cluster dendrogram for the rocks of the Goosly area. (* Assay of sample from discovery exposure at Equity mine.)

The statistics were obtained by plotting the frequency distribution of the elements. For example, in the case of the Cretaceous hostrocks, zinc gives a bell-shaped curve (Figure 4.10) which is an approximation of a single population log-normal distribution. The mode is determined as the mid-point on this symmetrical curve and the threshold is interpreted as the mean plus two standard deviations by the "MSCSTATI" computer program.

Comparing results from Upper Cretaceous hostrocks, the modal values are similar to the average for country rocks (Table 4.5, Column 1). However, thresholds are high, especially zinc, and resemble Silver Queen mineralization as shown in Table 4.5.

Middle Mesozoic hostrocks, comprising a variety of sedimentary and volcanic units, are skewed to siliceous composition. These rocks have relatively high copper, silver and nickel threshold values characteristic of the altered rocks in vicinity of the Equity mine.

The Goosly-type intrusions are a group of chemically related rocks with a notable abundance of copper, nickel and cobalt. These are considered a direct or indirect source of mineralization in the area.

Geochemical Maps

Computer-contoured lithogeochemical maps of the study area were published by Barakso and Church in 1973. Modifications of three of these are reproduced in Figure 4.11. The geology of the area is presented on Figure 4.12. These plots show the position of copper, mercury and arsenic anomalies related to the main rock groups and zones of mineralization.

The copper map (Figure 4.11) is the most striking. Copper anomalies coincide with a series of aligned Goosly-type syenomonzonite intrusions. The largest copper anomalies are directly over the Equity orebody, and slightly south of the main Silver Queen veins. These are examples of anomalies in the 3 to 6-kilometre diameter category for vein and replacement deposits according to Govett (1983, pages 116-119).

Mercury highs, plotted on Figure 4.11B, are widely scattered throughout the areas underlain by Mesozoic rocks. The anomalies are more or less satellitic to the intrusions, being displaced outward somewhat from the main zones of mineralization.

Arsenic surpasses copper and mercury in intensity over the mineralized zones and laterally (Figure 4.11C). The general dispersal of arsenic in the host rocks is so strong that it is possible to delineate these older formations without knowledge of the geology.

Other metals, such as silver, lead, zinc and cadmium, have similar distribution patterns to copper, mercury and arsenic, differing only in intensity and the extent of dispersion laterally from the source intrusions.

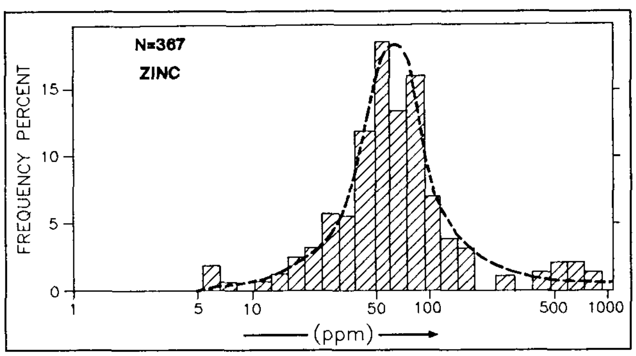


Figure 4.10. Frequency of zinc in Cretaceous hostrocks.

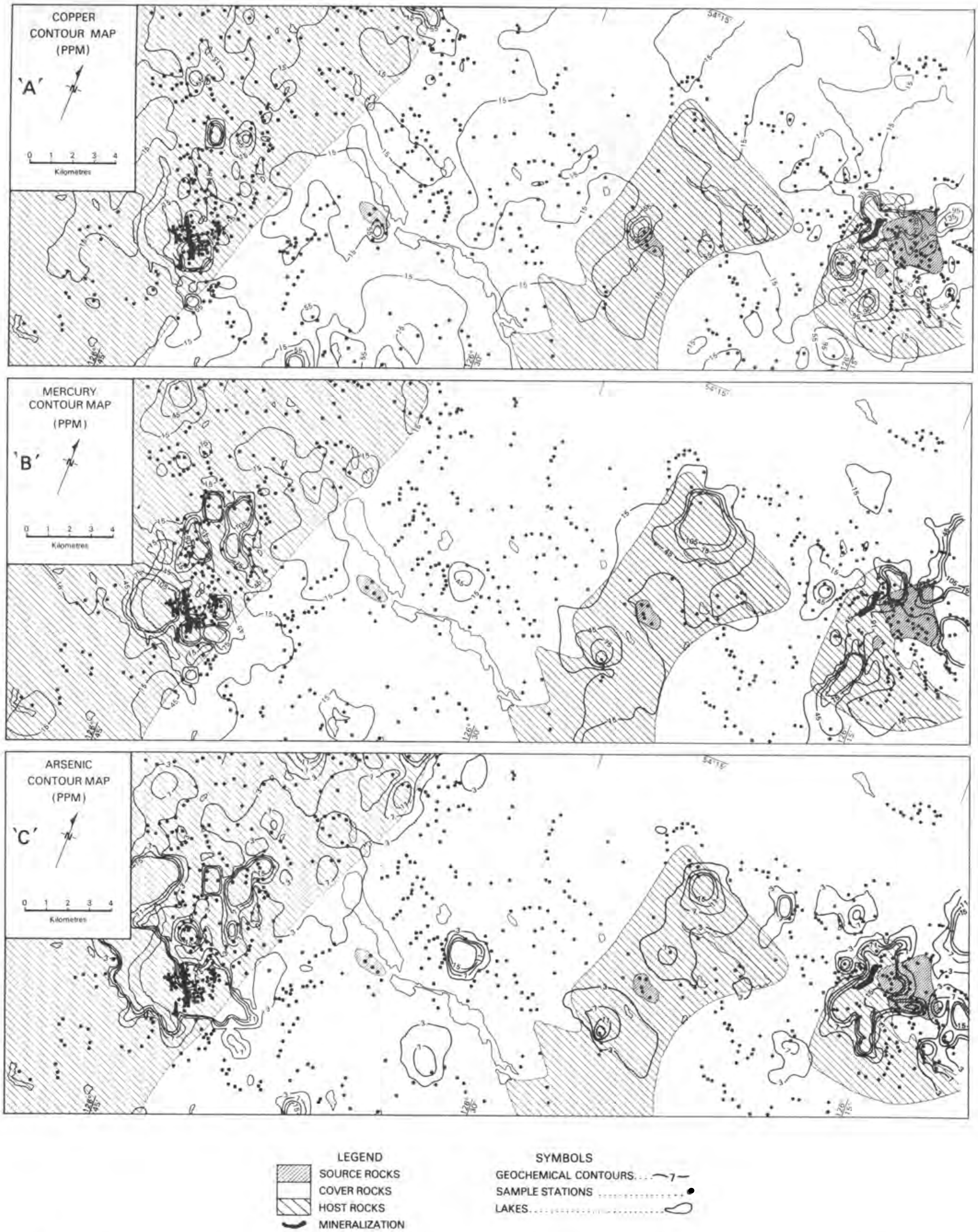


Figure 4.11. Geochemical maps showing the dispersion of (A) copper, (B) mercury and (C) arsenic, in the rocks of the Goosly - Owen Lake area (*see* Figure 4.12 for geology).

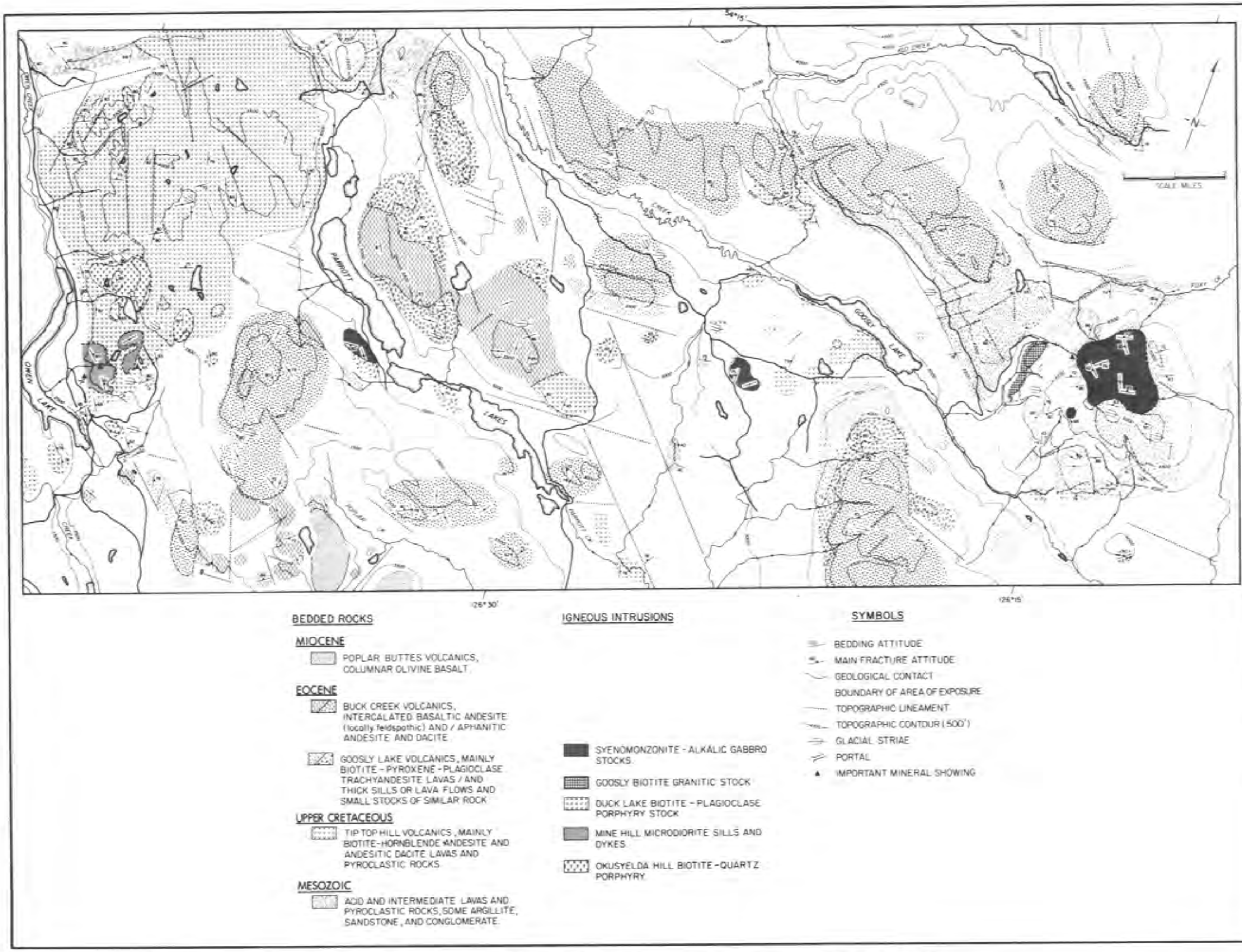


Figure 4.12. Geology of the Goosly - Owen Lake area, detailing the main lithological units.

ECONOMIC GEOLOGY

The Buck Creek area is underlain by a diverse suite of Mesozoic and Tertiary volcanic rocks and a number of small igneous intrusions, as outlined in preceding chapters.

The main stratigraphic divisions comprise tectonically disturbed and metamorphosed basement strata of Early Jurassic to Early Cretaceous(?) age, and little disturbed cover rocks of Late Cretaceous through Eocene age. The basement rocks are poorly exposed and little is known of their overall structural setting and total thickness. In contrast, the cover rocks have been mapped in detail and have been divided into numerous subunits. These are mainly volcanic rocks filling a broad fault-bounded depression, called here the "Buck Creek basin" — the base of which is 1000 to 3000 metres below older rocks on the surrounding hills. The original nature of this basin is unknown although it is suspected that withdrawal of magma at depth, during episodes of volcanism, was the main cause of subsidence resulting in a large volcano-tectonic sink or protocaldera structure (Church, 1983).

The alternative model is random block faulting accompanying volcanism. The objection to this is the sediments shed from uplifted fault blocks, and intercalated with the volcanics, are not common and occur only locally near major faults at the margins of the basin. Elsewhere in the basin local uplift may be related to the intrusion of stocks feeding the volcanics. However, generally it is clear that much of the block faulting in the region occurred after deposition of the Francois Lake group.

We do not imply that the basin is a true caldera (that would require a large volume of ash-flow tuffs that is not seen), but simply that the geological setting suggests a volcanic basin with some caldera-like features. For example, the perimeter of the Buck Creek basin is roughly outlined by a series of rhyolite fields and a semicircular alignment of volcanic centres between Francois Lake, Houston and Burns Lake (Figure 5.1). Another important feature is the alignment of Goosly intrusions which trends west-southwest from the Equity mine and the central "resurgent" uplifted area toward

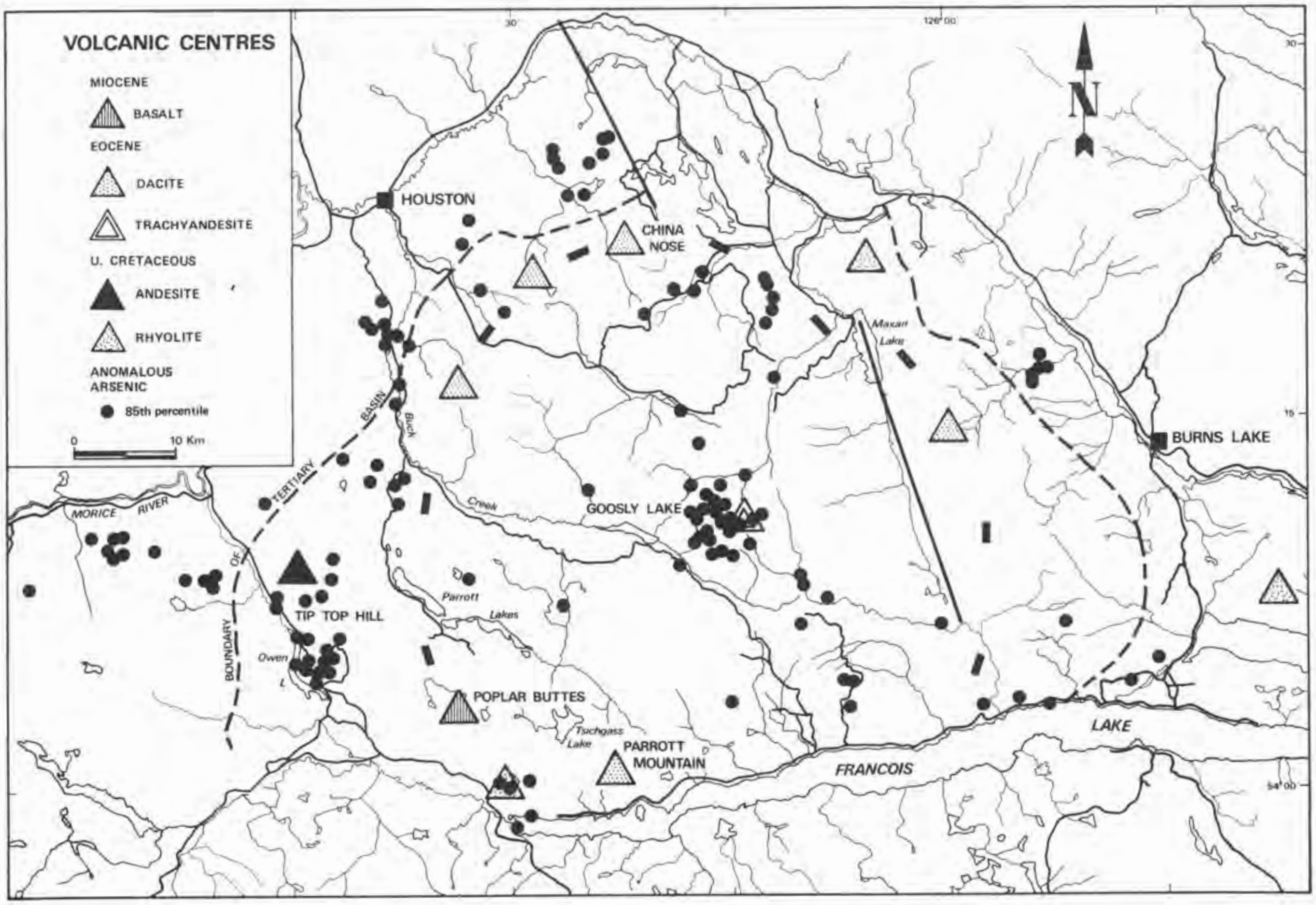


Figure 5.1. Elements of the Buck Creek volcanic basin showing the principal eruptive centres and arsenic anomalies.

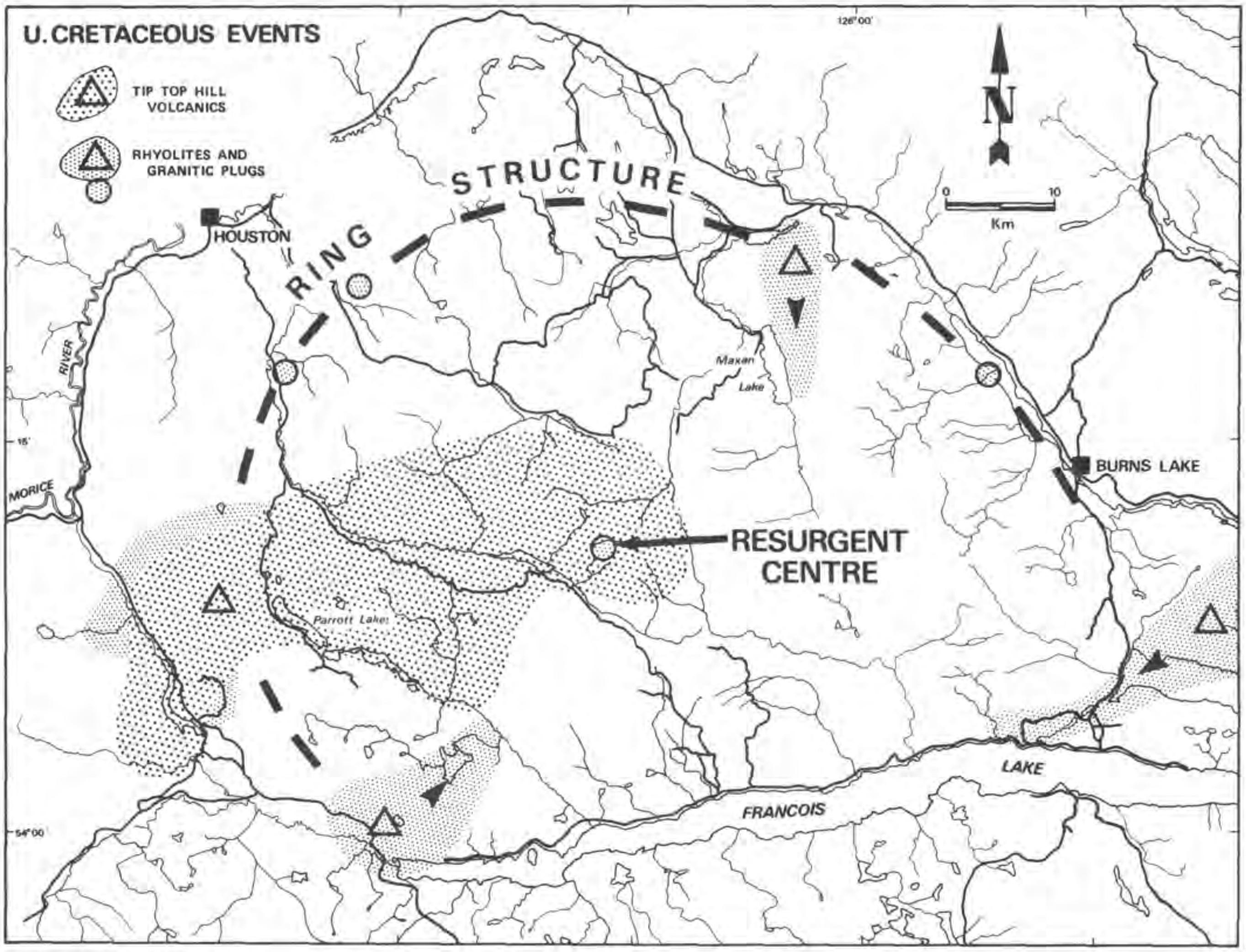


Figure 5.2. Volcanogenesis of the Buck Creek basin, Late Cretaceous events (solid arrowheads indicate outflow of lava from source vents).

Owen Lake, a distance of 30 kilometres. This appears to be the locus of a radial fracture and the source of the Upper Cretaceous Tip Top Hill volcanics (Figure 5.2) and the main feeder stocks and dikes of the Goosly Lake volcanics (Figure 5.3).

The principal mineral deposits in the area, the Equity and Silver Queen mines, are located several kilometres northeast of Goosly Lake and a few kilometres east of Owen Lake respectively. These deposits lie near the extremities of the radial structure.

At the Equity mine, erosion has cut deeply into a volcanic complex exposing the upper part of the Goosly stock and the main mineralized zone near the contact. This is a swollen pear-shaped body, largely of replacement origin, consisting of disseminated and massive sulphides rich in pyrite, chalcopyrite and tetrahedrite, with some pyrrhotite, and minor sphalerite and magnetite. Aluminous alteration characterized by scorzalite, andalusite, pyrophyllite and some corundum accompanies much of the mineralization. A tail-like appendage to the zone, which strikes southwards away from the intrusion, is a sharp-walled vein-like structure containing coarse ore.

The Silver Queen mine is developed on a vein system. The veins are mostly pyrite-sphalerite rich with local chalcopyrite concentrations and accessory galena and tennantite, and a quartz, rhodochrosite and barite-rich gangue. The veins are surrounded by highly altered hostrocks and a wide aureole of disseminated pyrite. A number of large dikes were emplaced more or less contemporaneously with the development of the veins. These seem to emanate from a deeply buried stock petrographically similar to the Goosly intrusion.

It appears that the Equity and Silver Queen deposits are related and, taken together, represent a complete range of a single ore-forming process. This is supported by the similarity in age of the Equity and Silver Queen mineralization (Eocene) and the proximity of the mineralization to petrographically related dikes and stocks (the Goosly intrusions).

The distribution of elements about the Goosly intrusions seems to confirm some genetic relationship. It is possible that the intrusions were only a source of heat in mobilizing mineral-bearing solutions. However, evidence suggests that copper, nickel, and possibly some of the other elements, moved directly from the intrusions.

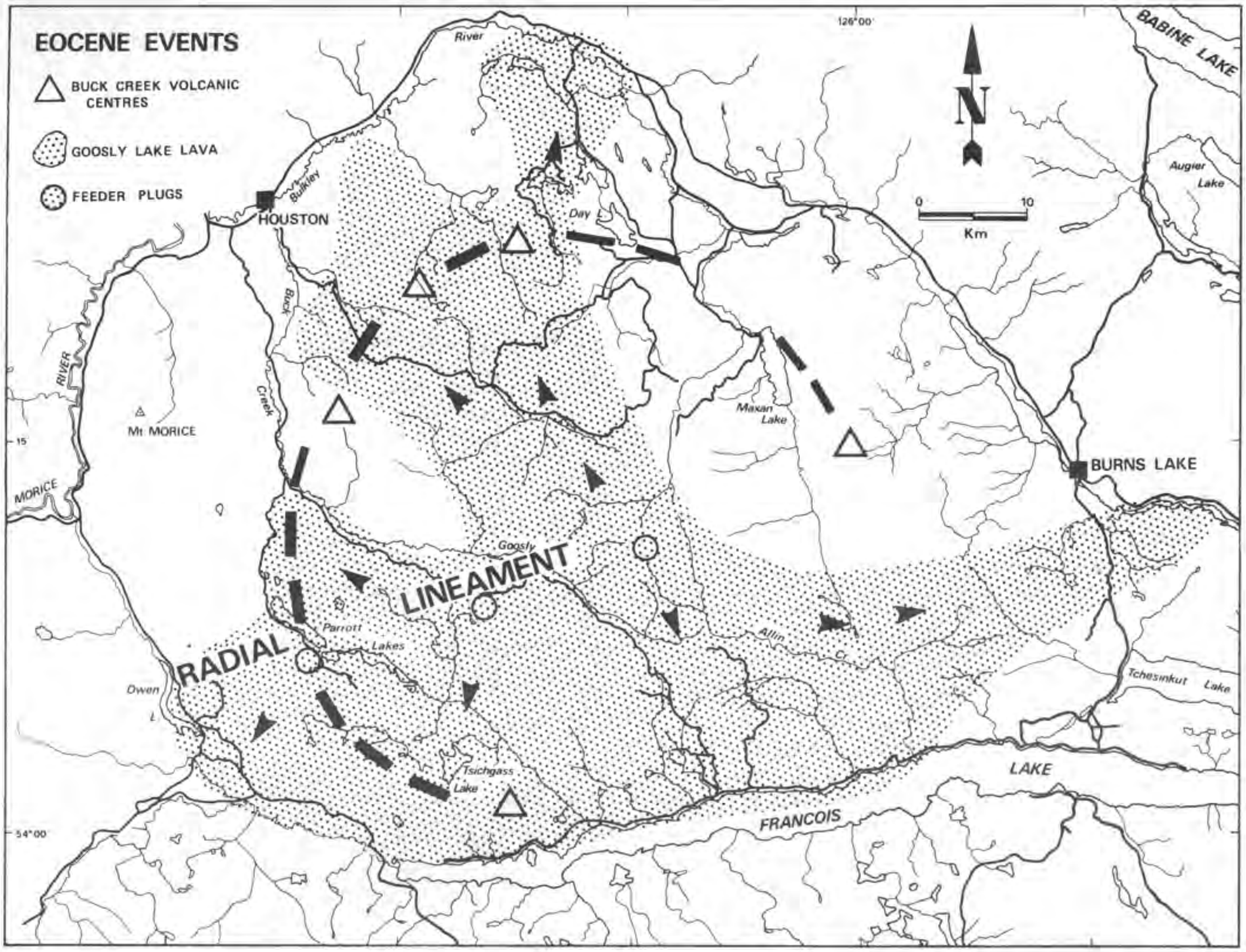


Figure 5.3. Volcanogenesis of the Buck Creek basin, Early Tertiary events (solid arrowheads indicate outflow of lava from source vents).

Figure 5.4 is an idealized cross-sectional model representing a synthesis of Equity and Silver Queen mineralization conforming to the generalities of the deposits. It is postulated that a Goosly-type stock lies subjacent to the Silver Queen deposit, and at the Equity mine a Silver Queen-type vein system has been largely eroded away.

According to the model a Tertiary syenomonzonite-gabbro stock, with numerous offshoot dikes, intrudes the Mesozoic basement assemblage releasing and mobilizing solutions which resulted in the formation of replacement sulphide lenses, typical of the Equity deposit, and satellitic vein systems such as found at the Silver Queen mine. An outflow of hydrothermal solutions from the area of the intrusion formed a broad aureole of alteration and sulphide dissemination.

The exact form and details of mineralization were no doubt partly controlled by the composition and structure of the hostrocks, the chemistry of the aqueous system and the prevailing physical conditions.

The application of rock geochemistry to mineral exploration is affirmed by this study. Broad patterns resulting from the dispersion of minor elements in the vicinity of orebodies may represent good targets for exploration. Success in this type of geochemical prospecting would undoubtedly depend on detailed geological and sampling control (*see* Figures 1 and 2) and adequate facilities for multi-element quantitative analysis and statistical processing of a large amount of data.

The various mineralized and nonmineralized units in the Buck Creek area are characterized by average compositions and threshold values. Subdivision of the data to obtain these statistics is assessed by cluster analysis. The results detailed in Chapter 4 of this report show distinctive metal ratios for rocks of the Silver Queen and Equity areas and above average copper content in the Goosly intrusions.

The main parameters of original rock composition are nickel and cobalt and, to a lesser extent, iron and copper, the most basic igneous rocks being enriched in these elements.

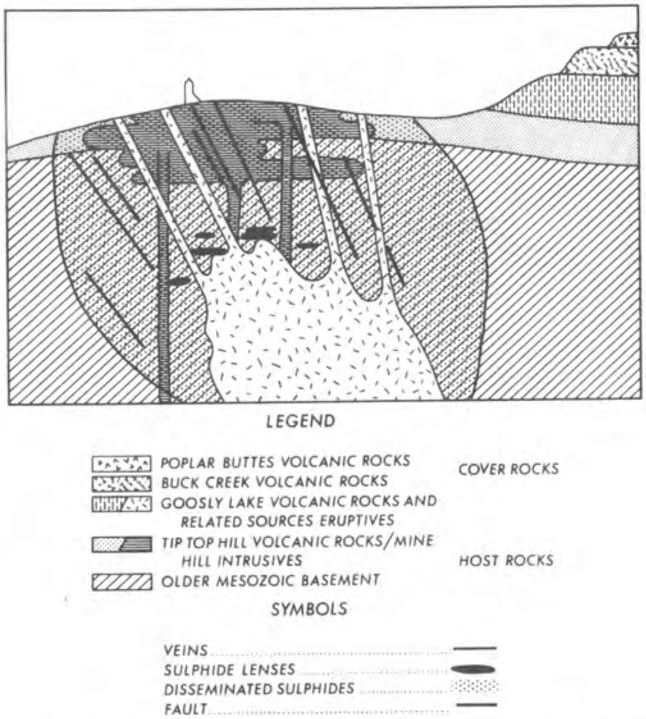


Figure 5.4. Metallogenic model of the Silver Queen and Equity deposits.

The effect of mineralization is best expressed in general terms by the behaviour of lead, silver, arsenic and cadmium and in specific terms, in the case of samples from the Silver Queen mine, by zinc and cadmium, and in the Equity samples by copper and nickel.

Geochemical maps show dispersion of the elements. It appears that migration is variable; some elements such as arsenic and mercury may extend beyond the source areas forming concentric zoned patterns.

MINERAL DEPOSITS

The principal mines and mineral occurrences of the area are shown in Figure 5.5. These comprise a variety of deposit types, including copper and molybdenum-bearing porphyries, epithermal and mesothermal veins, and replacement deposits such as some of the Main zone ore at the Equity mine.

The following descriptions of the properties are based on numerous visits to the area by the senior author between 1969 and 1984, together with thesis studies, private company reports and published papers. Where possible the descriptions are arranged sequentially by MINFILE number.

Plate 5.1. Panoramic view of the Equity mine (1984).

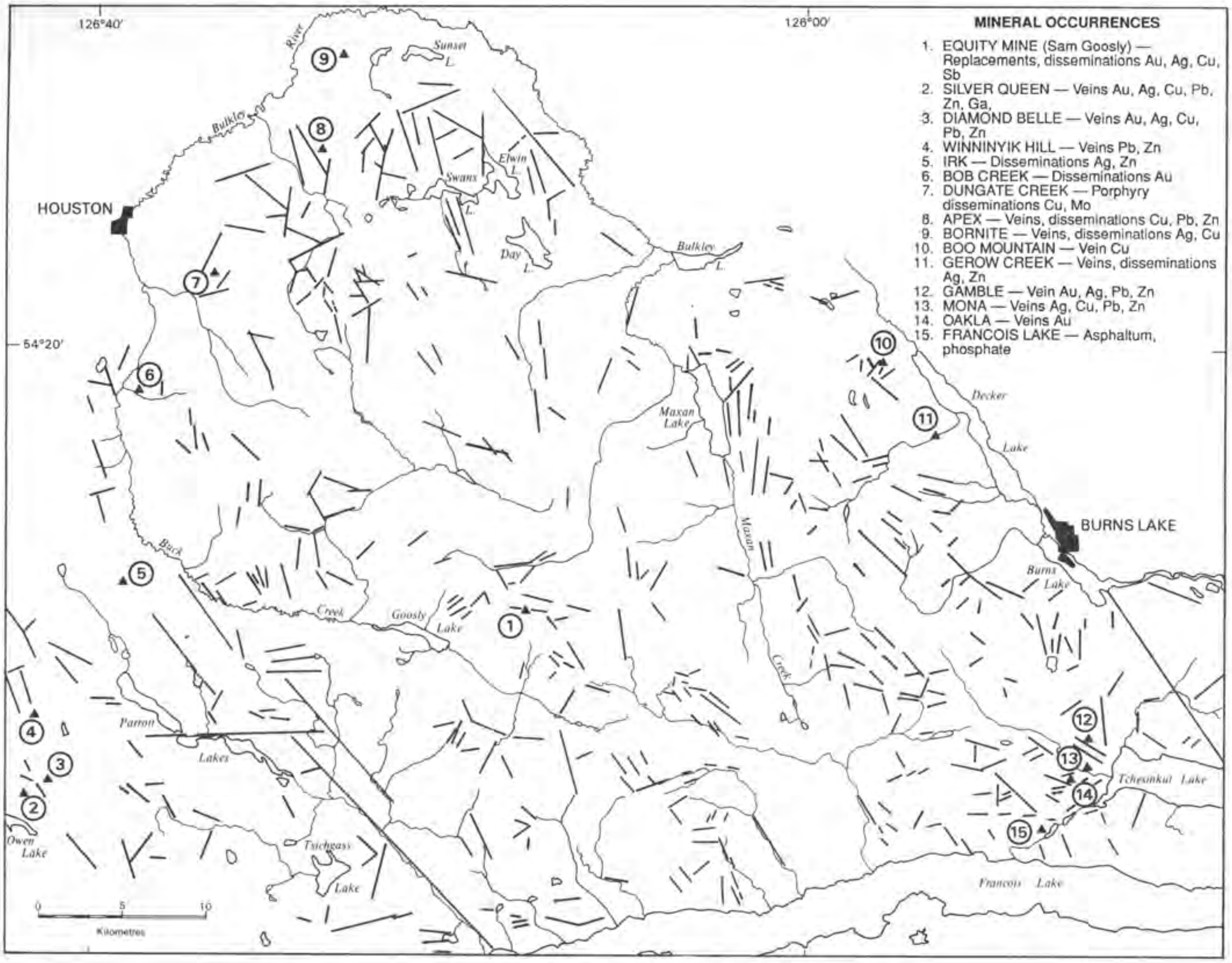


Figure 5.5. Lineaments and mineral occurrences in the Buck Creek area.

Equity Mine (Sam Goosly): MINFILE 093L 001 (Lat. 54°11′20″; Long. 126°15′40″)

The Equity mine, previously known as the Sam Goosly prospect, is 34 kilometres southeast of Houston, at about 1300 metres (4250 feet) elevation, on the drainage divide between Foxy Creek and Buck Creek. Access to the property is from Houston by the Dungate Creek gravel road.

EXPLORATION AND DEVELOPMENT HISTORY

The Sam Goosly discovery began with a team effort in conventional prospecting, but where geochemistry played a predominant role (Ney *et al.*, 1972). A regional stream-sediment geochemical program, conducted by Kennco Explorations, (Western) Limited in 1961 in its search for porphyry copper deposits, showed sediments from a stream east of Goosly Lake to be slightly anomalous in zinc and copper. The anomalous stream was known to drain a window of Hazelton rocks surrounded by Tertiary volcanic formations (Lang, 1941), but nothing was done with this information at the time, as the company had higher priorities. Sometime later J.J. Barakso, then Kennco's geochemist, suggested the use of fluorine geochemistry as a prospecting tool. He tested his ideas on a number of geochemical samples, including some from the Houston area, and found that sediments from the creek that were slightly anomalous in copper and zinc were also anomalous in fluorine. On the basis of this information, further exploration northeast of Goosly Lake was initiated in 1967. Weak chalcopyrite and molybdenite mineralization was found in a small granitic intrusion, and 58 claims comprising the SG group were located.

In 1968 Kennco completed an intensive program of geological mapping, magnetometer and induced polarization surveys, a geochemical soil-sampling survey, trenching, stripping, and 366 metres of diamond drilling in four holes. The focus of exploration shifted 300 metres eastward from the granitic body to a zone adjacent the west margin of a younger syenomonzonite stock. In 1969 the entire property was covered by airborne magnetometer and electromagnetic

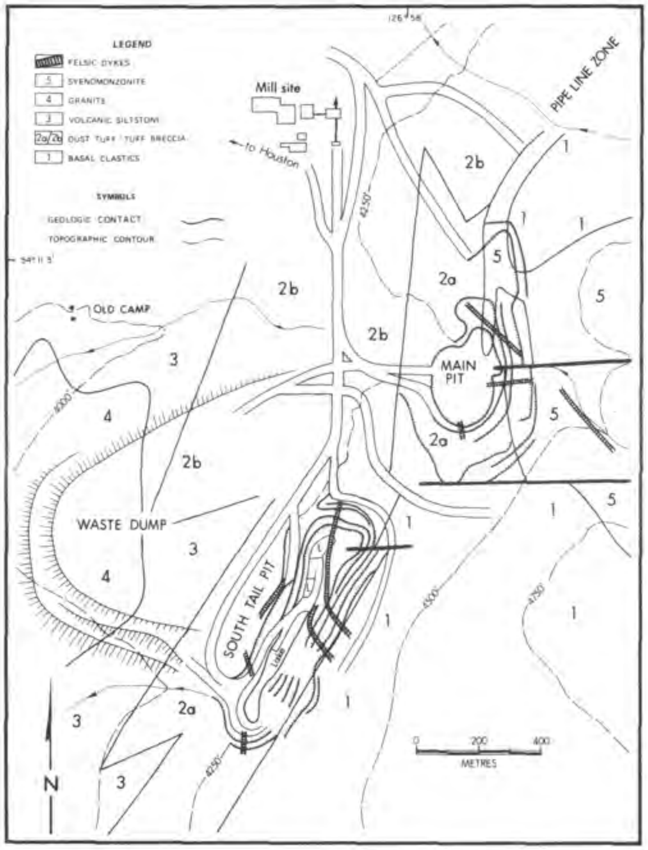


Figure 5.6. Geology in the vicinity of the Equity mine.

surveys, followed by further geophysical and geochemical work on the ground; and 5153 metres of drilling in 26 holes. The various ground surveys continued into 1970 and 1971 and 31 more holes were completed, adding 7532 metres of drilling. (A recent comparison of the Equity mine with other silver producers is given by Schroeter and Panteleyev, 1988).

Kennco chose not to invest in the further development of the property and, in 1972, Equity Mining Capital Limited arranged an option agreement under which it could earn a 50 per cent interest in the property. Kennco could retain a 50 per cent interest or, alternatively, could elect to receive a 30 per cent net profits royalty.

During 1973 and 1974 Equity, in joint venture with Congdon and Carey Ltd., delineated the Southern Tail and Main orebodies, completing 112 surface diamond-drill holes totalling 13 062 metres and driving a 112-metre decline and 66-metre crosscut to obtain a bulk sample from the centre of the proposed open pit. Analyses on a sample from this decline, showing a very high copper content, are presented in Table 5.1. Equity subsequently exercised its option, Kennco elected not to participate in further development work (R.W. Stevenson, personal communication, 1990) and the joint venture partners merged their interests in Equity Mining Corporation and published open-pit reserves of 39.5 million tonnes grading 0.89 gram per tonne gold, 95.4 grams per tonne silver, 0.33 per cent copper and 0.085 per cent antimony.

In 1978 Placer Development Limited (now Placer Dome Inc.) purchased the property from Equity Mining Corporation and bought out Kennco's royalty interest. Equity Silver Mines Ltd., was formed to act as Placer's operating subsidiary and a vehicle for raising public funds for mine development.

Mine development began on the Southern Tail orebody owing to the relatively high-grade and coarse-grained nature of this deposit. On completion of open-pit mining in 1983 this zone was exposed over a length of about 900 metres and an average width of 40 metres; it dips about 50° northwest. Below the mining depth of 60 metres much of the zone remains open to possible future underground development. To date this pit has yielded 6.8 million tonnes of ore grading 1.3 grams per tonne gold, 121 grams per tonne silver, 0.48 per cent copper and 0.085 per cent antimony.

Production from the Main orebody began in early 1983 and continued through 1987 from an elliptical northerly elongated pit measuring 400 by 800 metres (Figure 5.6; Plate 5.1). This deposit was brought into production as a second stage operation due to the fine-grained nature of much of the sulphides which required special milling techniques

Plate 5.2. Brecciated dust tuff in ore zone at Equity mine.

Plate 5.3. Sulphide replacement of breccia fragments.

Plate 5.4. Massive sulphides, Equity mine.

TABLE 5-1
ANALYTICAL RESULTS FROM THE EQUITY MINE AREA

Sample No.	Au ppb	Ag ppm	Cu %	Pb ppm	Zn %	Co ppm	Ni ppm	Mo ppm	As %	Sb %	Hg ppb	K %	Na %
1	965	178	7.30	83	0.45	20	119	18	0.18	0.04	148	1.23	0.13
2	2140	157	3.59	48	0.15	65	164	12	0.13	0.018	78	0.34	0.05
3	7092	103	3.47	65	0.99	11	28	<8	0.041	0.010	106	1.04	0.13
4	3064	211	0.28	734	0.012	9	24	10	0.14	0.19	92	5.00	0.23
5	4036	203	0.36	396	0.014	8	20	9	0.091	0.18	116	3.79	0.14
6	6688	203	4.50	69	0.57	17	38	<8	0.045	0.092	102	1.25	0.21
7	1700	161	1.04	150	0.023					0.10			

KEY TO ANALYSES

	Reference	
1	Lab. No. 038654	massive sulphide ore from the decline, Main zone
2	Lab. No. 038655	replacement mineralization, *see* Plate 5.3
3	Lab. No. 038656	brecciated ore, Main zone, *see* Plate 5.5
4	Lab. No. 038657	disseminated mineralization, Main zone
5	Lab. No. 038658	disseminated mineralization, Main zone
6	Lab. No. 038659	chalcopyrite ore from Southern Tail zone
7	Church 1970, p. 147	disseminated mineralization, discovery outcrop

developed through prolonged research and testing. The total open-pit reserves in the Main orebody were reported to be 21.6 million tonnes of ore grading 1.04 grams per tonne gold, 109 grams per tonne silver, 0.35 per cent copper and 0.07 per cent antimony (Cyr *et al.*, 1984).

The Waterline zone contains an ore reserve known from mineralized conglomerate in a creek bed (*see* Church 1970, Figure 29) and recent diamond drilling. This orebody is approximately 200 metres long, 12 metres wide and dips about 50° westerly. The company reports that the ore is characterized by relatively high gold grades.

GEOLOGY

The geology of the Equity mine area (Church, 1970b, 1971a, 1985; Church and Hutter, 1974) is shown in Figure 5.6. The principal rocks hosting the orebodies are Mesozoic volcanic and sedimentary beds (Units 0/3) (*see* Figure 1). Evidently these units have been uplifted, moved aside and

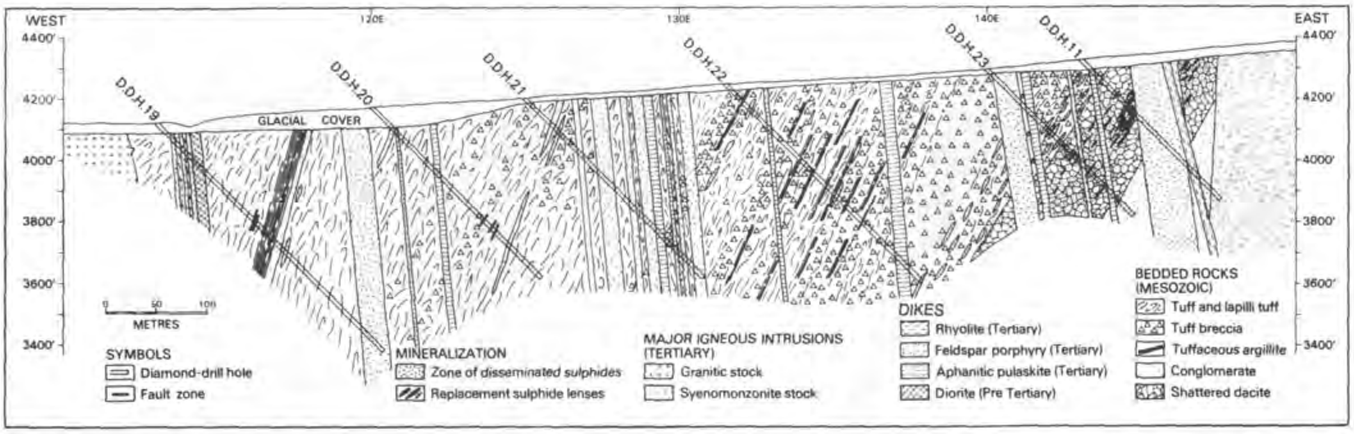


Figure 5.7. Diamond-drill hole section between the Goosly syenomonzonite-gabbro stock on the east and the Equity waste dump granitic intrusion on the west [from Church, 1971a, drilling by Kennco Explorations, (Western) Limited].

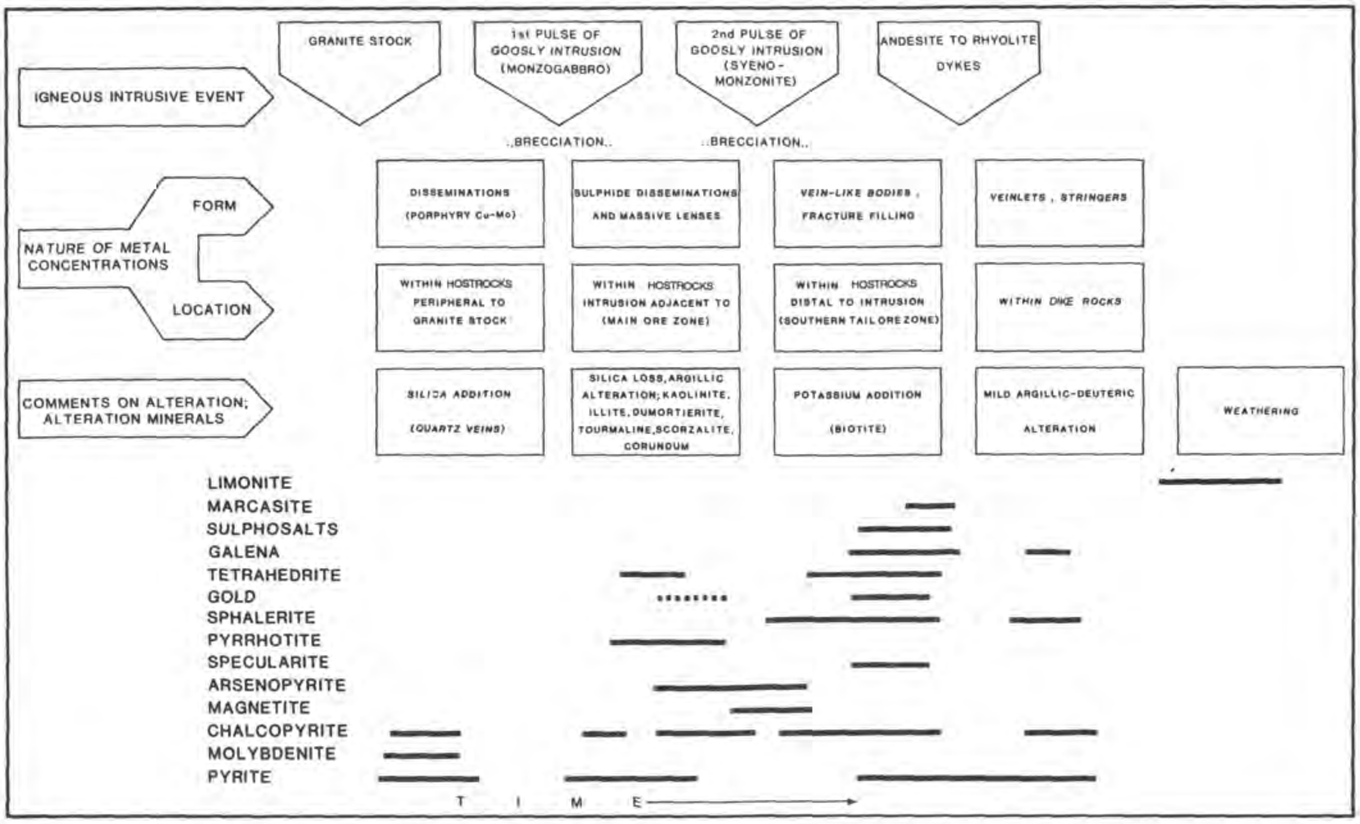


Figure 5.8. Paragenesis of the ore minerals at the Equity mine.

