Regional Mapping

QUESNEL GOLD BELT — ALKALIC VOLCANIC TERRANE BETWEEN HORSEFLY AND QUESNEL LAKES* (93A/6)

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INTRODUCTION

A four-year geological mapping program, the Quesnel Project, funded by the Canada/British Columbia Mineral Development Agreement (MDA) was initiated in 1986. It is primarily intended to study the geological setting and economic potential for gold and copper-gold deposits in the central volcanic-intrusive axis of the Quesnel belt, previously known as the Quesnel trough (Figure 3-1-1).

This report outlines results of the first summer's fieldwork during which 180 square kilometres were mapped at scale 1:15 840 (1 inch to ¼ mile) between the western end of Horsefly and Quesnel Lakes (Figure 3-1-2). An attendant study, conducted as part of the Quesnel Project by Mary Anne Bloodgood, is an investigation of the basal black phyllite units that underlie the volcanic rocks and flank them to the east and southeast; see the accompanying report by M.A. Bloodgood, this volume.

The project area is within the south-central portion of the Quesnel terrane, an allochthonous belt of predominantly Upper Triassic-Lower Jurassic basic to intermediate volcanic rocks that lies along the eastern margin of the Intermontane Belt. Quesnel terrane can be followed as a disrupted but nearly continuous narrow belt, from the southern to northern provincial boundaries. The belt includes rocks of the Quesnel River, Nicola, Takla, Stuhini and Rossland Groups (Tipper *et al.*, 1971). Quesnel terrane in the project area is a fault-bounded region that is flanked to the east by Precambrian to Paleozoic rocks of the Barkerville and Slide Mountain terranes (Struik, 1986) and to the west by Paleozoic rocks of the Cache Creek terrane.

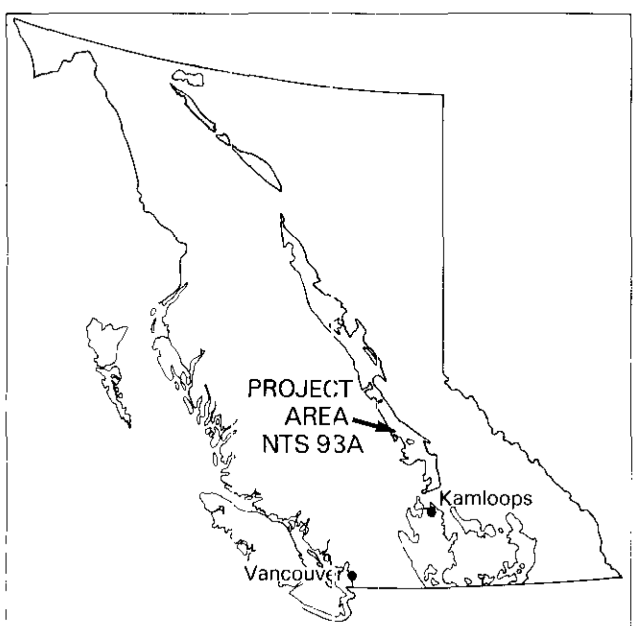

Figure 3-1-1. Location of the project area in Quesnel terrane (shaded area).

PREVIOUS WORK

Triassic volcanic rocks were first recognized to the south near Kamloops by G.M. Dawson and in the Quesnel River region by Amos Bowman in 1887. The broad extent of Triassic rocks was discovered in the 1940s and 1950s and in the 1960s they were interpreted to be part of a volcanic arc that is continuous throughout the Cordillera. Comprehensive regional studies in the Quesnel River area were made by the Geological Survey of Canada in the late 1950s and 1960s and are summarized by Campbell, 1978 (Geological Survey of Canada, Open File Map 574). The first synopsis of mineral potential in the region was by Campbell and Tipper (1970).

The alkaline nature of the volcanic rocks and related plutons became evident during the 1970s largely from work by Fox (1975) and Ministry work near Princeton by Preto (1979). Detailed stratigraphic and petrologic studies were by Lefebure (1976), Morton (1976) and Bailey (1978). Alkalic pluton-related mineralization was discussed by Barr *et al.* (1976) and Hodgson *et al.* (1976).

Placer gold in the Quesnel River drainage system has been historically important. Bedrock exploration in Quesnel River area was active during the late 1960s and throughout the 1970s, first for copper and copper-gold porphyry deposits and more recently for gold deposits (Saleken and Simpson, 1984). Exploration activity peaked in the early 1980s after release of the 1980 Regional Geochemical Survey (RGS) and recognition of the significance of the Quesnel River (QR) deposit. There Dome Exploration (Canada) Ltd. has discovered about one million tonnes of near-surface mineralization in altered basalts, containing some 8 tonnes of gold reserves (Fox, Cameron and Hoffman, in press).

STRATIGRAPHY

The scarcity of outcrops, abundant block faulting and similar appearance of map units within the basaltic sequence make correlation of many map units difficult. However some coarse-grained plagioclase pyroxene basalt and analcite-bearing rocks provide distinctive, readily identifiable map units.

The stratigraphic sequence consists predominantly of subaqueous pyroxene-phyric basalt flows, flow breccia, debris flow or lahar deposits and locally developed volcaniclastic and epiclastic rocks. These rocks overlie a basal sequence of basaltic-source volcanic sandstone and are in fault contact with younger feldspathic polylithic volcaniclastic rocks. The basaltic rocks are calc-alkalic to alkalic (shoshonitic) in composition and have associated cogenetic stocks of diorite to monzonite composition (Table 3-1-2). Most of the rocks lack modal quartz and many have nepheline and/or olivine in the normative mineralogy. They all contain abundant modal pyroxene. Some distinctive rocks also contain coarse-grained plagioclase laths up to 1.5 centimetres in length; others contain olivine or analcite.