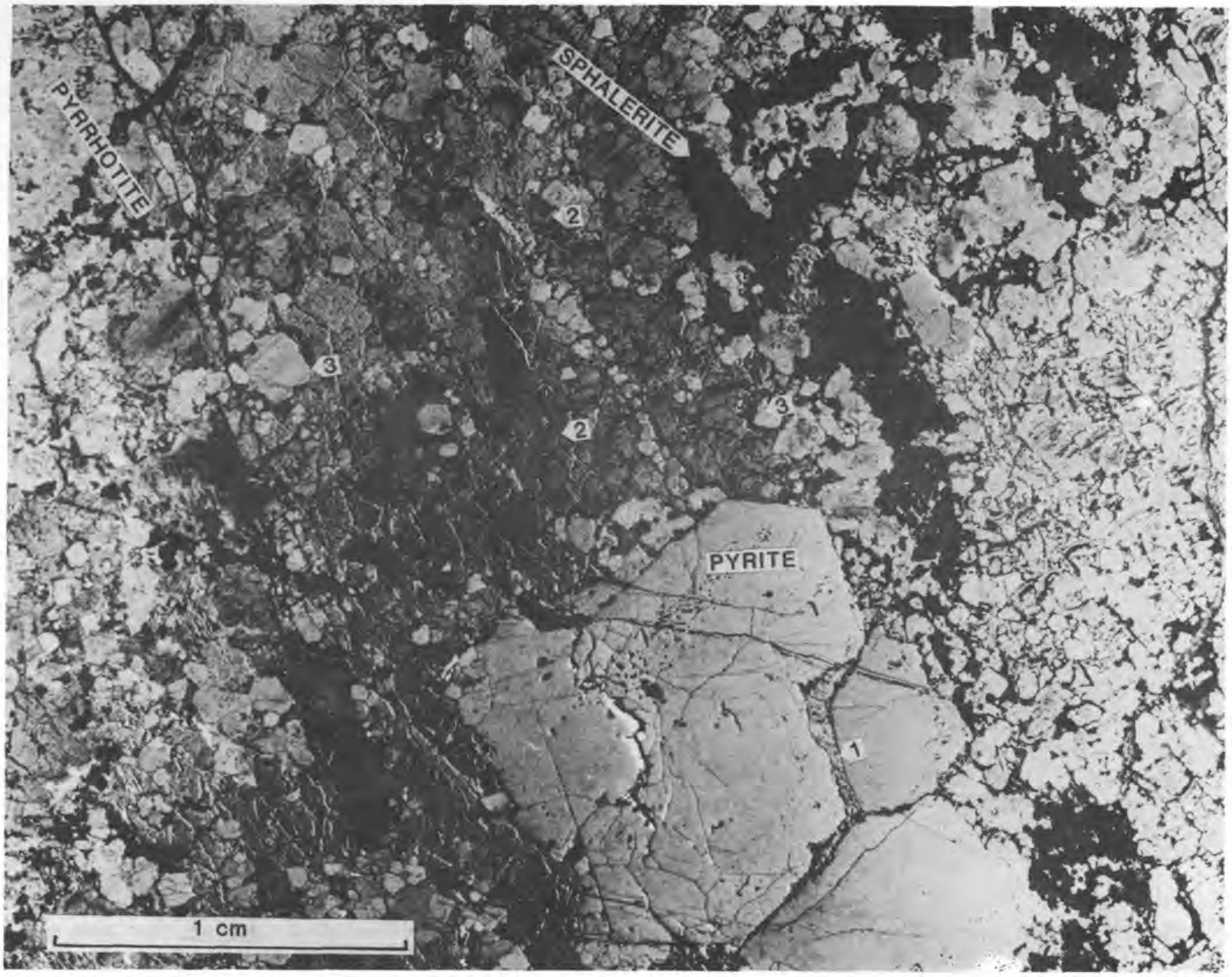


Plate 5.5. Ore from the main zone, Equity mine: (1) composite veinlet of pyrrhotite and chalcopyrite cutting pyritohedrons, (2) colloform marcasite adhering to small pyrite crystals, (3) blebs of chaclopyrite in sphalerite and pyrrhotite.

locally brecciated by intrusion of the Goosly syenomonzonite-gabbro stock (Unit F). A somewhat older and smaller "Equity" granitic intrusion (Unit E) cuts the same strata several hundred metres to the west and southwest.

An east-west cross-section of the area between these intrusions, including the main zone of mineralization, is shown in Figure 5.7. It shows a thickness of approximately 750 metres of steep, westerly dipping Mesozoic beds which are intruded by a swarm of nearly vertical Tertiary dikes having an apparent total thickness of about 150 metres.

The Main orebody, about 60 metres in true thickness, is composed of finely disseminated sulphides and coarse-grained sulphide replacement bodies located in the central part of the dust-tuff facies (Church and Hutter, 1974). Disseminated sulphides form the bulk of the mineralized zone and average 0.7 per cent chalcopyrite and 3.8 per cent pyrite plus grey sulphides (based on 25 modal estimates). Assay results from the disseminated mineralization are given in Table 5.1, (Nos. 4, 5 and 7). The coarse sulphide replacement bodies are irregularly distributed within the zone of intense sulphide dissemination. They are lens-like bodies as much as 3 metres thick, having an average modal composition of 31 per cent chalcopyrite, 23 per cent pyrite and 17 per cent pyrrhotite (based on 14 analyses). Preservation of the shattered dacite is locally almost perfect in these massive replacements (Plates 5.2 and 5.3). The well-indurated and competent conglomeratic unit at the base of the section contains some finely disseminated sulphides (mostly pyrite) interstitial to the large clasts. Elsewhere pyrite is scattered sparingly throughout the section as joint and cleavage fillings and, less commonly as disseminations in the host rock. The accessory minerals include arsenopyrite, sphalerite, magnetite and less commonly marcasite (Plates 5.4 and 5.5). A small amount of molybdenite and chalcopyrite was noted near the granitic intrusion and a trace of molybdenite and scheelite near the contact of the gabbro-monzonite stock (Cyr *et al.*, 1984). The occurrence of galena, sulphosalts and a number of rare sulphide minerals has also been noted but these are of little economic importance. Assay results of the massive sulphide

Plate 5.6. Sulphide concentration along footwall of dike, Southern Tail ore zone.

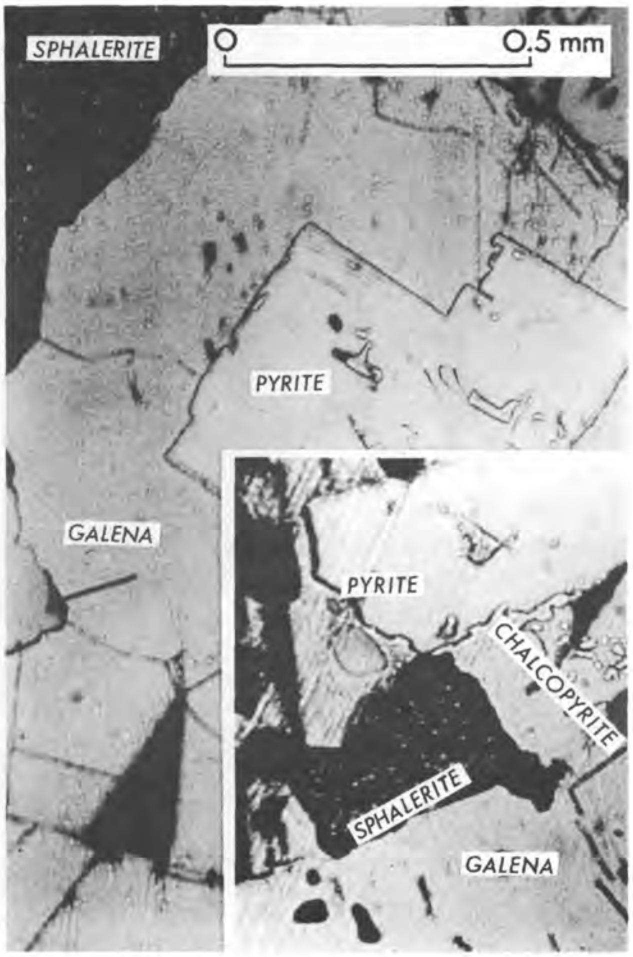


Plate 5.7. Photomicrograph of sulphides in dike, Southern Tail ore zone.

ore from the main zone are given in Table 5.1 (Nos. 1, 2 and 3). The relatively high nickel content of some samples is believed to be due to the presence of pyrrhotite — no other nickel-bearing sulphides have been identified.

Paragenesis of the ore minerals is illustrated in Figure 5.8. At least two generations of pyrite and pyrrhotite have been recognized in the Main orebody. The repeated generation of these minerals is attributed to periods of brecciation and "metamorphism" induced by the nearby Goosly syenomonzonite-gabbro stock. Magnetite is abundant locally in the Main orebody and appears to have an antipathetic relationship with pyrrhotite. Arsenopyrite is especially common in the Southern Tail zone where fragments of brecciated hostrock are rimmed and replaced by it. Chalcopyrite generally follows the early formed pyrite in the paragenic order and overlaps with sphalerite and tetrahedrite. The youngest mineralization is found in a few crosscutting dikes as small veinlets composed of pyrite, chalcopyrite, sphalerite and galena (Plates 5.6 and 5.7).

Alteration is related to at least three thermal events: (1) intrusion of the granite, (2) the Goosly syenomonzonite-gabbro stocks and (3) younger crosscutting dikes.

The earliest formed hydrothermal alteration is a phyllitic aureole around the granitic stock. This is manifest as white mica accompanied by veinlets of quartz and pyrite. The main chemical effects here are potassic metasomatism and silicification. Fluid inclusion studies by Wetherell (1979) indicate that the associated weak porphyry copper and molybdenum mineralization formed at about 400°C. A whole-rock K-Ar date on sericitized tuff from this aureole (Cyr *et al.*, 1984) gives an age of 58.1 ± 2.0 Ma, which corresponds roughly with the age of the stock (Table 2.4, No. 13).

The effects of the Goosly syenomonzonite-gabbro stock are multistaged. It appears that the intrusion of the stock was accommodated by the early development of a southwesterly trending zone of brecciation tangental to the west contact. The subsequent movement of high-temperature, silica-poor acidic solutions through the breccia led to leaching and argillic alteration at the core, then sulphide filling and replacement. Beyond this there is an envelope where the country rocks have been altered to a fine-grained mixture of quartz and sericite. A whole-rock K-Ar age of 48.3 to 51.7 Ma (Table 2.4, Nos. 3 and 8) on sericitized tuff from this area is also similar to the age of the stock (F values *in* Table 2.4).

Full emplacement of the Goosly stock occurred after successive intrusive pulses and crystal fractionation. This evolution has resulted in a regular chemical and mineralogical progression from basic to felsic rock types (Figure 5.9; Table 2.3, Nos. 5 to 13). The natural products of this process were heat, water and fugitives such as potassium, boron and phosphorous (significant components in the ore and altered rocks of the Equity mine).

The thermal effects along the contact of the Goosly stock are variable, depending in part on the composition of the adjacent rocks. Commonly the contact zone is a dense hornfels composed of recrystallized volcanic or sedimentary formations with new growth of biotite, quartz and feldspar. In the Main orebody the sulphides appear to be coarser grained near the intrusion and here pyrite is often replaced by pyrrhotite. The aluminous rocks in the clay-alteration facies are overprinted by the growth of andalusite, pyrophyllite and a minor amount of corundum. Redistribution of phosphate and boron in the mineralized core area and the alteration envelope has also led to the local growth of scorzalite and tourmaline.

A decrease in the intensity of alteration and mineralization passing from the Main orebody to the South Tail zone is evidently due to a decrease in temperature and activity of hydrothermal solutions as they moved outward from the contact of the Goosly syenomonzonite-gabbro stock. Fluid inclusion studies by Wojdak and Sinclair (1984) indicate a decrease in temperature from a maximum of 625°C near the stock to a possible minimum temperature of 200°C in the Southern Tail.

Propylitic alteration appears to have affected most of the crosscutting dikes and adjacent hostrocks. The most intensely altered rocks are commonly light coloured due to the abundance of clay, white mica and carbonate. The development of sericite and clay minerals has been at the expense of the original feldspar, and chlorite has substituted for some of the original ferromagnesian constituents. The age interval for these dikes, reported by Cyr *et al.* (1984) (48.3 to 50.7 ± 2.0 Ma), is similar to the age of the Goosly syenomonzonite-gabbro stock. Accessory sulphides within the dikes, consisting of disseminated pyrite grains and veinlets of pyrite, chalcopyrite, galena and sphalerite, are thought to represent the final hydrothermal residual in the mineralizing cycle.

GENETIC THEORIES

The several theories on the origin of the Equity ore deposit were outlined by Ney, Anderson and Panteleyev (1972) in their joint paper. These are epigenetic and syngenetic hypotheses that, to the present, retain divided allegiance among economic geologists:

"1. Epigenetic replacement from fluids associated with the quartz monzonite stock.

2. Epigenetic replacement from fluids associated with the gabbro-monzonite complex.

3. Epigenetic replacement by aggressive or thermally active fluids which derived metals from the enclosing rocks. These fluids may have been magmatic products or heated circulating vadose or connate waters.

4. The deposits are volcanogenic in the sense that mineralization is related to volcanic processes that formed the host rocks.

"(1) The first mode was suggested very early in exploration by C.J. Sullivan, who visualized the mineralized breccias as zones of fluid-streaming, dipping concially toward the quartz monzonite [Sullivan, personal communications and private reports 1968-70]. The quartz monzonite stock was a favoured source because it had some evidence of mineralization within it and was apparently connected to the copper-silver zones by a broad field of rock alteration and pyritization. The idea guided exploration, but lost influence as the breccias generally appeared through further work to be specific stratigraphic units rather than cone-sheets.

"(2) The second mode seems most logical simply because mineralization is best developed close to the gabbro-monzonite. However, the entire gabbro-monzonite complex is physically and geochemically unconvincing as the progenitor of copper-silver mineralization. It is neither veined nor otherwise mineralized and contains only background values in metals. The associated porphyritic formations clearly show, through studies of Church and Panteleyev, that it represents a volcanic centre. The associated effusive rocks may be well altered by pyritization, sericite and tourmaline, but even in this apparently well-prepared situation no valuable mineralization has been found. Both Nielsen [1969] and Church [1970b, 1971a] favoured the gabbro as a concentrating agent and probable source of metal, but Nielsen suspected that there may have been an early solfataric stage of alteration and mineralization.

"(3) The third mode requires no allegiance to any particular intrusion, either as a source of metals or a concentrating agent, but it does imply that the metals were brought into their present sites by replacement of country rock and open space filling. In this case the original structure and character of the rocks are less important than younger structures in localizing mineralization".

Ney, *et al.* (1972) favoured hypothesis No. 4 "... the main concentration of metals was affected by volcanic processes directly related to the formation of the host rocks ... we do not imply that the deposit is a massive black ore or "Kuroko" deposit but simply that in geological setting and style of mineralization the deposit is akin to the volcanogenic deposits so lucidly described by Japanese geologists". The chief argument against this, conceded by these authors, is that no alteration pipe associated with the orebody has been

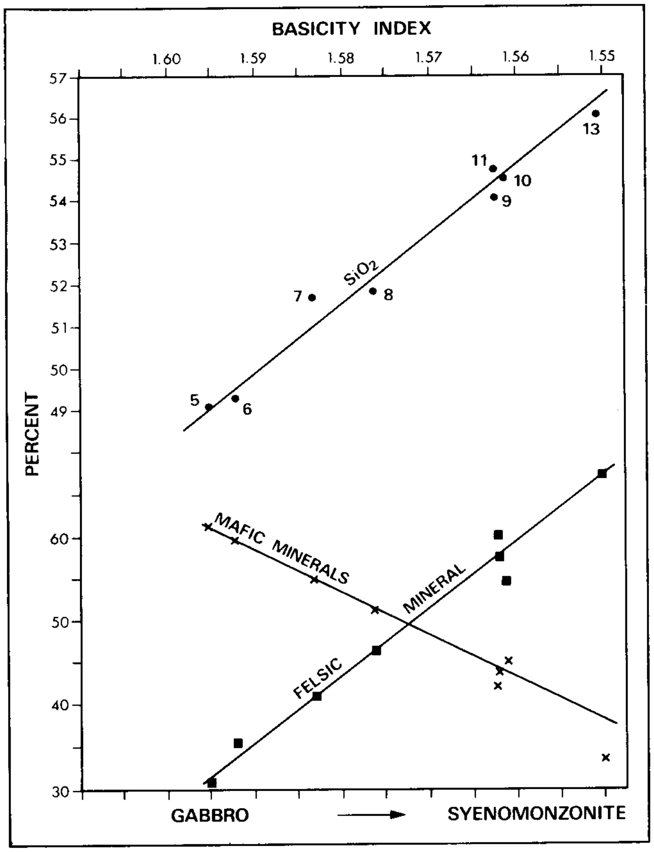


Figure 5.9. Mixing diagram showing the chemical and mineralogical similarities of the Goosly intrusions, Buck Creek area. (Basicity index = refractive index of fused rock).

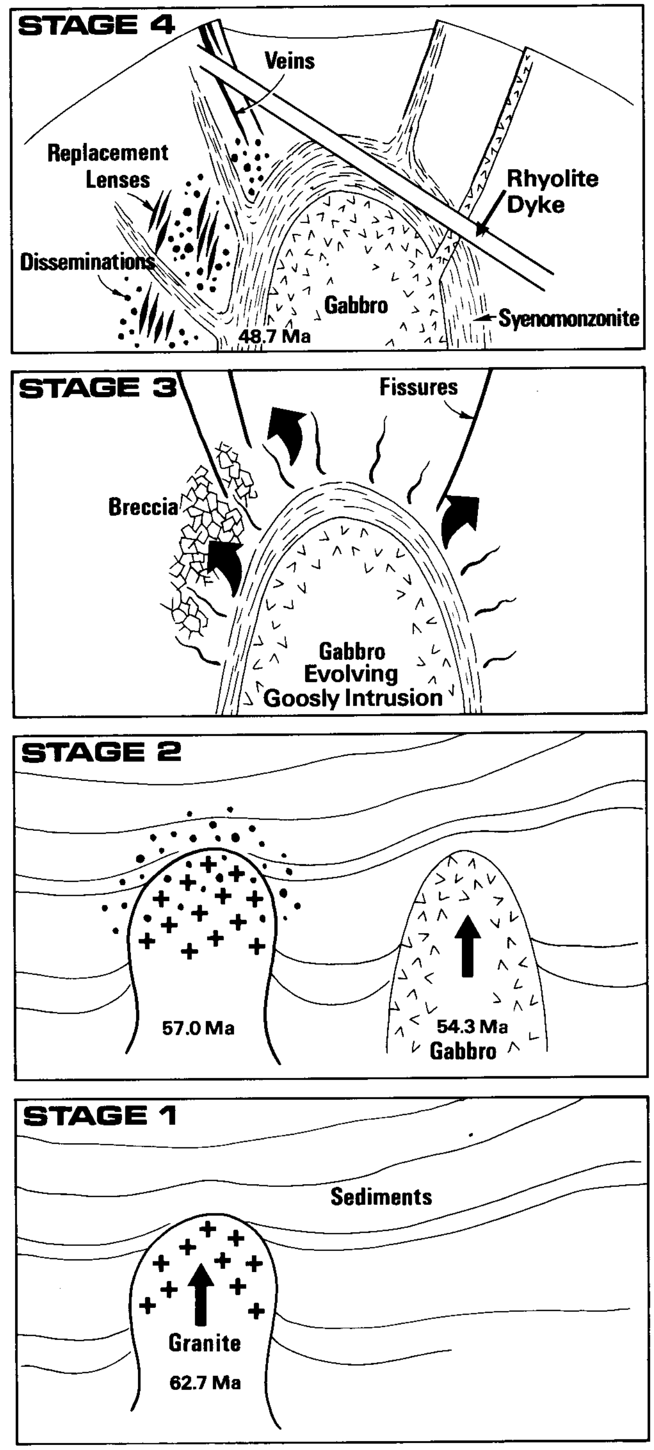


Figure 5.10. Metallogenic model showing the stages of igneous intrusion leading to mineralization at the Equity mine.

found. Also, mineralization clearly cuts across and replaces the pyroclastic rocks and breccias adjacent to the ore zones proving a younger age for the ore. Nevertheless, it is difficult to "see through" the metamorphic effect induced on the country rocks and mineralization by the nearby intrusions and it can be argued the association of the orebodies with an ancient dacitic edifice is itself compelling evidence supporting the volcanogenic theory.

However, Panteleyev, the third author, has subsequently adopted an epigenetic theory (Schroeter and Panteleyev, 1988) which relates the Equity deposit to the emplacement of the granitic stock (hypothesis No. 1 above). This concurs with Cyr *et al.* (1984). The main supporting evidence is K-Ar dates which suggest that part of the Southern Tail zone is within the thermal aureole of the granitic stock.

There is consensus that the present form of the main Equity deposit is the result of the last pulse of the Goosly syenomonzonite-gabbro intrusion (Wojdak and Sinclair, 1984) although Cyr *et al.* (1984) believe that this represents remobilization of a primary porphyry related-copper deposit.

However, from a purely geographical point of view, the small granitic body, situated as it is more than a kilometre west and southwest from the main and northern ore zones at the Equity mine, seems an unlikely source for the mineralization. There is no evidence from available magnetic maps that the granitic stock increases in size at depth (*see* Figure B1 and Church and Pettipas, 1990). Also, it is unlikely that nickel detected in the Equity ore, to 300 ppm, was derived from a granitic source (Table 5.1, Nos. 1 and 2; Table A.1, SG-69A).

Nielsen's (1969) interpretation of the origin of the Equity ore deposit is a combination of hypotheses 2 and 3 above: "Mineralization and alteration at Sam Goosly [the Equity mine] bears little similarity to that in porphyry copper environments. It is tentatively believed to be high temperature and hydrothermal, probably related to a subvolcanic environment. The breccia zone, which may have been produced in part by shallow igneous intrusions, is the principal structural control for copper-silver mineralization. This breccia may bear a systematic geometrical relationship to the margin of the diorite and thus provide an empirical prospecting guide. With very hot fluids streaming through a breccia zone during mineralization, I would expect thermal gradients in the wall rocks to be very steep and thus would expect mineralization to be confined to and in a narrow zone adjacent to the breccia zone".

A model proposed by the authors (*see* Church, 1970b, 1985; Kowalchuk *et al.*, 1984) suggesting the sequence of events leading to mineralization at the Equity mine is illustrated on Figure 5.10. This combines the main elements of the epigenetic theories, Hypotheses 1 and 2, and acknowledges that the ultimate source of all the mineralizing solutions is unknown, Hypothesis 3. Initially (Stage 1) a small granitic stock intruded Mesozoic volcanics and metasedimentary rocks resulting in weak porphyry copper-molybdenum mineralization. Several million years later a larger syenomonzonite-gabbro body, with many offshoot dikes, was emplaced several hundred metres to the east, brecciating the adjacent dacitic dust-tuff unit (Stage 2). Outward movement of hydrothermal solutions from the syenomonzonite produced a broad aureole of alteration and

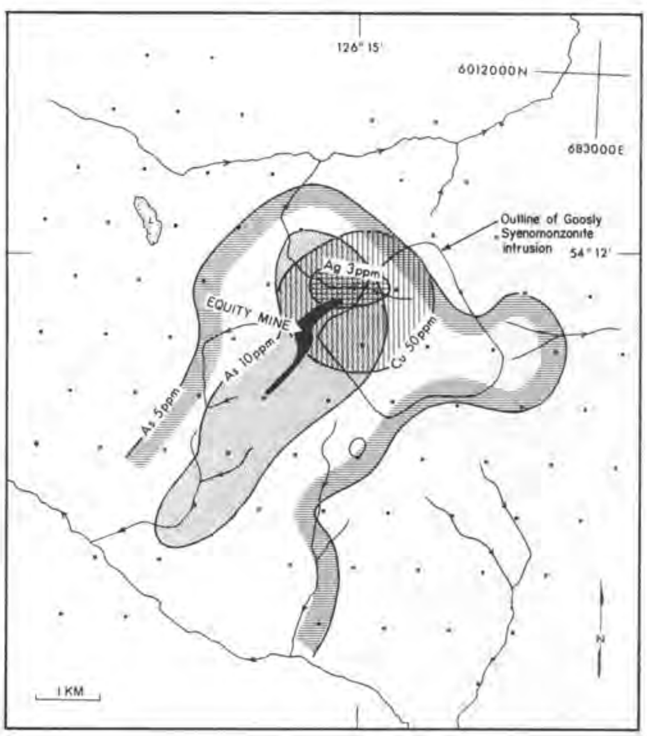


Figure 5.11. Dispersion of pathfinder and ore elements at the Equity mine.

sulphide dissemination, replacement and fracture filling (Stages 3 and 4). A late-stage hydrothermal event followed, accompanied by a resurgence of igneous activity. These events produced silver, copper, arsenic and potassium lithogeochemical halos (Church *et al.*, 1976) about the Equity ore zone and to some extent around the syenomonzonite-gabbro intrusion (Figure 5.11).

Silver Queen: MINFILE 093L 002 (Lat. 54°05'; Long. 126°15'40")

The Silver Queen mine is located 36 kilometres south of Houston. It is serviced from this town by an all-weather gravel road.

EXPLORATION AND DEVELOPMENT HISTORY

The original discovery was made by Dr. Wrinch a partners in 1912 on a small creek 1.5 kilometres east of Ow Lake. In the following years three adits were driven and the Wrinch vein system was traced north and south from the canyon section of the creek.

In 1928 the Owen Lake Mining and Development Company acquired the property and a full development program was initiated. The Earl adit crosscut was collared south of Wrinch Creek and driven easterly to intersect the veins at about 90 metres below the original discovery. In 1929 the worldwide stock market crash affected fundings adversely, ending further underground exploration.

The next period of significant development began in 1963 when Nadina Explorations Ltd. gained control of the property from Canadian Explorations Limited (a predecessor company of Placer Development). Nadina subsequently implemented a vigorous program of diamond drilling, deep trenching and tunnelling which was successful in tracing the Wrinch vein system several hundred metres to the "Ruby Extension zone" on the south part of the property.

In 1971 a consortium comprising Bralorne Can Fer Resources Limited and Pacific Petroleum Ltd. optioned the property and the Bradina Joint Venture was formed. A plan for production was agreed on and a 450 tonne per day mill was constructed (Plate 5.8). Mining began in March 1972 and continued to September 1973. This yielded 190 676 tonnes of ore with recoveries of 98 kilograms of gold, 13 646 kilograms of silver, 405 tonnes of copper, 702 tonnes of lead, 5049 tonnes of zinc and 15.8 tonnes of cadmium.

The extent of workings and known mineralization during this phase of development shown in Figure 5.12. Approximately 1400 lineal metres of vein mineralization had been exposed on surface. The underground development consisted of two levels totalling about 4900 metres of drifts and crosscuts.

The main access to the underground workings on the lower level is from the Earl adit crosscut which extends about 1200 metres northeast from the portal on the west side of Mine Hill at 790 metres (2600 feet) elevation. Ten drifts branch from the crosscut with a total length of about 2600 metres. The upper level consists of two main drifts; a northwest drift about 230 metres long and a southeast drift about 875 metres long. These are serviced by portals at 875 metres (2880 feet) elevation in Wrinch Creek canyon. The southeast drift is connected to the Earl adit crosscut by a three-compartment shaft which provides ventilation. The Alimak raise located in the southern part of the mine workings connects 2600 level to surface, providing an emergency exit and ventilation.

When the mine closed, drill-indicated reserves were estimated at 577 600 tonnes averaging 3.70 grams per tonne gold, 257 grams per tonne silver, 6.53 per cent zinc, 1.49 per cent lead and 0.49 per cent copper, mostly below the Earl adit (790-metre) level.

The most recent phase of development followed acquisition of the property by Bulkley Silver Resources Inc. in 1986. Bulkley Silver subsequently amalgamated with Cater Energy Inc. to form Houston Metals Corporation (now Pacific Houston Resources Inc.) which, during 1987 and 1988 completed an extensive program of underground exploration, including a decline from the Earl adit level, focused primarily on adding to reserves in the No. 3 vein below the 790-metre elevation. In 1988 indicated reserves were estimated 1.72 million tonnes grading 2.7 grams per tonne gold, 328 grams per tonne silver and 6.19 per cent zinc, but a feasibility study completed in October recommended further metallurgical testing and the need to outline additional reserves before a production decision could be considered (Lefebure and Malott, 1989).

GEOLOGY

The following outline of the geology of the mine area is quoted at length from a previous publication by the senior author (Church, 1970a, 1971b). The Mine Hill microdiorite, which hosts many of the veins, appears to be a subvolcanic intrusion feeding the Upper Cretaceous Tip Top Hill andesite. Underlying and peripheral to these rocks are slightly older rhyolite pyroclastic beds that are thought to be cogenic with rhyolite volcanics (78.1 Ma) and related intrusions (80.6 Ma) in the Bob Creek area. Younger rhyolites occur in the region as dikes cutting the Goosly stock near the Equity Silver mine and a volcanic dome complex at Fenton Creek (48.9 Ma). Bladed-feldspar porphyry dikes, feeders to the Eocene Goosly Lake volcanic beds, and slightly younger pulaskite (trachytic) dikes, bracket the period of mineralization.

Leitch *et al.* (1990) have compared some rocks of the Owen Lake area with units of the type Kasalka assemblage, 60 kilometres to the southwest, noting the older age range of the latter (*i.e.* 102 to 85 Ma).

Prior to the most recent phase of exploration four main vein systems had been discovered. These are the "Wrinch", "Portal", "Chisholm" and "Cole" systems — the latter lying to the northeast on the Diamond Belle claims. More recent work has outlined significant reserves in the Camp vein system.

Plate 5.8. View of the Bradina mill (Silver Queen mine) looking northwest to Mount Nadina (1972).

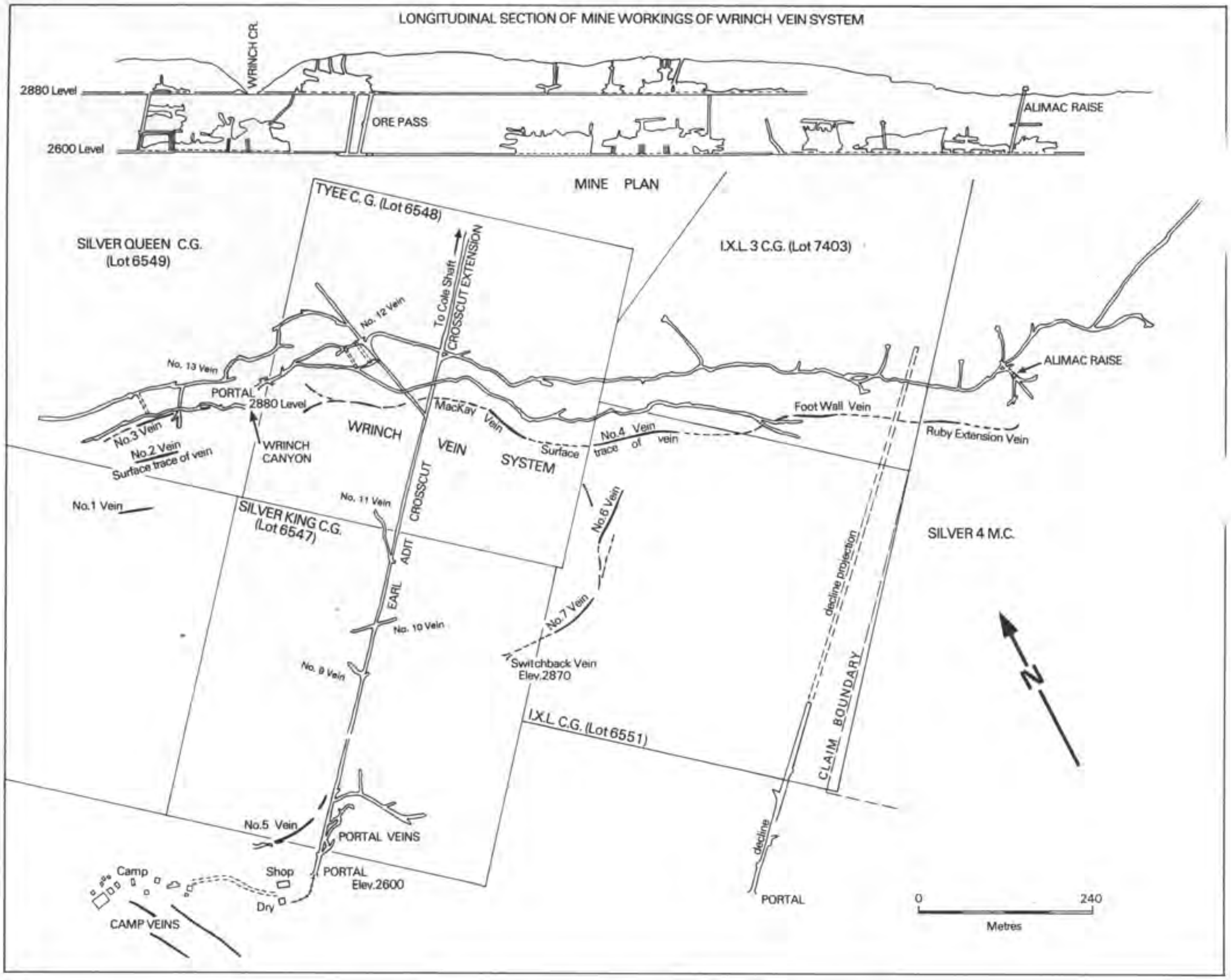


Figure 5.12. Plan and section of the Silver Queen mine workings.

The Wrinch vein system is the most important and was the focus of most of the mining and early development work. The system includes Nos. 1 to 4 veins exposed on surface and Nos. 12 and 13 intersected in the Earl adit crosscut (Figures 5.12 and 5.13). The average strike of the veins is about 130°. The system can be traced over a length of more than 1300 metres. Vertical depth from surface exposures of the veins to the Earl adit varies from about 90 to 150 metres, depending on local topography. Most of the veins vary in dip between 50° and 70° northeast, the average dip being 62° on 45 measurements. The veins are generally banded with sphalerite as the predominant sulphide mineral followed by pyrite, chalcopyrite and then galena. The gangue minerals consist mainly of cherty quartz, carbonate minerals, including rhodochrosite and some barite.

No. 3 vein is distinctive with generally a higher chalcopyrite content than the other veins of the system and correspondingly high average copper values (Table 5.2). Characteristically, the vein contains abundant rhodochrosite and numerous cavities lined with clear crystalline quartz and some pyrobitumen. Cockade structures and colloform banding are commonly well developed and symmetrical crustifications on the walls display the mineral paragenesis (Plate 5.9). In spite of the fact that the vein is severely splayed in places, zinc and copper values are sustained over mineable widths.

No. 4 vein is discontinuous, being segmented at the northwest and southeast ends into what are known as the "MacKay vein" and "Ruby extension" respectively. Sphalerite and pyrite are the main sulphides; specularite, galena, chalcopyrite and tennantite are concentrated locally. The ore is generally well banded with seams of grey cherty quartz and some carbonate minerals. Barite occurs as randomly oriented plates in vugs and pockets throughout the vein. As in the case of No. 3 vein, the sulphide minerals are commonly coarse grained and at a few points individual crystals measure several centimetres in diameter (Plate 5.10).

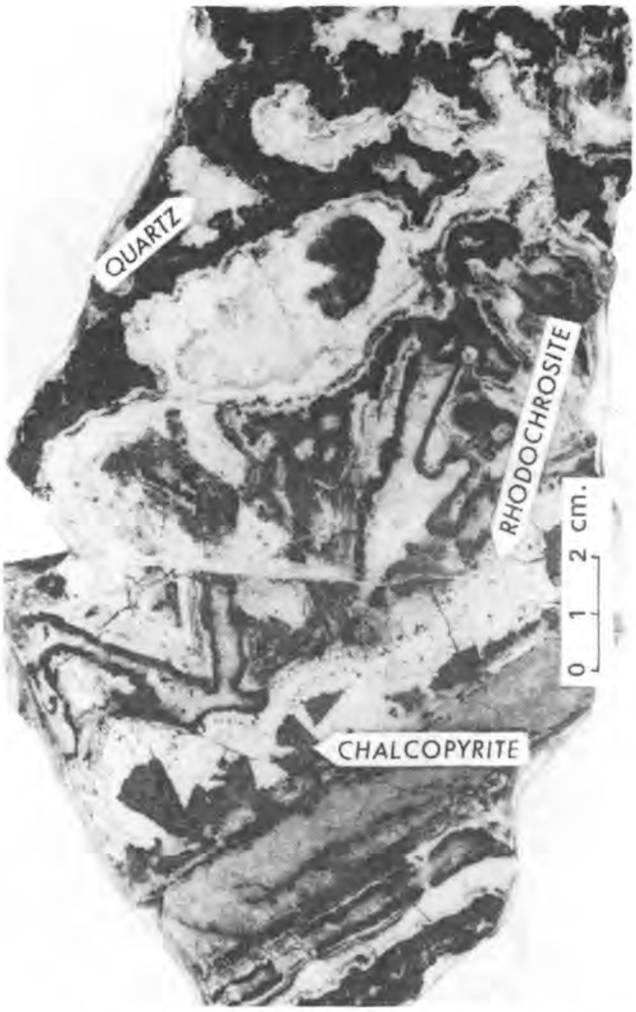


Plate 5.9. Polished section of ore sample from No. 3 vein of Wrinch vein system, showing typical cockade structure and colloform banding (Silver Queen mine).

Plate 5.10. Polished section of ore sample from No. 4 vein of Wrinch vein system, showing large twinned sphalerite crystal (Silver Queen mine).

The Ruby extension contains distinctive red sphalerite (ruby jack) and local concentrations of tennantite. The vein cuts the southern contact of the microdiorite and extends into coarse volcanic breccia and a quartz porphyry intrusion. At its mid-point the vein swings sharply to the east from its normal southeasterly trend and becomes increasingly pyritic in character (Plates 5.11 and 5.12). Near the quartz porphyry contact the vein turns southeasterly again but it thins and its dip flattens markedly. Assay results on the sphalerite-rich and pyrite-rich segments of the vein are given in Table 5.2, (Nos. 3 and 4). In spite of the variation in mineralogy, precious metal values remain high.

No. 2 vein may be the northwest extension of No. 4 and their downward extension is probably the Earl adit No. 12 vein; all three veins carry relatively little chalcopyrite compared to nearby No. 3. No. 2 vein and Earl adit No. 12 vein are similar in having only moderate precious metal values.

No. 1 vein is the most westerly vein of the Wrinch system. The copper-lead-zinc values are similar to those of the Ruby extension of No. 4 vein, however, precious metal grades are comparatively low.

The Portal vein system contains some of the most spectacular mineralization to be found on the property. However, the potential ore reserve above the adit level is relatively small. This is due to the position of the veins near the portal of the lower level where backs are generally less than 30 metres from surface. The system includes No. 5 vein and Earl adit Nos. 1 to 5 veins. Like the Wrinch system, the veins generally dip to the northeast, but have a more easterly strike.

No. 5 vein is exposed at intervals on surface over a length of 150 metres. It is typically chalcopyrite rich and carries above average precious metal values (Table 5.1). A quartz-chalcopyrite sample assayed in 1969 returned the following results: 9.6 grams per tonne gold; 830 grams per tonne silver; 7.19 per cent copper; 0.17 per cent lead; 0.17 per cent zinc; 11 per cent iron; 0.34 per cent manganese; cadmium, nil; arsenic, nil; antimony, nil; 0.11 per cent bismuth; 0.01 per cent barium.

The Chisholm vein system consists of three subparallel veins — Mae No. 1, Mae No. 2 and Mae No. 3, located about 1200 metres south of Mine Hill. These are poorly exposed but can be traced 50 metres along strike in a series of old trenches and excavations. The veins strike about 125° and dip northeasterly. The minerals are mainly argentiferous sphalerite, galena and pyrite — chalcopyrite is scarce. The hostrocks consist of strongly altered dacitic tuffs and tuff breccias.

The veins are mainly the result of fissure-filling, as evidenced by their vuggy structure and the colloform banding of the ore minerals and gangue. The exact amount of dilation of fissures prior to mineralization is difficult to estimate owing to the partial replacement of wallrocks by pyrite and other vein minerals, however, the average width of the veins is 1 to 1.5 metres, increasing to as much as 5 metres locally.

At least four distinctive mineral assemblages are recognized (*see* also Leitch *et al.*, 1990, page 290). These are, in approximate order of deposition:

(1) Pyrite, specular hematite.

(2) Sphalerite (ruby jack), pyrite, galena, tennantite.

(3) Chalcopyrite, pyrite, sphalerite, bismuthinite(?), tetrahedrite(?).

(4) Sphalerite (amber), pyrite, galena.

Plate 5.11. Polished section of ore sample from the Ruby extension of the Wrinch vein system, showing randomly arranged barite laths in sulphide matrix (Silver Queen mine).

The gangue constituents are mainly cherty quartz, carbonate minerals such as rhodochrosite and siderite, some barite, and rarely pyrobitumen. These assemblages occur as single veins or more commonly as lenses and layers in composite veins.

The veins show a rough zonal arrangement. The Wrinch and Portal vein systems in the Mine Hill area are composite, reflecting a cyclic history of mineralization with many changes in the temperature and composition of the hydrothermal solutions. On the other hand, in outlying areas such as near Cole Lake and the Chisholm shaft, the veins are uniformly carrying the low-temperature assemblage, sphalerite-pyrite-galena.

A locally intense alteration of wallrocks borders the veins and adjacent fissures. The lateral extent of the alteration zones away from the veins is variable, ranging from a few metres to several metres. Typically, the altered rocks are cream coloured and soft and have low magnetic susceptibility. At surface the veins are usually capped by a compact black deposit of manganese oxide. In the microdiorite, the plagioclase phenocrysts are evident as small greenish laths and plates. Thin-section studies show that the altered rocks consist of a mixture of clay and carbonate minerals, some chlorite, and minor epidote and disseminated pyrite.

Widespread alteration is also present. The affected country rock is mainly volcanic breccia exposed within a 2.5-kilometre radius of Mine Hill. The alteration is manifested in the development of numerous limonite and jarosite gossans and appears to be the result of pervasive kaolinization and pyritization. The extent of this alteration is greater than would normally be expected in association with the known vein systems. A deep and broad source of mineralizing solutions is suspected and the discovery of replacement sulphide bodies appears to be a possibility.

The attitude and frequency of fractures in the Mine Hill area are shown in Figure 3.1. The strongest joints strike about 130° and dip 68° northeast. This attitude coincides with prominent topographic lineaments, the main vein directions and shears. Other strong fractures strike northerly and dip steeply to the east. Weak fractures include cross-joints striking east and dipping steeply, and sheeting joints which strike about 050° and dip 25° northwest.

Much of the post-mineralization faulting in the Mine Hill area appears to be of a minor nature. This is evident from the marked continuity of the feldspar porphyry trachyte dike system (Figure 5.13). These dikes are readily traced on surface and through the underground workings. The maximum observed fault displacement is near the west end of No. 4 vein on the upper and lower levels of the mine where a feldspar porphyry dike is offset about 15 metres on a steeply dipping tear fault. Shearing and faulting in Wrinch Creek canyon clearly predate the dikes and veins. Both basalt and feldspar porphyry dikes are known to cross the canyon with little or no offset.

The general pattern of the vein systems is not fully understood however, it is thought that the main veins are fillings of northwesterly trending tension fractures and replacements along shears developed in response to the stress geometry

TABLE 5.2 ASSAY RESULTS FROM THE WRINCH VEIN SYSTEM

		1	2	3	4	5	6	7	8	9
Grams per tonne	Au	2.4	10.3	6.9	8.2	4.1	3.1	3.7	1.4	6.16
	Ag	596	520	531	746	397	476	1190	110	716
Per cent	Cu	2.48	0.16	0.25	0.30	0.62	0.64	2.28	0.05	1.09
	Pb	1.60	5.78	3.68	0.22	0.52	3.66	1.28	3.85	2.51
	Zn	12.2	18.5	7.9	3.6	1.7	16.50	8.9	16.0	10.2
	As	0.24	0.12	0.21	0.12	0.24	0.22	0.70	0.15	0.29
	Sb	0.04	0.07	0.05	0.05	0.09	0.09	0.60	0.04	0.16
	Cd	0.074	0.061	0.043	0.011	0.012	0.11	0.030	0.30	0.044
	Ba	0.07	4.11	1.21	0.82	3.48	1.99	0.03	0.60	1.25
	Fe	9.51	9.55	12.70	22.10	26.31	23.00	15.91	13.59	13.95
	Mn	7.44	3.64	0.12	0.032	0.14	0.19	8.00	14.36	3.84
	Bi	0.17	0.03	0.06	0.04	0.12	0.06	0.09	0.001	0.10
ppm	Te	Nil	31.3	8.8	10.0	22	14.3	2.5	3.6	10.4
	Ga	10	43	50	38	30	25	8	79	29.8
	In	100	12	24	5	25	10	10	25	30.2
	Ge	Nil	45	8	10	8	13	12	20	15
	Hg	Nil	12	Nil	Nil	Nil	Nil	23	Nil	8
Weight per cent	Gangue	58	46	66	50	44	24	51	44	—
Metres	Sample width ..	0.7	0.8	0.7	1.3	0.2	0.15	2.4	1.5	—

Sample locations numbers 1 to 6 are shown on Figure 5.13.
Sample No. 7 from the 2880 level, 600 metres from the portal in the south drift.
Sample No. 8 from trench on vein No. 2, 110 metres north of Wrinch Creek canyon.
Sample No. 9 the average of production zones, analysis numbers 1, 2, 3, 4 and 7.

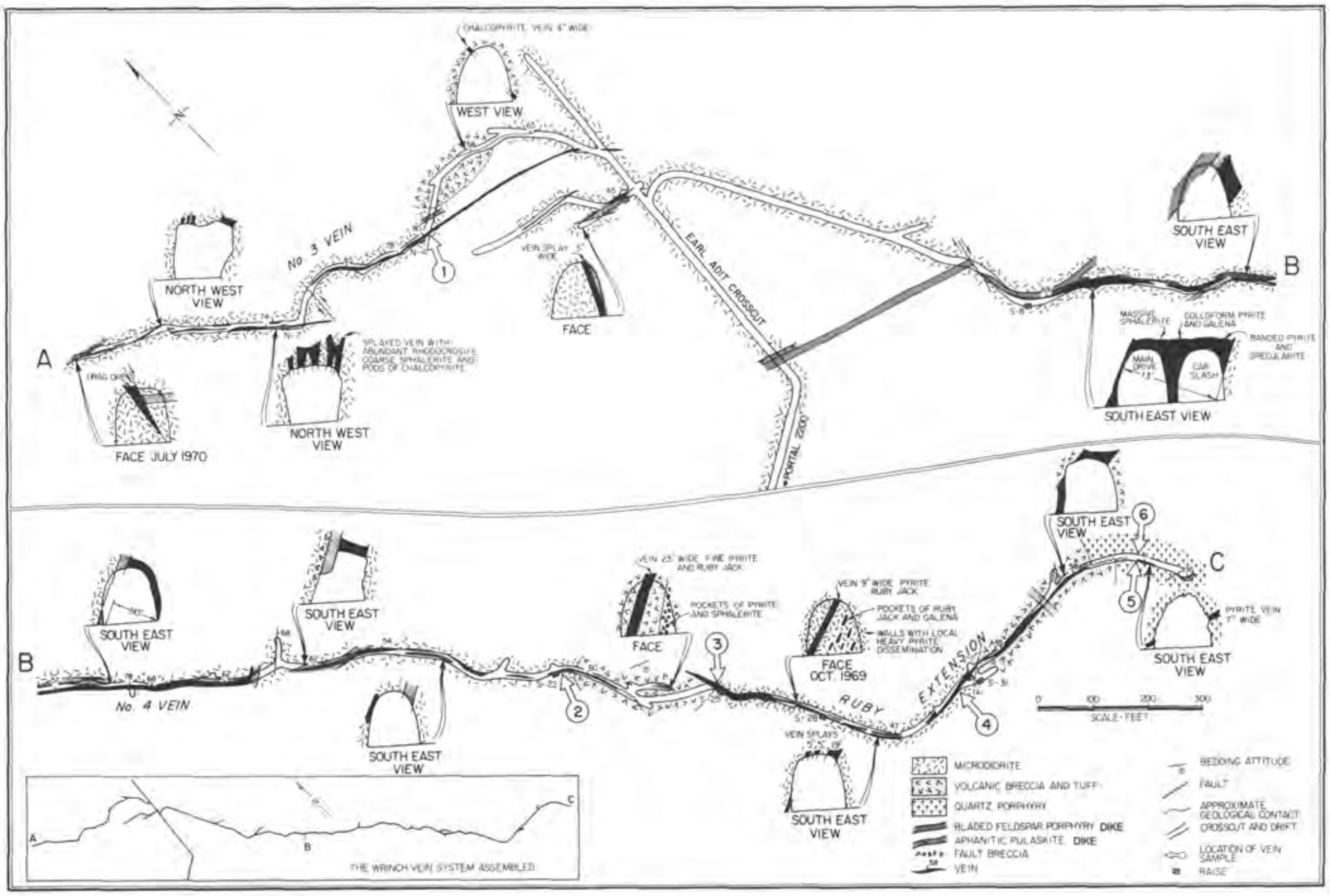


Figure 5.13. Geology of the Wrinch vein system, Earl adit level.

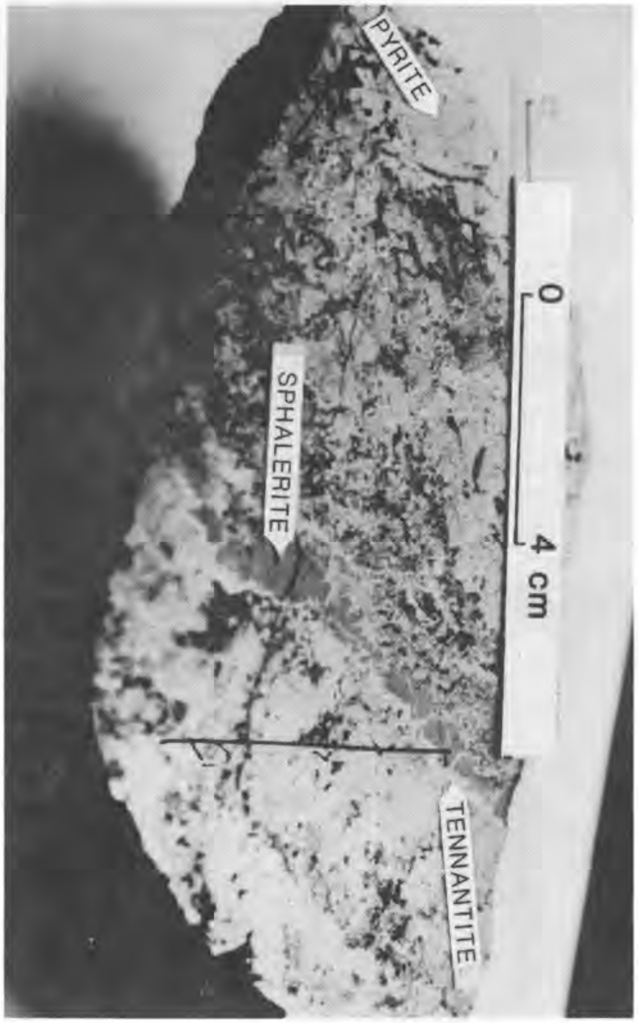


Plate 5.12. Polished section of ore sample from south end of the Ruby extension vein, showing irregular thin bands of sphalerite and tennantite in pyrite (Silver Queen mine).

described above. Most of the veins on the Nadina property are the former type, with a number of modifications. For example, Nos. 1 to 3 veins in the Wrinch vein system appear to form part of a "cymoid loop". These veins strike subparallel in the area northwest of Wrinch Creek and converge in the area to the southeast. Nos. 4, 6 and 7 veins are arranged in a pattern best described as a "chatter link". No. 4 vein is through-going and strikes southeasterly, roughly parallel to No. 7 vein . No. 6 vein and a subsidiary branching vein continue on the same fissure system as No. 7 vein but strike sharply toward No. 4 vein, forming a cross-connection. The Portal system forms what appears to be a tight en echelon series of overlapping but unconnected vein lenses. This pattern appears to be incomplete which may be due to poor exposure in the area.

Most of the vein systems on the Nadina property are open at both ends and much additional surface and underground exploration work is required before an adequate structural synthesis can be fully realized.

Diamond Belle: MINFILE 093L 162 (Lat. 54°06′; Long. 126°42′)

EXPLORATION HISTORY

The history of the Diamond Belle property closely parallels that of the Silver Queen (MINFILE 093L 002). The original claims were located by Mr. Cole and partners in 1915 in an area of vein mineralization northeast of the Silver Queen claim and immediately west of a shallow pond now known as Cole Lake (Figure 5.14). The Owen Lake Mining and Development Company obtained control of the ground in 1928 and sank a 25-metre shaft on the main vein. The Earl adit crosscut, collared on the 2600 level (790-metre elevation) on the Silver Queen property to the west, was intended to intersect this shaft, however plans were cancelled in 1929 because of the stock market crash.

The next significant period of activity began in 1966 when Frontier Exploration Limited acquired the holdings. The work of this company and the succeeding operators, which included diamond drilling and extensive trenching, revealed significant new potential.

GEOLOGY

The area of the showings is primarily underlain by a Late Mesozoic or Early Tertiary series of volcanic rocks and intrusions (Church, 1973c). The volcanic rocks consist mainly of dacites and dacitic andesites that are probably part of the Ootsa Lake volcanics (Figure 5.15). A sill-like body of microdiorite dated as 75.5 ± 1.0 Ma (Table 2.4, No. 16) intrudes these volcanic rocks. The showings are mainly hosted by a kaolinized and pyritized dacitic volcanic breccia with the microdiorite lying to the west. Pulaskite dikes occur in the vicinity of some veins. At least five veins have been discovered that host sulphide minerals consisting mainly of sphalerite, galena and pyrite with some accessory chalcopyrite. The gangue is composed of cherty quartz, carbonate minerals such as rhodochrosite, and some barite. Work on the showings has mainly been in conjunction with work on the adjacent Silver Queen showings.

The Diamond Belle vein was the focus of early exploration at the Cole shaft. The vein averages 0.6 to 0.9 metre in width, strikes 130° and dips steeply within its central segment, with the southern segment striking easterly before pinching out against the pulaskite dike which strikes 150°. Mineralization consists of sphalerite, galena, pyrite and minor chalcopyrite, in a gangue of quartz, carbonate, rhodochrosite and barite.

The Shear vein, near the east end of the Diamond Belle veins, strikes northerly and dips subvertically over an exposed length of some 200 metres. The mineralization is patchy and appears to be the result of replacement and cavity infilling in a shear zone.

Vein mineralization striking southeast and parallel to the Diamond Belle, 15 metres to the south, assayed 2.4 grams per tonne gold, 637.7 grams per tonne silver, 1.3 per cent copper, 2.2 per cent lead and 5.5 per cent zinc over a 1.0-metre width.

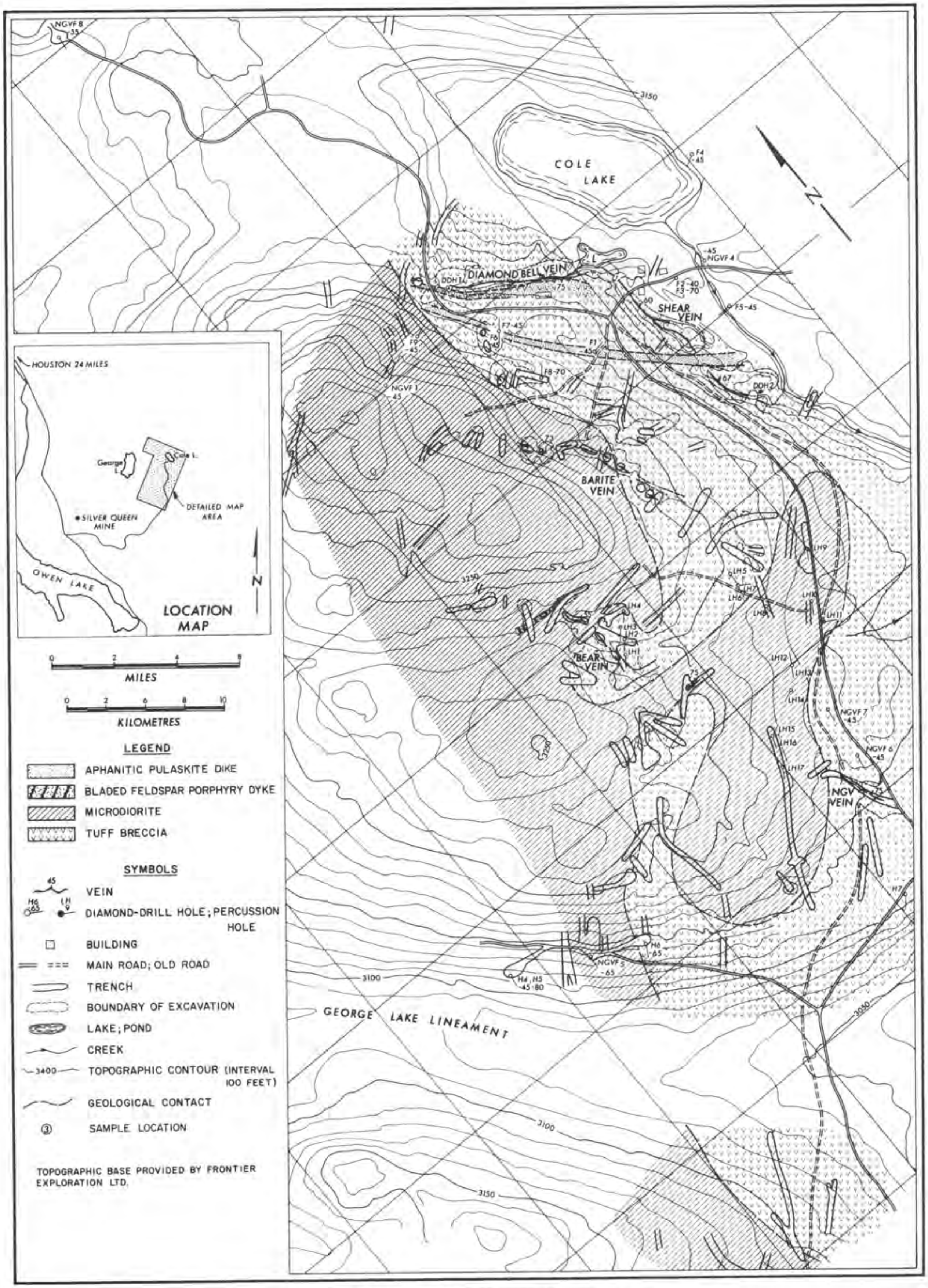


Figure 5.14. Geology of the Diamond Belle property.

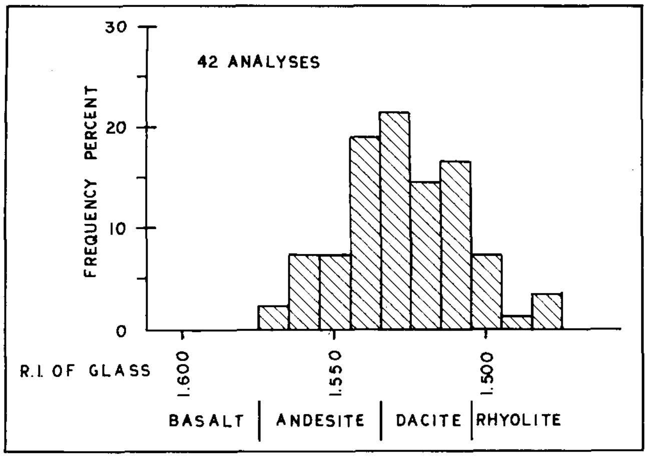


Figure 5.15. Composition frequency of Upper Cretaceous volcanic rocks in the Owen Lake area.

The Bear vein, 300 metres southwest of the Cole shaft, strikes south and is exposed for about 70 metres. A chip sample across the vein, comprised of almost pure amber sphalerite with minor pyrite returned modest precious metal values.

The Barite vein, outcropping 150 metres west of the Cole vein system, strikes southeast and is discontinuously exposed for 107 metres. A gangue-rich sample collected over a width of 107 centimetres assayed trace gold, 92.6 grams per tonne silver, 0.04 per cent copper, 0.58 per cent lead, 1.1 per cent zinc, 12.9 per cent iron, 7.8 per cent manganese, 0.36 per cent calcium, trace cadmium, 0.07 per cent arsenic and 0.03 per cent antimony.

The NGV vein, exposed in the southern part of the prospect area, strikes 160° and dips 75° northeast and is exposed for 50 metres. In 1970, a 76-centimetre length of mineralized drill core assayed 1.37 grams per tonne gold, 447.5 grams per tonne silver, 0.17 per cent copper, 12.8 per cent lead and 10.2 per cent zinc.

Bob Creek: MINFILE 093L 009
(Lat. 54°18′15″; Long. 126°37′35″)

The Bob Creek prospect is centred 10.6 kilometres south of Houston at 800 metres elevation. The showing is located approximately 1.4 kilometres east of Buck Creek and the Buck Flats road (Figure 5.16).

The property comprises the Buck and Lorne claim blocks which are relocated from previous claims including the old Porphyry Dike, Horseshoe and Gold Brick claim groups.

EXPLORATION HISTORY

A small amount of placer gold was recovered from Bob Creek prior to 1905. In 1914 claims were staked covering the apparent source area, which proved to be a zone of altered rocks exposed in the canyon of Bob Creek. Some exploratory tunnelling was completed by 1927. According to Lang (1929, page 93A): "A short adit has been driven into the right side of the canyon, exposing disseminations and small seams of pyrite, sphalerite, and a little galena, but no definite vein is exposed. About 100 yards [90 metres] upstream, a second short adit has been driven in the left side of the canyon where a 3-inch [7.6-centimetre] stringer is stated to have assayed: gold, 0.06 ounces [2.1 grams per tonne]; silver, 41 ounces [1400 grams per tonne]; lead, 3 per cent; zinc, 11 per cent".

A small mill was set up on the property in 1933 and 3 years later operations began under the management of Houston Gold Mines Ltd. According to reports, 77 tonnes of ore was produced averaging 3.5 grams per tonne gold, 35 grams per tonne silver and 1.1 per cent zinc.

The property was the focus of intermittent exploration in subsequent years. Some of the more important drilling programs were conducted by the Premier Gold Mining Company in 1945 (three diamond-drill holes totalling 240 metres), Denison Mines Limited in 1961 (eight drill holes totalling

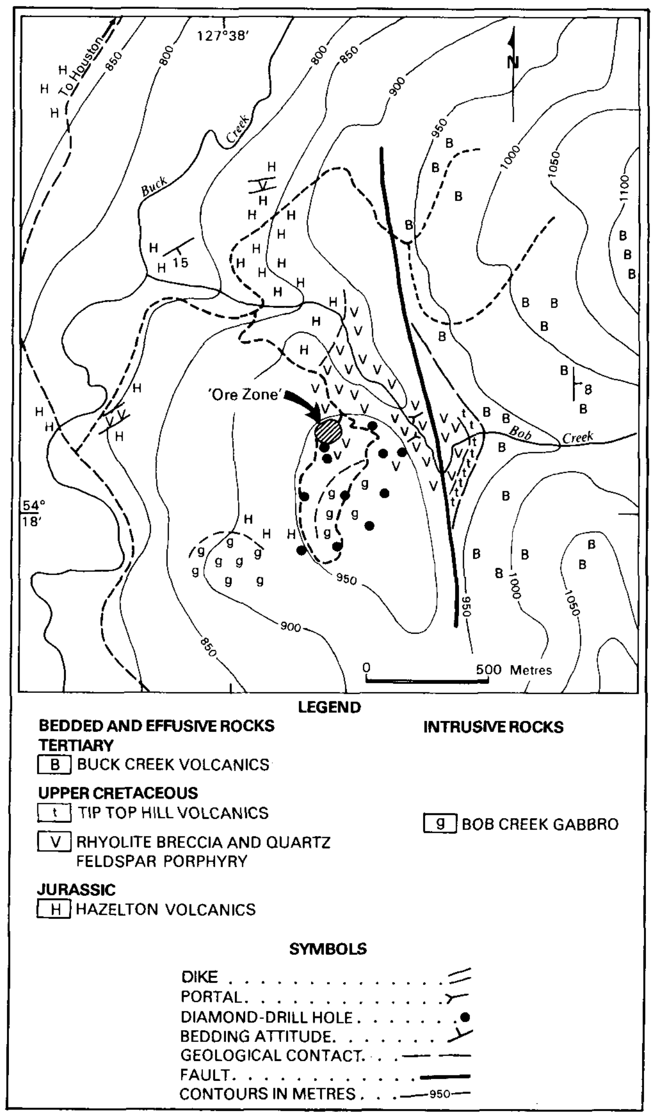


Figure 5.16. Geology in the vicinity of the Bob Creek prospect.

155 metres), American Smelting and Refining Company (Asarco) in 1968 (seven holes totalling 637 metres) and DuPont of Canada Exploration Limited in 1978 (six holes totalling 751 metres). Most recently, in 1984, Selco Division of B.P. Resources Canada Ltd. completed a major program consisting of eight diamond-drill holes totalling 1247 metres.

In addition to the drilling, a number of geochemical and geophysical programs were completed. In 1965 Triform Mining Ltd. joined with Coast Explorations Ltd. to geochemically test 4100 metres of bulldozer trenching and stripping. Later Minwealth Explorations Ltd. performed airborne magnetic and electromagnetic surveys and a geochemical program. In 1978 DuPont completed 13 kilometres of pulse electromagnetic survey and geological mapping. Cominco Ltd. completed a thorough review of the property in 1981 and followed this with an induced polarization survey, and soil, silt and lithogeochemical studies.

Most recently the property was optioned by Bard Silver and Gold Ltd. and subsequently reoptioned to Royalstar Resources Ltd., a subsidiary of Noramco Mining Corporation.

GEOLOGY

The rocks in the vicinity of the Bob Creek prospect consist predominantly of gently dipping volcanic formations of Jurassic, Cretaceous and Tertiary ages, a small gabbro stock, and a number of dikes.

The oldest rocks are mostly maroon volcanics of the Hazelton Group similar to the Lower Jurassic(?) assemblage on Morice Mountain to the west. These are exposed along the lower course of Bob Creek and on the valley slopes near the confluence of Bob Creek and Buck Creek. The most common unit is massive tuff-breccia with a few thin intercalations of accretionary lapilli and siltstone. The volcanic clasts are mostly dacitic with some rhyolite admixture (Table 2.2, No. 4). A thin shale facies from this section has been intersected in the exploration drilling. Although the base of the formation is not exposed, the total thickness certainly exceeds several hundred metres.

The hostrock for mineralization is a belt of altered felsic volcanic rocks, about 600 metres wide, exposed in the canyon of Bob Creek. These are quartz feldspar-porphyry feeder dikes and breccias equivalent in age to the Late Cretaceous Okusyelda Hill and Duck Lake intrusions.

The slightly younger Tip Top Hill formation appears to overlie the felsic volcanics east of the canyon. These rocks are brown, somewhat altered, andesitic tuffs and breccias; they form an erosional remnant immediately underlying the Tertiary sequence.

The youngest beds are assigned to the Buck Creek formation. These rocks comprise about 500 metres of Early Tertiary fine-grained, thinly layered dacitic lavas and breccias exposed along the upper course of Bob Creek and on the hills and ridges to the north and south. The layering of this sequence, displayed on the valley slopes, dips about 8° easterly.

The "Bob Creek gabbro" crops out on the crests of two low hills south of the canyon. This is a somewhat altered, medium to fine-grained stock intruding the Jurassic and Cretaceous volcanic rocks. Normative mineral calculations indicate a quartz deficiency similar to many gabbros (Table 2.3, No. 1).

Several feldspar porphyry dikes intrude the Hazelton rocks. The largest of these is exposed in a roadcut where the Bob Creek and the main Buck Flats roads join, and on a logging road north of Bob Creek. These dikes contain subhedral clusters of plagioclase, 0.5 centimetre across, in a matrix of fine-grained feldspar, biotite and quartz. A K-Ar age determination on a biotite separate from these rocks (Church, 1986) gives a Late Cretaceous age of 80.6 ± 2.8 Ma (Table 2.4, No. 20) similar to the Duck Lake intrusion.

The felsic effusive rocks exposed in the canyon of Bob Creek are a composite of hydrothermally altered breccias, including some round-clast vent breccias and quartz feldspar porphyry feeder dikes. Normative calculations from whole-rock chemical analyses suggest high quartz and alkali feldspar content typical of many unaltered rhyolites (Table 2.3, No. 2).

Alteration of these rocks is intense, consisting of kaolinization with local sericitization and silicification. Limonite is developed on many outcrops as a result of oxidation and leaching of sulphides. The principle sulphide minerals are pyrite and sphalerite with lesser amounts of galena and chalcopyrite. These occur as disseminations, stringers and in quartz veinlets of apparently random orientation.

The main target of exploration is a zone of high lithogeochemical values midway between the canyon and the north contact of the Bob Creek gabbro. This anomaly forms an elliptical 80 by 50 metre area with gold and silver analyses ranging to more than 4 ppm and 35 ppm respectively.

The age of mineralization has been determined to be 78.1 ± 2.8 Ma from K-Ar analyses of sericitized biotite from a hydrothermally altered porphyry from the canyon area (Table 2.4, No. 19). This is only slightly younger than unaltered biotite feldspar porphyry dikes of the region which have been correlated with the Duck Lake intrusion and Okusyelda volcanic event.

According to Caelles (1982): "The Au-Ag (Zn-Pb-Cu) mineralization in the Bob Creek property is epigenetic, deposited by circulation of hydrothermal fluids that are very likely related to the predominantly felsic volcanism. If this hypothesis is correct, lithological control of mineralization could be important, mainly through control of mineralizing fluid circulation by rock porosity and permeability".

Lingering hydrothermal activity may also be responsible for the altered condition of the Tip Top Hill andesites and the Bob Creek stock. In accordance with this, the lithogeochemical anomaly, which is close to the stock, coincides with the end phase of a Late Cretaceous rhyolite to andesite and gabbro eruptive cycle.

On the southern part of the property, several hundred metres south of previous drilling, diamond-drilling (1988 and early 1989) undertaken by the Noramco-Royalstar joint venture, reportedly intersected copper, zinc and precious metal mineralization below glacial drift in an area of similar lithology and alteration. This discovery greatly increases the potential for economic mineralization on the property.

DUNGATE CREEK: MINFILE 093L 010 (LAT. 54°22′09″; LONG. 126°33′30″)

The Dungate Creek property, also known as the Klondike Star claim group, is 6.2 kilometres southeast of Houston, just north of Dungate Creek at 960 metres (3150 feet) elevation.

EXPLORATION HISTORY

The initial discovery of chalcopyrite and molybdenite mineralization was made in the early 1960s in a shallow excavation on the newly constructed Dungate Creek logging road. Subsequent trenching parallel to the road failed to reveal any important extension to the mineralization and the claims were allowed to lapse.

In July 1964, E. Westgarde of Houston restaked the showing. Additional claims were staked in 1965 and the property was then optioned to Southwest Potash Corporation. A period of detailed exploration followed which included a magnetometer survey, a limited program of soil and rock geochemistry, 900 metres of bulldozer trenching, and geological mapping.

Early in 1966 Normont Copper Ltd. gained control of the property and initiated a new phase of investigation. Anco Explorations Ltd. was contracted for general fieldwork including a geochemical survey and in the fall of the same year Huntec Ltd. completed an induced polarization survey. In 1967, Chapman, Wood and Giswold Ltd. ran another detailed induced polarization survey to define diamond-drill targets. Normont optioned the property to Noranda Exploration Company, Limited in December 1967 and by April 1968 drilling began. The program included seven AQ wireline drill holes, totalling 610 metres. Results were disappointing and the claims were again allowed to lapse.

The original Westgarde holdings were restaked by prospector Ross Blusson in the spring of 1972 and the senior author visited the property later that year, in anticipation of renewed exploration activity on the property. The following description is largely quoted from the report prepared at that time (Church, 1973d).

GEOLOGY

Outcrops are sparse in the vicinity of the main showings, the area being mantled by glacial till and outwash sand which, according to diamond-drill logs, averages about 6 metres thick. The best bedrock exposures are formed by bluffs of nearly horizontal Tertiary lava immediately east and southeast of the property, and a few low hills and knolls of Hazelton volcanic rocks near the west and northwest boundaries; a good section of Hazelton volcanic rocks is also exposed in Dungate Creek canyon near the southwest corner of the claim block.

The conspicuous topographic bench which underlies most of the property is evidently part of an exhumed erosion surface which is roughly coincident in elevation with the base of the adjacent Tertiary pile. Easterly moving glaciers were probably responsible for stripping away most of the Tertiary cover rocks. The mean direction of glacial striae in the area is 083°.

Owing to exceedingly poor exposure details of the geology of the property are lacking, however, some interpretation of bedrock can be made from the few exposures on the property and surrounding areas, diamond-drill logs and geophysical data.

The oldest and predominant geological units in the area are believed to be part of the Mesozoic Hazelton Group. The suite is mainly volcanic although shales and greywacke are recorded in a few of the drill logs. The lavas and volcanic breccias exhibit both aphanitic and feldspathic phases and range in colour from dark to light grey, greenish grey and light brown. The results of arc fusions and quartz determinations performed on a volcanic suite collected from 20 geological stations in the area have been plotted (Figure 5.17). The samples show a bimodal composition distribution consisting of (1) basic and intermediate rocks: basalts and andesites, and (2) siliceous rocks: dacites and rhyolites.

The combination of basic volcanic beds, which normally have relatively high magnetic susceptibility, and siliceous units with low susceptibility, provides a basis for interpretation of available magnetic data. Figure 5.18 shows the known exposures and interpreted geology superimposed on a magnetometer survey map. The most conspicuous features are the bands of magnetic highs alternating with lows. These bands strike generally northeast at about 020° suggesting that this direction is the strike of the underlying Hazelton Group.

The area of very low magnetic response in the southeast corner of the map area appears to be, at least in part, a dipole edge-effect caused by the Tertiary volcanic pile lapping onto the Hazelton rocks. The Tertiary succession here consists of several tens of metres of typical Goosly Lake porphyritic

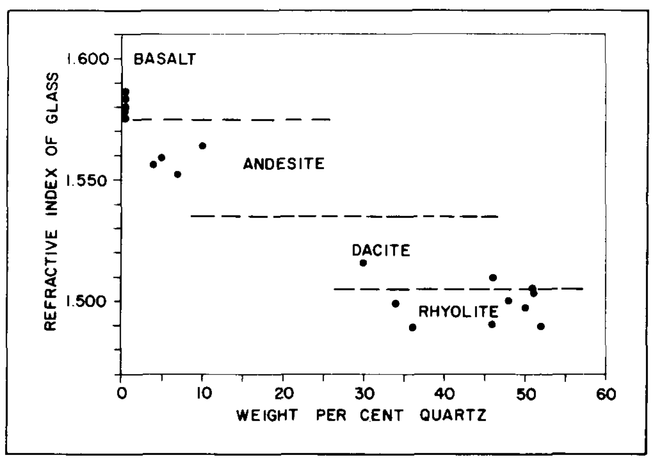


Figure 5.17. Composition range of Hazelton volcanics in the Dungate Creek area.

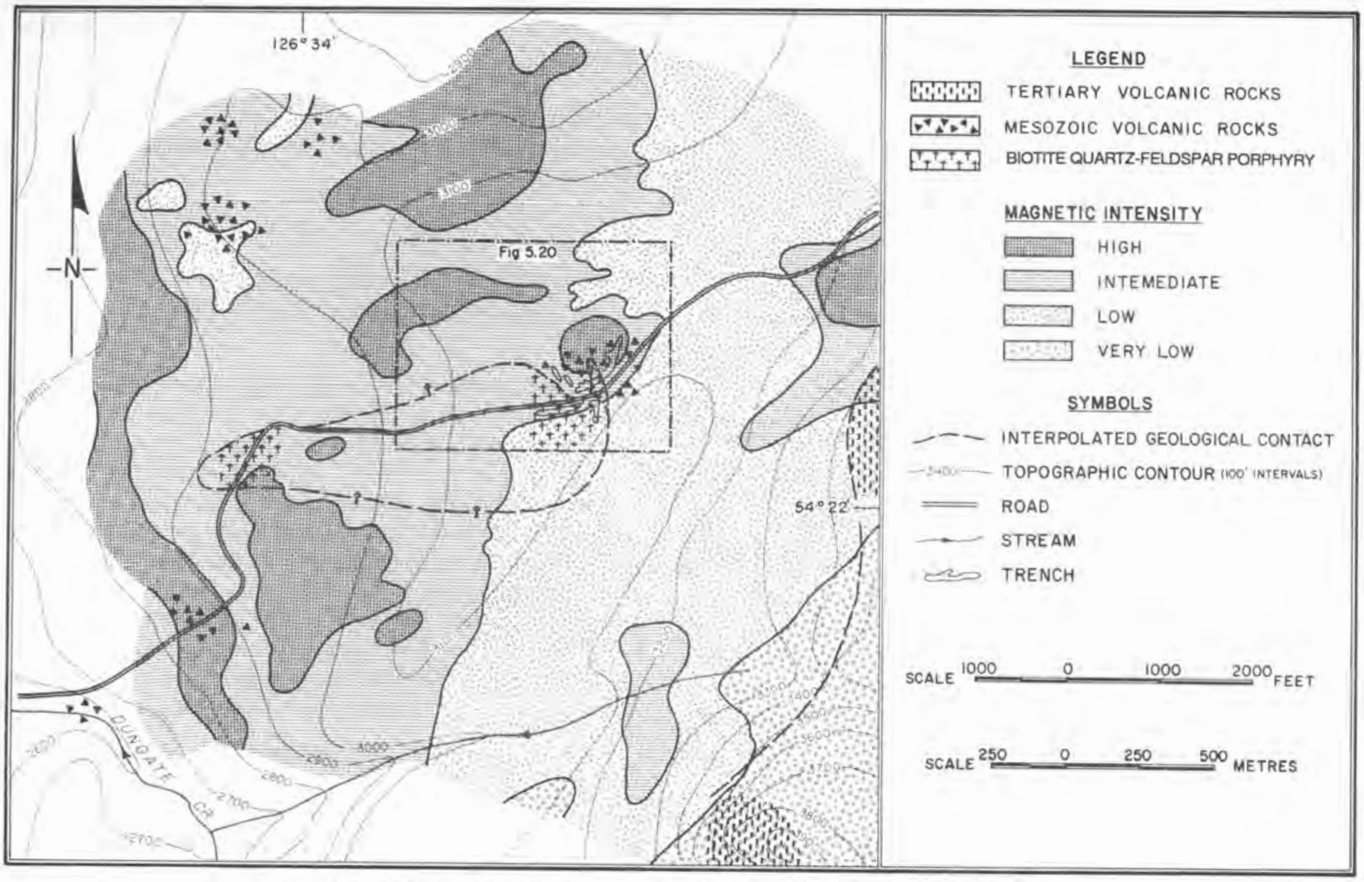


Figure 5.18. Geology and magnetic response in the vicinity of the Dungate Creek prospect.

trachyandesite lavas overlain by a few hundred metres of brown aphanitic Buck Creek dacitic andesite volcanic breccias.

Biotite-quartz-feldspar porphyry is exposed in trenches in the main prospect area in the east-central part of the property and on the logging road a kilometre to the west. No natural exposures are known and the outline of the intrusion shown in Figure 5.18 is wholly based on an interpretation by Noranda geologists. This interpretation appears to be somewhat oversimplified in view of the similar porphyry intersected in some of the outlying drill holes.

Typically the rock is cream-grey on freshly broken surfaces and rust-brown where weathered. The most common phase contains about 30 per cent subhedral plagioclase phenocrysts ranging from 1.5 to 7 millimetres in diameter, and a few scattered quartz eyes and biotite books embedded in a fine-grained groundmass. A partial analysis of this rock shows 3.20 per cent potash, 3.50 per cent soda and 1.15 per cent lime. According to normative calculations this would yield about 19 per cent orthoclase, 30 per cent albite and 6 per cent anorthite. Evidently the alkali feldspar is almost entirely a groundmass constituent.

Another less common phase of the intrusion is characteristically charged with small plagioclase phenocrysts which seldom exceed 2 millimetres in diameter; these comprise about 40 per cent of the rock volume. There is some suggestion that this rock is an apophysis or a dike offshoot phase of the main porphyry body.

The main area of mineralization is illustrated on Figure 5.19. It is characterized by pyrite and subordinate chalcopyrite occurring as thin fracture fillings and fine-grained disseminations within the porphyry intrusion and adjacent volcanic rocks. Molybdenite is found in minor amounts as thin smears on fractures at the edge of the intrusion.

Alteration of the porphyry has resulted locally in conversion and, in places, the complete breakdown of feldspar: albitization and carbonatization of plagioclase phenocrysts and sericitization and kaolinization of the fine-grained constituents. Biotite is commonly slightly chloritized and hornblende, where it occurs, is generally converted to magnetite and chlorite.

A well-developed zone of intense silicification, about 30 metres wide, lies immediately adjacent to the northeast contact of the porphyry in the northeast trench. Here, a system of composite reticulate quartz veinlets has been emplaced by repeated injections of hydrothermal solutions. Numerous cherty quartz seams, each not more than a few centimetres wide, are separated by narrow screens and wedges of intensely altered fine-grained country rock which is discoloured by a reddish yellow hematite-limonite mixture.

The most common jointing in the porphyry intrusion and surrounding Hazelton rocks strikes northeasterly; a very persistent steeply dipping joint set trends about 070° subparallel to the zone of silicification (Figure 5.20). A weaker, nearly vertical, cross-fracture set strikes southeasterly.

Diamond drilling by Noranda was to test geochemical and geophysical anomalies. According to company records hole Nos. 1, 2 and 3 were drilled to test combinations of induced polarization and magnetic anomalies; hole Nos. 4, 5, 6 and 7 tested various combinations of induced polarization, magnetic, electromagnetic and geochemical anomalies.

Hole Nos. 1 and 2, each 100 metres in length, intersected what appeared to be altered porphyry with narrow seams of magnetite and minor chalcopyrite. A quartz-rich section, between, 70 and 80 metres in hole No. 2, assayed 0.28 per cent copper.

Hole Nos. 4 and 6, drilled to 60 and 90 metres respectively, showed continuous intersections of pyrite-bearing porphyry. Chalcopyrite was scarce, the highest assay being only 0.14 per cent copper.

Hole Nos. 3, 5 and 7, all drilled to about 90 metres depth, had long intercepts of poorly mineralized Hazelton rocks; Nos. 3 and 5 contained mostly volcanic debris and 7, sedimentary rocks. The core from hole No. 3 contains an abundance of disseminated magnetite which probably accounts for the high magnetic anomaly in the area.

Six grab samples of mineralized bedrock were collected from the trenches by the senior author in 1972 (Figure 5.19). Analyses of the porphyry samples showed a range of 0.01 to 0.54 per cent copper and 3.80 and 5.00 per cent iron. The nearby country rock showed a range 0.01 to 0.18 per cent copper and 4.70 to 5.55 per cent iron. A report by Norman Shepherd (1965) of Southwest Potash Corporation quotes an average of 160 ppm copper and 20 ppm molybdenum for nine samples of porphyry, and 310 ppm copper and 50 ppm molybdenum for four samples of country rock. Also, com-

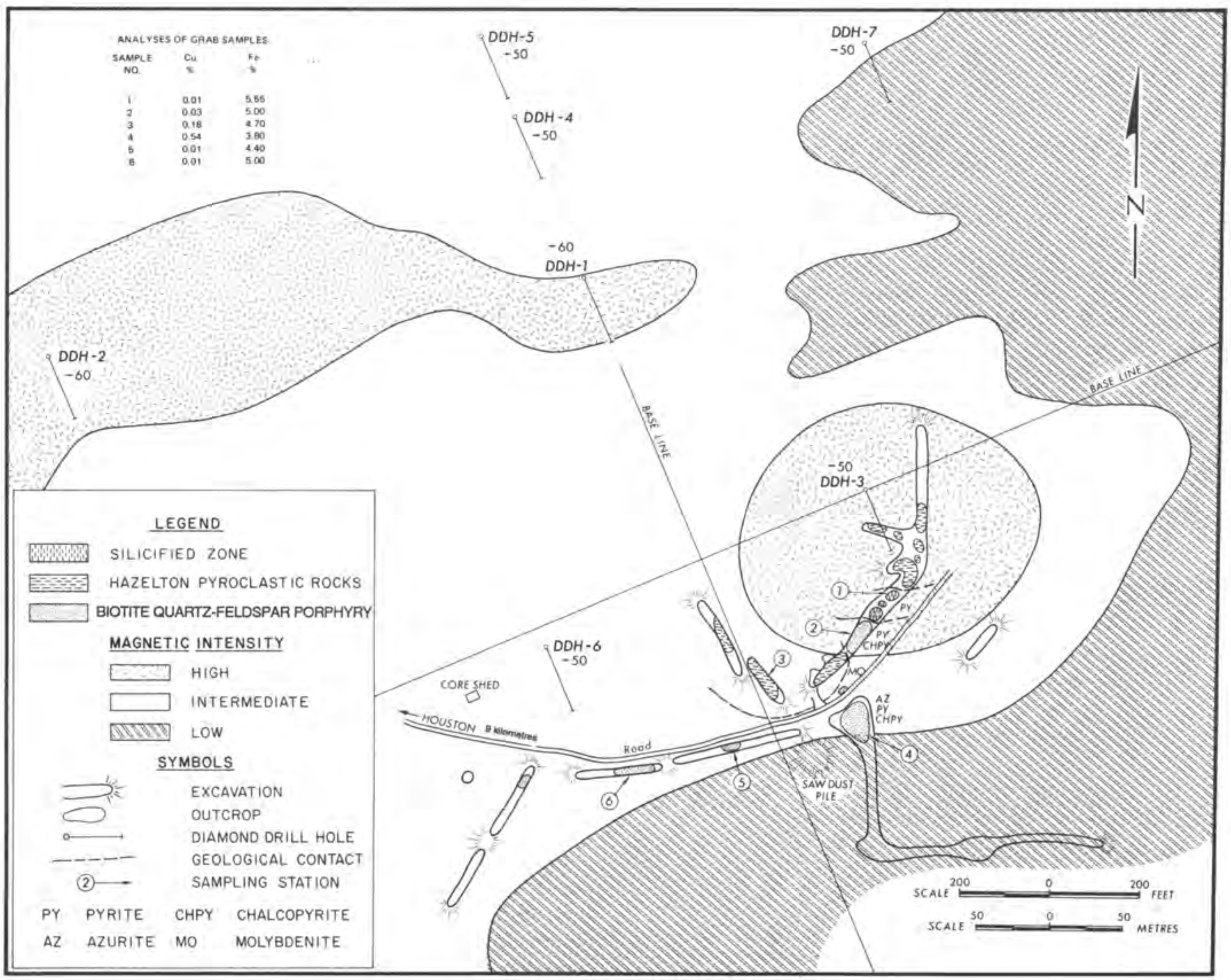


Figure 5.19. Detailed plan of mineral showings, Dungate Creek prospect.

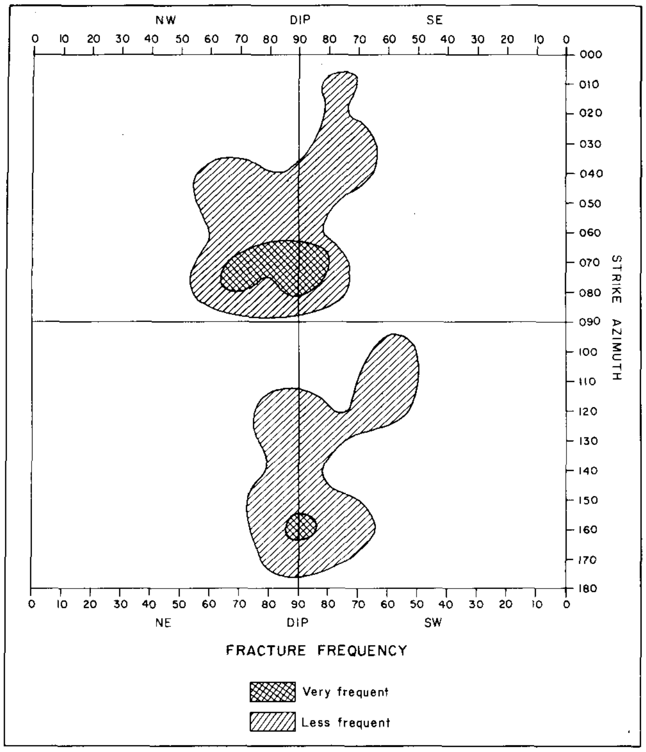


Figure 5.20. Plot of fracture frequencies in the Dungate Creek area.

posite samples submitted by the company for gold and silver assays returned results ranging from trace to 0.7 gram per tonne gold and 7 to 14 grams per tonne silver.

The generally low values, especially for copper as determined from core (Noranda) and surface rock chip samples collected by the senior author, do not appear to account for some very high soil geochemical results obtained by Southwest Potash Corporation. A total of 720 soil samples included 100 samples with more than 50 ppm copper and some of these with copper in excess of 500 ppm.

Bornite: Minfile 093L 012
(Lat. 54°29′40″; Long. 126°25′27″)

The Bornite prospect is located just west of Gilmore Lake at 760 metres (2500 feet) elevation, 18 kilometres northeast of Houston. In 1987 it was explored by Equity Silver Mines Ltd. (Dana I, Dana II and Tex I claims). The program included five NQ diamond-drill holes totalling 624.2 metres. Previous prospecting was done by Normont Copper Ltd. in 1967 and Summit Petroleum Corporation in 1977.

The property is underlain by Jurassic Hazelton Group volcanics consisting of light-coloured rhyolite flows and maroon andesite breccia. Weak chalcopyrite, bornite and tetrahedrite mineralization occurs mainly as rims to fragments, micro-vein fillings and disseminations in a matrix of silicified volcanic breccia. The zone of most intense silicification is about 20 metres wide, 300 metres long and dips about 80° northeast, roughly subparallel to bedding. The sporadic occurrence of sphalerite, galena and barite has been noted, and silver values ranging up to 65 grams per tonne have been reported.

Grouse Mountain: Minfile 93L 026, 288
(Lat. 54°33′30″; Long. 126°43′42″)

Grouse Mountain lies at the south end of the Babine Range 19 kilometres due north of Houston. It is accessible by a steep 5-kilometre-long dirt road leading from the Hungry Hill section of Highway 16 between Smithers and Houston. The following description is taken from an earlier report by the senior author (Church, 1973b) and based on fieldwork completed in 1972.

The prospect area extends westward from the gentle slopes near McQuarrie Lake, elevation 1050 metres (3448 feet), past the summit of Grouse Mountain, elevation 1619 metres (5312 feet) , to the western edge of the plateau which forms much of the upper part of the mountain. Coppermine Lake and a number of other small lakes and ponds occupy shallow depressions just below treeline on the plateau, in the vicinity of the main mineral prospects (Figure 5.21).

EXPLORATION AND DEVELOPMENT HISTORY

The early history of this prospect has been summarized by Church (1973b); more recent exploration activity (1985) is documented in the assessment report files maintained by the ministry.

In 1914 Samuel Bush, Louis Schorn and partners discovered what are now known as the Copper Crown, Ruby, Lakeview, Schorn and Eureka copper and zinc sulphide showings near Coppermine Lake. In 1916 the Cassiar Crown Copper Company, which was formed to consolidate the various holdings, sank a shaft to 17 metres, about 150 metres southwest of Coppermine Lake, on the Copper Crown showing. Soon afterwards, work began on an adit crosscut at the 1360-metre level, 260 metres to the west. The plan was to intersect an ore shoot some 75 metres below the shaft and the ore was to be transported 7.2 kilometres from the portal to Walcott station on the Canadian National Railway's main line through the Bulkley valley. However, by November 1917, the crosscut had advanced about 300 metres without encountering appreciable mineralization and work was stopped.

After reorganization of the company, attention was focused on the Ruby showing. Activity continued until 1923 by which time a lens of mixed sulphides was traced a few hundred metres from a short adit crosscut on the 1380-metre level. This underground exploration proved unsuccessful in locating mineralization commensurate with the surface showings and little was done for several years. In 1926 there was a marked revival of interest; a camp was constructed and extensive exploratory work began again. A total of 1130 metres of drifts and crosscuts, 50 metres of raises and a shaft linked the Ruby workings with those of the Copper Crown. Work was suspended in the summer of 1926 as the sulphide bodies outlined proved to be insufficient to support a mining operation.