* This project is a contribution to the Canada/British Columbia Mineral Development Agreement.
British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1986, Paper 1987-1.

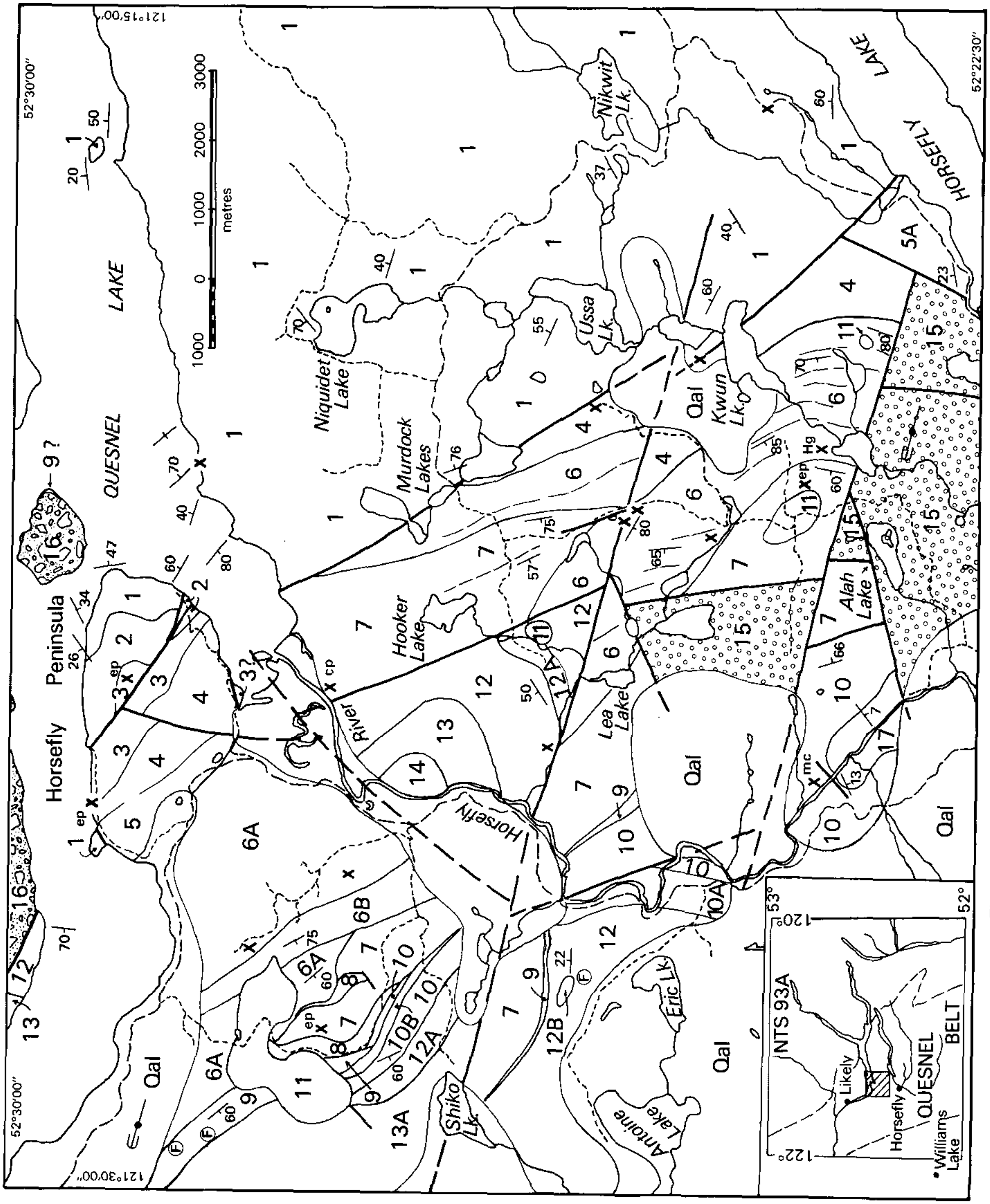

Figure 3-1-2. Geology of the central Quesnel terrane between Horsefly and Quesnel Lakes.

LEGEND

QUATERNARY

PLEISTOCENE AND RECENT

Qal — *Glacial and fluvial deposits; alluvium*

TERTIARY

EOCENE OR (?) YOUNGER

17 — *Pale grey to yellow grey sandstone, siltstone*

JURASSIC

LOWER AND (?) MIDDLE JURASSIC

16 — *Conglomerate with orange weathering carbonate matrix; polymictic with predominantly meta-sedimentary and rare granitic clasts*

LOWER JURASSIC

15 — *Volcaniclastic rocks; pale to dark brown, grey and lavender polylithologic conglomerate and breccia containing 'felsic' feldspathic clasts*

14 — *Dark grey to green grey polymictic volcanic breccia*

13 — *Dark green to grey alkali olivine basalt; 13A — pyroxene basalt breccia*

12 — *Dark grey to black analcite — pyroxene basalt; 12A — analcite crystal-lithic ash and lapilli tuff; 12B — brownish black sandstone and siltstone*

11 — *Diorite, monzonite and related dykes*

SYMBOLS

Trends of well bedded volcaniclastic units within major map units ....

Main roads ....

Logging and secondary roads ....

Quartz-carbonate alteration with pyrite and/or marcasite — Mc, cinnabar — Hg x

Propylitic alteration with pyrite, epidote, calcite, chlorite, actinolite and minor garnet and chalcopyrite — cp .... xep

TRIASSIC AND JURASSIC

UPPER TRIASSIC AND (?) YOUNGER

10 — *Green black to dark grey brown pyroxene basalt; 10A — fine-grained basalt; 10B — maroon pyroxene basalt breccia with mudstone matrix*

9 — *Dark brown sandstone, siltstone; limestone dominant locally*

8 — *Pale grey to pink breccia, intrusive in part. Monzonitic breccia with volcanic clasts; flow layered lithic tuff and breccia*

7 — *Grey to greyish green plagioclase-pyroxene phyric basalt; mainly autobrecciated flows. Extensively epidotized with pyrite near diorite intrusions*

6 — *Dark olive grey, grey to black pyroxene basalt and intercalated volcaniclastic rocks; 6A — includes fine-grained basalt flows or dykes, tuff and volcaniclastic sandstone, greywacke or pyroxene crystal tuff 6B — polymictic debris flows or lahar*

5 — *Brownish black to olive black, dusky red to reddish brown weathering alkali olivine basalt; breccia, pillow breccia and locally hyaloclastite*

4 — *Green grey to black pyroxene basalt flow breccia; includes some pyroclastic breccia and slide debris. Top of unit locally contains dykes of map unit 5 olivine basalt. Basal part contains medium-grained plagioclase phenocrysts*

3 — *Grey to grey green, rusty weathering pyroxene hornebende basalt or andesitic basalt. Breccia in part, extensively pyritic*

2 — *Dark green to black pyroxene basalt*

1 — *Dark greenish grey to olive grey greywacke, siltstone; locally chert and argillite with thin limestone lenses. Some beds contain abundant olivine and pyroxene grains*

Morton (1976) studied a large area that includes the area described in this report. He subdivided the rocks into 29 map units and identified three main cycles of magmatic activity. Morton's study provides much petrologic description and chemical analyses but none of his stratigraphy is retained in this study. Bailey (1976 and 1978) completed a similar study to the northwest of Morton and this project; Bailey's stratigraphy is compatible with this study. His two older map units and their subdivisions are equivalent to the map units shown on Figure 3-1-2. Bailey's Unit 1 is equivalent to this study's Unit 1; his Unit 2, with its seven subunits, corresponds to this study's Units 2 through 14.

The following map units representing an approximately 5-kilometre-thick sequence are shown on Figure 3-1-2:

UNIT 1: Volcanic-source sandstone and siltstone, minor chert and limestone lenses. A thinly bedded sequence containing turbidite members and beds with abundant olivine and pyroxene grains and limestone clasts.

UNIT 2: Dark green pyroxene basalt flows and flow breccia. Generally chloritized, with abundant calcite veinlets.

UNIT 3: Pale grey-green, pyritic, pyroxene hornblende basalt or basaltic andesite. Breccia in part. Pyritic rocks contain epidote and are rusty weathering.

UNIT 4: Alkalic pyroxene basalt. Coarse pyroxene-phyric flows, mainly autobrecciated flows; some pyroclastic breccia. Includes flow units containing fine to medium-grained plagioclase laths.

UNIT 5: Alkali-olivine basalt and pyroxene basalt autobrecciated flows and pillow breccia. Limestone is common in small lenses or as breccia matrix or clasts. 5A — Breccia debris flows or lahar.

UNIT 6: Pyroxene-phyric basalt. Pyroclastic and volcaniclastic breccias with variably oxidized green to purple and reddish coloured clasts in a mixed sequence of coarse breccia and tuffs. Many clasts are amygdaloidal or vesicular. Unit contains pyroxene-rich greywacke or crystal tuff, debris flows or lahar. Includes: 6A — massive flows of fine-grained basalt; 6B — polymictic lahar with predominantly Unit 6 debris but also diabase and feldspar-bearing clasts of volcanic or dyke rocks, and 6C — thinly bedded greywacke, pyroxene crystal lithic ash to lapilli tuff or epiclastic beds.

UNIT 7: Plagioclase pyroxene-phyric basalt flows and distinctive coarse fragmental monomictic autobrecciated units. Contains limestone blocks and breccia matrix in coarse slump debris at top of unit. Generally contains some epidote; strongly epidotized with abundant pyrite and rare garnet near intrusive rocks.

UNIT 8: Pink-weathering monzonite-latite breccia. Intrusive breccia adjoining the Shiko stock but part of the layered volcanic sequence further away. Milled polylithologic volcanic clasts in a dioritic matrix. Epidotized and weakly pyritic.

UNIT 9: Sandstone, siltstone; minor chert, locally predominantly limestone. Contains some Sinemurian faunal debris.

UNIT 10: Pyroxene basalt, mainly medium-grained pyroxene-phyric basalt flow breccia. Possibly locally analcite-bearing. Unit 10A — fine-grained to aphanitic basalt with sparse pyroxene phenocrysts; 10B — maroon basalt breccia with red mud matrix and lenses.

UNIT 11: Diorite and monzonite intrusions — small stocks, medium-grained equigranular to porphyritic, containing hornblende and biotite. Includes a related suite of dykes — differentiated from alkalic gabbro to hornblende syenite and felsic potassium-feldspar porphyries.

UNIT 12: Analcite-bearing pyroxene basalt flows and flow breccia. Includes 12A — analcite crystal-lithic ash tuff and interbedded thin flows; 12B — sandstone and siltstone, locally with faunal debris.