The Lakeview showing was re-examined during the period 1924 to 1925. The most significant work at that time was an

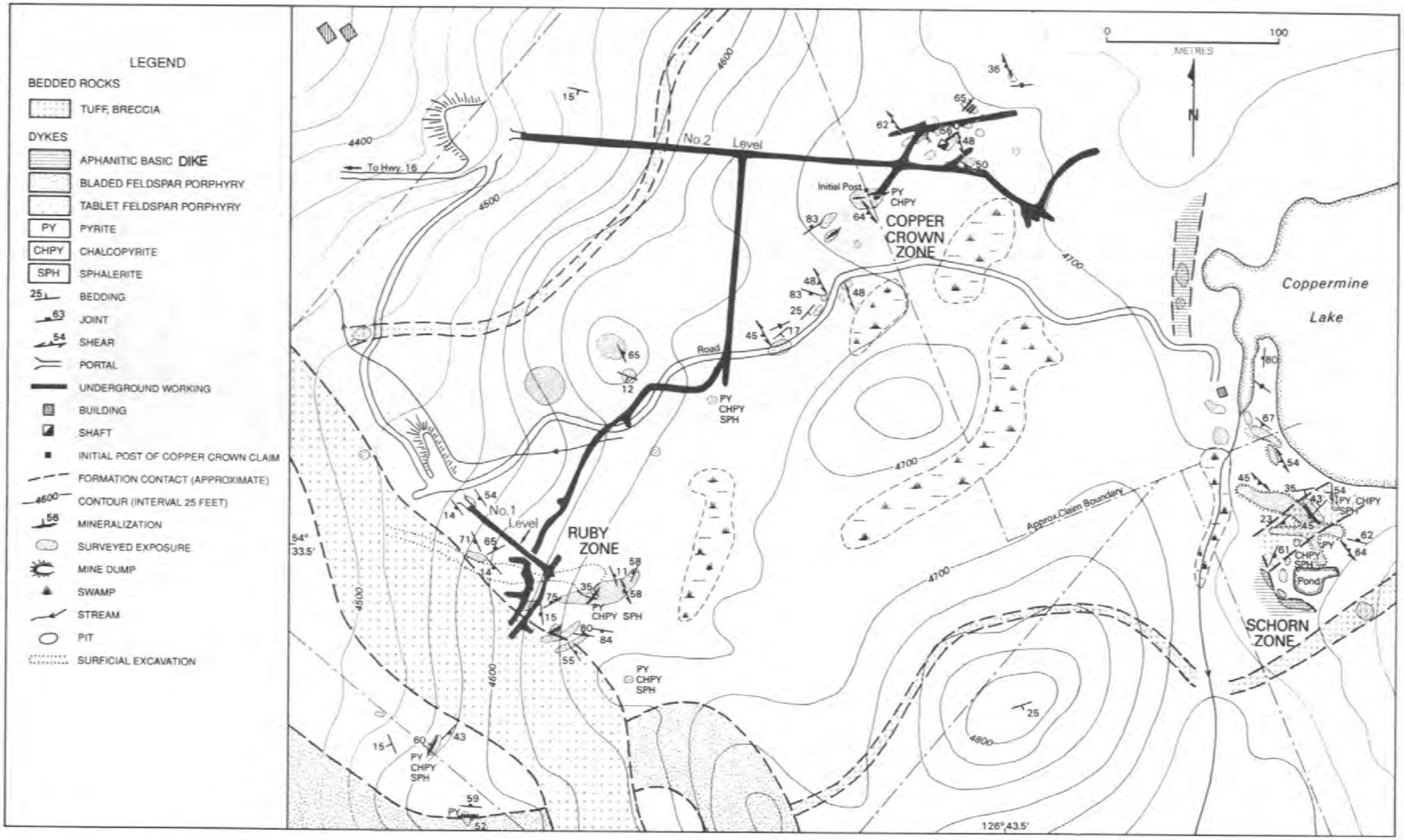


Figure 5.21. Geology of the Copper Crown, Ruby and Schorn zones, Grouse Mountain.

Ruby Zone: The detailed geology of the Ruby zone is based on information provided by MacKenzie (1915), Black (1951), and a chain-and-compass survey by the senior author.

Black's investigation of the drill core and underground workings of the mine indicated that the Ruby zone continues to the southwest more or less from where the Copper Crown zone ends and displays an abundance of sphalerite considerably in excess of chalcopyrite.

The Ruby zone dips steeply to the northwest and is divided into three southwesterly raking shoots over a strike length of roughly 335 metres. The shoot farthest to the southwest appears to be the best mineralized. It terminates against a large bladed-feldspar porphyry dike and is cut by a younger tablet-feldspar porphyry (Plate 5.14). Five samples from this shoot, taken by Black from the No. 1 level and representing a width of 1.5 metres, show the following average composition: trace gold; 79 grams per tonne silver; 1.0 per cent copper; and 12.1 per cent zinc. A surface sample, collected by the senior author, across a width of 1.5 metres in a trench 30 metres northeast of the tablet-feldspar porphyry dike assayed: trace gold; 147 grams per tonne silver; 1.80 per cent copper; 0.03 per cent lead; 9.20 per cent zinc; and 8.80 per cent iron. The sampled section is well banded displaying a layer adjacent the footwall composed mainly of quartz with scattered blebs of pyrite and chalcopyrite (Plate 5.15) and, toward the hangingwall, masses of pyrite, chalcopyrite and sphalerite alternating with solid and brecciated screens of country rock (Plate 5.16).

The zone widens considerably into a multi-vein system to the northeast. This is evident from Black's description of core from a drill hole recording a 7-metre intersection through the central shoot: "This length of core contains a vein 6 inches wide, a vein 2 inches wide, twenty-four veins about 1 inch wide, about twenty narrower veins in a 1-foot length of ore, and 1 foot of disseminated mineralization, largely sphalerite".

It appears that the veins and veinlets are concentrated toward the axial plane of the shoot. Nevertheless, the sulphides are relatively dispersed resulting in low metal values. An assay of 90 centimetres of core provided by Black shows: gold, nil; 17.1 grams per tonne silver; 0.02 per cent copper; and 7.0 per cent zinc.

The northeasterly shoot is obscured by glacial cover at surface. A sample over 46 centimetres obtained by Black from the underground workings assayed: gold, trace; 58 grams per tonne silver; 0.9 per cent copper; and 13.1 per cent zinc. This compares favourably with a grab sample collected by the senior author from a small surface showing: gold, trace; 58 grams per tonne silver; 1.05 per cent copper; lead, nil; 8.00 per cent zinc; and 7.07 per cent iron.

The 1986 ore reserve estimates by the operator are 181 440 tonnes at grades of 20.41 grams per tonne silver, 0.53 per cent copper, and 4.5 per cent zinc.

Schorn Zone: The Schorn zone comprises an assortment of veins and veinlets partially exposed in a series of old water-filled and sloughed pits and open cuts. These excavations extend northeasterly at about 025° azimuth from the contact

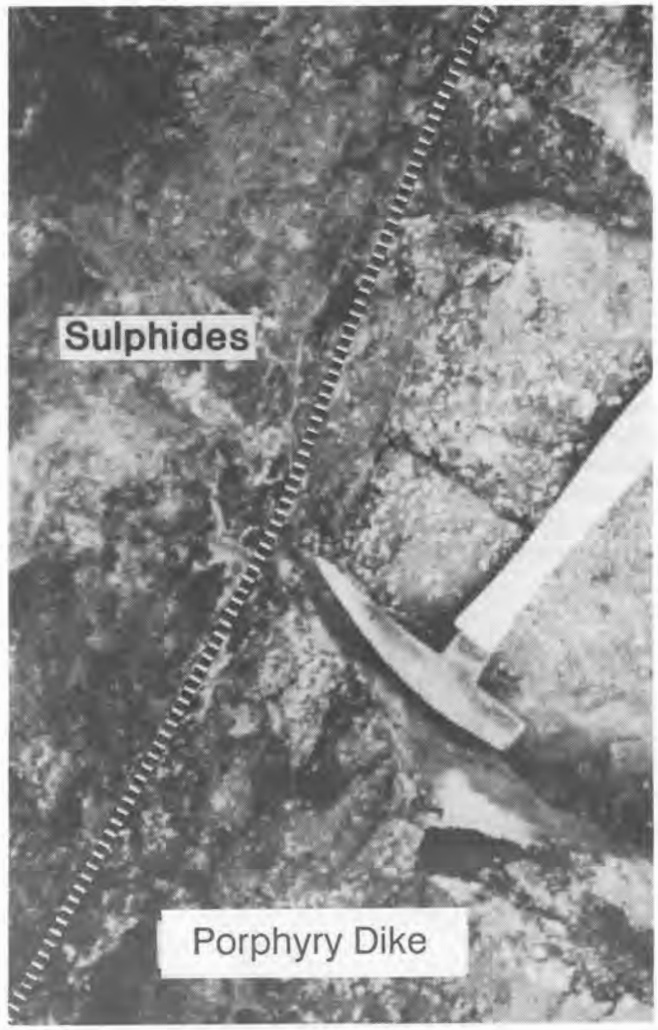


Plate 5.14. Feldspar porphyry dike in contact with sulphide mineralization, Ruby zone, Grouse Mountain.

of an aphanitic basic dike almost 65 metres to a point near the southwest shore of Coppermine Lake. This mineralized zone cuts across gently dipping beds of dark brown tuff and grey siltstones.

The main vein, exposed in trenches at the northeast end of the zone, is about 25 centimetres wide and consists of quartz and some mineralized wallrock with about 17 per cent combined pyrite, chalcopyrite and sphalerite. An assay of this material shows the following results: gold, trace; 116 grams per tonne silver; 1.00 per cent copper; 0.03 per cent lead; 9.10 per cent zinc; and 3.86 per cent iron.

Lakeview Zone: The Lakeview showing consists essentially of two quartz veins, locally enriched in chalcopyrite and sphalerite, exposed near the south shore of Coppermine Lake. These veins strike across gently dipping greywacke and siltstone beds toward an aphanitic basic dike about 75 metres to the southwest.

The east vein has been explored by a short adit near lake level, about 6 metres long, and an open cut immediately in 1928 at which time a number of trenches were dug on the north side of the hill, tracing the mineralization for a distance of about 60 metres. The showings consist of veinlets of pyrite, sphalerite and galena in Tip Top Hill pyroclastic rocks.

A similar but smaller area of mineralization (MINFILE 093L 218) occurs on an extension of the same ridge, 1.5 kilometres to the southwest.

APEX: MINFILE 093L 45, 246, 247
(LAT. 54°26′; LONG. 126°26′30″)

The Apex prospect is 14 kilometres east-northeast of Houston and 7 kilometres northwest of China Nose Mountain. Access is by a four-wheel-drive dirt road which connects with Highway 16, 8 kilometres northeast of Houston.

Mineralization was first discovered during construction of a logging road when a copper-bearing gossan zone was uncovered. In 1973 John McAndrew acquired the property and conducted a detailed magnetometer and soil geochemistry exploration program. This resulted in the discovery of mineralization several hundred metres south and southwest of the original road showing.

The property is underlain by Hazelton volcanic rocks consisting of green and maroon basaltic lavas and andesitic breccias and a lesser amount of massive, light-coloured rhyolite (Figure 1). These units are cut by small, irregular gabbroic intrusions.

The original road showing comprises fractured maroon andesite with disseminated chalcopyrite, chalcocite, galena, hematite and malachite accompanied by steeply dipping barite veins which range up to 0.3 metre wide. A grab sample of this mineralization (McAndrew, 1974) assayed 0.01 gram per tonne gold, 3.9 grams per tonne silver, 0.13 per cent copper, 0.076 per cent lead, 0.50 per cent zinc and 9.5 per cent barium.

A second area of mineralization, south of the road showing and a small beaver pond, consists of magnetite, chalcopyrite, bornite, malachite and calcite in fractured amygdaloidal basalt. McAndrew (1974) describes this showing: "In the stream bed draining the beaver pond to the west there is a zone of fracturing about 3 metres wide that contains appreciable chalcopyrite mineralization in quartz veins, fractures and the basalt host rock. Further downstream there are numerous additional showings".

In 1986 outcrops of rhyolite exposed in a roadcut on the east side of the property yielded assays showing enrichment in silver, cadmium and mercury. Similar rhyolitic volcanics in the southwest part of the property carry values ranging up to 0.05 gram per tonne gold and 10.5 grams per tonne silver, together with detectable arsenic, barium, cadmium, copper, antimony, zinc and mercury.

IRK: MINFILE 093L 265
(LAT. 54°12′; LONG. 126°38′)

The Irk property is 22 kilometres south of Houston on the drainage divide between the valleys of Owen Lake on the west and Buck Creek on the east. Access is from Houston via the Buck Flats and Parrott Lakes gravel roads.

The property is centred over a geochemical anomaly discovered by Orequest Exploration Syndicate in 1970. A zone of rusty weathering soils, visible near Rose's Ranch on the Parrott Lakes road, showed high concentrations of zinc. A series of percussion-drill holes across the zone, drilled by Orequest, failed to locate a source for the geochemical anomaly.

The property is underlain by Hazelton maroon tuff-breccia in the central part, east of the Parrott Lakes road. Rhyolite, possibly the same age as the tuff-breccia, is exposed on the crest of a hill west of the road. Somewhat younger Tip Top Hill andesite breccia crops out in the northern and western extremities of the property. Feldspar porphyry dikes, assigned to the Goosly intrusions, were noted in the central area.

Work by Asarco Exploration Company of Canada Limited 1982-84 consisted mainly of percussion drilling and trenching which uncovered a number of mineralized float boulders. These are commonly composed of rhyolite breccia with quartz, carbonate and tetrahedrite replacing the matrix around clasts. Assay results range up to 100 grams per tonne silver. The source of these boulders remains unknown.

BOO MOUNTAIN (THREE STAR): MINFILE 093K 029
(LAT. 54°19′40″; LONG. 125°56′)

This prospect is 2.5 kilometres west of the north end of Decker Lake at 1000 metres (3300 feet) elevation on the upper northwest-facing slope of Boo Mountain. Mineralization was discovered in 1929 and explored briefly by the Topley Richfield Mining Company. There is no record of recent exploration on this property.

The prospect is a quartz vein and silicified breccia in a steeply dipping, easterly striking fault zone in Hazelton andesitic volcanics. The mineralized zone is more than 50 metres long and up to 6 metres wide (Figure 5.22). According to Kerr (1936, page 161): "In one direction the zone pinches out into tiny stringers, and in the other it narrows and splits, then spreads out and is sparsely mineralized. At depth the workings show that the zone has a marked tendency to narrow and split".

The ore minerals are mainly pyrite, chalcopyrite and specularite. These occur as bands, varying from a few millimetres to several centimetres wide, and in cavities within brecciated country rock.

A sample collected by the senior author across 1.5 metres of breccia assayed gold, trace; silver, trace; copper, 0.88 per cent; lead, nil; zinc, trace; and iron, 11.55 per cent.

The main exploratory work on the property is a southerly directed 55-metre crosscut adit. The adit exposed 1.2 metres of well-mineralized quartz and country rock in the footwall, and 0.9 metre in the hangingwall, with a sparsely mineralized zone between.

GEROW CREEK: MINFILE 093K 030
(LAT. 54°17′11″; LONG. 125°52′53″)

The Gerow Creek prospect is 10 kilometres northwest of the town of Burns Lake and 2.2 kilometres southwest of

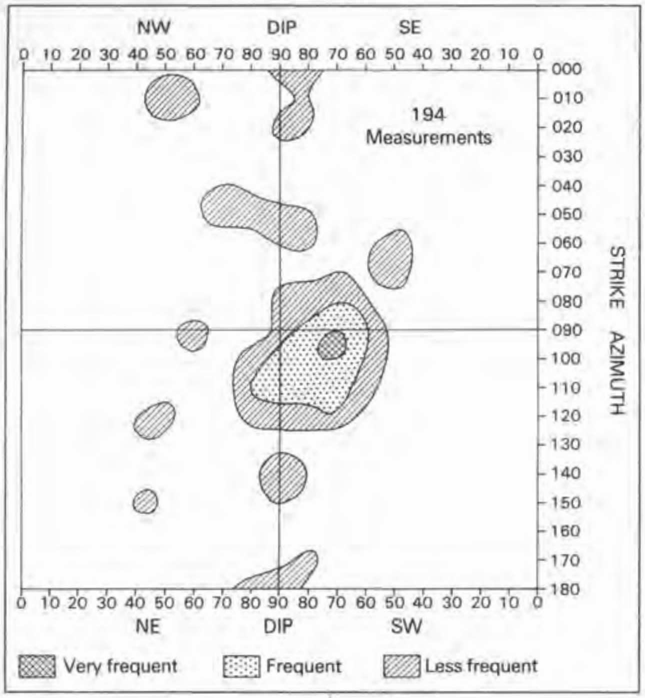


Figure 5.24. Plot of fracture frequency in the Gerow Creek area.

The property is underlain by greenish feldspathic andesite of the Hazelton Group and quartz porphyry intrusions of Late Cretaceous or Tertiary age.

Mineralization consists mainly of two narrow quartz veins, about 9 metres apart, containing seams and lenses of galena, sphalerite, chalcopyrite and pyrite accompanied by some barite and fluorite. A selected sample from one of the veins assayed trace gold; 28 grams per tonne silver; 0.8 per cent copper; 23 per cent lead; and 8 per cent zinc.

Three diamond-drill holes, totalling 117 metres, by Hillside Energy Corporation in 1979, tested resistivity anomalies near the old workings but intersected only disseminated pyrite.

FRANCOIS LAKE: MINFILE 093K 056
(LAT. 54°04′24″; LONG. 125°46′40″)

This unusual asphaltum-phosphate occurrence is exposed on the south side of a small hill 2.8 kilometres northwest of the ferry landing on the north shore of Francois Lake. Access is by foot from just south of a farm road at a point 3 kilometres west of Highway 35.

Veins of fibrous dark brown phosphate encrusted in asphaltum were discovered by E.M. Doston in 1923. These fracture fillings were emplaced as shallow-dipping lenses, up to 30 centimetres thick, across about 30 metres on the hill face. The host rocks are Tertiary amygdaloidal andesitic lavas and breccias.

According to studies by Poitevin (1927) the phosphates include collinsite (crystalline hydrous calcium-iron-magnesium phosphate) and quercyite (semi-amorphous carbonated hydrate of calcium phosphate).

Origin of the asphaltum-phosphate is ascribed to metamorphism (and distillation) of organic material. The deposit appears to have no commercial value other than as a source of museum specimens.

OAKLA: MINFILE 093K 060
(LAT. 54°05′; LONG. 125°45′)

This mineral occurrence is about 5 kilometres north of the ferry landing on the north shore of Francois Lake. The several veins on the property consist of gouge-filled fractures containing some quartz and pyrite. It is reported that a small well-defined quartz vein in the westerly part of the showing assayed 18.5 grams per tonne gold.

There is no report of recent exploration activity in the area.

GAMBLE: MINFILE 093K 962
(LAT. 54°07′12″; LONG. 125°44′30″)

This prospect is on a low grass-covered hill at about 900 metres (2950 feet) elevation, 2.5 kilometres west of the northwest corner of Tchesinkut Lake and 12 kilometres south of the town of Burns Lake.

The original claims were apparently located on slightly mineralized quartz in the early 1920s. The only significant development was a 6-metre adit which intersected a 0.6 to 0.9-metre-wide northeast-striking vein in andesite. The following assay is reported: 1.37 grams per tonne gold; 54.86 grams per tonne silver; 1.6 per cent lead; and 2.0 per cent zinc.

REFERENCES

Armstrong, J.E. (1965): Fort St. James Map Area, Cassiar and Coast Districts, British Columbia; *Geological Survey of Canada*, Memoir 252, 210 pages.

Barakso, J. and Church, B.N. (1973): Rock Geochemistry in the Owen Lake–Goosly Lake Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Preliminary Maps 13a to 13i.

Black, J.M. (1951): Cassiar Crown, Lakeview (Copper Ridge Silver Zinc Mines Limited); *Minister of Mines, B.C.*, Annual Report, 1950, pages A113-A117.

Caelles, J.C. (1982): Assessment Report of Geological Mapping and Soil, Silt and Rock Geochemistry on the Bob Creek Property; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 10166, 6 pages.

Carter, N.C. (1981): Porphyry Copper and Molybdenum Deposits of West-central British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 64, 150 pages.

Church, B.N. (1970a): Geology of the Owen Lake Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1969, pages 122-141.

——— (1970b): Sam Goosly; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1969, pages 142-148.

——— (1970c): DOM Claims; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1969, pages 87-91.

——— (1970d): SG (Sam Goosly); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1969, pages 126-127.

——— (1971a): Geology of the Owen Lake, Parrott Lakes and Goosly Lake Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1970, pages 119-128.

——— (1971b): Silver Queen (Nadina); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1970, pages 134-138.

——— (1973a): Geology of the Buck Creek Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1972, pages 353-363.

——— (1973b): Geology of the Grouse Mountain Area, Omineca Mining Division; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1972, pages 397-416.

——— (1973c): Diamond Belle; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1972, pages 366-370.

——— (1973d): Code Fen; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1972, pages 373-379.

——— (1973e): Star, Klondike (Hot, Chief); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1972, pages 384-390.

——— (1983): The Buck Creek Caldera and Associated Mineralization; *GAC/MAC/CGU*, Joint Annual Meeting, 1983, Abstracts, page A12.

——— (1985): Update on the Geology and Mineralization in the Buck Creek Area, the Equity Mine Revisited; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1984, Paper 1985-1, pages 174-187.

——— (1986): The Bob Creek Gold-silver Prospect; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1985, Paper 1986-1, pages 121-125.

Church, B.N., Barakso, J. and Bowman, A.F. (1976): The Endogenous Distribution of Minor Elements in the Goosly–Owen Lake Area of Central British Columbia; *Canadian Institute of Mining and Metallurgy*, Bulletin, Volume 69, pages 88-95.

Church, B.N. and Hutter, J.F. (1974): Sam Goosly; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology, Exploration and Mining in British Columbia 1973, pages 334-338.

Church, B.N. and Pettipas, A.R. (1990): Interpretation of Second Derivative Aeromagnetic Maps at the Silver Queen and Equity Silver Mines, Houston, British Columbia; *Canadian Institute of Mining and Metallurgy*, Bulletin, Volume 83, No. 934, pages 69 to 76.

Cyr, J.B., Pease, R.B. and Schroeter, T.G. (1984): Geology and Mineralization at Equity Silver Mine; *Economic Geology*, Volume 79, pages 947-968.

Diakow, L. and Mihalynuk, M. (1987): Geology of the Whitesail Reach and Troitsa Lake Map Areas (92E/10W, 11E); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1986, Paper 1987-1, pages 171-179.

Duffell, S. (1959): Whitesail Lake Map Area, British Columbia; *Geological Survey of Canada*, Memoir 299, 119 pages.

Govett, G.J.S. (1983): Handbook of Exploration Geochemistry, Volume 3, Rock Geochemistry; *in* Mineral Exploration, *Elsevier Scientific Publishing Company*, Amsterdam.

Hanson, G. (1924): Prince Rupert to Burns Lake; *Geological Survey of Canada*, Summary Report, 1923, Part A, 38 pages.

Hanson, G. and Phemister, T.C. (1929): Topley Map Area, British Columbia; *Geological Survey of Canada*, Summary Report, 1928, Part A, pages 50-77.

Kerr, F.A. (1936): Mineral Resources along the Canadian National Railway between Prince Rupert and Prince George, British Columbia; *Geological Survey of Canada*, Paper 36-20, 168 pages.

APPENDIX A

LITHOGEOCHEMICAL DATA

This introduces the lithogeochemical data of Table A.1. The analyses in this table represent 1791 rock samples from localities scattered across the entire Buck Creek area. The samples were originally collected for petrographic purposes. They were selected individually for freshness and lithological representation — parameters that also served the lithogeochemical study described in Chapter 4 of this report.

Table A.2 gives information on the most altered samples in this collection. These are predominantly pre-Tertiary "basement" rocks comprising the NAD and OL suites consisting mostly of Ootsa rhyolite, Tip Top Hill andesite and Mine Hill microdiorite from the Owen Lake area near the Silver Queen mine; the SG suite composed mostly of acidic volcaniclastic rocks of the Skeena Group(?) from the Goosly Lake area near the Equity Silver mine; and the DKR suite of Hazelton volcanics from the Decker Lake area. The large G and OPG suites of Table A.1 include many Tertiary samples from the Francois Lake group and some older rocks peripheral to the Buck Creek Tertiary outlier.

TABLE A.2
ALTERATION AND MINERALIZATION — ANALYSED SAMPLES

Sample No.		Sample No.		Sample No.	
DKR-33	a, c, m, s, u, v	NAD-1	a, m, v	NAD-117	a, o, u
DKR-34	o, p	NAD-2	a, o, s, u	NAD-118	c, o
DKR-35	p	NAD-3	c, m	NAD-134	m
DKR-36	o, p	NAD-6	c, o	NAD-138	a, m
DKR-37	c, m, p	NAD-10	a, m	NAD-140	b, m
DKR-40	m, s, v	NAD-13*	c, o, v	NAD-142	a
DKR-41	b, m, s, v	NAD-14	c, o, s, v	NAD-157	a, m
DKR-42	m, o, u	NAD-23	o	NAD-160	a, o
DKR-43	c, m, v	NAD-29	a	NAD-166	a, c, v
DKR-45	b, m	NAD-33	o	NAD-167*	a, m, u, v
DKR-46	m, o	NAD-49	a, m	NAD-171	b, m, s, v
DKR-53A	a, m	NAD-50	m	NAD-203	u
DKR-56	m, o	NAD-64*	m		
		NAD-71	a, b	OL-5	c, m, v
G-150	o	NAD-72	a, m, u, v	OL-8	c, m, v
G-185	o	NAD-81	a		
G-186	m, o	NAD-93	a, m, v	SG-69	f, m
G-295	b, o	NAD-97	a, o, s	SG-87	m, o, u
G-321	b, o	NAD-99*	a, m, s, u	SG-88	o
		NAD-102	a, m	SG-118	a, o
OPG-149	b, m	NAD-103	m, v	SG-124	o
OPG-203	c, m, o	NAD-104	p	SG-129	o, m
OPG-204	b, m, u	NAD-107	o	SG-131	a, m
OPG-210	m, o	NAD-108	o		
OPG-401	b, o	NAD-112	a, o		
OPG-616	o	NAD-113	a, b		
OPG-639*	o	NAD-114*	o		
OPG-753*	u	NAD-116	a, m, u		

* Tertiary rocks, mostly dikes.

Key: a — argillic alteration; b — breccia; c — carbonates; f — phyllic alteration, mica; m — sulphide mineralization; o — oxidation, gossan; p — propylitic alteration; s — silicification; v — veining; u — unassigned, including fluorite, barite, k-feldspar.