UNIT 13: Alkalic-olivine pyroxene basalt breccia. Includes 13A — pyroxene breccia; some lapilli tuff and rare amygdaloidal pillow basalt and pillow breccia.

UNIT 14: Breccia — dark grey to green polymictic breccia containing mainly pyroxene basalt clasts but also hornblende and plagioclase-bearing basaltic andesite debris.

UNIT 15: Polylithologic conglomerate and breccia; some feldspathic "felsic breccia"; locally arkosic sandstone. Very mixed clast lithologies, primarily feldspathic volcanic debris but includes clasts of intrusive rocks.

UNIT 16: Conglomerate and sandstone. Calcareous matrix, commonly orange-weathering with polymictic clasts derived from metamorphic and granitic terranes.

UNIT 17: Lacustrine siltstone. Laminated pale grey beds with abundant floral debris and rare fish imprints. Unconformably overlies volcanic rocks along a highly oxidized and weathered rock-paleosol surface.

AGES OF MAP UNITS

The main basaltic volcanic sequence (Units 2 to 7) and the basal basalt-derived sedimentary unit (Unit 1) are shown by Campbell (1978), to be Norian and possibly younger; the analcite-bearing rocks and maroon basaltic breccia and related sediments of Units 9, 10 and 12 are Norian to Sinemurian. Bailey (1978), on the basis of some additional faunal data, considers the basal sedimentary unit to be Carnian, the main volcanic sequence Norian, and the overlying polylithologic felsic volcaniclastic units earliest Jurassic.

The younger conglomerates (Unit 16) are identical to rocks 20 kilometres to the northwest along the Quesnel River between Likely and Quesnel Forks. Both Campbell and Bailey regard these as Pleinsbachian to Bajocian (Lower to Middle Jurassic).

Three fossil localities sampled during this mapping rendered indeterminable fragments of bivalves, gastropods, corals and sparse ammonites. The sites were extensively sampled in 1986 by H. Tipper (personal communication) and produced abundant Sinemurian fauna.

Results of radiometric dating of four diorite to monzonite stocks are shown on Table 3-1-1. The stocks sampled are the Bullion stock at the site of the Bullion placer mine near Likely, the Shiko Lake stock, and the Quesnel River (QR) stock 8 kilometres downstream from Quesnel Forks. The potassium-argon dates are similar to the previously reported ages from the Shiko Lake stock — 190 million years (Schink, 1974) and the Lemon Lake stock — 192 million years (Pilcher and McDougall, 1976).

PETROCHEMISTRY

Fifteen samples were analysed for major oxide and rare earth elements (REE) (Tables 3-1-2 and 3-1-3; Figures 3-1-3 and 3-1-4). These are additional to the nearly 100 analyses reported by Morton (1976) and Bailey (1978). The new data reaffirm that the volcanic suite is a calc-alkaline to alkaline assemblage of alkaline olivine basalt and alkaline basalt that has undergone little fractional crystallization. The sequence in the map area, with the exception of Unit 15, does not contain the trachyandesite and trachyte felsic breccia sequence described by Bailey. The rocks are typical of other deep water calc-alkaline to alkaline (shoshonitic) island arc rocks with low TiO_2 and moderately elevated light REE values (Spence, 1985).

TABLE 3-1-1.
POTASSIUM-ARGON ANALYTICAL DATA, QUESNEL RIVER ALKALIC STOCKS

Sample Number	Location (UTM)	Lithology	Material Analysed	%K	Ar^{40*} 10^{-10} (moles/gm)	Ar^{40*} Total Ar^{40}	Apparent Age (Ma)
(1) 85AP-8/9-71	591900E, 5831900N	Bullion pit stock, diorite	Biotite	5.40	19.037	87.7	193 ± 7
(2) 85AP-7/2-63	603750E, 5812800N	Shiko stock, hornblende porphyry dyke	Hornblende	0.828	2.967	91.8	196 ± 7
(3) 85AP-8/1-64	603550E, 581300N	Shiko stock, monzonite core zone	Biotite	4.67	16.408	86.7	192 ± 10
(4) 85AP-21/2-120	581450E, 5835300N	QR stock, diorite	Biotite (chloritized)	3.95	14.565	95.2	201 ± 7

* Radiogenic Ar.

Constants: $\lambda^{40}K\varepsilon = 0.581 \times 10^{-10} yr^{-1}$; $\lambda^{40}K\beta = 4.96 \times 10^{-10} yr^{-1}$; $^{40}K/K = 1.167 \times 10^{-4}$.
%K determined by the Analytical Laboratory, British Columbia Ministry of Energy, Mines and Petroleum Resources, Victoria.
Ar determination and age calculation by J.E. Harakal, The University of British Columbia.

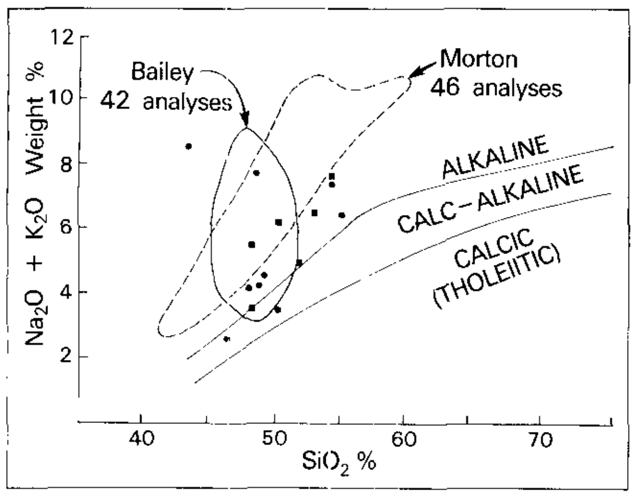

Figure 3-1-3. Alkali-silica diagram. New analyses: volcanic rocks, circles; intrusive rocks, squares. Fields of analysed samples from Morton (1976) and Bailey (1978). Field boundaries modified from Kuno by Spence (1985).