TABLE A.1
LITHOGEOCHEMICAL RESULTS

SAMPLE NO.		UTM CO-ORD EAST	NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
DKR 1	10	312100	6020650	2.3	0.7	1.	0.	640.	18000.	20.	4.	420.	0.	42.	2300.	0.	1260.	1.	310.	28.	13.	0.	240.	114.
DKR 2	10	311649	6020150	1.1	0.3	1.	0.	1190.	2150.	10.	3.	300.	0.	72.	830.	0.	685.	1.	460.	48.	7.	0.	140.	86.
DKR 3	10	311070	6019400	1.2	0.2	1.	0.	1580.	5650.	9.	3.	260.	0.	32.	1760.	0.	420.	1.	330.	33.	9.	0.	225.	30.
DKR 4	10	310500	6019650	1.9	0.8	1.	0.	670.	16500.	23.	8.	300.	0.	30.	1710.	0.	980.	1.	1100.	19.	17.	0.	365.	95.
DKR 5	10	310450	6019500	2.4	1.0	2.	0.	800.	31500.	26.	17.	320.	0.	5.	1850.	0.	1280.	1.	2700.	18.	23.	0.	445.	103.
DKR 6	10	310750	6019200	1.9	0.7	1.	0.	1470.	41000.	10.	7.	280.	0.	22.	2150.	0.	1240.	1.	1790.	9.	20.	0.	180.	32.
DKR 7	10	312000	6018000	1.6	2.8	1.	0.	800.	36500.	30.	53.	235.	0.	0.	600.	0.	1195.	3.	3160.	18.	31.	0.	475.	98.
DKR 8	10	312000	6018000	1.5	2.1	1.	0.	680.	21000.	29.	44.	160.	0.	0.	1450.	0.	598.	2.	2770.	17.	26.	0.	435.	88.
DKR 9	10	312000	6018000	0.6	1.1	2.	0.	790.	19000.	7.	9.	650.	0.	0.	1850.	0.	610.	2.	720.	5.	20.	0.	230.	60.
DKR 10	10	312020	6018620	0.8	1.2	8.	0.	300.	26100.	14.	8.	480.	0.	0.	300.	0.	390.	1.	180.	8.	22.	0.	112.	57.
DKR 11	10	312000	6018000	0.6	0.9	1.	0.	2600.	11400.	7.	7.	375.	0.	0.	1020.	0.	340.	3.	1200.	4.	28.	0.	250.	46.
DKR 12	10	312000	6018000	0.6	1.3	3.	0.	4650.	400.	6.	17.	680.	0.	0.	1400.	0.	520.	3.	230.	5.	60.	0.	170.	280.
DKR 13	10	312000	6018000	1.6	4.5	18.	0.	1550.	1650.	19.	75.	615.	0.	0.	1640.	0.	2480.	2.	600.	12.	76.	0.	200.	440.
DKR 14	10	312000	6018000	1.2	3.0	132.	0.	3100.	1370.	22.	51.	430.	0.	0.	960.	0.	3500.	2.	790.	10.	89.	0.	220.	310.
DKR 16	10	312350	6019100	4.1	3.6	3.	0.	2200.	1600.	30.	86.	950.	0.	0.	700.	0.	4500.	2.	410.	21.	410.	0.	80.	980.
DKR 18	10	312149	6018299	1.4	0.6	1.	0.	1700.	8300.	14.	31.	330.	0.	24.	1340.	0.	875.	2.	1510.	24.	12.	0.	555.	70.
DKR 19	10	311399	6018150	1.1	0.4	4.	0.	1370.	6750.	8.	10.	170.	0.	26.	2650.	0.	440.	2.	1550.	8.	8.	0.	535.	20.
DKR 20	10	310950	6017849	1.7	0.8	1.	0.	1190.	12000.	18.	20.	630.	0.	16.	1700.	0.	715.	2.	1860.	14.	15.	0.	600.	100.
DKR 21	10	311399	6017250	2.2	0.9	5.	0.	670.	11750.	28.	49.	270.	0.	5.	1170.	0.	765.	1.	2850.	103.	15.	0.	440.	46.
DKR 22	10	311450	6017049	1.4	0.4	1.	0.	1270.	7900.	10.	3.	550.	0.	21.	1560.	0.	600.	1.	1520.	16.	10.	0.	340.	60.
DKR 23	10	312549	6016849	0.	0.6	1.	0.	0.	0.	0.	2.	560.	0.	16.	0.	0.	0.	1.	0.	0.	12.	0.	0.	74.
DKR 24	10	312539	6016450	1.8	0.4	1.	0.	960.	16000.	13.	2.	620.	0.	100.	2350.	0.	630.	1.	850.	10.	8.	0.	300.	92.
DKR 25	10	312740	6015649	2.0	0.7	2.	0.	1500.	11500.	18.	48.	350.	0.	5.	1500.	0.	675.	1.	1270.	26.	19.	0.	760.	64.
DKR 26	10	313549	6015529	0.	0.9	1.	0.	0.	0.	0.	65.	840.	0.	16.	0.	0.	0.	1.	0.	0.	31.	0.	0.	91.
DKR 27	10	313750	6015649	2.0	0.4	1.	0.	2370.	8700.	10.	10.	330.	0.	5.	4200.	0.	490.	1.	2750.	12.	9.	0.	365.	78.
DKR 28	10	313750	6016099	2.2	1.0	1.	0.	1070.	22500.	22.	38.	360.	0.	20.	1360.	0.	600.	1.	3500.	26.	16.	0.	675.	62.
DKR 30	10	312850	6019020	0.8	1.1	14.	0.	3100.	8500.	13.	68.	400.	0.	0.	1530.	0.	3260.	3.	350.	10.	20.	0.	120.	285.
DKR 31	10	313020	6019130	1.0	1.8	1.	0.	720.	31500.	22.	39.	575.	0.	0.	1350.	0.	880.	4.	1280.	23.	28.	0.	262.	100.
DKR 32	10	312850	6019230	5.6	0.7	4.	0.	2730.	4000.	16.	71.	500.	0.	87.	5080.	0.	3200.	2.	610.	14.	95.	0.	100.	800.
DKR 33	10	312800	6019180	1.2	2.8	8.	0.	2080.	9400.	21.	385.	550.	0.	0.	5000.	0.	3450.	2.	100.	13.	33.	0.	130.	430.
DKR 34	10	312750	6019110	10.8	1.8	2.	0.	1800.	28400.	22.	32.	775.	0.	0.	1530.	0.	8100.	4.	560.	20.	620.	0.	125.	1860.
DKR 35	10	312800	6019010	4.2	1.3	6.	0.	2260.	9900.	22.	18.	565.	0.	0.	1160.	0.	4000.	3.	620.	16.	225.	0.	183.	960.
DKR 36	10	312750	6019000	7.3	1.1	10.	0.	1600.	16800.	26.	16.	835.	0.	0.	650.	0.	7250.	3.	650.	21.	350.	0.	130.	1240.
DKR 37	10	312700	6019100	4.0	1.9	2.	0.	3080.	3600.	17.	96.	365.	0.	0.	1200.	0.	3700.	2.	530.	14.	215.	0.	156.	750.
DKR 38	10	312600	6019050	0.7	1.0	1.	0.	2150.	10800.	14.	14.	315.	0.	0.	1650.	0.	1660.	2.	510.	10.	25.	0.	120.	250.
DKR 40	10	312560	6019000	11.8	2.0	23.	0.	2900.	5000.	22.	16.	730.	0.	0.	2680.	0.	6100.	2.	220.	14.	475.	0.	90.	1850.
DKR 41	10	312550	6019020	8.2	1.8	6.	0.	2760.	3250.	23.	64.	650.	0.	0.	2400.	0.	5020.	1.	340.	16.	360.	0.	86.	1380.
DKR 42	10	312520	6019980	4.1	3.3	59.	0.	4100.	1220.	18.	76.	990.	0.	0.	1500.	0.	3400.	2.	270.	20.	580.	0.	95.	830.
DKR 43	10	312500	6019010	1.6	1.6	37.	0.	1200.	1400.	26.	20.	740.	0.	0.	800.	0.	6760.	3.	1000.	25.	250.	0.	72.	580.
DKR 45	10	312400	6019050	16.2	3.1	34.	0.	2720.	5100.	20.	78.	950.	0.	0.	1460.	0.	3400.	2.	530.	21.	640.	0.	115.	1830.
DKR 46	10	312350	6019050	16.9	4.5	27.	0.	2500.	800.	24.	36.	950.	0.	0.	3750.	0.	3800.	4.	230.	22.	690.	0.	60.	1310.
DKR 47	10	312400	6019000	2.9	1.6	44.	0.	800.	810.	26.	29.	975.	0.	0.	850.	0.	3900.	1.	850.	25.	35.	0.	115.	360.
DKR 48	10	312300	6018850	1.4	3.7	19.	0.	2650.	580.	14.	49.	420.	0.	0.	1340.	0.	1640.	1.	930.	12.	91.	0.	195.	172.
DKR 49	10	312250	6019000	1.1	1.6	2.	0.	2500.	2400.	22.	66.	410.	0.	0.	1060.	0.	5670.	2.	620.	19.	38.	0.	150.	370.
DKR 50	10	312250	6018950	0.4	0.8	7.	0.	3050.	200.	4.	35.	215.	0.	0.	1920.	0.	610.	4.	310.	6.	76.	0.	80.	88.
DKR 51A	10	312250	6018850	0.6	0.8	1.	0.	1400.	5200.	16.	22.	395.	0.	0.	800.	0.	560.	1.	1530.	9.	12.	0.	415.	67.
DKR 51B	10	312250	6018850	1.3	1.6	1.	0.	2000.	17000.	26.	55.	565.	0.	0.	2560.	0.	3350.	2.	790.	20.	23.	0.	90.	230.
DKR 52A	10	312200	6018800	0.6	1.5	14.	0.	2350.	4600.	4.	12.	290.	0.	0.	1820.	0.	328.	4.	160.	4.	71.	0.	155.	70.
DKR 52B	10	312200	6018800	0.5	1.3	1.	0.	1700.	4760.	6.	8.	550.	0.	0.	2000.	0.	382.	2.	170.	5.	23.	0.	100.	46.
DKR 53A	10	312250	6019070	7.4	4.2	4.	0.	2000.	1980.	24.	26.	440.	0.	0.	1000.	0.	5650.	2.	620.	16.	465.	0.	168.	1230.
DKR 53B	10	312250	6019070	0.3	6.0	1.	0.	1200.	210.	6.	6.	675.	0.	0.	3340.	0.	72.	3.	950.	5.	34.	0.	81.	48.
DKR 54	10	312400	6018900	1.0	6.0	42.	0.	650.	2450.	32.	186.	210.	0.	0.	1500.	0.	1060.	4.	760.	14.	54.	0.	190.	108.
DKR 56	10	312600	6019100	6.4	3.1	27.	0.	2240.	1200.	25.	160.	355.	0.	0.	900.	0.	4800.	14.	110.	16.	275.	0.	60.	1850.
DKR 57	10	312750	6018950	0.6	1.2	3.	0.	1900.	10400.	13.	42.	290.	0.	0.	1080.	0.	2930.	2.	420.	12.	51.	0.	112.	310.
DKR 59B	10	312000	6018000	2.4	1.2	1.	0.	1120.	12500.	19.	8.	725.	0.	0.	2550.	0.	1080.	1.	2000.	13.	20.	0.	320.	138.
DKR 60	10	311800	6018450	0.9	1.0	16.	0.	1500.	18000.	14.	12.	500.	0.	0.	1160.	0.	855.	2.	810.	8.	17.	0.	295.	82.
DKR 61	10	308149	6024150	2.8	0.8	3.	0.	1590.	14000.	17.	18.	520.	0.	21.	1380.	0.	980.	2.	1480.	12.	42.	0.	365.	79.
DKR 62	10	308220	6023950	0.	1.3	1.	0.	0.	0.	0.	10.	350.	0.	5.	0.	0.	0.	4.	0.	0.	20.	0.	0.	58.
DKR 63	10	308399	6023700	1.4	0.4	1.	0.	3370.	5150.	10.	4.	405.	0.	5.	2900.	0.	725.	1.	890.	8.	11.	0.	420.	76.
DKR 64	10	308679	6023349	1.0	0.3	1.	0.	1410.	3800.	6.	8.	240.	0.	18.	2950.	0.	840.	1.	870.	6.	8.	0.	160.	32.
DKR 65	10	308950	6023319	1.2	0.3	1.	0.	1200.	2350.	6.	4.	220.	0.	5.	2200.	0.	640.	1.	880.	6.	6.	0.	160.	55.
DKR 66	10	309250	6023349	2.0	0.8	10.	0.	1500.	8900.	19.	4.	340.	0.	5.	1010.	0.	1280.	1.	1020.	14.	18.	0.	360.	96.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	UTM CO-ORD NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
G 34	9 671270	6005200	1.4	1.2	2.	5.	1600.	11000.	22.	21.	630.	45000.	10.	1180.	12000.	700.	1.	2300.	10.	18.	2.	1390.	96.
G 35	9 669900	6006240	1.4	1.0	2.	5.	1350.	38000.	22.	15.	220.	41000.	40.	1340.	10900.	600.	1.	380.	8.	16.	3.	380.	72.
G 36	9 669180	6005050	0.4	0.6	8.	10.	1300.	16000.	15.	32.	260.	38000.	10.	2400.	5600.	650.	1.	920.	10.	10.	6.	420.	54.
G 37	9 662750	5997760	1.2	1.6	2.	5.	1750.	5500.	26.	12.	480.	41500.	10.	930.	6000.	600.	1.	420.	47.	16.	4.	1130.	93.
G 38	9 661760	5996350	1.6	1.4	2.	5.	2400.	6000.	24.	33.	455.	44000.	10.	1300.	5400.	850.	1.	400.	48.	16.	7.	1170.	93.
G 39	9 661250	5995930	1.2	1.0	9.	5.	3300.	5600.	25.	33.	497.	42500.	10.	1360.	8100.	700.	2.	760.	35.	16.	4.	1200.	75.
G 40	9 661650	5995489	1.6	1.7	2.	5.	3150.	6000.	25.	36.	560.	44500.	10.	2050.	5700.	850.	1.	620.	24.	10.	2.	1240.	78.
G 41	9 662460	5996149	0.8	0.7	2.	10.	2250.	6500.	6.	15.	860.	9500.	10.	930.	7700.	500.	1.	760.	8.	12.	8.	1020.	33.
G 42	9 662829	5996060	0.2	0.5	2.	5.	2000.	4500.	6.	8.	235.	16500.	10.	690.	850.	225.	1.	460.	3.	6.	7.	950.	29.
G 43	9 663090	5995729	0.2	0.1	2.	5.	1600.	1900.	4.	10.	160.	16500.	10.	950.	1220.	150.	1.	580.	10.	4.	8.	360.	54.
G 44	9 664010	5995649	0.2	0.1	2.	5.	1400.	1700.	2.	9.	130.	6600.	10.	660.	750.	100.	1.	400.	6.	4.	4.	280.	24.
G 45	9 664400	6000250	0.2	0.1	2.	5.	1550.	250.	1.	10.	70.	5500.	10.	620.	330.	50.	1.	460.	4.	4.	2.	340.	24.
G 46	9 664170	6000190	0.6	0.1	2.	5.	1375.	3000.	3.	8.	265.	1500.	10.	1020.	540.	125.	2.	720.	4.	2.	7.	405.	21.
G 47	9 663935	6000251	0.3	0.5	1.	5.	1750.	3600.	20.	28.	300.	0.	0.	1370.	610.	830.	3.	1320.	26.	12.	9.	570.	94.
G 48	9 663070	6000429	0.2	0.1	2.	5.	1450.	2600.	17.	10.	80.	15000.	10.	780.	610.	600.	1.	730.	14.	6.	8.	1560.	42.
G 49	9 662510	6000789	0.2	0.5	2.	0.	0.	0.	5.	8.	0.	15000.	10.	0.	0.	150.	1.	0.	6.	18.	0.	0.	38.
G 51	9 661820	6001189	0.8	0.9	2.	5.	3750.	12500.	20.	30.	940.	48000.	10.	1800.	9200.	750.	1.	1120.	21.	18.	9.	1470.	88.
G 52	9 661440	6001099	0.6	0.8	2.	5.	3950.	10500.	22.	32.	1130.	50000.	10.	1620.	10900.	950.	1.	1180.	22.	22.	8.	1580.	92.
G 53	9 661420	6000560	1.0	1.0	2.	5.	3700.	13500.	26.	35.	980.	50000.	10.	2300.	14600.	700.	1.	1420.	50.	16.	9.	1500.	80.
G 54	9 661360	6000309	0.6	0.8	2.	5.	4000.	9000.	20.	22.	950.	48000.	10.	2200.	5300.	750.	1.	840.	18.	14.	6.	1520.	100.
G 55	9 661510	5999590	0.6	0.7	2.	5.	5000.	6400.	5.	3.	910.	23000.	10.	3300.	6500.	650.	1.	860.	2.	14.	9.	1100.	92.
G 56	9 658940	6000150	0.4	0.7	2.	5.	5200.	4500.	5.	3.	640.	19000.	10.	1380.	4200.	1200.	1.	520.	2.	16.	7.	1050.	100.
G 57A	9 659119	6000729	0.6	0.5	2.	5.	4400.	5500.	6.	10.	720.	21500.	10.	1560.	4400.	950.	1.	570.	3.	14.	5.	860.	73.
G 57B	9 659130	6000729	0.6	0.8	2.	5.	4800.	5600.	5.	6.	560.	19500.	10.	2100.	5300.	775.	1.	780.	2.	14.	6.	1100.	80.
G 57C	9 659119	6000729	0.4	0.4	2.	5.	4500.	3500.	6.	10.	780.	19000.	10.	900.	3900.	700.	1.	390.	3.	16.	3.	1470.	80.
G 58	9 658769	6001079	0.2	0.8	2.	5.	4850.	4500.	7.	3.	830.	29000.	10.	1570.	4800.	925.	1.	560.	2.	14.	9.	800.	84.
G 59	9 658800	6001459	0.2	0.8	2.	5.	5700.	5200.	8.	6.	800.	24000.	10.	1180.	4300.	3200.	1.	480.	2.	14.	5.	900.	112.
G 60	9 658960	6001629	0.4	0.9	2.	5.	5000.	4800.	6.	3.	830.	24000.	10.	1980.	4900.	750.	1.	560.	2.	18.	8.	700.	92.
G 62	9 659389	6001540	0.8	1.2	2.	5.	3800.	11000.	19.	42.	850.	47000.	10.	2000.	8000.	525.	1.	970.	20.	20.	7.	1300.	88.
G 63	9 659480	6001780	0.8	0.8	2.	10.	3400.	13500.	20.	32.	1020.	44000.	10.	2050.	8900.	700.	1.	2200.	19.	16.	6.	1050.	84.
G 64	9 659510	6001319	0.6	0.8	2.	5.	3600.	12000.	20.	30.	1000.	44000.	10.	2250.	7400.	750.	2.	1550.	19.	14.	4.	1100.	100.
G 65	9 659679	6001200	0.8	0.6	2.	5.	5800.	7000.	5.	28.	720.	18000.	10.	1480.	6200.	650.	1.	1000.	2.	14.	2.	850.	68.
G 66	9 659750	6001069	1.0	0.5	2.	5.	5200.	5500.	7.	3.	660.	31500.	10.	1080.	5800.	650.	1.	540.	2.	12.	4.	850.	108.
G 67	9 659780	6000950	0.2	0.7	2.	15.	2500.	4200.	8.	8.	310.	27500.	10.	800.	1890.	375.	1.	500.	5.	16.	4.	350.	108.
G 68	9 659760	6000859	0.4	0.8	2.	5.	2700.	5000.	8.	8.	280.	24000.	10.	2100.	2600.	825.	1.	1240.	7.	12.	5.	400.	100.
G 69	9 659699	6000770	0.4	0.5	2.	5.	2500.	2500.	5.	8.	285.	22000.	10.	430.	1080.	200.	1.	440.	3.	8.	3.	350.	48.
G 70	9 659750	6000750	0.4	0.4	2.	5.	2200.	4600.	8.	6.	310.	26500.	10.	620.	1660.	150.	1.	710.	2.	12.	7.	400.	62.
G 71	9 659719	6000679	0.8	0.9	2.	5.	5800.	7500.	10.	3.	640.	27500.	10.	4400.	8200.	775.	1.	980.	2.	24.	8.	800.	80.
G 72	9 659739	6000590	0.6	0.7	2.	5.	2500.	4500.	8.	25.	630.	30000.	10.	1900.	6700.	775.	1.	1080.	20.	16.	6.	400.	76.
G 73	9 659739	6000509	0.4	1.3	2.	5.	5200.	6500.	6.	3.	745.	24000.	10.	3900.	7500.	875.	1.	1000.	5.	18.	5.	700.	92.
G 74	9 659760	5999689	0.6	0.6	2.	5.	5100.	4000.	6.	3.	690.	23000.	10.	2200.	5300.	1050.	1.	720.	3.	14.	4.	750.	108.
G 75	9 660059	5999010	0.2	0.6	2.	5.	5200.	5000.	6.	3.	720.	24000.	10.	1840.	4400.	750.	1.	960.	3.	6.	7.	750.	96.
G 76	9 660389	5998739	0.4	0.8	2.	10.	5400.	5600.	8.	3.	660.	25500.	10.	1650.	4700.	1100.	1.	720.	3.	12.	6.	700.	117.
G 78	9 658210	6001319	0.4	0.7	2.	15.	5500.	5200.	5.	3.	910.	27500.	10.	1070.	4300.	775.	1.	660.	2.	14.	12.	1000.	80.
G 79	9 658110	6001540	0.8	0.8	2.	15.	4400.	10000.	15.	12.	1070.	35000.	10.	2650.	8100.	950.	1.	1120.	6.	16.	13.	1350.	100.
G 80	9 658110	6002030	1.0	1.3	2.	10.	3600.	13000.	17.	20.	1200.	41000.	10.	2100.	8200.	650.	1.	2500.	17.	22.	7.	1500.	76.
G 81	9 658469	6002039	0.8	1.0	2.	5.	3700.	14000.	17.	22.	325.	41000.	10.	1960.	11700.	450.	1.	3600.	20.	26.	5.	1450.	96.
G 82	9 657980	6002810	1.2	0.8	2.	5.	3700.	14500.	23.	25.	830.	47000.	10.	2000.	11400.	450.	1.	3500.	20.	30.	8.	1500.	84.
G 83	9 658130	6003289	0.2	0.9	2.	5.	3300.	2500.	3.	3.	360.	15500.	10.	1370.	3200.	300.	1.	730.	1.	10.	7.	350.	80.
G 84	9 657809	6003430	0.2	0.6	2.	5.	3100.	2000.	7.	6.	350.	19500.	10.	430.	1370.	525.	1.	520.	4.	6.	3.	550.	62.
G 85	9 657489	6003599	0.4	0.7	2.	30.	3100.	3500.	8.	8.	660.	25500.	10.	540.	7000.	400.	1.	570.	7.	4.	8.	600.	62.
G 86	9 657449	6003939	0.2	0.3	2.	10.	1600.	3200.	8.	8.	60.	25500.	10.	680.	5800.	450.	1.	450.	4.	6.	9.	750.	68.
G 87	9 657130	6003879	0.6	0.7	2.	5.	3500.	4000.	10.	10.	650.	21500.	10.	1190.	5100.	575.	1.	430.	6.	12.	3.	800.	68.
G 88	9 657059	6003569	0.4	0.4	2.	5.	3500.	3000.	6.	8.	665.	22000.	10.	760.	4300.	375.	1.	400.	5.	14.	5.	800.	62.
G 89	9 657130	6003289	0.6	0.3	2.	5.	3450.	4400.	10.	6.	880.	24000.	10.	1720.	3800.	500.	1.	620.	7.	18.	6.	800.	58.
G 90	9 657170	6003129	0.6	0.8	2.	5.	4600.	11000.	20.	30.	50.	32500.	10.	2400.	6600.	700.	1.	1080.	16.	12.	6.	1600.	62.
G 91	9 657090	6002900	1.2	0.9	2.	5.	4400.	12000.	25.	28.	600.	48000.	10.	1480.	6200.	1250.	1.	1400.	22.	20.	7.	1650.	108.
G 92	9 656949	6002740	1.0	1.1	2.	5.	4200.	13500.	23.	20.	55.	49000.	10.	2600.	8400.	1100.	1.	3400.	20.	18.	12.	1750.	73.
G 93	9 657010	6002150	0.8	1.2	2.	5.	3600.	12000.	26.	22.	60.	50000.	20.	1440.	12800.	1150.	1.	3100.	20.	16.	7.	1600.	80.
G 94	9 656980	6001980	0.8	0.8	2.	5.	4300.	9500.	23.	18.	80.	50000.	10.	1560.	8800.	700.	1.	870.	6.	16.	6.	1450.	92.
G 95	9 656889	6001739	0.2	0.8	2.	5.	3900.	2300.	5.	6.	560.	17000.	10.	1270.	3700.	650.	1.	580.	4.	8.	4.	600.	55.
G 96	9 655619	6003270	1.6	1.4	2.	5.	4400.	11000.	18.	18.	170.	26500.	10.	4000.	10000.	500.	1.	17000.	16.	40.	6.	1300.	48.
G 97	9 655820	6003430	0.8	0.9	2.	5.	3800.	15000.	22.	25.	90.	41000.	10.	1670.	9500.	575.	1.	2900.	19.	14.	3.	1550.	84.
G 98	9 656219	6003770	0.6	0.8	2.	5.	3900.	12500.	22.	22.	880.	44000.	10.	1520.	11800.	450.	1.	3400.	23.	16.	6.	1650.	92.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
G 170	9 672180	6003360	0.2	0.6	2.	5.	3850.	12000.	25.	20.	225.	37000.	10.	1470.	7700.	700.	1.	1260.	48.	16.	3.	1230.	78.
G 171	9 672730	6002960	0.8	0.3	2.	10.	3800.	6000.	25.	34.	280.	27500.	10.	990.	4600.	375.	1.	640.	50.	6.	9.	1490.	84.
G 172	9 672870	6002950	1.0	0.8	2.	5.	4150.	18000.	45.	24.	140.	35000.	10.	1520.	18500.	1000.	1.	2850.	215.	12.	8.	1140.	75.
G 173	9 672950	6002850	0.4	0.5	2.	5.	4750.	19500.	48.	54.	450.	37000.	10.	2200.	24500.	525.	2.	4650.	255.	18.	3.	1310.	75.
G 174	9 673120	6002900	0.2	0.4	2.	5.	2550.	5000.	8.	24.	970.	18000.	10.	2650.	7900.	225.	2.	970.	10.	6.	4.	900.	54.
G 175	9 673300	6002300	0.4	0.2	2.	5.	2300.	4600.	5.	20.	900.	19500.	10.	1950.	7000.	150.	1.	1010.	15.	8.	5.	920.	57.
G 176	9 673740	6002400	0.2	0.4	2.	5.	2550.	5000.	10.	22.	1055.	11000.	10.	2500.	7000.	325.	1.	920.	13.	4.	4.	920.	60.
G 177	9 673780	6002100	0.4	0.5	2.	5.	2600.	12500.	20.	40.	852.	26500.	10.	1490.	16200.	325.	1.	2100.	64.	12.	3.	1560.	57.
G 178A	9 673840	6001500	0.2	0.5	2.	5.	2550.	80000.	6.	20.	650.	24000.	20.	1950.	10300.	325.	3.	1480.	18.	4.	2.	680.	69.
G 178B	9 673840	6001500	0.6	0.5	1.	5.	1600.	10900.	13.	23.	600.	0.	0.	1290.	8300.	370.	7.	1200.	27.	11.	2.	700.	72.
G 179	9 674350	6001920	0.4	0.3	2.	5.	2550.	14500.	10.	14.	745.	14000.	10.	1330.	17600.	525.	1.	1950.	60.	10.	2.	1610.	69.
G 180	9 674360	6002160	0.2	0.4	2.	5.	2600.	11000.	20.	16.	710.	19500.	10.	1030.	17400.	375.	1.	1270.	55.	8.	2.	1540.	66.
G 181	9 674300	6002350	0.8	0.4	2.	5.	2750.	13500.	15.	46.	680.	21500.	10.	1460.	13500.	700.	1.	1420.	54.	14.	2.	1690.	60.
G 182	9 674390	6003100	0.2	0.5	2.	10.	2700.	10000.	7.	30.	852.	24000.	10.	670.	6300.	375.	5.	810.	20.	14.	3.	1270.	111.
G 183	9 675280	6002500	0.2	0.6	2.	15.	2250.	8500.	13.	16.	595.	22000.	10.	2450.	6500.	200.	1.	1620.	54.	8.	4.	1260.	78.
G 184	9 675970	6003600	0.2	0.7	9.	5.	2700.	7000.	7.	8.	1035.	7300.	10.	660.	6500.	300.	1.	1020.	28.	12.	2.	1690.	45.
G 185	9 654570	6008860	0.6	0.9	16.	5.	2200.	1800.	13.	50.	365.	18000.	30.	2200.	500.	200.	1.	300.	12.	22.	2.	210.	300.
G 186	9 654579	6009070	3.6	3.0	26.	5.	1750.	29000.	22.	230.	220.	37000.	10.	1690.	12900.	1000.	1.	520.	29.	72.	3.	480.	320.
G 187	9 655280	6009509	0.2	0.4	19.	5.	400.	2200.	8.	6.	365.	32500.	10.	2350.	870.	300.	1.	730.	4.	54.	2.	330.	62.
G 188A	9 655789	6009350	0.4	0.3	2.	5.	2950.	4000.	3.	3.	330.	12500.	10.	710.	2600.	575.	1.	950.	3.	8.	4.	730.	58.
G 188B	9 655780	6009350	0.4	0.8	2.	5.	3050.	9000.	8.	12.	825.	17000.	10.	3000.	9100.	525.	1.	1530.	9.	14.	6.	1420.	48.
G 189A	9 656019	6009039	0.2	0.7	2.	5.	2400.	11000.	9.	12.	852.	18000.	10.	1740.	10500.	250.	1.	1540.	8.	8.	2.	1390.	45.
G 189B	9 656019	6009039	0.4	0.5	2.	5.	2650.	5000.	12.	20.	680.	32500.	10.	2050.	5600.	375.	1.	1620.	11.	8.	2.	1630.	84.
G 190	9 656429	6008620	0.6	0.6	2.	5.	2500.	9500.	12.	30.	630.	27500.	10.	830.	10700.	375.	1.	1040.	36.	8.	3.	1700.	62.
G 191	9 656420	6008120	1.0	0.7	2.	5.	2600.	10000.	11.	20.	265.	26500.	10.	1710.	8500.	1000.	1.	890.	24.	6.	2.	1520.	80.
G 192	9 656829	6008289	0.4	0.7	3.	5.	2900.	11000.	10.	15.	330.	18000.	10.	1060.	7800.	450.	1.	1120.	17.	10.	3.	1530.	45.
G 193A	9 657070	6008470	0.4	0.7	2.	5.	2650.	5000.	8.	10.	535.	19500.	10.	730.	3100.	700.	1.	1140.	11.	6.	2.	1320.	45.
G 193B	9 657070	6008470	0.4	0.7	2.	5.	2500.	4000.	5.	8.	500.	16500.	10.	1190.	2100.	250.	1.	1010.	6.	10.	3.	1070.	32.
G 194	9 657130	6008629	0.6	0.9	2.	5.	2200.	11000.	12.	12.	595.	34000.	10.	1950.	9000.	500.	1.	1850.	10.	8.	3.	1320.	62.
G 195	9 657230	6008679	0.4	0.6	3.	5.	2250.	5400.	7.	6.	490.	30000.	10.	2500.	4100.	450.	1.	760.	3.	12.	2.	580.	76.
G 196	9 659260	6010049	0.2	0.4	2.	5.	1800.	2600.	3.	6.	340.	9000.	10.	1040.	780.	125.	1.	810.	5.	8.	2.	520.	17.
G 197	9 659369	6009980	0.6	0.6	2.	5.	2300.	11000.	13.	10.	445.	27500.	10.	1560.	9200.	575.	1.	1060.	8.	8.	2.	1240.	58.
G 198	9 659409	6009840	1.0	1.0	2.	5.	1950.	10000.	19.	25.	490.	30000.	10.	2200.	11300.	775.	1.	840.	17.	12.	2.	760.	65.
G 199	9 659860	6008629	0.4	0.5	2.	5.	2000.	4200.	3.	8.	235.	10500.	10.	4000.	1590.	225.	1.	610.	2.	12.	2.	450.	29.
G 201	9 662849	6004819	1.0	1.0	2.	5.	1650.	13500.	21.	28.	345.	29000.	10.	880.	17900.	525.	1.	520.	84.	22.	5.	940.	68.
G 202	9 663340	6003990	0.6	1.0	2.	5.	3200.	10000.	14.	53.	1035.	37000.	10.	1750.	8200.	250.	3.	770.	35.	10.	3.	1200.	68.
G 203	9 663320	6003120	0.2	0.5	2.	5.	3300.	1800.	3.	3.	595.	13400.	10.	1690.	3600.	450.	1.	660.	2.	8.	2.	650.	45.
G 204	9 662659	6006110	1.2	0.8	2.	5.	2250.	14500.	18.	32.	320.	47000.	10.	3500.	12800.	825.	1.	890.	30.	20.	2.	1030.	73.
G 205	9 662780	6006110	0.6	0.8	2.	5.	2100.	8000.	12.	35.	490.	41000.	10.	1280.	7500.	250.	1.	1280.	18.	14.	2.	770.	55.
G 206	9 663920	6005700	0.8	0.4	2.	5.	2200.	10000.	14.	38.	905.	41000.	10.	690.	8900.	750.	1.	760.	42.	8.	4.	1000.	80.
G 207	9 664100	6005600	0.2	0.6	2.	5.	2150.	14000.	24.	18.	530.	26500.	10.	1030.	15900.	500.	1.	3050.	62.	10.	3.	1110.	75.
G 208	9 664400	6005660	0.4	0.7	2.	5.	2500.	11500.	13.	12.	940.	25500.	10.	770.	14100.	325.	1.	910.	30.	8.	3.	1190.	52.
G 209	9 664890	6005330	0.6	1.0	2.	5.	2200.	10000.	13.	25.	795.	44000.	10.	990.	10600.	1150.	1.	1030.	27.	8.	4.	950.	80.
G 210	9 665400	6005100	0.4	0.7	2.	5.	2150.	12000.	12.	10.	430.	21500.	10.	2050.	11000.	450.	1.	1580.	24.	8.	2.	890.	65.
G 211	9 670190	6003810	0.6	1.0	2.	5.	1350.	14500.	14.	26.	100.	35000.	10.	3700.	14700.	450.	1.	1140.	15.	16.	2.	480.	54.
G 212	9 672670	6005589	0.4	0.9	3.	5.	1850.	8400.	15.	12.	140.	37000.	20.	980.	11400.	775.	1.	1530.	6.	12.	3.	530.	68.
G 213	9 670449	6009470	0.2	0.5	2.	5.	2500.	5000.	8.	18.	595.	27500.	10.	1640.	8500.	500.	2.	670.	11.	10.	2.	760.	88.
G 214	9 668989	6010039	0.4	0.1	2.	5.	1300.	6500.	5.	36.	265.	23000.	10.	860.	4100.	375.	1.	1270.	33.	4.	2.	580.	51.
G 215	9 668619	6010429	0.2	0.6	2.	5.	1650.	7500.	9.	25.	235.	20500.	20.	740.	6700.	300.	1.	1060.	34.	12.	8.	690.	48.
G 216	9 668119	6010870	0.8	0.7	3.	5.	2800.	11500.	13.	42.	595.	41000.	10.	1720.	10300.	750.	2.	880.	13.	12.	3.	820.	122.
G 217	9 667880	6011059	0.4	0.8	2.	5.	2700.	5000.	9.	3.	1055.	32500.	10.	2500.	7600.	1000.	2.	690.	3.	12.	2.	530.	108.
G 218	9 667630	6011100	0.4	1.1	2.	5.	2450.	8500.	17.	18.	430.	38000.	10.	1750.	11900.	600.	2.	820.	30.	10.	2.	1150.	84.
G 219	9 667420	6010960	0.4	1.0	2.	5.	2150.	9000.	15.	8.	40.	47000.	10.	3000.	7500.	875.	1.	850.	7.	10.	2.	1120.	100.
G 220	9 667449	6010840	0.6	0.8	3.	5.	2050.	10000.	15.	6.	20.	39500.	10.	1450.	10200.	750.	1.	1310.	6.	12.	2.	1080.	92.
G 221	9 667229	6010690	0.8	0.4	2.	5.	1700.	7800.	18.	18.	170.	44000.	10.	1340.	11600.	775.	1.	740.	56.	16.	4.	940.	88.
G 222	9 667159	6010500	0.4	0.7	2.	10.	1800.	10500.	12.	15.	550.	30000.	10.	1850.	9300.	525.	2.	890.	27.	10.	2.	770.	100.
G 223	9 666920	6010210	0.6	0.5	3.	5.	1800.	4600.	11.	25.	695.	42000.	10.	2050.	6400.	400.	3.	760.	25.	14.	2.	790.	100.
G 224	9 667060	6009919	0.8	1.1	2.	5.	2200.	13500.	21.	25.	330.	48000.	10.	1490.	10300.	750.	1.	1420.	55.	10.	3.	1220.	100.
G 225	9 667210	6009639	0.8	1.3	2.	5.	1650.	9000.	22.	45.	290.	47000.	10.	1010.	9900.	875.	1.	1590.	92.	16.	3.	990.	122.
G 226	9 667399	6009039	0.6	0.3	2.	5.	2400.	5600.	13.	20.	780.	24000.	10.	1720.	10800.	450.	1.	960.	34.	6.	4.	1010.	75.
G 227	9 666681	6008766	0.4	0.9	2.	5.	1950.	10500.	14.	35.	1060.	44000.	10.	2250.	8200.	500.	1.	1030.	42.	12.	2.	1090.	80.
G 228	9 665600	6008320	0.4	0.7	2.	5.	1900.	7500.	14.	30.	30.	32500.	10.	1090.	5100.	375.	1.	870.	42.	8.	2.	850.	80.
G 229	9 664569	6008879	0.8	0.9	2.	5.	1900.	9500.	18.	22.	340.	37000.	10.	1660.	13100.	525.	1.	990.	40.	8.	2.	710.	108.
G 230	9 663500	6006300	0.3	0.7	2.	5.	1650.	8500.	13.	35.	695.	35000.	10.	1310.	6800.	650.	3.	1040.	18.	12.	4.	830.	100.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	UTM CO-ORD NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
G 293	9 671800	6004100	0.4	0.3	2.	5.	2150.	24000.	10.	20.	90.	15500.	20.	1590.	8000.	1300.	1.	2300.	16.	16.	3.	700.	42.
G 294	9 671570	6004570	0.2	0.1	2.	10.	1850.	12500.	5.	6.	80.	7300.	10.	1000.	3700.	2350.	1.	790.	5.	6.	2.	400.	30.
G 295	9 668310	6003450	2.0	2.2	2.	0.	0.	0.	75.	242.	0.	50000.	10.	0.	0.	1250.	1.	0.	248.	68.	0.	0.	320.
G 296	9 678550	6001400	0.6	1.1	2.	5.	450.	15000.	38.	128.	110.	47000.	60.	1650.	30000.	750.	1.	780.	46.	30.	2.	950.	60.
G 297	9 678740	6000960	0.2	0.5	2.	5.	1950.	9800.	11.	30.	120.	30000.	30.	980.	9800.	250.	1.	2200.	8.	14.	3.	650.	60.
G 298A	9 681450	6005450	0.8	0.9	2.	5.	700.	1100.	6.	12.	85.	9900.	10.	3000.	3100.	200.	1.	230.	27.	14.	2.	100.	55.
G 298B	9 681450	6005450	1.0	1.0	13.	5.	2300.	20100.	20.	35.	530.	37000.	10.	1430.	15900.	575.	1.	670.	39.	26.	2.	1700.	88.
G 300	9 680780	6004800	1.0	0.8	3.	5.	1300.	6700.	10.	63.	270.	22000.	10.	7000.	8400.	575.	1.	590.	12.	16.	2.	450.	55.
G 301	9 680880	6004650	0.8	0.9	2.	5.	2800.	14400.	12.	25.	140.	15000.	10.	4500.	8100.	1050.	1.	2400.	10.	12.	3.	500.	45.
G 302	9 681750	6004320	0.6	1.2	2.	5.	600.	2300.	5.	3.	340.	6600.	10.	9800.	1900.	150.	1.	790.	6.	20.	4.	100.	26.
G 303	9 682580	6004800	1.2	1.9	6.	5.	1100.	9900.	15.	8.	140.	30000.	10.	11000.	8200.	225.	1.	710.	20.	20.	2.	200.	100.
G 304	9 682580	6004750	1.0	1.2	10.	5.	700.	3800.	10.	25.	155.	35000.	20.	8200.	3400.	100.	1.	680.	42.	22.	4.	350.	52.
G 305	9 682580	6004880	0.6	0.9	6.	5.	750.	9700.	9.	8.	160.	11000.	10.	3000.	5600.	300.	1.	340.	45.	12.	2.	100.	73.
G 306	9 682650	6005150	1.6	2.0	6.	10.	2650.	30500.	27.	25.	590.	41000.	10.	1800.	24500.	775.	1.	690.	88.	26.	3.	1300.	96.
G 307	9 681989	6005259	1.6	1.2	3.	5.	500.	3900.	7.	30.	135.	18000.	10.	3300.	7100.	1000.	1.	420.	48.	8.	3.	50.	126.
G 309	9 681939	6005300	0.2	0.5	2.	5.	1150.	1600.	1.	3.	300.	3000.	10.	5200.	800.	225.	1.	340.	3.	24.	3.	155.	23.
G 310	9 681920	6005350	1.4	1.5	6.	5.	3400.	27400.	31.	40.	530.	44000.	10.	1180.	23500.	700.	1.	2600.	90.	20.	2.	2500.	108.
G 312	9 681869	6005420	1.2	1.2	6.	5.	1100.	11700.	11.	22.	260.	20500.	10.	4800.	7500.	450.	1.	530.	41.	16.	2.	100.	73.
G 313	9 681829	6005490	1.2	1.3	2.	5.	1000.	21500.	15.	30.	300.	19500.	10.	5000.	7600.	600.	1.	560.	17.	12.	3.	700.	55.
G 314	9 673850	6008050	0.6	1.1	2.	5.	2250.	16800.	21.	25.	680.	21500.	10.	1250.	9200.	450.	1.	2500.	48.	10.	3.	1650.	92.
G 315	9 672950	6008750	0.6	0.5	2.	5.	2050.	5700.	10.	10.	680.	41000.	10.	1340.	6700.	250.	1.	710.	10.	14.	2.	850.	55.
G 316	9 668380	6009559	0.4	0.4	3.	10.	1200.	14300.	6.	4.	300.	19000.	40.	850.	4500.	250.	1.	1130.	10.	6.	2.	800.	42.
G 317	9 668489	6009360	0.2	0.2	3.	5.	1000.	5600.	12.	4.	155.	30000.	50.	760.	1300.	225.	1.	700.	9.	14.	4.	650.	51.
G 318A	9 668869	6009450	0.2	0.3	2.	5.	950.	10500.	9.	14.	160.	22000.	50.	710.	3900.	375.	1.	1580.	8.	10.	4.	500.	36.
G 318B	9 668864	6009451	0.8	0.6	9.	5.	1000.	13300.	14.	18.	200.	0.	0.	700.	3850.	472.	6.	1490.	15.	10.	4.	550.	46.
G 319	9 669029	6009059	0.2	0.4	25.	5.	1200.	11900.	5.	10.	90.	21500.	500.	430.	3100.	500.	1.	640.	10.	4.	3.	750.	51.
G 320	9 668670	6008860	0.2	0.3	6.	5.	1500.	10300.	8.	10.	160.	18000.	60.	1390.	5200.	700.	3.	870.	14.	10.	5.	900.	42.
G 321	9 653960	6008809	9.0	0.5	3.	5.	900.	3500.	25.	15.	100.	9900.	10.	890.	550.	500.	1.	430.	8.	96.	2.	400.	560.
G 322	9 653710	6008490	0.6	0.3	6.	5.	1650.	5400.	7.	6.	175.	24000.	10.	650.	420.	775.	1.	590.	3.	10.	3.	650.	96.
G 323	9 652750	6008759	0.6	0.6	6.	5.	1200.	5600.	5.	8.	190.	12000.	10.	460.	900.	575.	1.	360.	4.	12.	2.	450.	58.
G 324	9 652820	6008029	1.0	0.9	10.	5.	1400.	3100.	3.	3.	10.	5500.	10.	1130.	1500.	700.	1.	390.	4.	14.	2.	200.	58.
G 325	9 652570	6007829	0.6	0.5	2.	5.	1450.	790.	3.	3.	10.	3000.	10.	1320.	1600.	600.	1.	390.	3.	8.	2.	150.	62.
G 326	9 652360	6007870	0.2	0.7	3.	5.	1150.	3800.	4.	3.	10.	7300.	10.	1550.	450.	575.	1.	410.	4.	10.	4.	150.	29.
G 327	9 652210	6007899	0.4	0.5	2.	5.	1600.	3900.	3.	3.	40.	5500.	10.	2150.	1700.	700.	1.	440.	4.	14.	3.	200.	35.
G 328	9 651880	6007829	1.2	0.9	2.	5.	1200.	25000.	13.	12.	60.	29000.	10.	1240.	6300.	950.	1.	350.	6.	16.	5.	250.	62.
G 329	9 651860	6007370	0.8	0.8	2.	5.	1650.	3800.	14.	10.	115.	41000.	10.	4000.	1700.	775.	1.	710.	7.	16.	2.	400.	144.
G 330	9 651429	6007439	0.2	0.7	2.	5.	800.	1200.	3.	3.	65.	15500.	10.	1130.	420.	125.	1.	490.	3.	6.	3.	300.	23.
G 331	9 651159	6007500	0.4	0.6	2.	5.	1900.	6700.	9.	6.	135.	19500.	10.	1900.	650.	775.	1.	580.	4.	6.	3.	500.	55.
G 332	9 650909	6007660	1.2	2.7	2.	5.	1650.	3600.	2.	3.	40.	15000.	10.	1550.	500.	250.	1.	460.	2.	86.	2.	450.	154.
G 332B	9 650900	6007660	0.6	0.4	3.	0.	1470.	2380.	4.	6.	135.	12000.	10.	750.	0.	200.	1.	410.	4.	8.	0.	390.	29.
G 333	9 651710	6006589	2.0	0.6	3.	5.	1600.	2900.	9.	6.	190.	27500.	10.	1350.	620.	1150.	1.	490.	3.	12.	2.	450.	100.
G 334	9 653210	6007480	0.8	0.5	6.	5.	1550.	2500.	3.	8.	210.	12000.	10.	3000.	3700.	300.	1.	560.	6.	8.	3.	200.	29.
G 335	9 653190	6007329	1.6	1.0	2.	5.	600.	7300.	17.	20.	150.	39500.	10.	11200.	3900.	500.	1.	690.	8.	16.	2.	300.	154.
G 338	9 653090	6005079	1.8	1.0	3.	5.	1500.	26800.	12.	8.	180.	19500.	10.	3200.	6600.	1000.	1.	510.	10.	34.	3.	500.	96.
G 339	9 652739	6005089	1.2	0.9	2.	5.	2100.	18800.	6.	6.	55.	24000.	10.	2450.	1300.	500.	1.	550.	6.	20.	2.	550.	277.
G 340	9 652539	6004879	1.2	1.2	2.	5.	1700.	17900.	8.	6.	45.	27500.	10.	1450.	2400.	700.	1.	620.	7.	22.	5.	450.	300.
G 341	9 652170	6004800	1.2	0.5	3.	5.	1850.	11300.	9.	6.	120.	21500.	10.	1400.	2100.	500.	1.	610.	5.	16.	2.	450.	100.
G 342	9 651710	6004600	0.6	0.7	3.	5.	2000.	6900.	6.	6.	350.	19500.	10.	1750.	1900.	600.	1.	450.	5.	18.	3.	450.	48.
G 343	9 651880	6004529	1.0	1.0	4.	5.	1350.	11200.	11.	18.	98.	37000.	20.	910.	2300.	750.	1.	490.	9.	24.	2.	200.	96.
G 344	9 652250	6004259	1.0	0.9	2.	5.	2100.	19500.	8.	6.	65.	19000.	20.	1260.	2500.	775.	1.	470.	7.	16.	6.	400.	100.
G 346	9 653309	6004029	0.8	1.0	2.	5.	1300.	17500.	10.	10.	50.	26500.	10.	1850.	4600.	700.	1.	500.	8.	12.	3.	500.	55.
G 347	9 653590	6004019	1.0	1.1	3.	5.	1400.	22500.	11.	12.	120.	26500.	20.	1700.	4300.	700.	1.	580.	8.	14.	3.	400.	68.
G 348	9 654829	5999590	0.4	0.9	3.	5.	2400.	7900.	11.	32.	560.	20500.	20.	3100.	5000.	600.	1.	740.	18.	16.	4.	1650.	96.
G 349	9 654710	5999229	0.4	0.7	3.	5.	2950.	4900.	10.	3.	360.	22000.	30.	640.	5200.	650.	1.	430.	2.	12.	3.	1450.	133.
G 350	9 654489	5999020	0.2	0.8	2.	5.	2700.	6300.	5.	3.	500.	9900.	40.	790.	2300.	650.	1.	720.	3.	8.	4.	1300.	58.
G 351	9 654269	5998770	0.2	0.8	2.	5.	3500.	4800.	5.	3.	515.	18000.	20.	1250.	3600.	325.	1.	450.	3.	12.	3.	1600.	68.
G 352	9 654070	5998430	0.4	0.9	3.	5.	3400.	5700.	6.	3.	560.	19000.	20.	1800.	4700.	450.	1.	770.	2.	10.	2.	1500.	92.
G 353	9 653650	5998640	0.8	0.8	2.	5.	2700.	13200.	10.	18.	840.	23000.	10.	1250.	5700.	300.	1.	2200.	6.	14.	3.	2100.	58.
G 355	9 673600	6008660	0.6	0.8	2.	5.	2000.	5900.	8.	15.	160.	18000.	10.	1390.	6900.	300.	1.	790.	9.	8.	2.	800.	58.
G 356	9 673670	6009159	0.6	0.8	2.	5.	2350.	6700.	11.	10.	670.	13400.	10.	5500.	4000.	200.	1.	780.	21.	10.	3.	1250.	65.
G 357A	9 673720	6009100	0.4	1.0	2.	5.	1850.	7100.	11.	25.	620.	19500.	10.	1750.	9800.	225.	1.	1020.	20.	10.	3.	1100.	73.
G 357B	9 673720	6009100	0.6	0.8	6.	5.	1300.	15000.	16.	22.	660.	23000.	10.	1300.	12900.	225.	1.	4100.	71.	6.	3.	1100.	52.
G 359	9 674000	6009280	0.4	0.8	2.	5.	1400.	16000.	11.	30.	500.	15000.	10.	1460.	9400.	225.	1.	4700.	20.	6.	2.	1350.	35.
G 360	9 673380	6009900	0.6	0.8	2.	5.	1550.	15200.	19.	12.	645.	18000.	10.	1190.	15600.	400.	1.	2600.	58.	8.	3.	1000.	76.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE	UTM CO-ORD			CHEMICAL ELEMENTS																				
NO.		EAST	NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
NAD 49	9	648150	5995300	0.2	0.6	2.	0.	0.	0.	1.	2.	0.	3500.	180.	0.	0.	20.	1.	0.	2.	86.	0.	0.	8.
NAD 50A	9	647800	5995350	1.4	1.3	79.	10.	600.	420.	8.	30.	305.	8000.	100.	1800.	260.	20.	3.	240.	4.	76.	3.	250.	380.
NAD 50B	9	647800	5995350	38.0	0.5	12.	0.	575.	100.	10.	35.	350.	17000.	100.	900.	0.	50.	1.	200.	4.	910.	0.	147.	1000.
NAD 51A	9	648390	5995500	0.4	1.1	2.	10.	1750.	12800.	11.	16.	345.	30000.	40.	1220.	6900.	1240.	1.	640.	6.	28.	3.	600.	120.
NAD 51B	9	648390	5995500	0.2	0.8	2.	0.	1850.	10000.	12.	8.	370.	30000.	10.	500.	0.	650.	1.	450.	4.	16.	0.	508.	88.
NAD 55	9	648900	5995650	1.0	0.7	4.	0.	0.	0.	12.	14.	0.	31000.	40.	0.	0.	940.	2.	0.	5.	10.	0.	0.	160.
NAD 56A	9	649000	5995650	1.0	0.7	2.	5.	2650.	19000.	10.	12.	880.	29000.	30.	3600.	12700.	1200.	1.	1120.	5.	10.	4.	1050.	108.
NAD 56B	9	649000	5995650	0.8	0.8	2.	0.	2550.	18500.	18.	73.	600.	39500.	10.	2700.	0.	400.	1.	840.	23.	16.	0.	700.	55.
NAD 58	9	649050	5995780	0.6	0.7	2.	0.	0.	0.	11.	14.	0.	29500.	10.	0.	0.	700.	1.	0.	5.	10.	0.	0.	80.
NAD 59	9	648780	5995980	1.0	1.3	2.	0.	0.	0.	6.	10.	0.	19000.	50.	0.	0.	800.	1.	0.	7.	28.	0.	0.	144.
NAD 61	9	648700	5996630	0.6	0.8	2.	0.	0.	0.	8.	14.	0.	24500.	50.	0.	0.	1500.	1.	0.	5.	8.	0.	0.	128.
NAD 62A	9	648810	5996780	1.2	1.0	2.	15.	1200.	38000.	10.	6.	300.	20000.	20.	1700.	9200.	1040.	1.	460.	7.	18.	5.	300.	100.
NAD 62B	9	648810	5996780	0.8	1.1	2.	0.	1725.	38000.	11.	6.	320.	15500.	10.	750.	0.	700.	1.	380.	5.	14.	0.	250.	68.
NAD 63A	9	648500	5996950	0.8	0.9	2.	10.	1500.	23000.	6.	6.	485.	30000.	20.	1800.	1300.	1600.	1.	470.	5.	14.	2.	300.	88.
NAD 63B	9	648500	5996950	0.4	0.9	3.	0.	2000.	23200.	4.	6.	540.	19000.	10.	760.	0.	1250.	1.	330.	4.	10.	0.	248.	62.
NAD 64A	9	648500	5997250	1.0	0.7	38.	5.	2000.	1250.	8.	4.	250.	25000.	30.	4000.	450.	1000.	1.	710.	5.	14.	2.	200.	116.
NAD 64B	9	648500	5997250	0.2	0.8	5.	0.	2575.	800.	5.	18.	150.	22000.	10.	2480.	0.	50.	5.	570.	4.	12.	0.	165.	26.
NAD 65	9	648750	5997250	1.1	0.8	1.	10.	1350.	18400.	16.	38.	447.	0.	0.	2100.	3200.	575.	5.	630.	22.	18.	2.	245.	82.
NAD 66	9	648750	5997450	0.2	0.7	10.	15.	1400.	750.	8.	12.	185.	15000.	10.	2400.	500.	150.	1.	600.	4.	8.	7.	1450.	23.
NAD 67	9	648550	5997500	1.4	0.6	2.	100.	2150.	15500.	7.	10.	442.	27000.	30.	2600.	2400.	600.	1.	690.	5.	12.	8.	740.	100.
NAD 69	9	648250	5997000	0.6	0.8	2.	0.	0.	0.	10.	12.	0.	32000.	40.	0.	0.	800.	1.	0.	6.	8.	0.	0.	92.
NAD 70	9	648350	5995900	1.0	0.9	4.	0.	0.	0.	12.	14.	0.	33000.	40.	0.	0.	1300.	1.	0.	6.	20.	0.	0.	140.
NAD 71A	9	648910	5995500	2.4	1.2	2.	10.	1200.	6500.	10.	4.	730.	30000.	80.	10800.	1800.	2200.	1.	190.	5.	18.	3.	125.	400.
NAD 71B	9	648910	5995500	0.4	0.8	10.	0.	1525.	4200.	14.	6.	1030.	19500.	30.	6400.	0.	3125.	1.	130.	4.	18.	0.	96.	213.
NAD 72A	9	648950	5995550	1.4	1.9	8.	5.	950.	34000.	13.	10.	210.	22000.	30.	10000.	1900.	6000.	1.	190.	4.	40.	3.	150.	188.
NAD 72B	9	648950	5995550	1.2	1.2	2.	0.	825.	36000.	8.	3.	290.	15500.	10.	6050.	0.	2975.	4.	120.	5.	26.	0.	154.	100.
NAD 73	9	649080	5995650	0.8	0.7	2.	0.	0.	0.	11.	10.	0.	24500.	30.	0.	0.	1060.	1.	0.	6.	12.	0.	0.	180.
NAD 74	9	648600	5995100	1.6	1.5	31.	0.	0.	0.	11.	22.	0.	24000.	40.	0.	0.	1520.	1.	0.	5.	90.	0.	0.	144.
NAD 75	9	648690	5995270	1.0	1.0	2.	0.	0.	0.	16.	34.	0.	30500.	40.	0.	0.	940.	2.	0.	13.	20.	0.	0.	104.
NAD 76	9	648900	5995240	1.0	1.1	38.	0.	0.	0.	15.	18.	0.	33000.	30.	0.	0.	1100.	2.	0.	8.	36.	0.	0.	104.
NAD 80	9	649200	5994890	1.2	1.0	2.	0.	0.	0.	12.	14.	0.	32500.	20.	0.	0.	1120.	1.	0.	7.	40.	0.	0.	92.
NAD 81A	9	649920	5994900	1.0	1.0	2.	15.	1300.	15500.	15.	20.	460.	32000.	10.	1800.	39000.	1600.	1.	1750.	8.	30.	8.	550.	144.
NAD 81B	9	649920	5994900	1.0	0.9	5.	0.	1500.	15000.	33.	38.	635.	5000.	20.	900.	0.	825.	2.	950.	90.	22.	0.	450.	213.
NAD 84	9	649200	5995750	1.0	1.0	2.	0.	0.	0.	12.	16.	0.	31000.	30.	0.	0.	880.	1.	0.	6.	16.	0.	0.	144.
NAD 85A	9	649240	5995340	1.4	1.1	2.	5.	1700.	10400.	12.	8.	140.	24000.	20.	1200.	5600.	1720.	1.	1600.	9.	16.	2.	450.	144.
NAD 85B	9	649240	5995340	0.2	0.5	3.	0.	1250.	6000.	9.	12.	240.	26500.	20.	800.	0.	700.	1.	1250.	6.	8.	0.	510.	52.
NAD 86A	9	649250	5995100	0.2	1.2	2.	5.	1250.	32000.	3.	6.	200.	7500.	30.	1900.	14800.	80.	2.	2500.	3.	20.	3.	550.	8.
NAD 86B	9	649250	5995100	1.2	1.0	2.	0.	1180.	34000.	21.	32.	390.	38000.	10.	1050.	0.	1450.	3.	1330.	9.	24.	0.	590.	35.
NAD 87A	9	649420	5995400	1.6	0.5	2.	5.	2050.	24000.	10.	14.	150.	30000.	20.	4200.	1500.	700.	1.	240.	6.	10.	7.	225.	64.
NAD 87B	9	649420	5995400	0.6	1.0	2.	0.	1900.	21500.	7.	6.	280.	18000.	10.	3040.	0.	2000.	1.	180.	5.	20.	0.	265.	80.
NAD 88	9	649450	5995240	1.4	0.9	2.	0.	0.	0.	13.	18.	0.	31000.	30.	0.	0.	1160.	1.	0.	7.	18.	0.	0.	100.
NAD 90	9	649300	5995330	1.8	0.7	2.	0.	0.	0.	10.	18.	0.	32000.	50.	0.	0.	540.	1.	0.	8.	8.	0.	0.	68.
NAD 91	9	649600	5995460	0.8	0.8	2.	0.	0.	0.	13.	18.	0.	35000.	30.	0.	0.	760.	1.	0.	8.	16.	0.	0.	60.
NAD 92	9	649450	5994950	1.6	1.1	2.	5.	750.	2000.	10.	20.	481.	26000.	40.	8000.	700.	3500.	1.	180.	8.	24.	3.	270.	200.
NAD 93A	9	649620	5994900	7.0	5.0	76.	5.	900.	480.	12.	430.	30.	18000.	60.	8200.	600.	180.	1.	170.	5.	20.	5.	25.	975.
NAD 93B	9	649620	5994900	3.0	2.7	22.	0.	1350.	480.	14.	130.	290.	4000.	20.	5150.	0.	100.	3.	100.	5.	20.	0.	30.	490.
NAD 94A	9	649500	5994830	1.2	0.7	2.	140.	1300.	2700.	10.	14.	20.	34000.	40.	6800.	650.	940.	1.	210.	5.	10.	6.	100.	76.
NAD 94B	9	649500	5994830	250.0	13.2	183.	0.	1300.	1580.	30.	308.	900.	27500.	360.	2900.	0.	125.	63.	110.	7.	210.	0.	78.	23000.
NAD 95A	9	649400	5994780	1.2	0.9	2.	5.	1600.	19000.	16.	6.	590.	29000.	40.	7100.	7400.	6300.	1.	180.	8.	16.	3.	200.	224.
NAD 95B	9	649400	5994780	1.6	1.0	5.	0.	1260.	20000.	7.	6.	1025.	34000.	20.	5050.	0.	9500.	3.	100.	7.	16.	0.	110.	340.
NAD 96	9	649550	5994050	0.2	1.9	2.	40.	1450.	520.	1.	3.	830.	2000.	20.	8900.	1300.	100.	4.	400.	1.	124.	2.	200.	45.
NAD 97A	9	649800	5994230	0.2	0.5	2.	10.	2350.	430.	2.	8.	310.	4000.	50.	6600.	850.	60.	1.	290.	3.	10.	2.	150.	12.
NAD 97B	9	649800	5994230	0.2	5.3	2.	0.	1720.	250.	2.	3.	310.	5500.	800.	2960.	0.	100.	1.	190.	2.	410.	0.	200.	20.
NAD 98A	9	650210	5994780	0.4	0.4	4.	5.	700.	300.	1.	8.	30.	25000.	50.	4000.	500.	40.	1.	230.	2.	8.	2.	150.	16.
NAD 98B	9	650210	5994780	0.2	0.5	50.	0.	750.	300.	1.	3.	495.	3000.	70.	7300.	0.	50.	1.	310.	1.	14.	0.	135.	11.
NAD 99A	9	650050	5994780	1.6	8.4	240.	180.	3850.	500.	12.	710.	10.	29500.	100.	2000.	400.	60.	1.	160.	6.	18.	10.	75.	204.
NAD 99B	9	650050	5994780	58.0	15.0	41.	0.	4600.	320.	9.	118.	220.	6600.	210.	1890.	0.	100.	1.	110.	3.	20.	0.	57.	10000.
NAD100	9	650240	5993750	1.2	0.9	4.	5.	1500.	15000.	11.	16.	218.	31000.	40.	1600.	3400.	860.	1.	800.	7.	10.	12.	450.	136.
NAD101	9	649910	5993760	0.2	0.3	1.	5.	350.	1700.	4.	6.	126.	0.	0.	1700.	900.	30.	4.	860.	11.	6.	5.	55.	21.
NAD102	9	649990	5994680	50.0	3.5	34.	0.	0.	0.	10.	46.	0.	22000.	10.	0.	0.	3200.	1.	0.	6.	30.	0.	0.	8400.
NAD103A	9	649800	5994700	8.4	1.3	34.	45.	900.	1800.	11.	34.	60.	29500.	10.	3100.	200.	5100.	1.	160.	5.	32.	2.	75.	1188.
NAD103B	9	649800	5994700	10.2	44.0	1925.	0.	980.	1000.	17.	64500.	225.	38000.	500.	1400.	0.	50.	2.	60.	7.	520.	0.	52.	3500.
NAD104A	9	649750	5994700	7.0	1.2	4.	5.	1750.	17000.	14.	22.	80.	35000.	30.	4100.	9000.	4000.	3.	580.	7.	26.	2.	325.	1100.
NAD104B	9	649750	5994700	7.4	1.3	26.	0.	1920.	14400.	11.	180.	335.	35000.	10.	2200.	0.	5250.	1.	700.	8.	16.	0.	350.	730.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD	EAST	NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
NAD167B	9	650100	5996150	1.6	0.7	36.	0.	460.	6180.	8.	6.	415.	29000.	100.	6450.	0.	12500.	1.	110.	4.	14.	0.	30.	690.
NAD168	9	650180	5996180	0.6	1.2	3.	2400.	180.	750.	15.	4.	8.	31500.	40.	700.	400.	3800.	1.	130.	11.	26.	6.	65.	88.
NAD169	9	650090	5996190	3.0	1.2	2.	0.	0.	0.	21.	30.	0.	50000.	30.	0.	0.	1360.	1.	0.	12.	74.	0.	0.	200.
NAD170	9	650150	5996050	0.6	0.9	2.	0.	0.	0.	15.	10.	0.	41000.	50.	0.	0.	400.	1.	0.	8.	12.	0.	0.	96.
NAD171	9	650200	5995980	3.2	1.4	2.	0.	0.	0.	17.	8.	0.	50000.	70.	0.	0.	4000.	1.	0.	9.	28.	0.	0.	840.
NAD174	9	651230	5992600	0.8	0.5	2.	5.	2150.	18000.	25.	26.	587.	46000.	50.	3400.	11000.	1040.	1.	4600.	45.	18.	9.	1225.	88.
NAD175	9	650990	5992600	1.1	0.6	1.	5.	1850.	13500.	20.	38.	643.	0.	0.	1700.	6800.	300.	4.	4000.	32.	59.	5.	950.	105.
NAD177	9	650200	5991250	0.2	0.5	2.	5.	2550.	14000.	18.	16.	720.	32500.	50.	1500.	11600.	1600.	1.	2300.	13.	16.	2.	1420.	55.
NAD178	9	650700	5992080	0.2	0.5	2.	0.	0.	0.	13.	14.	0.	23000.	60.	0.	0.	350.	1.	0.	30.	10.	0.	0.	55.
NAD180A	9	651200	5997300	0.4	0.6	2.	5.	1600.	16000.	6.	6.	220.	13400.	40.	4600.	1100.	480.	1.	520.	4.	20.	3.	300.	26.
NAD180B	9	651200	5997300	0.2	0.6	3.	0.	1500.	11200.	4.	3.	260.	9000.	10.	2800.	0.	775.	3.	500.	3.	12.	0.	272.	42.
NAD181A	9	651150	5997600	1.0	0.7	3.	5.	2250.	22500.	18.	12.	360.	42000.	40.	1700.	2200.	1240.	1.	1460.	9.	18.	2.	750.	45.
NAD181B	9	651150	5997600	0.8	0.8	3.	0.	2250.	20500.	12.	8.	355.	34000.	10.	800.	0.	1300.	1.	830.	4.	14.	0.	720.	80.
NAD182	9	651000	5997750	1.0	0.5	2.	0.	0.	0.	6.	8.	0.	16500.	30.	0.	0.	800.	1.	0.	5.	16.	0.	0.	140.
NAD183	9	651150	5997950	0.2	0.3	1.	5.	450.	1400.	5.	8.	150.	0.	0.	3800.	400.	88.	2.	1380.	8.	12.	2.	105.	14.
NAD184	9	650750	5998380	1.4	0.6	7.	5.	1800.	9500.	8.	8.	45.	24000.	10.	2000.	1300.	1500.	1.	1060.	5.	12.	4.	400.	154.
NAD185A	9	650100	5998450	0.8	0.5	6.	5.	1800.	9200.	13.	8.	10.	35000.	50.	2000.	1200.	1200.	1.	780.	13.	24.	2.	400.	154.
NAD185B	9	650100	5998450	0.4	0.6	5.	0.	2000.	6650.	6.	6.	285.	21500.	10.	1200.	0.	1300.	1.	700.	5.	22.	0.	462.	187.
NAD186A	9	650350	5998150	0.4	0.4	6.	5.	1950.	13800.	15.	14.	295.	41000.	40.	2100.	1900.	1800.	1.	600.	7.	10.	2.	500.	84.
NAD186B	9	650350	5998150	0.2	0.5	12.	0.	2150.	8650.	9.	10.	290.	23000.	20.	1070.	0.	1050.	1.	390.	4.	10.	0.	510.	62.
NAD187	9	650400	5996550	0.8	1.1	3.	0.	0.	0.	18.	24.	0.	44000.	30.	0.	0.	1200.	1.	0.	13.	100.	0.	0.	48.
NAD190A	9	649450	5994250	0.2	2.4	36.	5.	1200.	630.	5.	6.	790.	15500.	50.	4800.	300.	160.	4.	180.	5.	22.	2.	50.	11.
NAD190B	9	649450	5994250	0.2	1.4	5.	0.	1720.	180.	1.	6.	295.	5000.	170.	2870.	0.	100.	1.	110.	2.	340.	0.	48.	76.
NAD200	9	647650	5991210	0.2	0.5	2.	5.	1800.	15000.	5.	12.	10.	23000.	10.	1760.	1300.	700.	1.	840.	4.	12.	2.	550.	48.
NAD201	9	647810	5991190	0.6	0.7	2.	5.	2350.	30000.	7.	10.	10.	24000.	10.	2200.	3600.	2500.	1.	840.	4.	16.	5.	700.	58.
NAD202	9	648350	5992000	0.6	0.7	2.	5.	1650.	14600.	9.	6.	380.	32500.	10.	780.	4900.	925.	1.	1480.	4.	8.	2.	700.	88.
NAD203	9	648500	5992210	1.2	0.6	2.	5.	2050.	21000.	11.	25.	340.	24000.	10.	2000.	17200.	2050.	1.	800.	6.	34.	2.	600.	96.
NAD204	9	648450	5992500	1.0	0.6	1.	5.	1900.	17500.	16.	26.	233.	0.	0.	1800.	11400.	1340.	4.	1380.	21.	17.	2.	780.	61.
NAD205	9	648400	5992990	1.0	0.9	2.	10.	1250.	19000.	7.	6.	380.	19500.	20.	3600.	2600.	1100.	1.	640.	5.	30.	2.	250.	360.
OL 1	9	647329	6000160	0.4	0.4	2.	5.	1150.	11400.	9.	8.	170.	19500.	10.	1090.	1900.	575.	1.	310.	4.	10.	2.	300.	55.
OL 3	9	647829	6000600	0.2	0.2	3.	10.	1800.	15900.	9.	8.	225.	19500.	10.	810.	2200.	525.	1.	380.	5.	12.	2.	500.	58.
OL 5A	9	648269	5999979	0.4	0.4	3.	5.	1800.	15200.	8.	6.	220.	17000.	10.	820.	1700.	575.	1.	470.	5.	10.	2.	550.	76.
OL 5B	9	648280	5999979	42.0	4.1	60.	5.	1650.	32500.	19.	68.	135.	44000.	310.	740.	4600.	2050.	1.	280.	14.	740.	3.	300.	6700.
OL 6	9	648800	6000150	1.8	0.6	3.	5.	1800.	11700.	10.	8.	170.	30000.	10.	1250.	1200.	1400.	1.	290.	6.	30.	2.	350.	425.
OL 8A	9	649409	6000399	3.0	1.2	10.	0.	1600.	17900.	9.	6.	150.	41000.	20.	1160.	2200.	1000.	1.	450.	8.	102.	0.	450.	2000.
OL 8B	9	649409	6000399	148.0	1.4	68.	5.	1750.	24000.	27.	38.	222.	50000.	450.	670.	2500.	2250.	2.	370.	13.	3900.	2.	350.	6700.
OL 10	9	649880	6000859	10.8	0.9	5.	10.	1800.	6100.	9.	6.	170.	32500.	20.	1350.	1300.	1050.	1.	410.	6.	30.	4.	300.	630.
OL 11	9	649840	6001120	1.8	0.7	5.	5.	1750.	16800.	9.	6.	190.	21500.	10.	1700.	1000.	1100.	1.	460.	6.	18.	2.	450.	122.
OL 13	9	648880	6000960	0.8	0.7	2.	5.	1400.	2500.	8.	6.	10.	21500.	20.	1250.	400.	650.	1.	340.	4.	22.	2.	500.	48.
OL 15	9	648349	6001290	2.0	0.8	3.	5.	1350.	4000.	7.	10.	310.	24000.	10.	1120.	900.	575.	1.	380.	4.	12.	2.	300.	84.
OL 16	9	647780	6001459	0.6	0.3	2.	10.	1350.	5900.	11.	12.	395.	19500.	20.	950.	14700.	700.	1.	570.	8.	8.	3.	650.	45.
OL 19	9	646940	6001459	0.6	0.4	2.	5.	1400.	3900.	10.	6.	220.	25500.	10.	1550.	1900.	775.	1.	330.	5.	8.	2.	250.	122.
OL 20	9	646710	6001209	1.4	0.7	2.	10.	1050.	10000.	11.	18.	300.	47000.	10.	960.	4300.	750.	1.	360.	10.	18.	2.	500.	80.
OL 21A	9	646599	6001030	0.6	0.9	2.	5.	900.	32100.	11.	6.	370.	17000.	10.	1110.	10200.	1000.	3.	320.	6.	8.	5.	500.	88.
OL 21B	9	646599	6001030	1.4	0.9	3.	5.	2000.	20800.	10.	18.	440.	32500.	10.	1400.	4400.	1350.	1.	430.	10.	18.	4.	420.	55.
OL 23	9	646210	6000670	0.2	0.3	2.	15.	1900.	2600.	6.	6.	225.	17000.	10.	930.	1000.	375.	1.	390.	4.	4.	3.	900.	48.
OL 24	9	646079	6000240	1.0	0.7	2.	5.	450.	19800.	20.	38.	1000.	24000.	10.	1350.	17200.	525.	1.	650.	37.	12.	6.	100.	55.
OL 25A	9	645528	6000073	0.2	0.2	2.	0.	1650.	750.	1.	6.	220.	4500.	10.	950.	650.	200.	1.	370.	3.	12.	0.	450.	55.
OL 25B	9	645528	6000073	1.6	0.5	2.	5.	2700.	17900.	13.	8.	470.	44000.	10.	1400.	11000.	1500.	1.	530.	8.	14.	2.	620.	160.
OL 28A	9	650789	5999409	1.2	0.7	7.	0.	950.	17000.	12.	8.	285.	16500.	10.	1250.	6300.	775.	1.	390.	6.	26.	0.	350.	73.
OL 28B	9	650944	5999829	1.2	0.4	1.	0.	1720.	20600.	13.	15.	290.	0.	0.	570.	0.	1060.	2.	490.	8.	42.	0.	440.	115.
OL 30	9	650690	6000440	1.8	1.1	3.	10.	950.	43700.	13.	6.	240.	19500.	10.	1150.	29500.	1100.	1.	350.	12.	24.	2.	350.	55.
OL 31	9	650489	6000880	0.6	0.4	5.	5.	1950.	6600.	10.	25.	560.	24000.	10.	2400.	7800.	325.	1.	720.	16.	8.	2.	850.	73.
OL 32	9	650619	6001019	1.2	0.4	5.	5.	1350.	7500.	9.	6.	320.	38000.	10.	1450.	1900.	775.	1.	510.	18.	20.	2.	400.	213.
OL 33	9	650269	6001469	0.6	0.6	53.	5.	1150.	4300.	12.	20.	355.	30000.	10.	890.	1000.	950.	1.	530.	16.	14.	2.	450.	88.
OL 34	9	650119	6001629	0.4	0.4	36.	5.	1400.	2900.	8.	20.	590.	19500.	30.	1400.	650.	950.	1.	380.	14.	6.	3.	350.	55.
OL 36	9	650199	6002090	1.6	1.0	5.	0.	0.	0.	13.	12.	0.	37000.	10.	0.	0.	1450.	1.	0.	10.	12.	0.	0.	52.
OL 37	9	650190	6002219	1.2	0.7	2.	10.	1100.	15500.	11.	10.	290.	27500.	10.	1200.	6200.	700.	1.	2800.	9.	6.	2.	500.	62.
OL 38	9	650230	6002490	1.2	0.6	2.	5.	1500.	13500.	21.	35.	645.	44000.	10.	2500.	10400.	250.	1.	1880.	28.	10.	2.	950.	62.
OL 39	9	650203	6002085	1.6	1.0	5.	5.	1150.	28200.	13.	12.	340.	37000.	10.	6000.	8500.	1450.	1.	490.	10.	12.	3.	400.	52.
OL 40	9	650860	6001760	1.0	0.7	10.	10.	1300.	13300.	10.	8.	190.	32500.	10.	2400.	1500.	875.	1.	600.	6.	6.	2.	350.	80.
OL 41	9	650789	6000689	1.8	0.6	5.	5.	900.	23000.	13.	18.	168.	27500.	10.	1500.	3700.	600.	1.	310.	8.	10.	3.	300.	68.
OL 43	9	651099	6000440	1.0	0.7	5.	5.	950.	18900.	18.	10.	560.	25500.	10.	1080.	5400.	875.	1.	320.	7.	8.	2.	350.	35.
OL 44	9	651840	5999479	2.6	0.8	3.	5.	3300.	14600.	15.	25.	1120.	47000.	20.	4000.	5900.	1250.	1.	550.	30.	22.	2.	700.	234.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	UTM CO-ORD NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
			CHEMICAL ELEMENTS																				
OL 111	9 648449	6003759	0.6	0.7	2.	10.	1900.	10300.	7.	10.	280.	18000.	10.	730.	3200.	750.	1.	480.	8.	8.	2.	400.	92.
OL 112A	9 644920	6001010	1.0	0.8	2.	5.	1450.	16500.	8.	12.	245.	32500.	10.	2450.	2500.	1200.	1.	460.	7.	10.	3.	350.	80.
OL 112B	9 644929	6001019	0.2	0.4	3.	10.	1950.	13900.	5.	12.	190.	21500.	10.	2100.	1800.	500.	1.	600.	5.	2.	3.	400.	23.
OL 113	9 645730	6004860	0.2	0.5	2.	10.	400.	550.	1.	3.	190.	3500.	10.	2300.	380.	125.	1.	300.	2.	6.	2.	50.	20.
OL 114	9 645900	6005069	0.2	0.6	2.	5.	550.	480.	2.	3.	192.	3000.	20.	2500.	360.	200.	1.	320.	2.	8.	2.	50.	17.
OL 115A	9 646599	6005379	0.2	0.6	2.	5.	400.	600.	1.	3.	180.	3000.	10.	2450.	320.	200.	1.	410.	8.	8.	2.	50.	17.
OL 115B	9 646590	6005379	0.2	0.3	2.	5.	500.	590.	1.	3.	205.	2000.	10.	2700.	580.	225.	1.	420.	6.	14.	2.	50.	23.
OL 116	9 647050	6005750	0.8	0.8	2.	5.	400.	13900.	10.	18.	185.	30000.	10.	980.	8500.	700.	1.	520.	8.	14.	3.	200.	52.
OL 117	9 647780	6005550	0.6	0.5	2.	5.	1250.	20000.	7.	12.	290.	13400.	10.	1550.	7300.	450.	1.	430.	8.	8.	2.	200.	26.
OL 118	9 648489	6005899	1.0	0.8	2.	5.	3100.	28900.	15.	20.	200.	24000.	10.	1450.	12600.	400.	1.	650.	13.	16.	2.	500.	38.
OL 119A	9 649000	6005040	1.0	1.6	4.	10.	2450.	20500.	15.	20.	298.	37000.	10.	1190.	7200.	500.	1.	490.	11.	14.	2.	500.	100.
OL 119B	9 649000	6005040	0.8	0.6	3.	15.	2300.	15800.	12.	30.	485.	27500.	10.	1800.	12700.	700.	1.	670.	8.	10.	2.	400.	62.
OL 120	9 649909	6005290	1.0	0.7	3.	10.	2000.	27200.	17.	35.	400.	32500.	10.	930.	9400.	525.	2.	460.	12.	14.	3.	300.	104.
OL 121	9 650369	6005620	0.8	0.7	2.	5.	3500.	16900.	8.	6.	160.	26500.	10.	750.	3300.	1100.	1.	470.	6.	8.	2.	400.	58.
OL 122	9 651519	6005769	2.2	0.9	3.	5.	3050.	4300.	9.	8.	170.	25500.	10.	2350.	1400.	1050.	1.	380.	7.	24.	2.	350.	122.
OL 123	9 652159	6006139	1.8	1.0	6.	5.	3100.	18500.	14.	8.	205.	30000.	10.	1850.	2300.	1250.	1.	460.	8.	18.	3.	500.	96.
OL 124	9 640130	6002242	22.0	1.3	2.	10.	400.	11900.	2.	6.	210.	3000.	20.	3100.	420.	575.	1.	370.	3.	56.	6.	100.	710.
OL 125	9 638821	6001795	0.8	1.7	2.	5.	850.	19000.	19.	36.	290.	25500.	10.	540.	14300.	600.	1.	1160.	85.	16.	2.	700.	38.
OL 128	9 638757	6001769	2.7	1.2	2.	5.	600.	19200.	40.	32.	260.	49000.	10.	2200.	33000.	950.	1.	350.	132.	48.	2.	450.	65.
OL 129A	9 638829	6001429	0.8	0.8	2.	20.	3950.	17000.	20.	92.	825.	47000.	10.	4500.	12200.	500.	1.	440.	33.	12.	2.	1000.	88.
OL 129B	9 638823	6001426	0.8	0.4	2.	10.	3400.	7400.	3.	3.	425.	13400.	10.	5000.	3700.	825.	1.	410.	5.	18.	2.	350.	68.
OL 129C	9 638835	6001431	0.6	1.2	3.	15.	1300.	14300.	32.	20.	150.	44000.	10.	850.	32500.	575.	1.	420.	160.	16.	3.	250.	18.
OL 130	9 639009	6001243	2.4	4.9	2.	25.	400.	790.	1.	20.	270.	2000.	30.	2450.	520.	1150.	1.	430.	5.	750.	2.	75.	425.
OL 131	9 639241	6001243	1.8	0.9	2.	5.	1700.	24800.	29.	6.	310.	41000.	10.	1250.	23500.	875.	1.	470.	75.	22.	2.	450.	88.
OL 132	9 639249	6001109	9.0	3.2	60.	15.	350.	10400.	1.	60.	160.	4500.	140.	4000.	850.	5250.	2.	220.	3.	1500.	3.	50.	1600.
OL 133	9 639417	6000487	0.2	2.6	2.	10.	500.	700.	2.	3.	150.	2000.	10.	2500.	430.	50.	1.	290.	1.	16.	2.	50.	20.
OL 134	9 639617	6000899	8.4	2.8	2.	15.	600.	17900.	3.	43.	160.	4000.	30.	4800.	390.	775.	1.	190.	8.	30.	2.	50.	900.
OL 135	9 639561	6000985	0.8	4.2	7.	0.	0.	0.	3.	15.	0.	3500.	20.	0.	0.	100.	1.	0.	3.	38.	0.	0.	171.
OL 137	9 639348	6001233	5.2	1.9	13.	0.	0.	0.	2.	9.	0.	2000.	20.	0.	0.	1050.	1.	0.	3.	12.	0.	0.	750.
OL 138	9 641027	6000901	1.2	1.7	3.	0.	0.	0.	33.	38.	0.	47000.	20.	0.	0.	700.	1.	0.	90.	20.	0.	0.	80.
OL 139	9 640899	6000895	0.8	1.8	2.	0.	0.	0.	23.	138.	0.	42000.	10.	0.	0.	600.	2.	0.	79.	22.	0.	0.	35.
OL 140	9 640674	6000926	1.0	0.8	2.	0.	0.	0.	23.	21.	0.	38000.	10.	0.	0.	575.	1.	0.	90.	16.	0.	0.	58.
OL 141	9 640511	6000824	2.8	1.1	2.	0.	0.	0.	2.	26.	0.	1500.	20.	0.	0.	1350.	1.	0.	4.	132.	0.	0.	226.
OL 142	9 641222	6000645	0.6	0.5	3.	0.	0.	0.	2.	3.	0.	3000.	10.	0.	0.	925.	1.	0.	6.	12.	0.	0.	29.
OL 143A	9 640458	6001001	1.2	1.0	3.	0.	0.	0.	25.	6.	0.	34000.	10.	0.	0.	600.	1.	0.	110.	22.	0.	0.	62.
OL 143B	9 640464	6001003	1.2	1.8	2.	0.	0.	0.	22.	6.	0.	38500.	10.	0.	0.	0.	1.	0.	108.	18.	0.	0.	63.
OL 144	9 639984	6000790	1.2	1.3	4.	0.	0.	0.	30.	50.	0.	44000.	10.	0.	0.	450.	1.	0.	90.	20.	0.	0.	45.
OL 145	9 639792	6001005	1.2	1.2	6.	5.	3700.	11000.	30.	6.	160.	46000.	10.	470.	29000.	750.	1.	520.	110.	18.	2.	800.	86.
OL 146	9 639617	6001344	0.8	1.8	2.	5.	1500.	28250.	27.	6.	312.	50000.	10.	1800.	36500.	700.	1.	730.	132.	140.	2.	650.	111.
OL 147	9 639687	6001524	1.6	1.5	3.	0.	0.	0.	32.	3.	0.	48000.	10.	0.	0.	1000.	1.	0.	90.	24.	0.	0.	73.
OL 148	9 639281	6001561	1.6	1.4	2.	0.	0.	0.	28.	6.	0.	37000.	10.	0.	0.	1350.	1.	0.	90.	22.	0.	0.	168.
OL 149	9 639296	6001773	2.2	2.1	3.	0.	0.	0.	24.	18.	0.	30000.	10.	0.	0.	1300.	1.	0.	85.	30.	0.	0.	68.
OL 150	9 639490	6002017	1.4	1.5	3.	0.	0.	0.	22.	3.	0.	24000.	10.	0.	0.	575.	1.	0.	82.	18.	0.	0.	45.
OL 155	9 640012	6000555	0.4	2.0	10.	10.	620.	1200.	3.	3.	74.	3000.	20.	2000.	370.	150.	1.	620.	4.	34.	3.	95.	45.
OL 156	9 639317	6006111	0.2	1.1	2.	5.	2550.	2900.	4.	3.	178.	10000.	10.	1900.	3900.	300.	1.	290.	4.	4.	4.	250.	24.
OL 157	9 639690	6004813	0.2	0.6	2.	0.	0.	0.	24.	3.	0.	9500.	10.	0.	0.	250.	1.	0.	3.	4.	0.	0.	21.
OL 158A	9 640030	6004139	1.0	1.2	3.	0.	0.	0.	33.	30.	0.	37000.	10.	0.	0.	1000.	1.	0.	150.	26.	0.	0.	76.
OL 158B	9 640036	6004141	0.6	0.9	2.	0.	0.	0.	40.	6.	0.	9500.	10.	0.	0.	300.	1.	0.	4.	4.	0.	0.	18.
OL 159	9 639976	6003972	0.4	0.7	2.	0.	0.	0.	45.	3.	0.	9000.	10.	0.	0.	350.	1.	0.	3.	8.	0.	0.	21.
OL 160A	9 641467	6000631	0.8	1.4	6.	0.	0.	0.	14.	12.	0.	22000.	10.	0.	0.	775.	1.	0.	61.	12.	0.	0.	76.
OL 160B	9 641473	6000633	0.2	0.8	2.	0.	0.	0.	22.	3.	0.	10500.	10.	0.	0.	250.	6.	0.	4.	8.	0.	0.	18.
OL 162	9 639437	6003338	0.2	1.0	2.	0.	0.	0.	28.	60.	0.	10500.	10.	0.	0.	250.	1.	0.	4.	4.	0.	0.	18.
OL 163	9 639084	6003247	0.6	0.7	2.	0.	0.	0.	42.	3.	0.	11000.	10.	0.	0.	350.	7.	0.	4.	8.	0.	0.	24.
OL 164	9 638820	6003288	0.8	0.9	2.	10.	2650.	1300.	44.	210.	610.	9500.	10.	1320.	4000.	350.	63.	310.	4.	8.	2.	250.	27.
OL 170	9 638476	6002680	2.0	2.5	2.	0.	0.	0.	20.	30.	0.	15000.	30.	0.	0.	250.	1.	0.	100.	48.	0.	0.	45.
OL 171	9 638454	6002534	1.0	1.1	8.	0.	0.	0.	16.	6.	0.	8500.	20.	0.	0.	300.	1.	0.	100.	14.	0.	0.	42.
OL 172	9 637973	6002389	1.4	2.0	4.	0.	0.	0.	19.	6.	0.	5000.	10.	0.	0.	325.	1.	0.	34.	34.	0.	0.	26.
OL 173	9 638546	6002394	6.6	2.3	4.	0.	0.	0.	30.	82.	0.	37000.	10.	0.	0.	925.	1.	0.	150.	32.	0.	0.	775.
OL 174	9 645289	6001049	1.0	1.2	4.	0.	0.	0.	10.	10.	0.	18000.	10.	0.	0.	575.	1.	0.	9.	14.	0.	0.	48.
OL 175	9 645840	6001140	1.2	1.2	6.	0.	0.	0.	12.	10.	0.	15500.	20.	0.	0.	700.	1.	0.	8.	18.	0.	0.	55.
OL 177	9 646119	6001510	0.6	1.0	4.	0.	0.	0.	8.	18.	0.	30000.	20.	0.	0.	375.	1.	0.	6.	12.	0.	0.	104.
OL 178A	9 646380	6001629	0.4	1.0	2.	0.	0.	0.	9.	15.	0.	18500.	10.	0.	0.	1050.	1.	0.	6.	6.	0.	0.	24.
OL 178B	9 646380	6001629	0.8	1.3	3.	0.	0.	0.	10.	8.	0.	25500.	20.	0.	0.	575.	1.	0.	7.	14.	0.	0.	68.
OL 179	9 647119	6002169	0.8	1.0	3.	0.	0.	0.	12.	6.	0.	26500.	30.	0.	0.	950.	1.	0.	6.	12.	0.	0.	80.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	UTM CO-ORD NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
OL 256A	9 637416	6001467	1.2	1.2	2.	0.	0.	0.	25.	36.	0.	50000.	10.	0.	0.	900.	1.	0.	60.	14.	0.	0.	84.
OL 256B	9 637422	6001469	0.8	1.0	5.	0.	0.	0.	14.	6.	0.	23500.	10.	0.	0.	400.	1.	0.	38.	18.	0.	0.	60.
OL 257	9 636993	6000319	1.4	1.6	2.	10.	850.	17000.	27.	45.	399.	48000.	20.	110.	28500.	850.	1.	780.	100.	20.	2.	700.	72.
OL 259	9 637365	5999603	1.8	2.2	2.	0.	0.	0.	35.	21.	0.	44500.	10.	0.	0.	500.	6.	0.	160.	22.	0.	0.	75.
OL 260	9 637595	6000520	1.0	1.2	2.	10.	1200.	14600.	15.	9.	254.	35500.	10.	2500.	8300.	350.	2.	680.	46.	14.	2.	230.	93.
OL 261	9 652539	5997279	0.8	0.7	5.	0.	0.	0.	12.	18.	0.	23000.	10.	0.	0.	300.	1.	0.	9.	8.	0.	0.	87.
OL 262	9 653469	5996729	0.6	0.8	2.	0.	0.	0.	7.	3.	0.	30000.	10.	0.	0.	200.	2.	0.	3.	8.	0.	0.	66.
OL 263	9 653670	5996699	0.8	0.7	2.	0.	0.	0.	19.	3.	0.	29500.	10.	0.	0.	400.	1.	0.	4.	10.	0.	0.	94.
OL 265	9 653880	5996720	0.8	0.8	2.	0.	0.	0.	21.	27.	0.	37500.	10.	0.	0.	500.	1.	0.	50.	12.	0.	0.	84.
OL 266	9 653809	5996890	0.8	0.7	2.	0.	0.	0.	14.	27.	0.	33000.	10.	0.	0.	400.	1.	0.	18.	10.	0.	0.	66.
OL 267	9 653750	5997000	0.8	0.7	2.	0.	0.	0.	22.	27.	0.	43500.	10.	0.	0.	450.	1.	0.	21.	10.	0.	0.	108.
OL 268	9 654409	5997350	1.2	0.9	2.	0.	0.	0.	21.	18.	0.	35000.	10.	0.	0.	550.	1.	0.	20.	14.	0.	0.	111.
OL 269	9 654309	5997250	1.2	0.7	2.	0.	0.	0.	26.	24.	0.	42500.	10.	0.	0.	550.	1.	0.	23.	16.	0.	0.	84.
OL 270	9 654519	5997539	1.4	0.8	2.	15.	4050.	13100.	20.	18.	1226.	41000.	10.	2100.	6500.	500.	1.	1300.	9.	10.	3.	1650.	87.
OL 271	9 654710	5997460	1.0	0.8	2.	10.	460.	5900.	7.	6.	340.	20000.	10.	1400.	2300.	600.	1.	500.	4.	10.	2.	1250.	57.
OL 272	9 655019	5997739	0.8	0.5	2.	10.	4200.	7200.	9.	3.	185.	30000.	10.	1390.	4100.	650.	1.	630.	3.	4.	3.	1250.	87.
OL 273	9 655699	5998439	1.4	1.2	2.	5.	2150.	13600.	22.	42.	490.	32000.	10.	1800.	11300.	300.	1.	1550.	65.	16.	2.	1100.	54.
OL 274	9 657030	5998399	0.6	1.0	2.	5.	3700.	6500.	7.	6.	610.	27000.	10.	1700.	6700.	700.	1.	580.	4.	10.	2.	1050.	99.
OL 275	9 657429	5998149	1.0	1.3	2.	5.	3900.	5700.	6.	3.	950.	23000.	10.	1350.	4600.	1000.	1.	440.	5.	8.	2.	1150.	75.
OL 276	9 657480	5998930	0.8	0.7	2.	10.	3950.	7800.	8.	3.	720.	22500.	10.	2000.	6600.	650.	2.	570.	5.	8.	2.	1100.	81.
OL 277	9 649789	5987960	1.0	1.5	2.	5.	1700.	15800.	15.	15.	340.	36500.	10.	470.	5900.	300.	1.	1080.	9.	8.	3.	650.	99.
OL 278	9 649280	5988180	2.4	2.5	2.	5.	4100.	32500.	24.	18.	950.	46000.	10.	5800.	10500.	750.	2.	620.	11.	18.	4.	450.	120.
OL 279	9 649130	5988220	1.6	2.4	2.	5.	900.	24000.	18.	3.	750.	37500.	10.	5000.	8300.	850.	1.	620.	6.	20.	3.	400.	60.
OL 280	9 649190	5988199	3.6	1.9	5.	5.	1050.	28500.	26.	24.	550.	41000.	10.	2800.	4700.	550.	1.	700.	40.	46.	2.	200.	420.
OL 282	9 645849	5987409	1.2	2.0	2.	15.	1800.	19800.	56.	9.	580.	29000.	10.	1900.	7500.	650.	1.	540.	7.	14.	2.	450.	66.
OL 283	9 644329	5986109	0.8	1.4	2.	10.	2100.	5400.	12.	12.	270.	34000.	10.	1800.	12400.	400.	1.	550.	6.	8.	2.	500.	57.
OL 284	9 652380	5992279	1.0	0.8	2.	5.	3050.	9900.	11.	39.	580.	31000.	10.	2100.	5700.	1000.	2.	720.	11.	10.	4.	1000.	181.
OL 285	9 652630	5992189	1.2	0.8	2.	5.	2850.	8700.	12.	24.	1000.	28500.	10.	2200.	6100.	550.	1.	620.	10.	8.	3.	900.	181.
OL 286	9 652659	5992420	1.0	1.4	2.	5.	3200.	6300.	11.	18.	1100.	26000.	10.	2100.	6800.	850.	1.	460.	8.	14.	3.	750.	90.
OL 287	9 652280	5992710	0.8	1.1	2.	5.	3100.	5400.	8.	21.	845.	24500.	10.	1900.	4600.	250.	1.	420.	8.	14.	2.	650.	99.
OL 290	9 639918	6001612	1.8	1.8	2.	5.	600.	21700.	30.	3.	280.	46000.	10.	1900.	41000.	1600.	1.	290.	190.	28.	2.	250.	144.
OL 291	9 640212	6001645	1.4	1.3	2.	5.	500.	21000.	26.	6.	330.	50000.	10.	2600.	23500.	700.	1.	500.	86.	12.	2.	300.	99.
OL 292	9 640323	6001493	0.2	0.7	4.	5.	2450.	1100.	2.	3.	85.	1500.	10.	2300.	790.	150.	2.	360.	3.	14.	2.	100.	14.
OL 293	9 640444	6001351	1.0	0.8	3.	5.	950.	13600.	2.	6.	60.	500.	10.	1900.	590.	650.	1.	210.	3.	94.	2.	50.	55.
OL 297	9 639651	6002488	1.0	0.9	5.	5.	900.	13500.	20.	3.	265.	37000.	10.	18000.	22500.	750.	1.	1080.	58.	14.	2.	1000.	93.
OL 298	9 639561	6002095	0.6	0.7	2.	5.	450.	590.	3.	3.	12.	3000.	10.	1800.	350.	50.	1.	480.	2.	14.	2.	50.	9.
OL 299	9 639603	6002373	0.2	0.9	2.	5.	500.	570.	3.	3.	120.	1000.	10.	1900.	210.	50.	1.	370.	3.	10.	2.	75.	6.
OL 300	9 637360	6005810	1.4	2.8	8.	5.	1300.	55000.	12.	15.	228.	30000.	10.	2800.	7800.	2175.	1.	340.	23.	20.	2.	550.	78.
OL 301	9 637420	6005689	0.4	0.6	5.	10.	3250.	10900.	6.	12.	348.	20500.	10.	1300.	3800.	1150.	1.	580.	18.	10.	2.	450.	51.
OL 303	9 638619	6005589	0.4	0.6	5.	10.	1600.	4800.	2.	3.	25.	19000.	10.	1550.	4000.	525.	1.	280.	5.	10.	2.	300.	45.
OL 304	9 638730	6005480	0.6	1.4	2.	5.	400.	14000.	17.	38.	460.	39000.	10.	1700.	14500.	775.	3.	410.	110.	8.	2.	500.	72.
OL 305	9 638710	6005720	1.0	1.2	2.	10.	500.	16000.	20.	6.	390.	42000.	10.	2000.	23000.	775.	2.	1380.	146.	12.	2.	550.	96.
OL 306	9 638349	6004800	0.4	0.6	2.	5.	500.	6800.	1.	12.	45.	4000.	10.	1900.	750.	125.	1.	1300.	40.	24.	2.	100.	30.
OL 307	9 644119	6003969	0.4	0.7	2.	10.	450.	720.	1.	6.	170.	3500.	10.	1800.	220.	50.	1.	310.	15.	12.	2.	50.	27.
OL 308	9 644050	6004730	0.2	1.3	2.	15.	300.	650.	1.	3.	165.	4000.	10.	1800.	190.	125.	1.	320.	10.	18.	2.	26.	27.
OL 309	9 644559	6003810	0.2	0.7	8.	5.	150.	570.	2.	3.	180.	3000.	60.	1290.	150.	50.	2.	320.	30.	12.	2.	25.	12.
OL 310	9 644769	6004399	0.2	0.3	2.	15.	300.	380.	1.	3.	270.	1000.	140.	1800.	170.	50.	1.	390.	38.	16.	2.	25.	6.
OL 311	9 643544	6003957	1.2	1.2	2.	10.	600.	12000.	28.	18.	165.	35000.	10.	310.	23800.	600.	1.	1260.	100.	16.	2.	500.	62.
OL 312A	9 641491	6001634	1.2	1.2	12.	5.	1050.	1700.	2.	8.	85.	2000.	10.	2000.	320.	325.	1.	390.	4.	40.	3.	50.	104.
OL 312B	9 641497	6001636	1.4	1.6	2.	5.	1300.	18500.	27.	6.	232.	35000.	10.	1800.	25800.	525.	1.	960.	100.	18.	2.	600.	58.
OL 313	9 640853	6001952	0.8	1.1	2.	5.	150.	23000.	35.	32.	228.	50000.	10.	100.	23600.	750.	3.	480.	112.	12.	4.	300.	72.
OL 314	9 641260	6001860	3.8	4.0	8.	15.	900.	1600.	2.	22.	120.	2000.	50.	2400.	520.	2300.	4.	410.	3.	340.	2.	50.	880.
OL 315	9 640849	6002656	1.6	1.3	4.	10.	650.	9600.	31.	6.	284.	50000.	10.	3200.	32400.	825.	1.	570.	90.	24.	3.	450.	92.
OL 316	9 641638	6001743	1.0	3.6	6.	10.	500.	540.	3.	12.	100.	3000.	40.	2600.	490.	1000.	1.	300.	2.	370.	2.	25.	92.
OL 317	9 641813	6001651	0.8	1.0	2.	5.	1050.	11900.	16.	25.	190.	24000.	10.	1250.	12400.	325.	1.	1270.	69.	10.	3.	500.	42.
OL 318	9 642026	6001451	1.2	1.4	2.	5.	550.	14200.	30.	22.	204.	41000.	10.	270.	24000.	700.	1.	600.	120.	18.	2.	800.	55.
OL 319	9 646179	6000110	1.8	0.5	14.	5.	2350.	5100.	10.	15.	130.	36500.	10.	270.	1600.	1250.	1.	400.	28.	170.	2.	450.	940.
OL 320	9 646159	5999590	0.8	0.6	75.	5.	2300.	12250.	8.	15.	292.	38000.	10.	880.	1500.	575.	1.	820.	37.	8.	5.	500.	108.
OL 321	9 646528	5998980	0.8	0.8	2.	5.	1600.	13900.	17.	15.	120.	41000.	10.	1700.	8300.	700.	1.	520.	20.	10.	3.	300.	108.
OL 322	9 641760	6000659	0.2	0.3	3.	5.	200.	780.	3.	3.	165.	1000.	10.	1800.	350.	50.	1.	400.	2.	6.	2.	25.	23.
OL 323	9 641590	5999439	0.2	0.4	2.	5.	250.	650.	1.	3.	16.	3000.	10.	1700.	390.	200.	1.	440.	19.	10.	2.	25.	15.
OL 324A	9 641630	5999010	0.4	0.8	2.	5.	800.	2500.	35.	50.	225.	41000.	10.	5700.	10600.	325.	1.	810.	65.	22.	2.	150.	84.
OL 324B	9 641639	5999010	2.0	1.0	2.	5.	2250.	17900.	40.	62.	532.	39500.	20.	1900.	18200.	575.	5.	2900.	60.	28.	2.	950.	105.
OL 325	9 641510	5998779	1.4	2.0	3.	5.	1000.	7200.	27.	65.	1160.	44000.	10.	4000.	10900.	650.	1.	3200.	90.	22.	3.	200.	140.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	UTM CO-ORD NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
			CHEMICAL ELEMENTS																				
OPG 46	9 654199	6028000	0.	1.1	1.	0.	0.	0.	0.	50.	580.	0.	112.	0.	0.	0.	3.	0.	0.	21.	0.	0.	100.
OPG 47	9 663210	6021250	0.	1.5	7.	0.	0.	0.	0.	21.	440.	0.	58.	0.	0.	0.	1.	0.	0.	19.	0.	0.	175.
OPG 48	9 662850	6020700	0.8	0.2	1.	0.	1450.	1600.	4.	9.	525.	0.	0.	610.	0.	130.	1.	700.	8.	5.	0.	492.	20.
OPG 50	9 662730	6021280	1.3	0.4	2.	0.	1650.	4580.	16.	36.	835.	0.	0.	770.	0.	430.	2.	380.	30.	11.	0.	1120.	70.
OPG 51	9 662250	6021700	0.8	0.3	3.	0.	1175.	2800.	6.	16.	630.	0.	0.	580.	0.	185.	1.	560.	7.	7.	0.	400.	42.
OPG 52	9 662100	6022230	1.6	0.2	1.	0.	1475.	2940.	20.	13.	505.	0.	0.	440.	0.	560.	1.	320.	50.	11.	0.	692.	69.
OPG 54	9 662350	6022300	1.4	0.5	12.	0.	1400.	1390.	18.	9.	125.	0.	0.	390.	0.	510.	1.	370.	53.	10.	0.	600.	48.
OPG 55	9 661900	6022700	1.2	0.6	1.	0.	1050.	2000.	16.	10.	660.	0.	0.	700.	0.	380.	2.	450.	50.	6.	0.	615.	38.
OPG 56	9 661750	6021780	0.6	0.2	7.	0.	1400.	1400.	4.	6.	725.	0.	0.	320.	0.	100.	2.	600.	5.	7.	0.	740.	14.
OPG 57	9 661920	6021250	1.0	0.2	1.	0.	1300.	3200.	7.	20.	660.	0.	0.	460.	0.	210.	1.	400.	8.	11.	0.	555.	46.
OPG 58	9 661450	6020400	1.1	0.1	10.	0.	1275.	2400.	7.	15.	600.	0.	0.	440.	0.	230.	2.	420.	8.	6.	0.	430.	36.
OPG 59	9 661050	6021020	1.0	0.2	1.	0.	1650.	1220.	9.	8.	975.	0.	0.	520.	0.	210.	2.	330.	26.	6.	0.	1000.	30.
OPG 60	9 660650	6021550	1.7	0.5	4.	0.	1400.	5360.	22.	20.	755.	0.	0.	390.	0.	700.	2.	650.	62.	16.	0.	940.	84.
OPG 61	9 660010	6022000	1.1	0.4	1.	0.	1350.	5300.	14.	19.	1075.	0.	0.	970.	0.	485.	3.	520.	28.	13.	0.	660.	106.
OPG 62	9 659550	6022450	0.8	0.2	10.	0.	1625.	830.	2.	6.	865.	0.	0.	830.	0.	230.	3.	580.	3.	12.	0.	200.	50.
OPG 63	9 659450	6022350	0.8	0.1	7.	0.	1775.	800.	2.	6.	695.	0.	0.	620.	0.	275.	2.	580.	3.	9.	0.	220.	57.
OPG 64	9 659300	6022200	0.6	0.2	11.	0.	1800.	970.	2.	6.	750.	0.	0.	1000.	0.	320.	3.	500.	4.	10.	0.	228.	59.
OPG 66	9 670550	6028650	1.0	0.3	5.	0.	1750.	3980.	10.	14.	950.	0.	0.	800.	0.	355.	1.	600.	20.	10.	0.	900.	58.
OPG 67	9 667120	6026100	1.3	0.3	1.	0.	2000.	4120.	11.	16.	1025.	0.	0.	630.	0.	390.	1.	610.	30.	9.	0.	1050.	61.
OPG 68	9 667250	6026620	1.2	0.2	1.	0.	1925.	2000.	12.	12.	750.	0.	0.	510.	0.	375.	2.	600.	35.	8.	0.	1100.	46.
OPG 69	9 667450	6027000	1.1	0.2	6.	0.	1500.	3000.	14.	13.	1050.	0.	0.	700.	0.	390.	2.	1170.	51.	13.	0.	990.	54.
OPG 70	9 667350	6027300	1.4	1.0	9.	0.	625.	13200.	24.	28.	280.	0.	0.	3760.	0.	510.	2.	3360.	88.	18.	0.	612.	53.
OPG 71	9 667300	6027600	0.6	0.4	4.	0.	1825.	4420.	3.	7.	1000.	0.	0.	3620.	0.	190.	1.	620.	7.	8.	0.	340.	26.
OPG 72	9 666620	6028450	1.9	1.2	5.	0.	700.	21000.	27.	46.	380.	0.	0.	450.	0.	620.	4.	2920.	86.	22.	0.	438.	70.
OPG 73	9 665800	6029450	0.	0.2	3.	0.	0.	0.	0.	2.	460.	0.	61.	0.	0.	0.	1.	0.	0.	5.	0.	0.	69.
OPG 74	9 665280	6030300	1.2	0.3	2.	0.	1400.	7000.	15.	14.	640.	0.	0.	560.	0.	845.	2.	1450.	14.	7.	0.	970.	73.
OPG 75	9 665150	6030450	1.3	0.7	6.	0.	1500.	7400.	13.	14.	900.	0.	0.	720.	0.	625.	2.	1530.	12.	11.	0.	1040.	80.
OPG 76	9 664950	6030700	1.0	0.4	6.	0.	1375.	6580.	13.	13.	800.	0.	0.	600.	0.	500.	3.	1310.	12.	8.	0.	1020.	64.
OPG 77	9 664720	6031350	0.6	0.2	2.	0.	1600.	3850.	3.	3.	975.	0.	0.	800.	0.	200.	2.	1190.	3.	8.	0.	510.	30.
OPG 78	9 664750	6031450	0.	0.4	1.	0.	0.	0.	0.	2.	1040.	0.	120.	0.	0.	0.	1.	0.	0.	6.	0.	0.	42.
OPG 79	9 663699	6032349	0.	0.4	2.	0.	0.	0.	0.	3.	470.	0.	82.	0.	0.	0.	1.	0.	0.	7.	0.	0.	51.
OPG 80	9 659650	6035220	1.1	0.5	7.	0.	1825.	7050.	12.	32.	795.	0.	0.	850.	0.	610.	4.	1120.	30.	11.	0.	950.	82.