The breccia (Unit 8) associated with the Shiko Lake stock is intermediate in character (analyses 31600 and 31603) and similar in composition to the diorite and monzonite stocks analysed (samples 31601, 31602, 31605, 31606, 31610 and 31612).

STRUCTURE

The region is extensively block faulted with generally steeply dipping, southwesterly to west-facing panels of poorly bedded volcanic rocks. The basal sedimentary unit is complexly folded but there is little development of any penetrative foliation. Between Horsely and Quesnel Lakes the basal unit is in fault contact with the overlying volcanic rocks; on Horsefly Peninsula it is conformably overlain by pyroxene-phyric basalt flows.

In the south and southwestern part of the map area (Figure 3-1-2) between Horsefly Lake and Horsefly River, there appears to be a series of small grabens containing felsic-clast conglomerates. These might be part of a series of larger, northwesterly trending grabens along the medial axis of the volcanic arc. A similar structure is shown to the northwest by Bailey (1978).

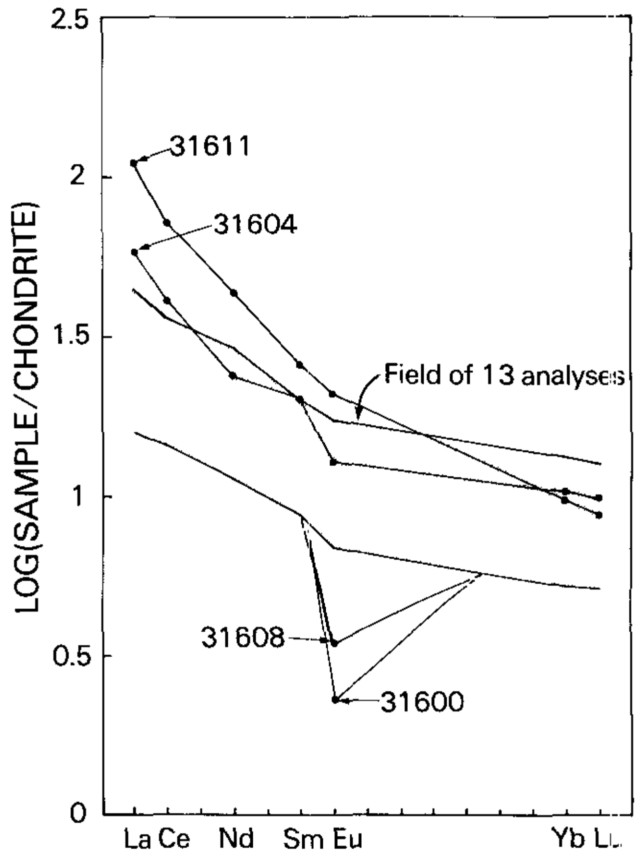

Figure 3-1-4. Chondrite normalized rare earth element (REE) plot for 15 samples (31597 to 31612).

An invaluable aid to locating faults, tracing map units across faults and providing correlation between fault blocks, is provided by regional aeromatic maps (Aeromagnetic Series Map 5239G, 1:63 360). The magnetic highs (Figure 3-1-5) outline alkalic intrusive centres and analcite-bearing volcanic units (total field strength 4000 to 5000 gammas). Magnetic troughs correspond to the coarse

TABLE 3-1-2. CHEMICAL ANALYSIS AND CIPW NORMS FOR INTRUSIVE AND VOLCANIC ROCKS

OXIDES AS DETERMINED

Sample	31597	31598*	31599	31600	31601	31602	31603	31604	31605	31606	31607	31608	31609	31610	31611	31612
SiO_2	49.19	43.82	48.13	55.18	42.20	54.34	54.40	48.07	50.35	48.20	46.80	50.32	49.28	53.55	48.51	52.36
TiO_2	0.57	0.65	0.61	0.64	1.04	0.55	0.55	0.76	0.68	0.99	0.55	0.51	0.97	0.77	0.69	0.63
Al_2O_3	11.15	15.39	9.94	17.31	14.98	18.07	16.75	16.23	15.61	17.80	9.23	10.64	11.41	17.93	16.63	17.34
Fe_2O_3	6.12	6.34	6.35	5.23	2.72	4.43	3.70	5.55	6.14	6.20	5.22	4.11	2.74	4.39	4.22	4.75
FeO	4.51	1.91	5.37	4.22	8.33	3.57	3.43	4.14	5.28	4.64	5.43	5.86	6.08	4.41	4.91	3.44
MnO	0.16	0.19	0.20	0.24	0.22	0.15	0.14	0.19	0.21	0.11	0.18	0.19	0.15	0.19	1.21	0.16
MgO	9.21	2.78	10.63	4.05	6.16	3.33	4.42	5.56	4.95	4.13	10.96	12.54	7.59	3.01	4.07	3.28
CaO	12.96	11.06	13.33	5.21	9.25	6.76	5.88	11.18	9.31	9.65	15.18	9.51	13.13	7.41	6.80	6.62
Na_2O	3.51	4.45	1.56	5.11	2.97	4.00	3.13	2.91	2.48	3.02	1.57	11.50	4.29	3.71	4.68	3.79
K_2O	0.65	4.06	2.18	1.30	1.82	3.56	4.38	1.13	3.65	2.50	0.93	1.88	0.04	2.55	2.96	3.74
P_2O_5	0.45	0.50	0.32	0.33	0.33	0.48	0.26	0.62	0.48	0.39	0.29	0.24	0.22	0.42	0.54	0.48
CO_2	0.70	5.50	0.11	0.10	0.10	0.10	1.11	0.10	0.34	0.34	0.38	0.20	3.27	0.10	0.73	0.11
H_2O-	0.31	0.38	0.44	0.37	0.13	0.13	0.31	0.16	0.05	0.11	0.29	0.43	0.12	0.20	1.25	0.16
H_2O+	1.34	3.47	1.48	2.00	0.64	0.86	0.78	2.40	0.08	2.00	1.75	2.28	1.60	1.11	3.45	0.82
Total	100.83	100.50	100.65	101.23	100.89	100.33	99.24	99.00	99.61	100.08	98.76	100.11	100.89	99.80	98.65	97.68