OPG 81	9 658199	6034199	0.	0.7	4.	0.	0.	0.	0.	40.	260.	0.	22.	0.	0.	0.	3.	0.	0.	20.	0.	0.	52.
OPG115	9 660800	6032550	1.0	0.4	1.	0.	2200.	8400.	14.	38.	850.	0.	0.	1100.	0.	720.	2.	1080.	32.	12.	0.	1080.	89.
OPG141	9 652099	6021849	0.	1.0	11.	0.	0.	0.	0.	8.	330.	0.	73.	0.	0.	0.	2.	0.	0.	23.	0.	0.	67.
OPG142	9 652019	6021049	1.0	0.7	12.	0.	1400.	21500.	8.	12.	260.	0.	97.	1640.	0.	460.	2.	810.	10.	17.	0.	545.	58.
OPG143	9 652400	6020750	0.9	0.6	15.	0.	3500.	4800.	7.	6.	240.	0.	36.	3950.	0.	520.	1.	2000.	8.	17.	0.	320.	66.
OPG144	9 651699	6019700	0.5	0.5	10.	0.	1310.	1780.	5.	14.	250.	0.	100.	1180.	0.	152.	2.	650.	6.	10.	0.	400.	49.
OPG145	9 652099	6019380	0.9	0.3	6.	0.	1380.	5550.	8.	12.	340.	0.	18.	1480.	0.	700.	1.	790.	9.	8.	0.	525.	47.
OPG146	9 653099	6019900	1.7	1.2	2.	0.	1260.	37000.	7.	2.	280.	0.	24.	7600.	0.	2520.	2.	470.	10.	30.	0.	600.	104.
OPG147	9 653550	6019599	0.	0.5	20.	0.	0.	0.	0.	2.	250.	0.	41.	0.	0.	0.	1.	0.	0.	42.	0.	0.	96.
OPG148	9 654300	6020099	0.	0.4	13.	0.	0.	0.	0.	2.	360.	0.	18.	0.	0.	0.	2.	0.	0.	21.	0.	0.	56.
OPG149	9 655150	6019500	0.	12.9	1500.	0.	0.	0.	0.	103.	280.	0.	600.	0.	0.	0.	8.	0.	0.	560.	0.	0.	9800.
OPG150	9 652920	6009250	0.8	0.5	25.	0.	1300.	14000.	6.	10.	280.	0.	5.	1320.	0.	630.	1.	820.	7.	17.	0.	520.	124.
OPG151	9 652599	6009250	0.6	0.5	13.	0.	1360.	4400.	4.	6.	280.	0.	5.	820.	0.	325.	2.	650.	6.	12.	0.	400.	63.
OPG152	9 652179	6009350	0.8	0.4	1.	0.	1320.	12000.	8.	9.	315.	0.	5.	1200.	0.	660.	2.	1210.	10.	12.	0.	515.	58.
OPG153	9 652050	6009500	0.8	0.3	5.	0.	1580.	5250.	12.	11.	320.	0.	5.	620.	0.	565.	1.	630.	14.	11.	0.	495.	56.
OPG154	9 651650	6009740	1.0	0.3	1.	0.	1540.	8200.	10.	11.	250.	0.	5.	800.	0.	360.	2.	840.	14.	8.	0.	460.	46.
OPG155	9 651300	6009950	1.0	0.4	8.	0.	1160.	7600.	9.	18.	300.	0.	5.	600.	0.	590.	1.	560.	12.	10.	0.	445.	53.
OPG156	9 650300	6009750	1.3	0.5	10.	0.	1330.	5300.	10.	34.	250.	0.	8.	1110.	0.	420.	1.	820.	8.	13.	0.	400.	138.
OPG157	9 650320	6009899	1.4	0.7	4.	0.	1500.	7400.	12.	19.	220.	0.	5.	1100.	0.	1660.	1.	830.	8.	13.	0.	355.	140.
OPG158	9 650699	6010750	1.3	0.8	16.	0.	1400.	25000.	19.	39.	295.	0.	32.	500.	0.	1360.	2.	680.	16.	16.	0.	570.	55.
OPG160	9 653199	6010399	1.6	0.7	16.	0.	1540.	15250.	16.	20.	645.	0.	24.	740.	0.	800.	1.	800.	12.	10.	0.	630.	83.
OPG161	9 654250	6009649	2.0	1.1	2.	0.	910.	9400.	20.	48.	600.	0.	8.	1850.	0.	625.	2.	13000.	26.	20.	0.	670.	61.
OPG162	9 654849	6010950	0.	0.5	6.	0.	0.	0.	0.	20.	150.	0.	5.	0.	0.	0.	1.	0.	0.	17.	0.	0.	63.
OPG163	9 654869	6011100	0.	0.4	5.	0.	0.	0.	0.	10.	120.	0.	5.	0.	0.	0.	2.	0.	0.	14.	0.	0.	45.
OPG164	9 653050	6022819	0.	0.5	13.	0.	0.	0.	0.	11.	220.	0.	6.	0.	0.	0.	1.	0.	0.	24.	0.	0.	215.
OPG165	9 653349	6021000	0.	2.6	13.	0.	0.	0.	0.	17.	235.	0.	720.	0.	0.	0.	1.	0.	0.	17.	0.	0.	103.
OPG166	9 653420	6019700	0.	1.2	4.	0.	0.	0.	0.	4.	300.	0.	5.	0.	0.	0.	2.	0.	0.	38.	0.	0.	142.
OPG167	9 654449	6015100	0.	0.6	6.	0.	0.	0.	0.	8.	310.	0.	5.	0.	0.	0.	2.	0.	0.	20.	0.	0.	40.
OPG167A	9 654449	6015100	1.5	0.8	25.	0.	540.	14500.	20.	17.	360.	0.	8.	2650.	0.	480.	2.	2050.	34.	19.	0.	180.	46.
OPG168	9 653900	6013049	0.5	0.4	4.	0.	1430.	6000.	6.	4.	190.	0.	5.	720.	0.	270.	2.	630.	6.	13.	0.	420.	51.
OPG169	9 653500	6013100	0.9	0.4	9.	0.	1370.	14750.	6.	20.	175.	0.	5.	940.	0.	505.	2.	780.	9.	9.	0.	500.	40.
OPG170	9 654849	6016049	1.6	0.9	4.	0.	1260.	25500.	9.	3.	175.	0.	5.	5250.	0.	460.	2.	660.	8.	45.	0.	395.	110.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	UTM CO-ORD NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
OPG238	9 663420	5990700	0.9	0.5	1.	0.	1560.	5340.	14.	23.	500.	0.	0.	630.	0.	880.	2.	690.	22.	12.	0.	510.	110.
OPG239	9 663390	5991080	1.2	0.8	1.	0.	1700.	21000.	18.	52.	440.	0.	0.	780.	0.	915.	2.	660.	29.	16.	0.	660.	74.
OPG240	9 664300	5991470	0.5	0.4	1.	0.	1300.	4800.	10.	30.	455.	0.	0.	300.	0.	370.	2.	470.	20.	10.	0.	545.	70.
OPG241	9 664310	5990820	0.8	0.4	1.	0.	1180.	2420.	15.	53.	450.	0.	0.	480.	0.	450.	1.	500.	25.	14.	0.	300.	104.
OPG242	9 664400	5989750	0.7	0.3	1.	0.	1500.	11200.	14.	40.	470.	0.	0.	610.	0.	760.	2.	520.	23.	13.	0.	592.	84.
OPG244	9 667150	5986080	0.1	0.1	5.	0.	500.	400.	2.	6.	135.	0.	0.	1350.	0.	96.	1.	490.	3.	7.	0.	36.	12.
OPG245	9 667350	5986020	0.1	0.1	1.	0.	830.	350.	2.	6.	170.	0.	0.	1260.	0.	262.	1.	770.	4.	12.	0.	40.	36.
OPG246	9 666300	5987150	0.6	0.2	2.	0.	1500.	5980.	14.	20.	465.	0.	0.	550.	0.	380.	1.	580.	20.	13.	0.	430.	83.
OPG247	9 667300	5991850	0.9	0.4	2.	0.	1700.	3450.	8.	19.	425.	0.	10.	2650.	0.	179.	3.	610.	16.	8.	0.	375.	66.
OPG248	9 678250	5995600	0.3	0.1	1.	0.	2430.	5000.	13.	18.	375.	0.	0.	590.	0.	610.	1.	410.	28.	8.	0.	1120.	58.
OPG249	9 677500	5995600	0.6	0.4	4.	0.	1950.	5420.	17.	28.	1050.	0.	0.	890.	0.	475.	1.	860.	36.	13.	0.	935.	67.
OPG250	9 677500	5996650	0.6	0.3	3.	0.	1560.	5620.	16.	26.	775.	0.	0.	690.	0.	530.	2.	680.	24.	9.	0.	850.	70.
OPG251	9 677350	5997390	0.2	0.4	1.	0.	1660.	5580.	11.	28.	575.	0.	0.	800.	0.	270.	2.	700.	16.	8.	0.	820.	57.
OPG252	9 676500	5997500	0.4	0.4	7.	0.	2000.	6240.	14.	64.	1130.	0.	0.	600.	0.	345.	2.	390.	27.	18.	0.	1220.	53.
OPG253	9 675350	5997480	0.2	0.3	1.	0.	1300.	4380.	14.	30.	1050.	0.	0.	430.	0.	365.	2.	600.	20.	7.	0.	765.	55.
OPG254	9 676350	5997240	0.8	0.6	1.	0.	1720.	8220.	22.	25.	960.	0.	0.	730.	0.	350.	2.	780.	104.	22.	0.	880.	76.
OPG255	9 676200	5997000	0.6	0.5	2.	0.	1500.	5380.	12.	14.	1275.	0.	0.	1100.	0.	440.	3.	920.	20.	13.	0.	720.	65.
OPG256	9 675550	5997040	0.3	0.5	1.	0.	1560.	3600.	10.	23.	660.	0.	0.	800.	0.	276.	3.	560.	10.	9.	0.	780.	37.
OPG257	9 674980	5997040	0.5	0.4	1.	0.	1600.	5820.	18.	34.	675.	0.	0.	430.	0.	575.	2.	580.	56.	21.	0.	915.	67.
OPG258	9 674780	5997250	0.7	0.6	1.	0.	1500.	6450.	21.	39.	765.	0.	0.	390.	0.	560.	2.	520.	70.	16.	0.	900.	85.
OPG259	9 674160	5997730	0.5	0.2	1.	0.	1670.	5800.	18.	18.	780.	0.	0.	430.	0.	342.	2.	790.	58.	11.	0.	860.	68.
OPG260	9 673950	5998000	0.4	0.3	3.	0.	1800.	7000.	17.	37.	775.	0.	0.	390.	0.	315.	1.	500.	60.	14.	0.	1155.	73.
OPG261	9 682700	5988250	1.4	1.0	4.	0.	1140.	6000.	34.	88.	1125.	0.	0.	14200.	0.	765.	1.	14800.	96.	29.	0.	2000.	101.
OPG262	9 692100	5990450	0.4	0.7	1.	0.	1320.	7400.	20.	52.	630.	0.	0.	500.	0.	325.	1.	1100.	40.	20.	0.	980.	92.
OPG263A	9 692735	5990450	0.2	0.6	1.	0.	2100.	8380.	14.	68.	1200.	0.	0.	360.	0.	600.	1.	440.	21.	11.	0.	1100.	80.
OPG263B	9 692740	5990450	0.2	0.6	1.	0.	2500.	8400.	16.	34.	1275.	0.	0.	400.	0.	1580.	1.	530.	25.	45.	0.	1175.	104.
OPG263C	9 692745	5990450	0.4	1.0	4.	0.	2350.	7420.	16.	48.	800.	0.	0.	290.	0.	178.	2.	500.	28.	13.	0.	1140.	55.
OPG264	9 693460	5990500	0.6	0.5	7.	0.	1820.	6600.	18.	22.	665.	0.	0.	500.	0.	560.	3.	970.	14.	82.	0.	980.	69.
OPG265	9 693550	5990350	0.4	0.6	3.	0.	2600.	5200.	16.	38.	550.	0.	0.	710.	0.	455.	2.	530.	40.	15.	0.	1390.	38.
OPG266	9 694050	5990440	0.1	0.5	1.	0.	1950.	3000.	6.	20.	655.	0.	0.	570.	0.	120.	2.	350.	13.	6.	0.	1220.	40.
OPG267	9 694450	5990750	0.5	0.5	1.	0.	2700.	7400.	12.	36.	660.	0.	0.	9300.	0.	338.	2.	3370.	26.	18.	0.	1400.	56.
OPG269	9 670100	5987980	0.4	0.4	1.	0.	1800.	4000.	22.	24.	515.	0.	0.	690.	0.	1040.	2.	600.	30.	12.	0.	555.	114.
OPG270	9 668900	5988950	0.8	0.6	1.	0.	1100.	13800.	11.	24.	405.	0.	0.	2100.	0.	540.	2.	710.	24.	16.	0.	390.	67.
OPG271	9 668950	5989300	0.6	0.3	1.	0.	1160.	1600.	10.	6.	250.	0.	0.	1680.	0.	525.	1.	540.	20.	6.	0.	240.	25.
OPG272	9 669250	5989900	0.6	0.8	1.	0.	4650.	22200.	8.	12.	290.	0.	0.	2400.	0.	695.	2.	260.	18.	26.	0.	380.	57.
OPG273	9 668620	5990300	0.4	0.9	1.	0.	2500.	21000.	8.	22.	295.	0.	0.	1330.	0.	500.	2.	560.	23.	15.	0.	690.	41.
OPG274	9 668720	5990890	1.3	1.6	2.	0.	1670.	4450.	17.	15.	395.	0.	5.	1380.	0.	440.	2.	1230.	28.	17.	0.	510.	40.
OPG275	9 668899	5992149	1.6	1.6	1.	0.	1220.	12500.	19.	10.	520.	0.	5.	1850.	0.	660.	2.	870.	28.	16.	0.	345.	102.
OPG276	9 668880	5992399	0.8	1.0	2.	0.	850.	19300.	8.	24.	370.	0.	6.	2000.	0.	665.	1.	480.	21.	17.	0.	220.	80.
OPG277	9 668300	5993260	0.9	1.0	1.	0.	40800.	4050.	8.	4.	150.	0.	36.	3100.	0.	255.	1.	1260.	10.	14.	0.	405.	35.
OPG278	9 666250	5991289	1.0	1.7	4.	0.	5250.	8600.	14.	28.	380.	0.	5.	1720.	0.	425.	1.	660.	15.	16.	0.	320.	68.
OPG279	9 665949	5991020	1.2	1.0	1.	0.	1200.	6850.	16.	5.	330.	0.	5.	4000.	0.	840.	1.	470.	18.	12.	0.	215.	46.
OPG280	9 665909	5990479	1.1	0.5	1.	0.	460.	6600.	12.	13.	260.	0.	5.	3800.	0.	315.	2.	560.	13.	6.	0.	200.	27.
OPG281	9 665899	5990050	0.	0.3	1.	0.	0.	0.	0.	4.	950.	0.	5.	0.	0.	0.	2.	0.	0.	8.	0.	0.	32.
OPG282	9 666590	5989650	0.	0.4	0.	0.	0.	0.	0.	7.	610.	0.	0.	0.	0.	0.	2.	0.	0.	12.	0.	0.	60.
OPG283	9 666700	5989350	0.4	0.5	5.	0.	1600.	8600.	12.	6.	430.	0.	0.	990.	0.	665.	1.	710.	13.	15.	0.	285.	49.
OPG285	9 665420	5988470	0.4	0.2	1.	0.	1560.	5820.	14.	13.	470.	0.	0.	700.	0.	660.	1.	650.	16.	12.	0.	425.	88.
OPG286	9 665150	5988750	0.7	0.4	1.	0.	1400.	12700.	17.	32.	330.	0.	0.	480.	0.	745.	2.	530.	23.	11.	0.	474.	67.
OPG287	9 665000	5989240	0.4	0.6	2.	0.	1500.	4770.	14.	21.	460.	0.	0.	480.	0.	228.	1.	780.	15.	12.	0.	490.	48.
OPG288	9 664660	5990350	2.0	0.8	1.	0.	1220.	15200.	16.	36.	385.	0.	0.	700.	0.	550.	1.	500.	19.	16.	0.	420.	174.
OPG289	9 664850	5990300	0.1	0.3	1.	0.	1460.	1650.	6.	20.	220.	0.	0.	490.	0.	180.	1.	400.	8.	5.	0.	575.	52.
OPG290	9 671460	5987910	0.1	0.3	1.	0.	1400.	2760.	7.	22.	575.	0.	0.	800.	0.	228.	3.	550.	11.	8.	0.	530.	63.
OPG291	9 671800	5987950	0.1	0.4	5.	0.	1360.	2990.	9.	21.	320.	0.	0.	660.	0.	190.	2.	510.	15.	8.	0.	590.	60.
OPG292	9 672350	5987450	0.2	0.6	1.	0.	1400.	3600.	12.	23.	480.	0.	0.	810.	0.	370.	2.	700.	16.	142.	0.	525.	56.
OPG293	9 672550	5987650	0.1	0.2	4.	0.	3420.	2840.	11.	17.	565.	0.	0.	1980.	0.	130.	2.	610.	20.	5.	0.	395.	55.
OPG294	9 673500	5987400	0.2	0.3	5.	0.	1460.	2720.	6.	16.	365.	0.	0.	700.	0.	335.	1.	500.	10.	5.	0.	610.	37.
OPG295	9 674050	5987500	0.5	0.4	1.	0.	1720.	11000.	11.	28.	460.	0.	0.	1240.	0.	530.	1.	490.	14.	7.	0.	380.	43.
OPG296	9 674600	5987180	0.2	0.5	1.	0.	1420.	4180.	12.	21.	560.	0.	0.	1170.	0.	206.	2.	840.	16.	6.	0.	545.	78.
OPG297	9 674650	5986350	0.6	0.4	2.	0.	1680.	6050.	14.	27.	545.	0.	0.	1370.	0.	475.	1.	700.	19.	13.	0.	580.	65.
OPG298	9 678850	5990550	0.2	0.2	1.	0.	1420.	2600.	7.	18.	650.	0.	0.	600.	0.	218.	1.	660.	6.	7.	0.	785.	39.
OPG299	9 678730	5990820	0.4	0.4	6.	0.	1520.	3140.	8.	20.	710.	0.	0.	510.	0.	270.	1.	640.	8.	6.	0.	720.	51.
OPG300	9 677350	5992250	0.2	0.	1.	0.	2030.	3400.	13.	0.	0.	0.	0.	1400.	0.	406.	0.	950.	33.	0.	0.	1140.	0.
OPG301	9 678700	5992250	0.3	0.3	1.	0.	2100.	3800.	14.	16.	850.	0.	0.	970.	0.	530.	1.	700.	32.	11.	0.	1130.	60.
OPG302	9 678300	5992500	0.8	0.6	1.	0.	2060.	6440.	18.	32.	625.	0.	0.	1060.	0.	710.	2.	560.	37.	17.	0.	1200.	70.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	UTM CO-ORD NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
OPG382	9 672100	6038080	0.1	0.3	6.	0.	2100.	3600.	7.	14.	1095.	0.	0.	1370.	0.	255.	2.	360.	7.	11.	0.	542.	66.
OPG383	9 672750	6038200	0.2	0.5	1.	0.	1100.	7600.	22.	26.	820.	0.	0.	680.	0.	735.	2.	960.	34.	13.	0.	665.	98.
OPG384	9 673050	6038400	0.1	0.4	1.	0.	1300.	7760.	15.	24.	880.	0.	0.	730.	0.	500.	2.	760.	38.	13.	0.	1080.	97.
OPG385	9 673000	6038750	0.1	0.2	5.	0.	2325.	4640.	11.	20.	1250.	0.	0.	1620.	0.	640.	3.	380.	10.	22.	0.	580.	80.
OPG386	9 673300	6037750	0.1	0.3	2.	0.	1450.	6400.	16.	30.	835.	0.	0.	1030.	0.	595.	2.	940.	30.	11.	0.	650.	86.
OPG387	9 673620	6037550	0.2	0.4	3.	0.	1450.	7900.	20.	40.	985.	0.	0.	700.	0.	470.	3.	920.	56.	15.	0.	1180.	78.
OPG388	9 673650	6038050	0.7	0.3	1.	0.	3000.	5900.	20.	26.	725.	0.	0.	1770.	0.	650.	2.	690.	34.	11.	0.	900.	96.
OPG389	9 670550	6036150	0.	0.3	1.	0.	0.	0.	0.	1.	640.	0.	5.	0.	0.	0.	1.	0.	0.	6.	0.	0.	168.
OPG390	9 670300	6036600	1.0	0.4	2.	0.	2080.	5750.	13.	2.	710.	0.	5.	390.	0.	720.	1.	390.	6.	6.	0.	910.	75.
OPG391	9 669600	6036010	0.	0.2	17.	0.	0.	0.	0.	5.	140.	0.	28.	0.	0.	0.	2.	0.	0.	4.	0.	0.	14.
OPG392	9 669250	6035800	0.	0.2	22.	0.	0.	0.	0.	5.	40.	0.	5.	0.	0.	0.	2.	0.	0.	4.	0.	0.	18.
OPG393	9 668880	6035800	0.	0.2	2.	0.	0.	0.	0.	19.	40.	0.	5.	0.	0.	0.	1.	0.	0.	4.	0.	0.	10.
OPG394	9 667829	6035329	0.	0.6	4.	0.	0.	0.	0.	3.	710.	0.	5.	0.	0.	0.	2.	0.	0.	12.	0.	0.	160.
OPG395	9 667729	6035030	0.	0.6	1.	0.	0.	0.	0.	4.	410.	0.	5.	0.	0.	0.	1.	0.	0.	15.	0.	0.	57.
OPG396	9 667750	6034699	0.	0.4	1.	0.	0.	0.	0.	3.	160.	0.	5.	0.	0.	0.	1.	0.	0.	8.	0.	0.	95.
OPG397	9 667979	6034199	0.	1.2	3.	0.	0.	0.	0.	10.	320.	0.	5.	0.	0.	0.	1.	0.	0.	20.	0.	0.	120.
OPG398	9 668300	6033949	0.	6.8	16.	0.	0.	0.	0.	310.	315.	0.	12.	0.	0.	0.	1.	0.	0.	21.	0.	0.	620.
OPG399	9 668449	6033550	0.	1.3	4.	0.	0.	0.	0.	82.	360.	0.	5.	0.	0.	0.	1.	0.	0.	12.	0.	0.	100.
OPG400	9 668850	6033800	0.	0.3	4.	0.	0.	0.	0.	14.	180.	0.	200.	0.	0.	0.	1.	0.	0.	8.	0.	0.	37.
OPG401	9 669149	6034650	0.	12.7	250.	0.	0.	0.	0.	1500.	240.	0.	1860.	0.	0.	0.	2.	0.	0.	390.	0.	0.	210.
OPG402	9 669949	6034849	2.2	2.0	4.	0.	320.	14000.	30.	28.	220.	0.	18.	430.	0.	680.	1.	3750.	34.	30.	0.	340.	96.
OPG403	9 671350	6034250	1.8	1.0	2.	0.	2360.	10500.	22.	18.	930.	0.	5.	760.	0.	1280.	2.	1320.	14.	16.	0.	1140.	118.
OPG404	9 674800	6036700	1.8	1.2	2.	0.	800.	39600.	23.	30.	3400.	0.	0.	10000.	0.	590.	2.	11400.	36.	23.	0.	355.	70.
OPG405	9 671350	6039350	1.2	0.6	3.	0.	2250.	10400.	22.	43.	925.	0.	0.	490.	0.	750.	2.	350.	64.	15.	0.	1040.	102.
OPG406	9 671150	6039020	1.0	0.6	1.	0.	2200.	7750.	26.	40.	770.	0.	0.	430.	0.	525.	1.	380.	76.	14.	0.	980.	94.
OPG407	9 670750	6038700	1.0	0.4	2.	0.	2300.	11200.	23.	40.	855.	0.	0.	500.	0.	705.	2.	400.	62.	15.	0.	1020.	91.
OPG408	9 670200	6038730	0.8	0.1	2.	0.	1850.	6770.	18.	26.	850.	0.	0.	860.	0.	760.	2.	370.	46.	10.	0.	1060.	96.
OPG410	9 669350	6038650	0.2	0.3	1.	0.	3200.	2990.	6.	5.	730.	0.	0.	400.	0.	446.	2.	500.	6.	8.	0.	885.	76.
OPG411	9 668350	6037150	0.	1.0	1.	0.	0.	0.	0.	6.	725.	0.	18.	0.	0.	0.	1.	0.	0.	22.	0.	0.	430.
OPG412	9 668000	6039300	0.	1.8	10.	0.	0.	0.	0.	50.	260.	0.	5.	0.	0.	0.	2.	0.	0.	26.	0.	0.	76.
OPG413	9 668699	6040000	0.8	0.6	2.	0.	2100.	5200.	8.	4.	770.	0.	5.	1170.	0.	440.	1.	1250.	4.	8.	0.	720.	74.
OPG414	9 668449	6040590	1.0	0.5	1.	0.	2320.	4700.	8.	2.	960.	0.	5.	1730.	0.	755.	2.	870.	5.	12.	0.	765.	122.
OPG415	9 668649	6040599	1.5	0.6	1.	0.	1880.	4750.	20.	21.	530.	0.	5.	760.	0.	1015.	1.	770.	45.	8.	0.	810.	84.
OPG416	9 668800	6040950	0.7	0.6	1.	0.	1600.	6000.	20.	32.	675.	0.	0.	710.	0.	532.	2.	510.	56.	21.	0.	810.	91.
OPG419	9 669500	6040680	1.2	0.5	1.	0.	1400.	8750.	26.	31.	525.	0.	0.	300.	0.	1000.	4.	750.	78.	16.	0.	935.	97.
OPG420	9 670300	6039730	0.6	0.4	4.	0.	1450.	25000.	24.	30.	610.	0.	0.	2620.	0.	760.	2.	6700.	66.	10.	0.	720.	110.
OPG421	9 666750	6031390	0.	0.8	50.	0.	0.	0.	0.	4.	40.	0.	300.	0.	0.	0.	2.	0.	0.	12.	0.	0.	33.
OPG422	9 666949	6031349	0.	1.2	9.	0.	0.	0.	0.	35.	430.	0.	38.	0.	0.	0.	1.	0.	0.	21.	0.	0.	42.
OPG423	9 667100	6031390	0.	1.4	4.	0.	0.	0.	0.	43.	360.	0.	5.	0.	0.	0.	1.	0.	0.	27.	0.	0.	70.
OPG424	9 667300	6031250	0.	1.1	5.	0.	0.	0.	0.	27.	240.	0.	5.	0.	0.	0.	1.	0.	0.	14.	0.	0.	77.
OPG425	9 667449	6031119	0.	0.9	8.	0.	0.	0.	0.	76.	250.	0.	5.	0.	0.	0.	1.	0.	0.	16.	0.	0.	64.
OPG426	9 667699	6030720	0.	0.4	3.	0.	0.	0.	0.	5.	80.	0.	400.	0.	0.	0.	1.	0.	0.	8.	0.	0.	30.
OPG427	9 668199	6030549	0.	0.5	8.	0.	0.	0.	0.	3.	190.	0.	560.	0.	0.	0.	1.	0.	0.	9.	0.	0.	14.
OPG428	9 668300	6030970	0.	0.4	5.	0.	0.	0.	0.	5.	55.	0.	500.	0.	0.	0.	1.	0.	0.	14.	0.	0.	27.
OPG429	9 668399	6031049	0.	0.3	5.	0.	0.	0.	0.	2.	20.	0.	170.	0.	0.	0.	2.	0.	0.	11.	0.	0.	23.
OPG430	9 670410	6030790	1.7	1.3	1.	0.	1350.	26400.	34.	28.	670.	0.	0.	3150.	0.	1070.	3.	8780.	114.	25.	0.	440.	93.
OPG432	9 667899	6031450	0.	0.4	120.	0.	0.	0.	0.	2.	15.	0.	210.	0.	0.	0.	1.	0.	0.	12.	0.	0.	20.
OPG433	9 665750	6030200	0.4	0.4	4.	0.	2850.	4000.	12.	39.	725.	0.	0.	490.	0.	620.	3.	380.	16.	10.	0.	728.	63.
OPG434	9 660250	5991250	0.2	0.2	6.	0.	1600.	1700.	3.	5.	105.	0.	0.	860.	0.	114.	1.	590.	6.	8.	0.	260.	21.
OPG436	9 660900	5991710	1.5	1.4	5.	0.	1100.	10100.	34.	86.	1250.	0.	0.	4600.	0.	715.	2.	8800.	92.	20.	0.	1700.	102.
OPG437	9 662280	5991700	0.6	0.5	1.	0.	1550.	3600.	10.	45.	290.	0.	0.	880.	0.	214.	1.	630.	20.	48.	0.	408.	52.
OPG438	9 662150	5991390	0.4	0.4	1.	0.	1975.	4200.	8.	9.	950.	0.	0.	2050.	0.	380.	2.	570.	7.	8.	0.	608.	60.
OPG439	9 661700	5989790	0.2	0.2	1.	0.	1800.	3400.	8.	13.	380.	0.	0.	680.	0.	46.	1.	610.	8.	5.	0.	426.	37.
OPG440	9 661370	5989500	0.3	0.4	5.	0.	1750.	1950.	6.	12.	1300.	0.	0.	510.	0.	80.	1.	480.	8.	5.	0.	402.	34.
OPG441	9 660350	5989590	0.2	0.3	2.	0.	1650.	2200.	5.	13.	1025.	0.	0.	580.	0.	188.	2.	500.	8.	36.	0.	340.	28.
OPG442	9 674900	6038920	0.6	0.5	1.	0.	2325.	11600.	22.	93.	840.	0.	0.	680.	0.	700.	2.	400.	48.	15.	0.	1060.	106.
OPG443	9 675400	6038850	0.5	0.2	2.	0.	2400.	6900.	24.	67.	200.	0.	0.	730.	0.	700.	3.	390.	52.	9.	0.	1270.	107.
OPG444	9 676200	6038600	0.7	0.4	3.	0.	2175.	3800.	10.	5.	545.	0.	0.	1290.	0.	1015.	2.	420.	14.	7.	0.	525.	140.
OPG446	9 676310	6037250	0.6	0.2	1.	0.	2300.	7000.	13.	4.	895.	0.	0.	500.	0.	750.	3.	410.	6.	7.	0.	1000.	101.
OPG447	9 676020	6036900	1.3	1.5	4.	0.	1050.	15500.	22.	29.	840.	0.	0.	10600.	0.	522.	3.	2760.	30.	21.	0.	327.	70.
OPG448	9 674220	6037450	0.8	0.7	1.	0.	1425.	10500.	24.	35.	375.	0.	0.	1220.	0.	695.	3.	1240.	48.	15.	0.	461.	91.
OPG449	9 674220	6037450	0.6	0.8	3.	0.	1400.	6000.	18.	36.	460.	0.	0.	1080.	0.	420.	2.	560.	24.	18.	0.	500.	62.
OPG450	9 674220	6037450	0.8	0.9	3.	0.	1475.	800.	22.	6.	480.	0.	0.	1500.	0.	1555.	3.	420.	13.	8.	0.	350.	340.
OPG453	9 663550	6031930	0.4	0.6	2.	0.	1700.	5600.	12.	4.	500.	0.	0.	1200.	0.	760.	2.	400.	6.	5.	0.	100.	114.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD	EAST	NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
OPG529	9	673100	6022850	0.8	0.4	1.	0.	1600.	5000.	10.	15.	410.	0.	0.	790.	0.	480.	3.	1320.	18.	6.	0.	590.	59.
OPG530	9	673350	6023100	0.8	0.3	6.	0.	1625.	5400.	9.	15.	875.	0.	0.	930.	0.	240.	4.	910.	22.	4.	0.	580.	53.
OPG531	9	673800	6023250	1.1	0.3	1.	0.	1950.	7450.	12.	19.	1175.	0.	0.	660.	0.	145.	2.	1000.	38.	3.	0.	850.	65.
OPG532	9	674300	6023350	0.8	0.4	1.	0.	1975.	7200.	10.	11.	845.	0.	0.	500.	0.	270.	2.	1090.	35.	8.	0.	900.	46.
OPG533	9	674700	6023500	1.0	0.4	8.	0.	2000.	7500.	11.	11.	955.	0.	0.	540.	0.	540.	4.	1020.	32.	5.	0.	950.	67.
OPG534	9	674800	6023700	0.7	0.4	7.	0.	1950.	5550.	6.	23.	715.	0.	0.	440.	0.	145.	1.	670.	14.	6.	0.	760.	70.
OPG535	9	661500	6024250	1.3	1.1	4.	0.	2025.	9700.	12.	14.	2700.	0.	0.	4200.	0.	565.	2.	1100.	18.	17.	0.	920.	91.
OPG536	9	676450	6024600	1.2	1.2	13.	0.	1600.	10300.	24.	24.	380.	0.	0.	1540.	0.	695.	3.	2830.	76.	18.	0.	540.	65.
OPG537	9	676900	6024800	1.7	1.6	7.	0.	1400.	20200.	23.	37.	480.	0.	0.	950.	0.	1340.	3.	3550.	68.	17.	0.	500.	65.
OPG538	9	677200	6024700	1.4	1.4	11.	0.	800.	12000.	25.	33.	300.	0.	0.	790.	0.	670.	2.	3300.	82.	14.	0.	420.	73.
OPG539	9	677500	6024690	1.5	1.0	1.	0.	750.	10100.	26.	38.	440.	0.	0.	810.	0.	1630.	2.	2450.	71.	9.	0.	415.	72.
OPG540	9	677100	6025950	1.9	1.2	16.	0.	850.	10400.	25.	18.	290.	0.	0.	1700.	0.	1460.	3.	1820.	82.	16.	0.	410.	46.
OPG541	9	677550	6026050	1.4	0.8	4.	0.	825.	8000.	24.	17.	390.	0.	0.	4200.	0.	575.	3.	1160.	122.	15.	0.	405.	51.
OPG542	9	678000	6026700	1.4	0.7	4.	0.	1050.	9400.	18.	27.	675.	0.	0.	4400.	0.	610.	4.	820.	68.	16.	0.	485.	51.
OPG543	9	677950	6026850	1.0	0.4	3.	0.	1575.	4950.	9.	21.	800.	0.	0.	890.	0.	175.	3.	900.	16.	6.	0.	600.	49.
OPG544	9	678450	6027230	1.0	0.4	2.	0.	1750.	6650.	12.	15.	1200.	0.	0.	940.	0.	295.	4.	860.	29.	5.	0.	825.	76.
OPG545	9	678700	6027540	1.2	0.5	3.	0.	1650.	5000.	8.	25.	1200.	0.	0.	1750.	0.	410.	2.	970.	22.	8.	0.	545.	61.
OPG546	10	306850	6024299	0.	1.6	5.	0.	0.	0.	0.	47.	250.	0.	5.	0.	0.	0.	1.	0.	0.	26.	0.	0.	95.
OPG547	10	305600	6024599	0.	1.9	3.	0.	0.	0.	0.	9.	280.	0.	5.	0.	0.	0.	2.	0.	0.	22.	0.	0.	84.
OPG549	9	693500	6024650	0.	2.4	1.	0.	0.	0.	0.	10.	490.	0.	5.	0.	0.	0.	2.	0.	0.	26.	0.	0.	112.
OPG551	9	693750	6025099	0.	2.2	2.	0.	0.	0.	0.	12.	305.	0.	5.	0.	0.	0.	2.	0.	0.	24.	0.	0.	92.
OPG552	9	694899	6025549	1.8	2.8	4.	0.	690.	23500.	23.	10.	420.	0.	5.	2850.	0.	840.	3.	590.	24.	26.	0.	180.	88.
OPG553	10	305250	6025900	0.	1.6	2.	0.	0.	0.	0.	5.	280.	0.	5.	0.	0.	0.	2.	0.	0.	18.	0.	0.	23.
OPG555	9	694600	6027900	0.	2.1	5.	0.	0.	0.	0.	29.	310.	0.	5.	0.	0.	0.	2.	0.	0.	27.	0.	0.	128.
OPG556	9	693350	6029900	1.3	0.8	4.	0.	500.	800.	15.	4.	245.	0.	0.	780.	0.	775.	3.	1200.	12.	10.	0.	120.	85.
OPG557	10	325799	6004300	0.	1.0	2.	0.	0.	0.	0.	20.	1085.	0.	5.	0.	0.	0.	2.	0.	0.	18.	0.	0.	90.
OPG558	10	326230	6004350	1.0	0.6	1.	0.	1550.	7150.	10.	22.	980.	0.	0.	380.	0.	550.	3.	1020.	20.	6.	0.	635.	57.
OPG559	10	326300	6004000	1.0	0.7	4.	0.	1450.	7600.	11.	24.	750.	0.	0.	730.	0.	170.	3.	1140.	20.	11.	0.	520.	58.
OPG560	10	327200	6003200	0.1	0.5	2.	0.	1500.	3550.	13.	23.	560.	0.	0.	610.	0.	350.	2.	540.	19.	8.	0.	445.	48.
OPG560A	10	327200	6003200	0.2	0.6	1.	0.	1575.	3600.	14.	15.	515.	0.	0.	550.	0.	320.	3.	500.	20.	7.	0.	455.	57.
OPG561	10	325650	6002150	1.3	1.0	1.	0.	1940.	6600.	15.	18.	1075.	0.	5.	1860.	0.	375.	1.	790.	18.	18.	0.	280.	95.
OPG562	10	326049	6001900	0.6	0.2	1.	0.	180.	1050.	4.	2.	350.	0.	5.	1320.	0.	112.	1.	640.	2.	6.	0.	5.	25.
OPG563	10	307000	6004350	0.1	0.4	1.	0.	1800.	3600.	10.	13.	875.	0.	0.	300.	0.	230.	3.	490.	16.	9.	0.	575.	61.
OPG564	10	304700	6002950	0.2	0.5	1.	0.	1850.	4000.	13.	21.	950.	0.	0.	810.	0.	282.	4.	470.	19.	7.	0.	600.	51.
OPG565	10	306100	6004300	0.1	0.3	1.	0.	2000.	3970.	12.	20.	1005.	0.	0.	380.	0.	240.	3.	450.	17.	8.	0.	580.	65.
OPG566	10	305700	6004250	0.3	0.5	6.	0.	1800.	3800.	12.	21.	1010.	0.	0.	670.	0.	755.	4.	490.	16.	11.	0.	540.	60.
OPG567	10	305250	6003930	0.2	0.5	3.	0.	1825.	5200.	15.	22.	600.	0.	0.	660.	0.	260.	3.	510.	22.	7.	0.	605.	73.
OPG568	10	305270	6003380	0.2	0.4	2.	0.	1950.	3400.	12.	25.	750.	0.	0.	700.	0.	640.	4.	480.	13.	6.	0.	475.	70.
OPG570	10	305950	6001800	0.4	0.8	4.	0.	1750.	6600.	20.	25.	1200.	0.	0.	480.	0.	545.	4.	400.	34.	9.	0.	690.	137.
OPG571	10	304089	5999979	0.5	0.7	18.	0.	1300.	1050.	5.	13.	215.	0.	420.	1110.	0.	25.	1.	160.	5.	11.	0.	95.	16.
OPG573	10	303850	5997800	0.4	0.5	1.	0.	2025.	4050.	14.	13.	805.	0.	0.	510.	0.	900.	4.	300.	23.	10.	0.	1025.	93.
OPG574	10	303850	5997580	0.3	0.4	8.	0.	2100.	4200.	13.	21.	525.	0.	0.	860.	0.	780.	2.	330.	26.	11.	0.	1020.	54.
OPG575	10	304550	5997450	0.4	0.3	1.	0.	1800.	4800.	14.	22.	1005.	0.	0.	620.	0.	310.	1.	320.	19.	8.	0.	680.	70.
OPG576	10	305150	5997450	0.2	0.3	5.	0.	1850.	4200.	14.	17.	965.	0.	0.	890.	0.	675.	3.	490.	18.	14.	0.	765.	90.
OPG577	10	306200	5994200	0.2	0.4	2.	0.	1825.	4800.	16.	37.	935.	0.	0.	630.	0.	390.	2.	470.	24.	7.	0.	680.	77.
OPG578	10	306400	5993550	0.1	0.3	1.	0.	1700.	1950.	6.	15.	650.	0.	0.	490.	0.	150.	3.	550.	6.	5.	0.	615.	22.
OPG579	10	318150	5995150	0.4	0.7	11.	0.	1550.	6800.	15.	27.	905.	0.	0.	640.	0.	960.	31.	390.	25.	6.	0.	460.	91.
OPG580	10	318280	5994850	1.2	1.0	16.	0.	2100.	14800.	23.	44.	1660.	0.	0.	1290.	0.	2920.	7.	560.	47.	14.	0.	765.	106.
OPG581	10	315799	5994979	0.4	0.7	5.	0.	1320.	1000.	3.	2.	100.	0.	5.	2950.	0.	117.	1.	610.	2.	11.	0.	100.	44.
OPG582	10	316200	5993550	0.6	0.4	7.	0.	1520.	2750.	4.	4.	190.	0.	5.	3000.	0.	295.	2.	800.	4.	18.	0.	80.	13.
OPG583	9	694800	6014550	0.2	0.2	4.	0.	2150.	4000.	9.	11.	690.	0.	0.	390.	0.	255.	4.	320.	21.	4.	0.	485.	40.
OPG584	10	304950	6015050	0.1	0.2	1.	0.	1975.	2300.	6.	20.	590.	0.	0.	590.	0.	125.	3.	400.	8.	7.	0.	540.	37.
OPG585	10	305450	6016000	0.1	0.2	3.	0.	1600.	1800.	6.	15.	525.	0.	0.	540.	0.	300.	5.	330.	8.	5.	0.	640.	49.
OPG586	10	306430	6017000	0.1	0.3	6.	0.	2150.	3400.	9.	24.	640.	0.	0.	550.	0.	130.	4.	400.	12.	7.	0.	870.	31.
OPG587	10	305700	6018550	0.4	0.4	4.	0.	1800.	4000.	12.	19.	485.	0.	0.	400.	0.	950.	2.	380.	20.	7.	0.	635.	66.
OPG588	10	306300	6019980	0.4	0.4	1.	0.	1625.	4500.	12.	27.	765.	0.	0.	440.	0.	250.	1.	510.	24.	8.	0.	640.	46.
OPG589	10	306450	6020170	0.2	0.3	2.	0.	1775.	2000.	8.	13.	485.	0.	0.	660.	0.	110.	3.	410.	10.	8.	0.	725.	32.
OPG590	10	306949	6023730	0.	1.3	1.	0.	0.	0.	0.	78.	220.	0.	5.	0.	0.	0.	2.	0.	0.	20.	0.	0.	98.
OPG591	10	320019	5995500	0.1	0.3	1.	0.	500.	1700.	2.	3.	200.	0.	5.	1620.	0.	58.	2.	300.	4.	13.	0.	20.	22.
OPG592	10	315830	5994020	0.7	0.4	11.	0.	1280.	2350.	5.	2.	120.	0.	35.	3000.	0.	400.	1.	670.	4.	7.	0.	85.	20.
OPG593	10	315000	6008150	0.2	0.5	4.	0.	1800.	7400.	16.	31.	510.	0.	0.	540.	0.	320.	3.	780.	40.	11.	0.	920.	57.
OPG594	10	315670	6007500	0.2	0.4	3.	0.	2175.	4500.	9.	21.	1150.	0.	0.	560.	0.	530.	5.	460.	12.	7.	0.	1270.	64.
OPG595	10	315550	6006900	0.2	0.3	1.	0.	1425.	2350.	8.	20.	255.	0.	0.	440.	0.	189.	4.	610.	12.	6.	0.	420.	57.
OPG596	10	315600	6006300	0.4	0.5	2.	0.	2250.	9000.	11.	30.	1175.	0.	0.	400.	0.	404.	5.	500.	14.	10.	0.	980.	58.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.		UTM CO-ORD EAST	NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
OPG660A	9	689750	5995400	0.6	0.4	1.	0.	2325.	6400.	20.	49.	800.	0.	0.	500.	0.	380.	1.	400.	56.	7.	0.	1340.	81.
OPG660B	9	689710	5995400	0.2	0.6	12.	0.	2550.	5200.	12.	76.	1125.	0.	0.	510.	0.	56.	3.	520.	26.	12.	0.	1040.	76.
OPG661	9	689500	5995250	0.3	0.6	3.	0.	2200.	4550.	11.	11.	750.	0.	0.	370.	0.	430.	2.	600.	8.	7.	0.	885.	49.
OPG662	9	688940	5994430	0.4	0.6	4.	0.	575.	1400.	12.	15.	260.	0.	0.	680.	0.	160.	2.	330.	84.	9.	0.	60.	57.
OPG664	10	329800	6005650	0.6	0.6	2.	0.	2000.	4800.	21.	29.	1200.	0.	0.	770.	0.	800.	4.	430.	38.	12.	0.	420.	77.
OPG665	10	330039	6005750	0.6	0.2	1.	0.	370.	1100.	3.	2.	280.	0.	5.	740.	0.	250.	2.	390.	2.	6.	0.	18.	22.
OPG666	10	329100	6006150	0.4	0.5	1.	0.	2200.	3580.	13.	13.	895.	0.	0.	730.	0.	450.	3.	460.	15.	6.	0.	325.	94.
OPG667	10	328650	6006500	0.5	0.3	1.	0.	320.	1300.	3.	2.	275.	0.	5.	810.	0.	100.	1.	350.	2.	12.	0.	42.	29.
OPG668	10	328549	6006399	0.8	0.2	1.	0.	340.	950.	4.	4.	280.	0.	5.	750.	0.	130.	2.	860.	3.	4.	0.	25.	26.
OPG669	10	327900	6006200	0.4	0.4	1.	0.	1775.	4300.	15.	25.	775.	0.	0.	660.	0.	370.	4.	500.	27.	7.	0.	335.	58.
OPG670	10	327750	6006000	0.5	0.5	3.	0.	1825.	6400.	17.	30.	1475.	0.	0.	700.	0.	730.	5.	560.	20.	15.	0.	535.	53.
OPG671	10	327550	6006000	0.2	0.3	6.	0.	1650.	3950.	9.	19.	850.	0.	0.	650.	0.	220.	3.	540.	16.	12.	0.	540.	46.
OPG672	10	326250	6006740	0.6	0.4	2.	0.	2050.	4400.	12.	24.	385.	0.	0.	720.	0.	650.	3.	400.	32.	7.	0.	450.	67.
OPG673	10	325750	6006800	1.2	0.9	1.	0.	1300.	8150.	37.	47.	395.	0.	0.	840.	0.	1085.	4.	920.	102.	13.	0.	595.	73.
OPG674	10	325200	6007700	1.0	0.7	5.	0.	2025.	9600.	27.	38.	1025.	0.	0.	440.	0.	680.	3.	900.	78.	12.	0.	685.	61.
OPG675	10	324700	6008000	0.6	0.4	3.	0.	1600.	9300.	22.	31.	950.	0.	0.	390.	0.	495.	4.	1030.	62.	10.	0.	680.	74.
OPG676	10	324450	6008080	0.8	0.5	2.	0.	1625.	9400.	29.	53.	575.	0.	0.	500.	0.	660.	3.	1340.	92.	10.	0.	620.	91.
OPG677	9	689750	6030650	0.7	0.2	1.	0.	330.	900.	3.	2.	160.	0.	5.	780.	0.	42.	1.	560.	2.	4.	0.	24.	28.
OPG678	9	689460	6030680	0.2	0.3	1.	0.	2700.	4400.	9.	25.	650.	0.	0.	620.	0.	256.	3.	620.	20.	4.	0.	680.	33.
OPG679	9	689149	6030250	0.2	0.4	1.	0.	2425.	5000.	10.	26.	550.	0.	5.	940.	0.	280.	3.	700.	20.	5.	0.	680.	36.
OPG680	10	320200	5996100	0.6	0.8	8.	0.	1750.	8100.	20.	26.	1300.	0.	0.	1950.	0.	620.	5.	870.	38.	8.	0.	540.	125.
OPG681	10	319519	5996000	1.8	0.9	5.	0.	1500.	9100.	26.	31.	1060.	0.	5.	1830.	0.	1490.	4.	820.	40.	13.	0.	240.	112.
OPG682	10	319650	5995650	0.3	0.6	5.	0.	2325.	6600.	22.	27.	855.	0.	0.	510.	0.	980.	4.	560.	27.	12.	0.	435.	94.
OPG683	9	689540	5995450	0.3	0.5	11.	0.	2800.	6400.	14.	40.	1060.	0.	0.	320.	0.	520.	2.	280.	16.	7.	0.	1120.	72.
OPG684	9	689100	5995500	0.6	0.3	12.	0.	3400.	7800.	12.	23.	1300.	0.	0.	200.	0.	420.	3.	340.	22.	6.	0.	1130.	92.
OPG685	9	688520	5995550	0.2	0.3	6.	0.	3400.	3850.	10.	17.	835.	0.	0.	360.	0.	620.	4.	290.	14.	8.	0.	1320.	76.
OPG686	9	688100	5995050	0.3	0.4	5.	0.	2550.	6800.	12.	28.	965.	0.	0.	400.	0.	292.	3.	500.	43.	7.	0.	1325.	44.
OPG687	9	688120	5994800	0.4	0.3	1.	0.	2775.	7200.	10.	29.	1075.	0.	0.	900.	0.	350.	4.	600.	19.	10.	0.	1200.	45.
OPG688	9	688150	5994400	0.2	0.2	9.	0.	3200.	5200.	10.	11.	625.	0.	0.	460.	0.	190.	4.	710.	7.	7.	0.	1240.	26.
OPG689	9	688650	5994550	0.4	0.4	7.	0.	3350.	6150.	11.	30.	1400.	0.	0.	1180.	0.	210.	1.	490.	18.	9.	0.	1340.	50.
OPG690	9	689300	5994010	2.4	0.5	9.	0.	2300.	6800.	12.	27.	805.	0.	0.	700.	0.	1745.	2.	410.	28.	7.	0.	1190.	116.
OPG691A	9	689500	5993500	0.3	0.3	12.	0.	3200.	5600.	10.	13.	1100.	0.	0.	740.	0.	394.	3.	820.	9.	9.	0.	1165.	56.
OPG691B	9	689500	5993560	0.5	0.9	6.	0.	3050.	10300.	14.	64.	1550.	0.	0.	710.	0.	900.	3.	680.	35.	11.	0.	1140.	98.
OPG692	9	689940	5993150	0.3	0.4	4.	0.	2850.	4800.	9.	9.	800.	0.	0.	630.	0.	233.	2.	550.	6.	7.	0.	925.	61.
OPG693	9	690220	5993050	0.4	0.5	9.	0.	2800.	5500.	12.	15.	540.	0.	0.	530.	0.	202.	2.	680.	8.	8.	0.	1135.	77.
OPG694	9	690500	5992690	0.2	0.4	6.	0.	2775.	7000.	8.	49.	825.	0.	0.	530.	0.	470.	3.	610.	20.	8.	0.	1360.	71.
OPG695	9	690550	5992200	0.6	0.7	7.	0.	3100.	8500.	12.	43.	1155.	0.	0.	700.	0.	440.	1.	580.	14.	11.	0.	1060.	94.
OPG696	9	690470	5992210	0.2	0.3	8.	0.	2650.	4550.	7.	10.	875.	0.	0.	580.	0.	146.	2.	660.	5.	3.	0.	855.	37.
OPG697	10	307620	5993080	0.6	0.4	10.	0.	3000.	7100.	12.	42.	1100.	0.	0.	1350.	0.	495.	1.	520.	28.	15.	0.	980.	95.
OPG698	9	689600	5995490	0.3	0.6	5.	0.	2450.	3950.	7.	20.	500.	0.	0.	500.	0.	162.	3.	500.	22.	4.	0.	925.	43.
OPG699	9	690700	5995500	0.4	0.4	6.	0.	2100.	3600.	10.	16.	660.	0.	0.	430.	0.	350.	3.	410.	16.	8.	0.	800.	55.
OPG700	9	692200	5994650	0.4	0.4	4.	0.	1975.	4600.	14.	17.	540.	0.	0.	2100.	0.	465.	4.	580.	30.	11.	0.	760.	50.
OPG701	9	692680	5994300	0.4	0.3	4.	0.	2425.	4200.	13.	19.	545.	0.	0.	760.	0.	392.	3.	460.	25.	9.	0.	755.	58.
OPG702	9	692850	5994150	0.6	0.5	3.	0.	1750.	4000.	13.	14.	280.	0.	0.	1200.	0.	350.	3.	660.	29.	7.	0.	800.	47.
OPG703	9	693300	5994800	0.7	0.7	2.	0.	1825.	4200.	12.	17.	630.	0.	0.	1950.	0.	422.	4.	460.	30.	9.	0.	755.	49.
OPG704	9	694950	5994450	1.2	0.7	5.	0.	1950.	8300.	14.	18.	840.	0.	0.	3200.	0.	695.	4.	560.	12.	10.	0.	685.	97.
OPG705	10	315929	5994949	1.0	0.4	2.	0.	1630.	2050.	5.	3.	80.	0.	5.	2150.	0.	1060.	1.	540.	8.	9.	0.	135.	43.
OPG706	10	315899	5995449	1.8	2.1	1.	0.	890.	10250.	27.	91.	175.	0.	5.	740.	0.	720.	1.	4900.	21.	24.	0.	660.	77.
OPG707	10	315799	5996149	1.8	2.0	1.	0.	800.	13750.	31.	81.	345.	0.	5.	980.	0.	480.	2.	4200.	22.	20.	0.	640.	63.
OPG708	10	315600	5996399	1.7	1.0	1.	0.	1090.	11000.	18.	35.	490.	0.	5.	1670.	0.	660.	1.	2850.	10.	14.	0.	520.	69.
OPG709	10	315600	5997250	1.9	1.6	1.	0.	630.	16500.	30.	125.	290.	0.	5.	1150.	0.	1415.	1.	6350.	23.	19.	0.	675.	82.
OPG710	10	314200	5999350	0.8	0.3	5.	0.	1800.	3250.	10.	29.	310.	0.	0.	670.	0.	500.	3.	760.	20.	5.	0.	465.	55.
OPG711	10	314000	5999500	0.6	0.4	4.	0.	2200.	5000.	8.	11.	1925.	0.	0.	1150.	0.	235.	3.	530.	20.	5.	0.	1100.	54.
OPG712	10	313450	5999700	1.1	0.3	30.	0.	1575.	1600.	12.	13.	360.	0.	0.	640.	0.	885.	2.	720.	8.	6.	0.	165.	50.
OPG714	10	314049	5995850	0.8	0.4	1.	0.	900.	1050.	4.	6.	90.	0.	48.	890.	0.	1030.	2.	330.	3.	11.	0.	80.	64.
OPG715	10	313950	5994850	0.7	0.3	1.	0.	1300.	1950.	5.	2.	20.	0.	5.	1230.	0.	230.	1.	590.	2.	5.	0.	130.	19.
OPG716	10	313850	5993869	0.8	0.2	1.	0.	1010.	1400.	4.	2.	70.	0.	5.	1750.	0.	300.	1.	840.	2.	5.	0.	140.	23.
OPG717	9	692550	6028200	0.	0.5	5.	0.	0.	0.	0.	6.	110.	0.	240.	0.	0.	0.	3.	0.	0.	19.	0.	0.	45.
OPG718	9	691729	6028130	0.	0.1	1.	0.	0.	0.	0.	2.	290.	0.	5.	0.	0.	0.	1.	0.	0.	6.	0.	0.	20.
OPG719	9	691000	6028339	0.6	0.1	1.	0.	290.	1450.	5.	2.	125.	0.	5.	940.	0.	90.	1.	580.	3.	5.	0.	40.	25.
OPG720	9	690750	6028000	1.0	0.3	1.	0.	1360.	4500.	10.	13.	690.	0.	5.	440.	0.	235.	1.	610.	14.	8.	0.	415.	40.
OPG721	9	691199	6026549	0.6	0.3	1.	0.	280.	1150.	5.	1.	380.	0.	5.	1320.	0.	123.	2.	630.	3.	10.	0.	38.	26.
OPG722	9	692000	6027450	0.	1.6	1.	0.	0.	0.	0.	40.	355.	0.	61.	0.	0.	0.	2.	0.	0.	20.	0.	0.	97.
OPG723	9	692060	6027840	0.8	0.3	10.	0.	1500.	700.	3.	3.	100.	0.	0.	3350.	0.	425.	2.	340.	4.	4.	0.	45.	30.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

TABLE A.1
LITHOGEOCHEMICAL RESULTS — Continued

SAMPLE NO.	UTM CO-ORD EAST	UTM CO-ORD NORTH	Cd	Ag	As	Au*	Ba	Ca	Co	Cu	F	Fe	Hg*	K	Mg	Mn	Mo	Na	Ni	Pb	Sn	Sr	Zn
SG 41	9 676860	6009790	0.4	0.4	2.	10.	2200.	7500.	27.	32.	680.	37000.	20.	830.	3200.	500.	1.	1160.	70.	4.	2.	900.	78.
SG 42	9 678100	6009800	0.2	0.3	2.	10.	1400.	2500.	1.	6.	300.	8000.	10.	4000.	750.	50.	1.	580.	3.	8.	2.	100.	117.
SG 43	9 678750	6010350	0.5	2.5	10.	10.	2200.	19000.	30.	110.	554.	0.	0.	2850.	12250.	800.	15.	555.	90.	20.	3.	1080.	100.
SG 46A	9 678200	6006300	0.6	0.8	11.	10.	650.	2000.	25.	14.	190.	49000.	40.	1270.	7750.	700.	1.	440.	70.	20.	2.	50.	69.
SG 46B	9 678200	6006300	0.8	0.8	19.	10.	820.	2100.	20.	18.	190.	0.	0.	3700.	6300.	800.	1.	455.	82.	12.	2.	120.	100.
SG 48	9 679100	6006920	0.2	0.4	3.	10.	100.	2750.	10.	6.	170.	15500.	10.	260.	1500.	150.	1.	360.	180.	6.	2.	25.	23.
SG 49	9 678740	6004140	1.6	1.5	2.	5.	250.	36000.	55.	82.	320.	46000.	40.	1310.	37000.	750.	5.	770.	110.	36.	4.	200.	51.
SG 50A	9 679290	6004750	0.8	0.7	5.	5.	1500.	32500.	22.	57.	620.	27500.	70.	4000.	14050.	650.	5.	780.	24.	14.	2.	450.	52.
SG 50B	9 679290	6004750	1.2	1.1	14.	5.	3000.	16300.	22.	66.	842.	0.	0.	1180.	7950.	755.	1.	1000.	31.	14.	3.	2050.	70.
SG 52A	9 680100	6004580	1.2	0.8	3.	15.	1350.	38500.	19.	48.	430.	25500.	10.	1770.	21000.	650.	1.	820.	20.	14.	2.	550.	42.
SG 52B	9 680100	6004580	1.4	1.0	13.	5.	2600.	24000.	20.	62.	919.	0.	0.	1110.	17750.	795.	1.	1150.	26.	18.	4.	2000.	61.
SG 53	9 680150	6004680	1.0	1.1	3.	10.	2100.	35000.	29.	20.	140.	41000.	10.	3300.	18600.	650.	1.	970.	28.	20.	5.	500.	62.
SG 54	9 680280	6004520	1.0	0.7	2.	10.	3550.	20000.	26.	25.	860.	37000.	170.	1160.	20000.	950.	1.	1040.	45.	16.	2.	800.	38.
SG 55	9 680350	6004370	0.4	0.8	2.	10.	2400.	21500.	24.	18.	360.	37000.	10.	1730.	20000.	575.	3.	1180.	29.	16.	8.	550.	55.
SG 58	9 679080	6007600	0.2	0.7	130.	155.	1550.	8000.	23.	3.	800.	5500.	10.	3200.	600.	300.	1.	530.	3.	20.	10.	25.	29.
SG 60	9 679200	6007280	0.6	0.8	3.	25.	3650.	10500.	13.	25.	620.	19500.	10.	3100.	8700.	250.	1.	830.	42.	8.	12.	1050.	32.
SG 62	9 680180	6006780	0.4	0.5	22.	10.	2450.	10000.	18.	20.	1160.	30000.	10.	3600.	12950.	225.	1.	1010.	55.	8.	3.	1100.	62.
SG 62A	9 680180	6006780	0.7	0.7	20.	15.	2100.	17000.	21.	24.	656.	0.	0.	4300.	12750.	300.	1.	815.	52.	8.	6.	1550.	74.
SG 64	9 680000	6006550	0.4	0.8	14.	15.	2500.	9600.	20.	56.	680.	0.	0.	4700.	7900.	320.	8.	555.	66.	16.	8.	1550.	60.
SG 65	9 680020	6005920	1.0	1.0	2.	5.	2800.	18000.	25.	38.	330.	26500.	10.	2450.	13500.	500.	1.	890.	18.	24.	5.	800.	57.
SG 68	9 679490	6006020	0.6	1.5	5.	10.	2800.	17500.	23.	32.	1400.	29000.	10.	3400.	19150.	450.	1.	1180.	96.	16.	6.	1200.	73.
SG 69A	9 678750	6007800	4.2	50.0	684.	280.	750.	2500.	96.	13650.	270.	42000.	60.	3500.	1000.	50.	2.	580.	300.	280.	5.	25.	450.
SG 69B	9 678750	6007800	1.8	55.0	223.	500.	950.	2000.	21.	1520.	240.	5500.	80.	4100.	550.	50.	3.	560.	36.	180.	5.	50.	62.
SG 71A	9 679010	6007720	0.6	1.3	22.	15.	2250.	21500.	28.	60.	1620.	48000.	10.	5800.	18300.	250.	1.	890.	93.	18.	9.	1200.	96.
SG 71B	9 679010	6007720	0.8	0.9	36.	10.	1900.	16000.	26.	61.	1285.	0.	0.	6600.	14500.	245.	1.	600.	69.	14.	4.	1550.	76.
SG 72	9 679450	6007750	0.	0.	0.	15.	1800.	1900.	0.	0.	335.	0.	0.	3850.	650.	0.	0.	360.	0.	0.	0.	245.	0.
SG 74	9 680180	6007320	0.	0.	0.	15.	2700.	14000.	0.	0.	718.	0.	0.	1500.	6650.	0.	0.	535.	0.	0.	4.	1350.	0.
SG 75	9 680600	6007000	1.0	0.5	20.	10.	1150.	10500.	20.	28.	860.	30000.	20.	5350.	17000.	200.	1.	2100.	35.	8.	4.	600.	41.
SG 77A	9 680950	6007200	0.6	0.4	2.	10.	2400.	9500.	20.	32.	620.	23000.	10.	1240.	14000.	200.	1.	880.	38.	28.	5.	1300.	75.
SG 77B	9 680950	6007200	0.7	0.8	11.	5.	2100.	13100.	18.	42.	478.	0.	0.	1360.	9750.	272.	1.	685.	39.	18.	3.	1600.	91.
SG 78	9 680600	6006850	0.8	0.6	6.	5.	1900.	9000.	15.	18.	220.	26500.	10.	490.	18400.	375.	1.	960.	30.	12.	4.	650.	48.
SG 80	9 680650	6006480	1.2	1.1	2.	5.	1600.	22000.	26.	22.	430.	37000.	10.	3050.	15000.	775.	1.	860.	27.	22.	3.	500.	76.
SG 81	9 680900	6006250	0.8	1.2	3.	5.	2150.	21500.	18.	18.	480.	37000.	10.	3800.	13400.	600.	1.	890.	10.	24.	2.	650.	80.
SG 82	9 681000	6006140	0.8	1.1	2.	5.	1450.	20000.	26.	18.	560.	44000.	10.	3550.	12600.	1000.	1.	740.	14.	20.	2.	400.	80.
SG 84	9 680260	6007100	0.8	1.2	6.	10.	2900.	16200.	20.	120.	790.	0.	0.	3300.	8150.	440.	12.	785.	72.	26.	18.	1450.	76.
SG 86	9 679370	6008000	0.6	0.4	7.	5.	2950.	9500.	15.	80.	1400.	24000.	10.	4200.	9000.	300.	1.	850.	36.	18.	15.	950.	55.
SG 87	9 679330	6008270	3.4	148.0	140.	1250.	1600.	2500.	8.	2480.	230.	10500.	80.	4300.	550.	50.	1.	520.	15.	400.	12.	25.	96.
SG 87A	9 679330	6008270	2.0	255.0	96.	1300.	600.	1200.	8.	1100.	85.	0.	0.	6300.	425.	102.	1.	215.	14.	620.	2.	125.	36.
SG 87B	9 679330	6008270	5.0	140.0	296.	1550.	1100.	1100.	16.	5840.	69.	0.	0.	8100.	480.	140.	1.	280.	36.	332.	2.	62.	206.
SG 88	9 679330	6008500	8.6	30.0	98.	0.	460.	1650.	14.	6850.	385.	0.	0.	5450.	0.	59.	1.	650.	68.	240.	0.	35.	605.
SG 89	9 679530	6008500	0.6	0.8	2.	10.	3050.	1600.	17.	420.	1584.	32500.	30.	6250.	16350.	450.	1.	1470.	50.	18.	8.	1000.	75.
SG 90A	9 680000	6008900	1.0	1.0	3.	20.	3600.	21500.	28.	84.	1024.	37000.	20.	980.	22000.	700.	1.	910.	35.	22.	8.	900.	75.
SG 90B	9 680000	6008900	1.0	2.5	9.	20.	2250.	17000.	23.	98.	871.	0.	0.	4500.	10750.	740.	1.	460.	34.	20.	5.	630.	99.
SG 91	9 679900	6007900	1.0	2.0	6.	10.	2900.	16000.	20.	96.	1100.	25500.	30.	1610.	16050.	375.	2.	1150.	23.	20.	2.	1150.	51.
SG 92	9 680050	6007600	1.4	1.8	7.	15.	2550.	18500.	22.	63.	740.	41000.	20.	3100.	19500.	450.	3.	780.	61.	20.	5.	850.	200.
SG 93A	9 679950	6007400	0.6	1.3	7.	5.	2900.	19500.	20.	135.	620.	39500.	10.	2300.	16300.	375.	4.	800.	44.	18.	3.	1100.	92.
SG 93B	9 679950	6007400	1.0	1.6	20.	5.	2750.	17500.	20.	144.	895.	0.	0.	3700.	11500.	375.	1.	640.	43.	18.	2.	1400.	76.
SG 95	9 679750	6006750	1.2	1.5	17.	10.	2450.	17000.	35.	32.	1664.	50000.	10.	5200.	25500.	825.	4.	890.	100.	24.	5.	1400.	144.
SG 97	9 680050	6006700	0.6	0.8	2.	15.	2100.	8000.	15.	48.	1135.	30000.	10.	1440.	9300.	225.	1.	760.	49.	16.	4.	1375.	73.
SG 99A	9 679750	6006540	0.4	1.0	3.	15.	7200.	3000.	10.	12.	30.	12500.	10.	990.	6350.	375.	2.	1180.	14.	14.	4.	400.	45.
SG 99B	9 678800	6008460	0.	0.	0.	0.	1020.	7900.	0.	0.	511.	0.	0.	4950.	7100.	0.	0.	1520.	0.	0.	0.	490.	0.
SG 103	9 680550	6009120	0.4	1.1	2.	10.	1300.	2250.	9.	15.	1824.	4500.	540.	2700.	650.	225.	2.	440.	8.	14.	2.	150.	29.
SG 104	9 680470	6009350	1.6	1.1	2.	5.	1450.	38500.	30.	24.	1680.	37000.	10.	3800.	19000.	750.	1.	870.	40.	30.	4.	475.	70.
SG 106	9 680450	6009480	2.0	0.9	2.	5.	1900.	30500.	45.	18.	1220.	50000.	10.	3300.	22500.	825.	1.	900.	30.	26.	4.	550.	108.
SG 107A	9 680900	6010850	0.2	0.9	14.	15.	1450.	2000.	6.	10.	620.	7300.	220.	4000.	500.	50.	1.	680.	11.	14.	5.	300.	20.
SG 107B	9 680900	6010850	0.5	1.0	29.	5.	425.	570.	10.	12.	1055.	0.	0.	6000.	390.	40.	1.	820.	16.	17.	8.	85.	24.
SG 109	9 680440	6010900	1.6	0.5	2.	15.	1050.	15500.	25.	32.	1220.	35000.	200.	4200.	1550.	925.	1.	640.	26.	20.	4.	300.	78.
SG 114	9 680220	6010900	1.7	1.7	2.	10.	1500.	43000.	30.	35.	1040.	44000.	10.	2850.	22000.	825.	1.	620.	90.	30.	5.	750.	88.
SG 118	9 678880	6008550	32.0	2.0	5.	100.	425.	520.	5.	90.	126.	0.	0.	3750.	490.	100.	1.	265.	25.	1600.	13.	85.	2540.
SG 118A	9 678880	6008550	0.4	33.6	77.	455.	400.	2000.	4.	25.	440.	8500.	10.	540.	500.	100.	1.	350.	6.	2700.	15.	50.	38.
SG 118B	9 678880	6008550	1.6	24.0	59.	225.	450.	2250.	1.	14.	170.	5000.	250.	670.	450.	50.	1.	360.	6.	820.	14.	25.	132.
SG 120	9 675850	6003880	0.	0.	0.	5.	2300.	9300.	0.	0.	610.	0.	0.	950.	7450.	0.	0.	695.	0.	0.	5.	1500.	0.
SG 122	9 676100	6003740	0.6	2.0	12.	30.	950.	2400.	16.	30.	285.	0.	0.	1650.	5400.	410.	6.	810.	60.	20.	4.	135.	80.
SG 123	9 678550	6004600	1.6	1.6	22.	10.	1300.	10800.	32.	92.	300.	0.	0.	2650.	13000.	920.	14.	300.	80.	28.	6.	305.	132.

Note: Values are in parts per million (grams per tonne) except where marked by asterisk (*) indicating parts per billion.

APPENDIX B

AEROMAGNETIC MAPS

Two detailed aeromagnetic maps covering the Equity mine area (Figure B.1) and Silver Queen mine area (Figure B.2) were prepared by Lockwood Survey Corporation Ltd. Figure B.1 is an 80-square-kilometre quadrangle centred northeast of Goosly Lake, 34 kilometres southeast of Houston. Figure B.2 is a 40-square-kilometre circular area adjacent to Owen Lake, 36 kilometres south of Houston. Both maps were prepared in 1969 at the original scale of 1:1200. Contours are at 20, 100 and 500-gamma intervals. Mean flight line spacing shown on both maps is 600 feet (180 metres); the approximate terrain clearance for magnetometer readings is 200 feet (60 metres).

Both maps feature high gamma readings in a central region surrounded by a semicircular or annular zone of low readings set in an outer field characterized by numerous side-by-side high and low values (Figure B.3). The high readings of the central area in Figure B.1 coincide approximately with the Goosly syenomonzonite-gabbro stock; in Figure B.2 the central high lies over the massive microdiorite body. On both maps the annular-shaped loci of low gamma values roughly coincides with hydrothermally altered host rocks; the dipole area beyond is typical of the unmineralized volcanics of the Francois Lake group.

These maps were provided through the courtesy of the late C.S. Ney of Kennco Exploration (Western) Ltd. (Figure B.1) and J.T. Williamson formerly of Nadina Mines Ltd. (Figure B.2).

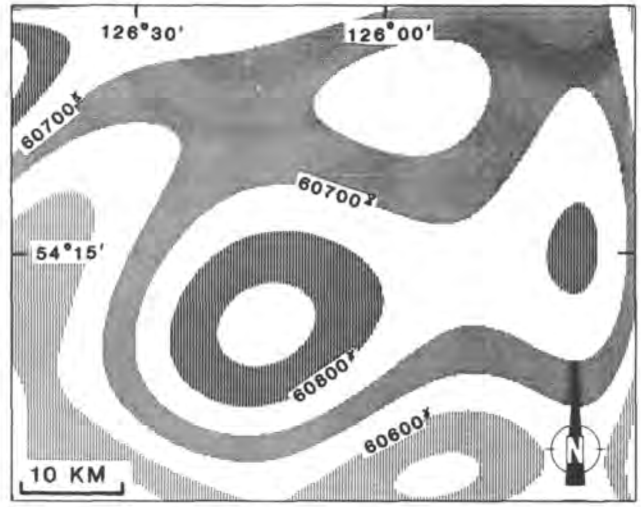


Figure B.3. Subcircular regional magnetic trend (6th order polynomial surface), Buck Creek area.

An interpretation of the second derivative aeromagnetic data from the Silver Queen and Equity Silver mines is provided by Church and Pettipas (1990).

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

FIGURE 1

GEOLOGY OF THE BUCK CREEK TERTIARY OUTLIER

GEOLOGY COMPILED BY B.N. CHURCH

SCALE ~ 1:100 000

LEGEND

BEDDED ROCKS

MIOCENE

11 — **POPLAR BUTTES FORMATION**: COLUMNAR OLIVINE BASALT

FRANCOIS LAKE GROUP

EOCENE

BUCK CREEK FORMATION

10 — *PARROTT MOUNTAIN MEMBER*: MAINLY ANDESITE BRECCIA

9 — *SWANS LAKE MEMBER*: MAINLY BASALTIC LAVA

8 — *HOUSTON MEMBER*: APHANITIC ANDESITE AND DACITE LAVAS AND VOLCANIC BRECCIA, MINOR BASALT

7 — **GOOSLY LAKE FORMATION**: MAINLY FELDSPATHIC ANDESITE AND TRACHYANDESITE LAVAS; BRECCIAS, SILLS, AND STOCKS

6 — **BURNS LAKE FORMATION**: CONGLOMERATE, SANDSTONE INCLUDING SHALE

UPPER CRETACEOUS

5 — **TIP TOP HILL FORMATION**: MAINLY BIOTITE-HORNBLENDE ANDESITE AND ANDESITIC DACITE LAVAS AND PYROCLASTIC ROCKS

4 — ACID VOLCANIC ROCKS, MAINLY RHYOLITE LAVA IN THE TCHESINKUT LAKE AND BULKLEY LAKE AREAS AND RELATED QUARTZ PORPHYRY INTRUSIONS ON OKUSYELDA HILL

LOWER CRETACEOUS

SKEENA GROUP ?

3/0 — A MIXED ASSEMBLAGE OF CHERT PEBBLE AND POLYMICTIC CONGLOMERATE, SANDSTONE, AND FELSIC VOLCANIC FRAGMENTAL ROCKS; SHALE AND MASSIVE RHYOLITE LAVA FORM LOCAL DEPOSITS; INCLUDES CONGLOMERATE WITH SOME WEYLA-BEARING FRAGMENTS

JURASSIC

HAZELTON GROUP

2 — UNDIVIDED FINE-GRAINED DACITIC ANDESITE, RHYOLITE, AND BASALTIC LAVAS AND VOLCANICLASTIC ROCKS AND DYKES

1 — **TELKWA FORMATION**: INCLUDES MAROON TUFF AND TUFF BRECCIA

0 — **MAXAN LAKE FORMATION**: WEYLA-BEARING BROWN SANDSTONES; MAY ALSO INCLUDE CHERT PEBBLE CONGLOMERATE AND ASSOCIATED BEDS ASSIGNED TO UNIT 3

IGNEOUS INTRUSIONS

F — **GOOSLY INTRUSIONS**: SYENOMONZONITE-GABBROIC STOCKS; INCLUDES THE PARROTT LAKE INTRUSION AND GOOSLY LAKE INTRUSION

E — **NANIKA INTRUSIONS**: EQUITY GRANITE STOCK AND QUARTZ FELDSPAR PORPHYRY AT DUNGATE CREEK

BULKLEY INTRUSIONS

D — MINE HILL MICRODIORITE SILLS AND DYKES

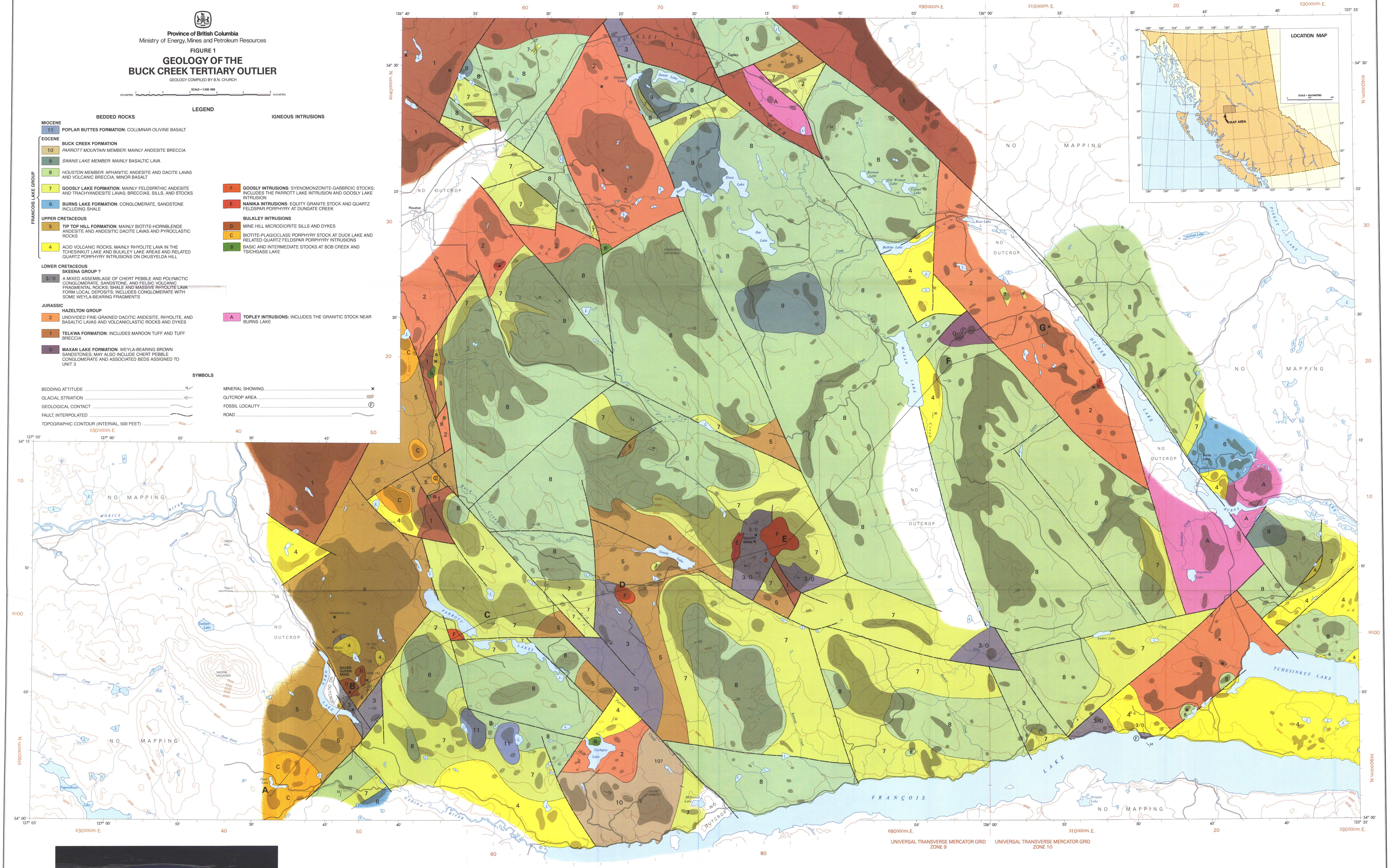
C — BIOTITE-PLAGIOCLASE PORPHYRY STOCK AT DUCK LAKE AND RELATED QUARTZ FELDSPAR PORPHYRY INTRUSIONS

B — BASIC AND INTERMEDIATE STOCKS AT BOB CREEK AND TSICHGASS LAKE

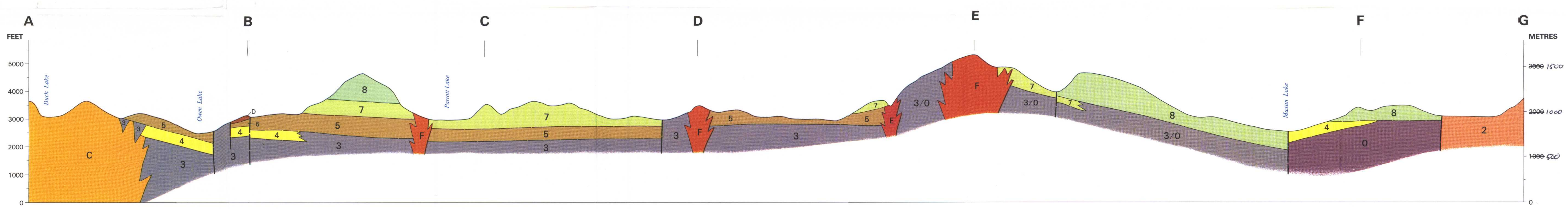
A — **TOPLEY INTRUSIONS:** INCLUDES THE GRANITIC STOCK NEAR BURNS LAKE

SYMBOLS

BEDDING ATTITUDE
GLACIAL STRIATION
GEOLOGICAL CONTACT
FAULT, INTERPOLATED
TOPOGRAPHIC CONTOUR (INTERVAL, 500 FEET)
MINERAL SHOWING
OUTCROP AREA
FOSSIL LOCALITY
ROAD



A PANORAMIC VIEW OF THE EQUITY SILVER MINE, OPEN PIT OPERATIONS, JULY 1984.



CROSS SECTION FROM OWEN LAKE THROUGH THE GOOSLY AREA, (LOOKING NORTHWEST)

CARTOGRAPHY BY P. CHICORELLI

TO ACCOMPANY PAPER 1990-2

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

GEOLOGY OF THE BUCK CREEK TERTIARY OUTLIER

GEOLOGY COMPILED BY B.N. CHURCH

SCALE ~ 1:100 000

LEGEND

BEDDED ROCKS

MIOCENE

11	**POPLAR BUTTES FORMATION**: COLUMNAR OLIVINE BASALT

EOCENE (FRANCOIS LAKE GROUP)

BUCK CREEK FORMATION

10	*PARROTT MOUNTAIN MEMBER*: MAINLY ANDESITE BRECCIA
9	*SWANS LAKE MEMBER*: MAINLY BASALTIC LAVA
8	*HOUSTON MEMBER*: APHANITIC ANDESITE AND DACITE LAVAS AND VOLCANIC BRECCIA, MINOR BASALT
7	**GOOSLY LAKE FORMATION**: MAINLY FELDSPATHIC ANDESITE AND TRACHYANDESITE LAVAS; BRECCIAS, SILLS, AND STOCKS
6	**BURNS LAKE FORMATION**: CONGLOMERATE, SANDSTONE INCLUDING SHALE

UPPER CRETACEOUS

5	**TIP TOP HILL FORMATION**: MAINLY BIOTITE-HORNBLENDE ANDESITE AND ANDESITIC DACITE LAVAS AND PYROCLASTIC ROCKS
4	ACID VOLCANIC ROCKS, MAINLY RHYOLITE LAVA IN THE TCHESINKUT LAKE AND BULKLEY LAKE AREAS AND RELATED QUARTZ PORPHYRY INTRUSIONS ON OKUSYELDA HILL

LOWER CRETACEOUS

SKEENA GROUP ?

3/0	A MIXED ASSEMBLAGE OF CHERT PEBBLE AND POLYMICTIC CONGLOMERATE, SANDSTONE, AND FELSIC VOLCANIC FRAGMENTAL ROCKS; SHALE AND MASSIVE RHYOLITE LAVA FORM LOCAL DEPOSITS; INCLUDES CONGLOMERATE WITH SOME WEYLA-BEARING FRAGMENTS

JURASSIC

HAZELTON GROUP

2	UNDIVIDED FINE-GRAINED DACITIC ANDESITE, RHYOLITE, AND BASALTIC LAVAS AND VOLCANICLASTIC ROCKS AND DYKES
1	**TELKWA FORMATION**: INCLUDES MAROON TUFF AND TUFF BRECCIA
0	**MAXAN LAKE FORMATION**: WEYLA-BEARING BROWN SANDSTONES; MAY ALSO INCLUDE CHERT PEBBLE CONGLOMERATE AND ASSOCIATED BEDS ASSIGNED TO UNIT 3

IGNEOUS INTRUSIONS

F	**GOOSLY INTRUSIONS**: SYENOMONZONITE-GABBROIC STOCKS; INCLUDES THE PARROTT LAKE INTRUSION AND GOOSLY LAKE INTRUSION
E	**NANIKA INTRUSIONS**: EQUITY GRANITE STOCK AND QUARTZ FELDSPAR PORPHYRY AT DUNGATE CREEK

BULKLEY INTRUSIONS

D	MINE HILL MICRODIORITE SILLS AND DYKES
C	BIOTITE-PLAGIOCLASE PORPHYRY STOCK AT DUCK LAKE AND RELATED QUARTZ FELDSPAR PORPHYRY INTRUSIONS
B	BASIC AND INTERMEDIATE STOCKS AT BOB CREEK AND TSICHGASS LAKE
A	**TOPLEY INTRUSIONS:** INCLUDES THE GRANITIC STOCK NEAR BURNS LAKE

SYMBOLS

BEDDING ATTITUDE
GLACIAL STRIATION
GEOLOGICAL CONTACT
FAULT, INTERPOLATED
TOPOGRAPHIC CONTOUR (INTERVAL, 500 FEET)
MINERAL SHOWING
OUTCROP AREA
FOSSIL LOCALITY
ROAD

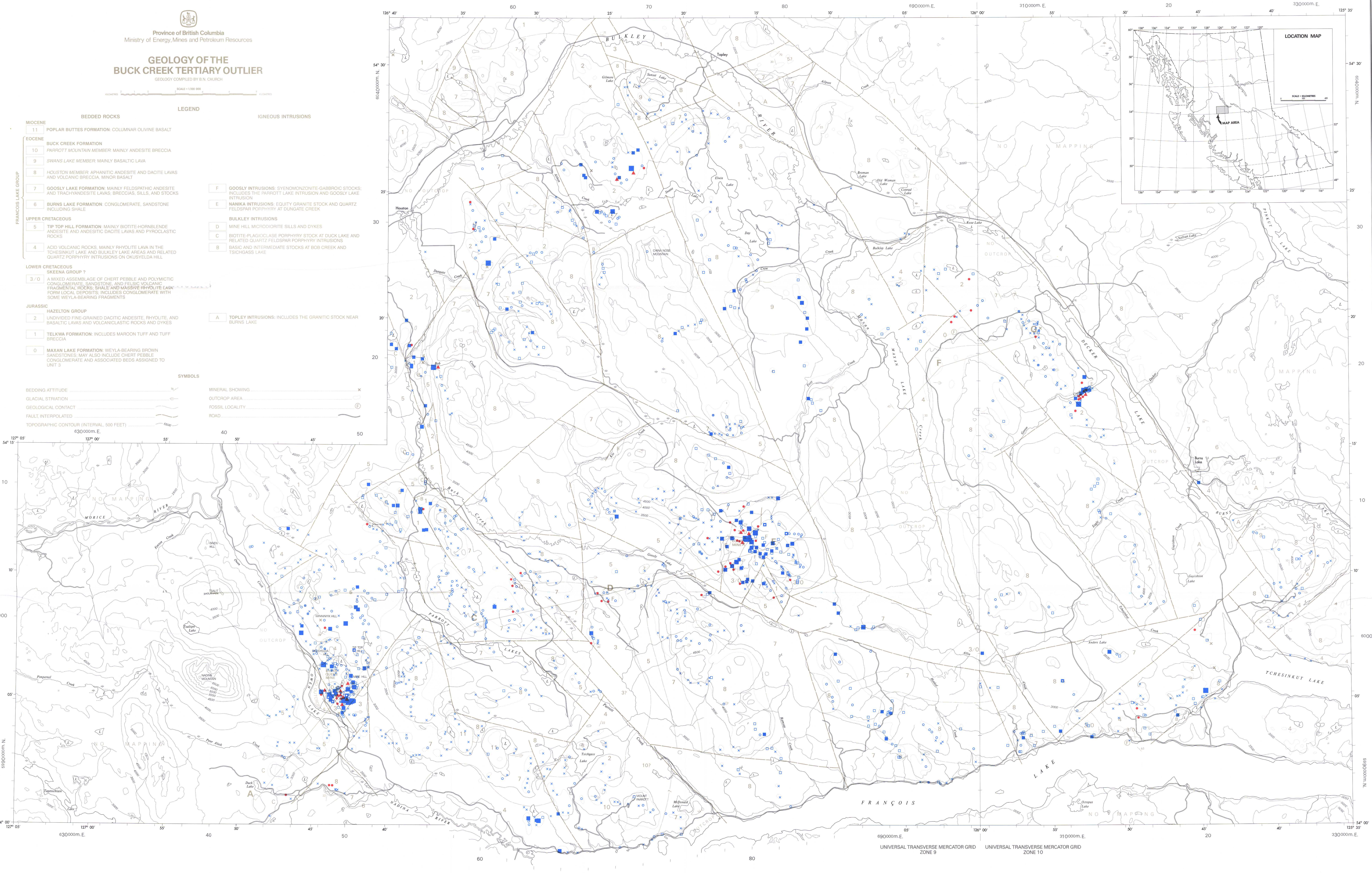
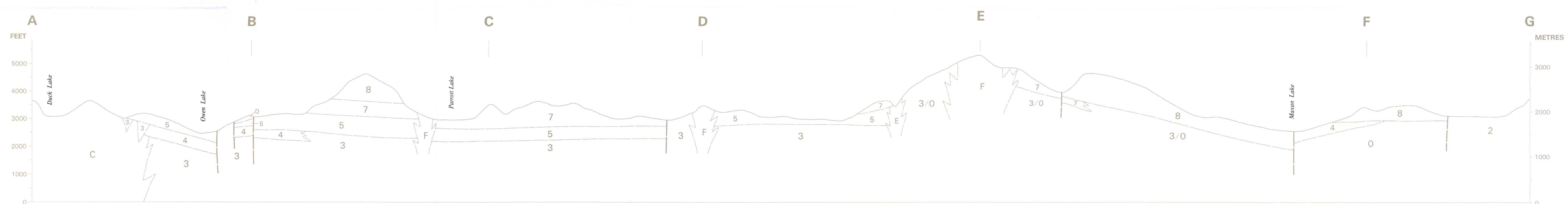


FIGURE 2

SILVER AND ARSENIC LITHOGEOCHEMISTRY OF THE BUCK CREEK TERTIARY OUTLIER

BY B.N. CHURCH

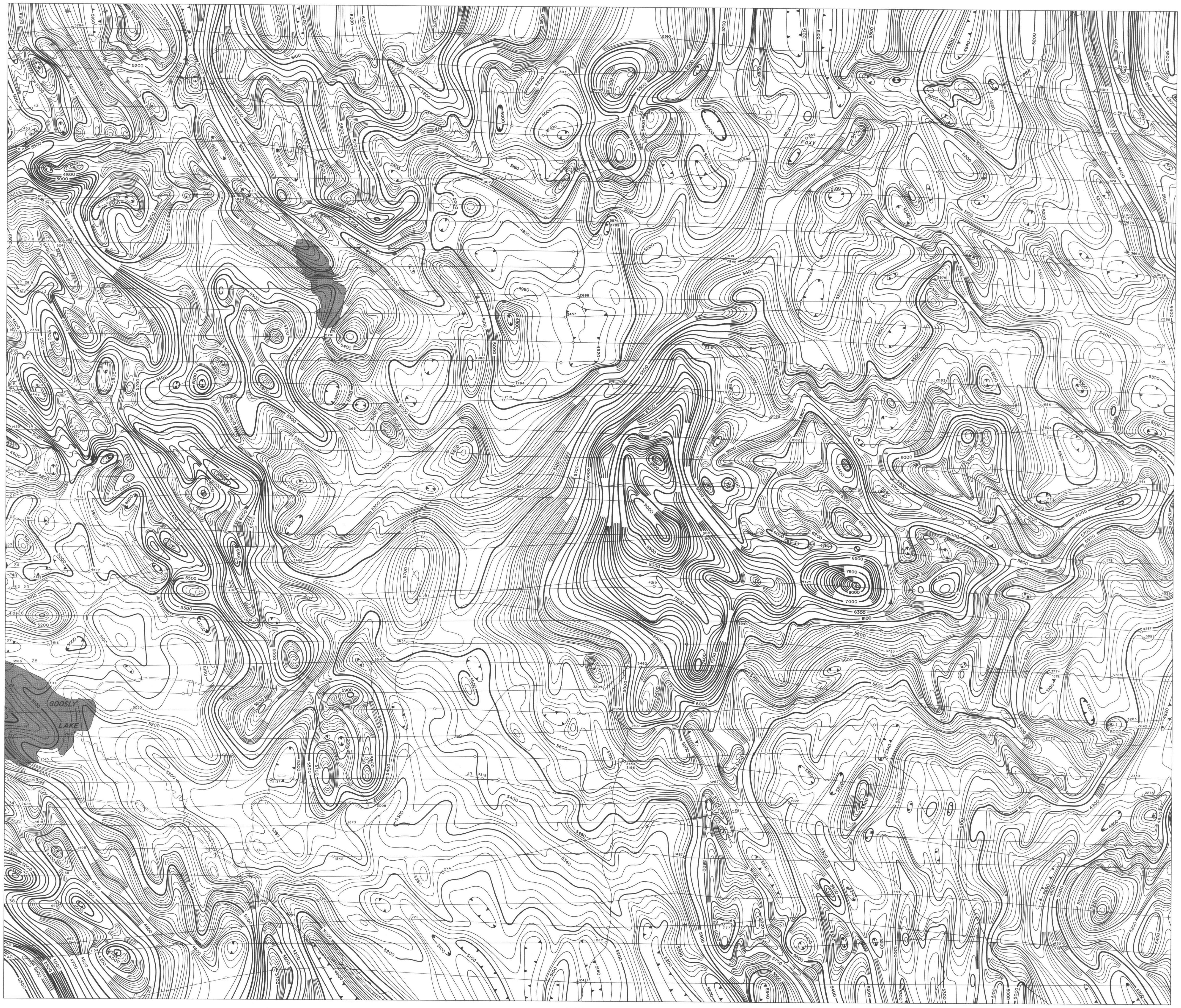
PARTS PER MILLION	SYMBOL	PERCENTILE
ARSENIC		
131	large filled square	99
60	filled square	98
22	filled square	95
12	small filled square	90
5	open square	75
2	open circle	50
	×	
SILVER		
5	triangle	
2	dot	



CROSS SECTION FROM OWEN LAKE THROUGH THE GOOSLY AREA, (LOOKING NORTHWEST)

CARTOGRAPHY BY P. CHICORELLI

TO ACCOMPANY PAPER 1990-2



CONTOUR INTERVAL ---------------- 20 GAMMA
MEAN FLIGHT LINE SPACING --------- 660 FEET
MEAN TERRAIN CLEARANCE ---------- 200 FEET
500 GAMMA CONTOUR
100 GAMMA CONTOUR
20 GAMMA CONTOUR
MAGNETIC LOW
FIDUCIAL POINTS ---------------- O 3690
FLIGHT LINES

FIGURE B-1

AEROMAGNETIC MAP OF THE EQUITY MINE AREA

(TOTAL FIELD INTENSITY MAGNETIC MAP)

SCALE : 1 Inch to 1000 Feet

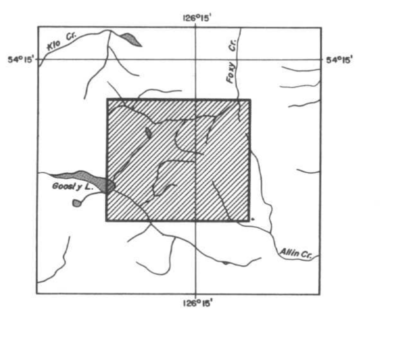
1000 FEET — 0 — 1000 — 2000 — 3000 FEET

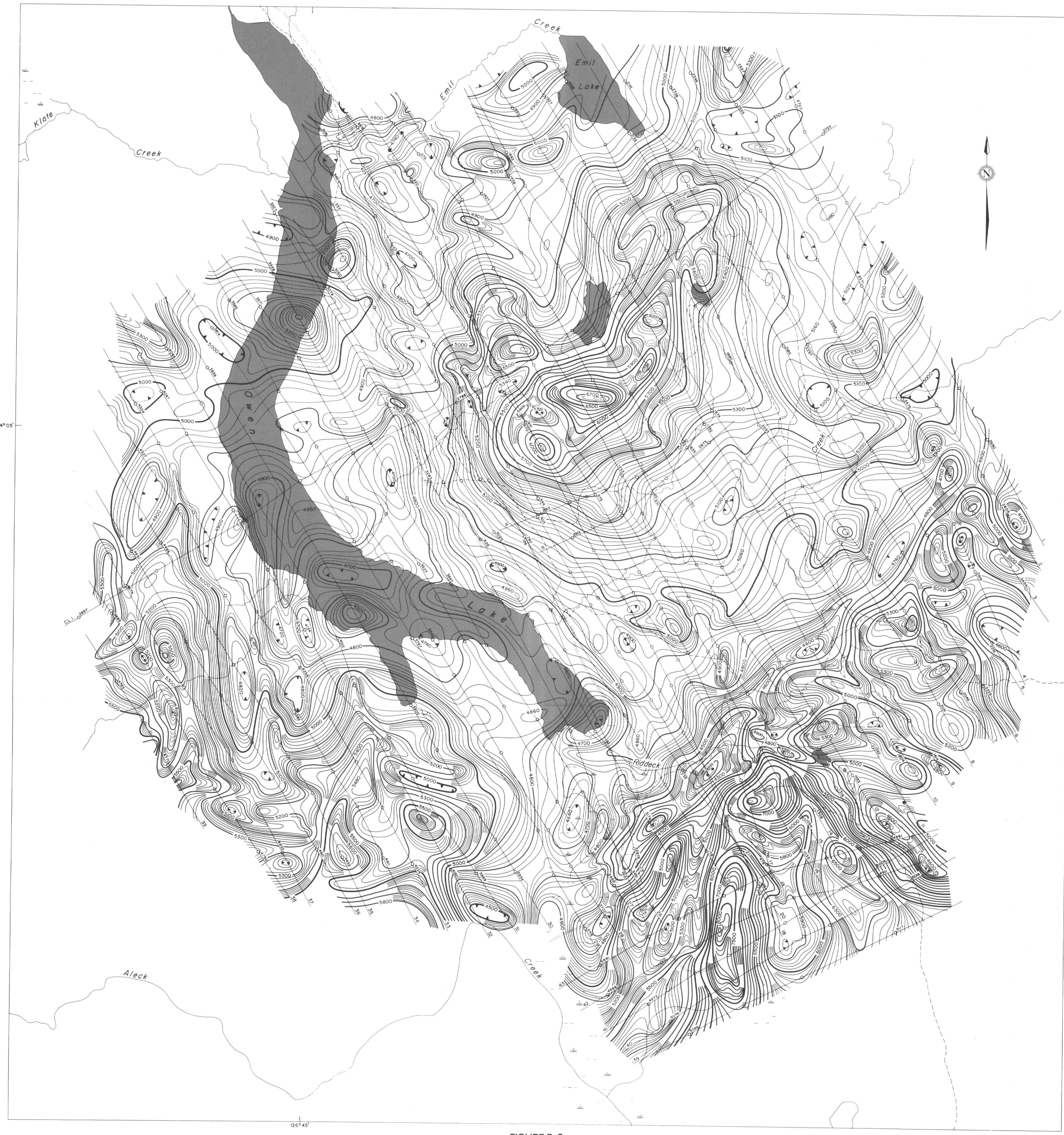
Flown and Compiled by

LOCKWOOD SURVEY CORPORATION LIMITED FOR KENNCO EXPLORATION (WESTERN) LIMITED

1969

TO ACCOMPANY PAPER 1990 - 2





CONTOUR INTERVAL .... 20 GAMMA
MEAN FLIGHT LINE SPACING ... 660 & 1320 FEET
MEAN TERRAIN CLEARANCE .... 200 FEET
500 GAMMA CONTOUR
100 GAMMA CONTOUR
20 GAMMA CONTOUR
MAGNETIC LOW
FIDUCIAL POINTS .... ○ 3690
FLIGHT LINES

FIGURE B-2

AEROMAGNETIC MAP OF THE SILVER QUEEN MINE AREA

(TOTAL FIELD INTENSITY MAGNETIC MAP)

SCALE : 1 Inch to 1000 Feet

1000 FEET 0 1000 2000 3000 4000 FEET

Flown and Compiled by

LOCKWOOD SURVEY CORPORATION LIMITED FOR J.T.WILLIAMSON

1969

TO ACCOMPANY PAPER 1990 - 2