OXIDES RECALCULATED VOLATILE FREE

Sample	31597	31598*	31599	31600	31601	31602	31603	31604	31605	31606	31607	31608	31609	31610	31611	31612
SiO_2	49.95	48.08	48.80	55.84	52.19	54.76	56.06	49.90	50.79	49.37	48.58	51.72	51.39	54.45	51.49	54.21
TiO_2	0.58	0.71	0.62	0.65	1.04	0.55	0.57	0.79	0.69	1.01	0.57	0.52	1.01	0.78	0.73	0.65
Al_2O_3	11.32	16.89	10.08	17.52	14.98	18.21	17.26	16.85	15.75	18.23	9.58	10.94	11.90	18.23	17.65	17.95
Fe_2O_3	6.21	6.96	6.44	5.29	2.72	4.46	3.81	5.76	6.19	6.35	5.42	4.22	2.86	4.46	4.48	4.92
FeO	4.58	2.10	5.45	4.27	8.33	3.60	3.53	4.30	5.33	4.75	5.64	6.02	6.34	4.48	5.21	3.56
MnO	0.16	0.20	0.20	0.24	0.22	0.15	0.14	0.20	0.21	0.11	0.19	0.20	0.16	0.19	0.22	0.17
MgO	9.35	3.05	10.78	4.10	6.16	3.36	4.55	5.77	4.99	4.23	11.38	12.89	7.91	3.06	4.32	3.40
CaO	13.16	12.13	13.52	4.27	9.25	6.81	6.06	11.60	9.39	9.88	15.76	9.77	13.69	7.54	7.22	6.85
Na_2O	3.56	4.88	1.58	5.17	2.97	4.03	3.23	3.02	2.50	3.09	1.63	1.54	4.47	3.77	4.97	3.92
K_2O	0.66	4.45	2.21	1.32	1.82	3.59	4.51	1.17	3.68	2.56	0.97	1.93	0.04	2.59	3.14	3.87
P_2O_5	0.46	0.55	0.32	0.33	0.33	0.48	0.27	0.64	0.48	0.40	0.30	0.25	0.23	0.43	0.57	0.50
Total	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

CIPW NORM VOLATILE FREE

Sample	31597	31598*	31599	31600	31601	31602	31603	31604	31605	31606	31607	31608	31609	31610	31611	31612
Q	0.00	0.00	0.00	3.70	0.00	0.42	1.77	0.48	0.00	0.00	0.00	0.00	0.00	3.50	0.00	0.00
Or	3.89	26.25	13.06	7.77	10.75	21.20	26.67	6.93	21.76	15.13	5.70	11.42	0.25	15.32	18.56	22.88
Ab	24.86	9.20	12.68	43.74	25.12	34.09	27.28	25.55	21.16	25.94	12.34	13.04	26.27	31.91	29.03	33.19
An	12.96	10.98	13.88	20.72	22.18	21.01	19.30	29.96	20.87	28.31	15.98	17.22	12.27	25.17	16.60	19.95
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	2.86	20.70	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.78	0.00	6.27	0.00	7.03	0.00
Di	38.85	9.37	40.34	2.60	17.76	7.68	7.17	19.29	18.05	14.36	47.72	23.57	43.59	7.62	12.50	8.57
Hy	0.00	0.00	0.00	11.82	15.51	6.98	10.61	7.47	4.39	0.00	0.00	24.87	0.00	7.55	0.00	5.43
Ol	5.42	6.30	8.42	0.00	2.11	0.00	0.00	0.00	2.40	4.10	7.85	2.21	4.78	0.00	7.08	0.48
Wo	0.00	9.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Q.00	0.00	0.00
Mt	9.01	3.37	9.33	7.67	3.94	6.47	5.53	8.35	8.98	9.21	7.86	6.12	4.14	6.47	6.49	7.13
Il	1.10	0.99	1.17	1.23	1.97	1.05	1.08	1.50	1.30	1.93	1.08	1.00	1.92	1.49	1.39	1.24
Hm	0.00	2.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ap	1.07	1.00	0.76	0.78	0.77	1.13	0.62	1.50	1.13	0.93	0.70	0.57	0.53	1.00	1.34	1.16
AN =	34.27	53.00	52.25	32.14	46.89	38.13	41.43	53.13	49.66	52.19	56.43	56.91	31.85	44.10	36.38	37.54

Analyses by X-ray fluorescence, Analytical Laboratory, British Columbia Ministry of Energy, Mines and Petroleum Resources.
*31598 — Calcite-bearing analcite crystal tuff with unusual CIPW norm; 31612 is duplicate of 31602.

TABLE 3-1-3. TRACE AND RARE EARTH ELEMENT ANALYSES
(in ppm)

Sample Number	La	Ce	Nd	Sm	Eu	Yb	Lu	Se	Br	Sb	As	Ba	Rb	Sr	Y	Nb	Sv	Cs	Th	U	Hf	Ta	Cr	Co
31597	10.0	21	9	2.4	0.7	1.5	0.20	<5	<1.1	1.0	11	200	<30	620	12	4	54.0	<1.4	1.0	1.1	<1	<1	620	62
31598	15.0	30	11	3.2	1.1	2.1	0.36	<5	<0.9	0.4	26	1000	50	770	20	4	18.0	2.9	2.1	1.7	1	<1	30	26
31599	7.0	14	8	2.2	0.6	1.5	0.22	<5	<1.0	0.2	4	900	40	410	12	4	64.3	1.9	0.9	0.5	<1	<1	600	65
31600	8.0	19	9	2.7	<0.2	2.4	0.31	<5	1.0	0.7	6	700	40	480	22	4	29.2	<0.5	1.1	1.1	<1	<1	30	21
31601	11.0	26	11	3.9	1.5	3.3	0.49	<5	2.4	2.4	4	1100	50	390	26	6	41.3	2.3	1.4	1.2	2	<1	170	49
31602	14.0	27	15	3.1	0.7	2.1	0.32	<5	1.5	0.7	2	1500	90	770	18	4	21.5	1.4	3.0	1.7	2	<1	10	38
31603	15.0	35	13	3.7	1.1	2.5	0.39	<5	1.2	1.0	14	1500	100	510	24	4	26.2	<0.5	2.3	1.1	2	<1	220	19
31604	22.0	40	17	4.6	1.1	2.6	0.38	<5	<1.0	3.5	16	800	40	760	20	6	33.8	10.0	2.6	4.7	2	<1	470	28
31605	13.0	28	11	3.4	0.9	1.9	0.23	<5	1.2	0.2	2	1200	100	780	16	4	38.3	<1.3	1.2	0.9	<1	<1	40	52
31606	12.0	23	13	3.5	0.9	2.0	0.34	<5	<0.9	0.3	7	1000	80	600	22	4	30.4	<1.2	1.2	1.0	1	<1	10	36
31607	9.0	15	11	2.6	0.9	1.3	0.22	<5	<1.2	<0.2	<2	800	<20	470	10	4	91.4	2.8	1.2	<0.5	<1	<1	310	56
31608	7.0	17	9	2.0	0.3	1.9	0.24	<5	<0.9	3.3	7	500	50	330	14	4	40.3	2.9	1.1	0.8	1	<1	1000	57
31609	6.0	19	9	3.1	0.7	2.3	0.33	31	<1.1	1.9	9	<100	<30	300	18	4	45.9	<1.4	0.3	<0.5	2	<1	1100	64
31610	17.0	30	21	4.1	1.4	2.5	0.38	<5	<1.0	0.4	<2	1500	80	560	24	6	23.9	3.0	3.6	2.2	2	1	10	35
31611	42.0	70	31	5.9	1.8	2.4	0.34	<5	<1.2	0.5	7	1100	110	630	24	10	30.8	2.0	8.3	3.2	2	<1	40	29
31612	14.0	28	13	3.1	1.0	2.2	0.30	<5	<0.9	0.4	2	1500	90	770	20	6	21.9	1.8	2.3	1.1	2	<1	10	42

SAMPLE DESCRIPTIONS TO ACCOMPANY TABLES 3-1-2 and 3-1-3

Number	Sample	Map Unit	Location	Description
(1) 31597	85AP-1/1-35A	13A	Shiko Lake	Clast from coarse breccia; clast-supported angular blocks, mainly coarse-grained pyroxene-phyric basalt
(2) 31598	85AP-3/5-41	12A	Shiko Lake	Analcite crystal ash lithic tuff
(3) 31599	85AP-5/8-56A	11	Shiko stock	Mafic coarse-grained biotite syenite, lamprophyre
(4) 31600	85AP-5/9-57	8	Shiko Lake	Intermediate breccia, in part intrusive
(5) 31601	85AP-7/2-63	11	Shiko stock	Hornblende porphyry-syenite dyke
(6) 31602	85AP-8/1-64	11	Shiko stock	Medium-grained pink monzonite, core zone of Shiko stock
(7) 31603	85AP-8/6-67	8	Shiko Lake	Intermediate breccia, extrusive equivalent to sample 85AP-5/9-57
(8) 31604	85AP-8/6-68	7	Shiko Lake	Clast from coarse monomictic autobreccia of coarse-grained plagioclase pyroxene porphyritic basalt
(9) 31605	85AP-8/7-69	11	Shiko stock	Medium-grained grey diorite, main phase Shiko stock
(10) 31606	85AP-8/9-71	11	Bullion stock (Likely)	Medium-grained grey diorite, main phase Bullion stock
(11) 31607	85P-9/1-72	5	Horsefly River road near Mitchell Bay	Olivine pyroxene basalt, brecciated, locally with limestone matrix, in part hyaloclastite
(12) 31608	85AP-12/4-84	7	Shiko Lake	Pyroxene-phyric basalt, monomictic breccia underlying map Units 7 and 8
(13) 31609	85AP-20/2-115	2	Horsefly Peninsula	Pyroxene basalt breccia clast
(14) 31610	85AP-21/2-120	11	QR stock	Medium-grained diorite, main phase
(15) 31611	85AP-22/3-123	3	Horsefly Peninsula	Basaltic andesite breccia, clast of main lithologic type from polylithic breccia
(16) 31612	85AP-8/1-64	11	Shiko stock	Duplicate analyses of 31602

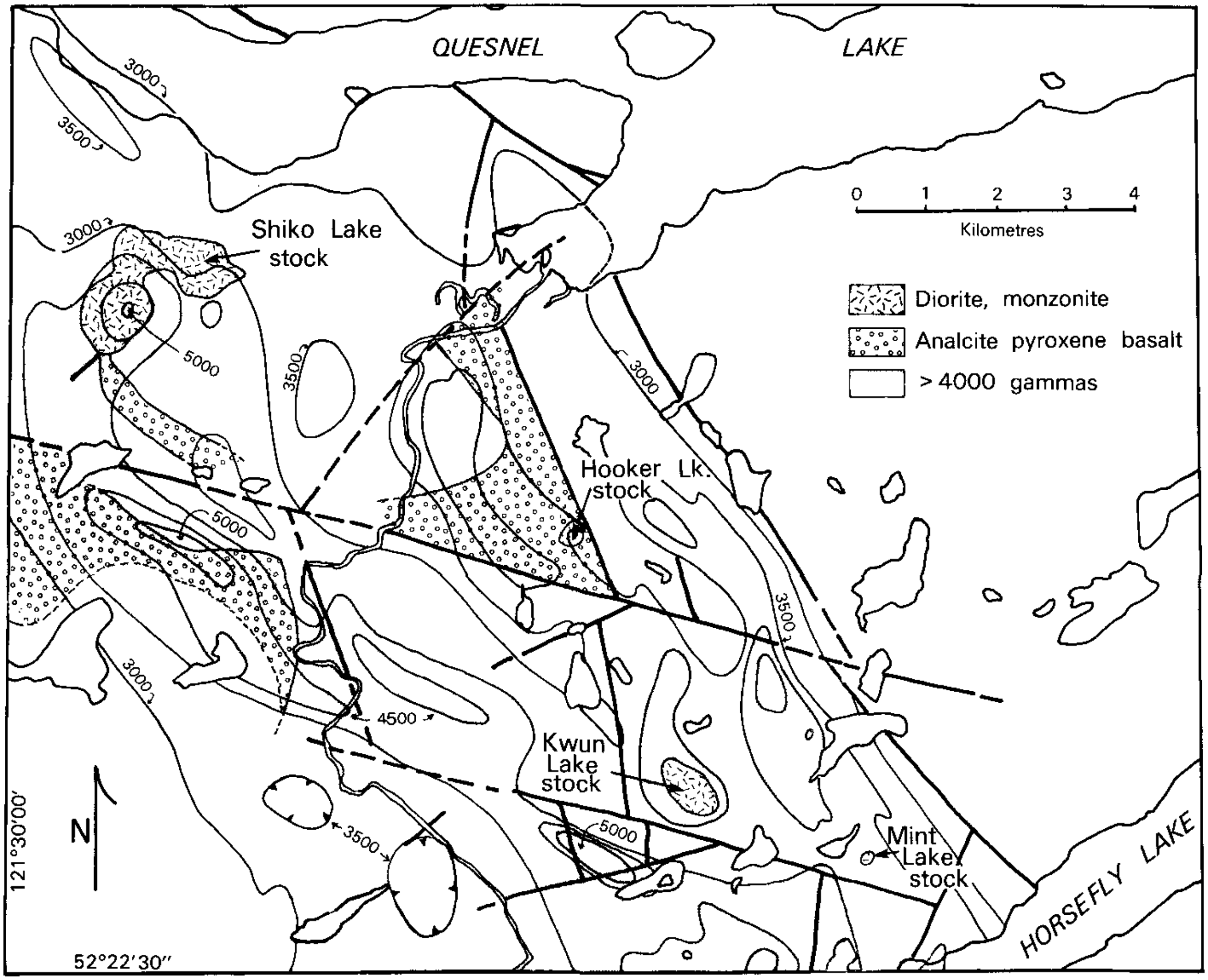

Figure 3-1-5. Total field strength aeromagnetic patterns outlined by high magnetic susceptibility diorite/monzonite stocks, analcite pyroxene basalts, and low susceptibility sedimentary rocks.

plagioclase pyroxene-phyric flows and flow breccias of Unit 7. The low magnetic susceptibility (2500 to 3000 gammas) of the basal sedimentary unit allows clear definition of its contact with overlying volcanic rocks.

ALTERATION AND MINERALIZATION

The alkalic intrusive stocks, particularly stocks near Shiko and Kwun Lakes, have been explored for porphyry copper and skarn mineralization but without notable success. The volcanic rocks surrounding these and the other small stocks or intrusive-extrusive breccia zones are extensively epidotized, chloritized and pyritic. Zeolites are widespread. These zones are being re-evaluated for their gold potential and comparisons drawn with the propylite-related QR deposit (Fox *et el.*, in press).

During this mapping project a number of orange-weathering carbonate and quartz-carbonate hydrothermal alteration zones were noted; some contain pyrite and/or marcasite. The alteration is related to small fault or fracture zones in basalts. One, on the Beekeeper property southwest of Kwun Lake, contains visible cinnabar. This zone appears to be associated with a number of small hornblende porphyry or hornblende syenite dykes.

The overall association of broad pervasive propylite alteration with intrusive rocks, iron and mercury sulphide-bearing quartz-carbonate alteration with fractured basaltic rocks, and widespread zeolite, imply large low temperature hydrothermal fluid systems. These indications are compatible with low temperature gold deposits or peripheral zones of mesothermal gold deposits and therefore provide some encouragement for further exploration.

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