880363
Babine Range
93L/M

February 17, 1992

W.J. McMillan
Manager
Mapping and Resource Evaluation

Dear Bill,

Attached is the first complete draft of the Mineral Resource Potential of the Babine Mountains Recreation Area. In order to complete this report by the end of the contract (February 14, 1992), 105 hours of overtime were worked between January 13 and February 16, 1992: this can be attributed to the time spent (approximately 3-4 weeks) writing a Geological Fieldwork report in the fall of 1991 which was not called for in the contract.

Also attached are mylar overlays for the 1:50 000 maps to accompany this report. The following arrangement is used:

GEOLOGY MAP

a) topography base map
b) geology map (MacIntyre and Desjardins)
c) structure overlay (MacIntyre and Desjardins)
d) alteration zones
e) RGS sample locations / anomalies
f) lithogeochemical sample locations / anomalies
g) geophysics: airborne magnetic survey
h) mineral occurrences

MINERAL POTENTIAL MAP

a) topographic base map
b) final mineral potential map
c) mineral occurrences (not labeled, but designated as occurrence, past producer, or mineral resource with proven reserves with different symbols).
** mineral potential maps for each mineral deposit type considered are also included for your information.

Sincerely,

Bob Gaba
Contract Geologist

cc: G. McLaren, R.W. Smyth, D. MacIntyre.

Comments to readers:

a) There is no reference in the text to the 1:50 000 maps that will accompany this report (i.e., a geology map with: RGS sample sites, lithogeochem sites, alteration, geophysics(?), mineral occurrences; and a mineral potential map). All this data is presented in reduced form within the report.

b) A geologic time scale has been added as Appendix D - is this needed?

c) The report so far has no photos - I have thought about putting in a high-level airphoto of the whole study area as a frontispiece (is this a good idea?). Also, a photo of the Big Onion workings on the side of Astlais Mountain. Should some suitable historical photos from archives be looked for?

Absolutely! VGS (Feb. 28/92)

d) The Abstract has not yet been written.

MINERAL RESOURCE POTENTIAL

OF THE

BABINE MOUNTAINS RECREATION AREA

By Robert G. Gaba

February 15, 1992

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

▪BACKGROUND

The Babine Mountains Recreation Area covers much of the southern part of the Babine Range, 15 kilometres northeast of the town of Smithers in west-central British Columbia (Figure 1). Before the advent of Europeans, the Babine Range marked the boundary between the territories of the Na'doet'en (Babine People) to the east and the Wet'suwet'en (People of the Watsonquah) to the west (L'Orsa, 1990). The name Babine was used by servants of the North West or Hudson Bay Companies in reference to the local Indian custom of wearing a wooden labret or lip-piece in the lower lip (Dawson, 1881).

The region has an exploration and mining history that began early in the century, and has seen precious and base metal production from several mines and prospects. Numerous roads and trails within the recreation area were originally built to access mineral deposits in alpine regions, in many cases the cost of trail building being subsidised by the B.C. government. Many of these trails are still used by mineral explorationists and recreationists alike to access the high country.

The region covered by the recreation area was initially within the bounds of the much larger "Babine Mountains Integrated Management Unit" created in September, 1976 to ensure better land management and to limit the use of all-terrain-vehicles in alpine and subalpine terrain. An exception to this ordinance was the creation of a special zone in the Ganokwa Basin to allow for snowmobiling during winter months (Babine Master Plan Study Team, 1991).

The "Babine Mountains Recreation Area" was established in April, 1984 as a step towards formal park status, and encloses approximately 32 400 hectares of

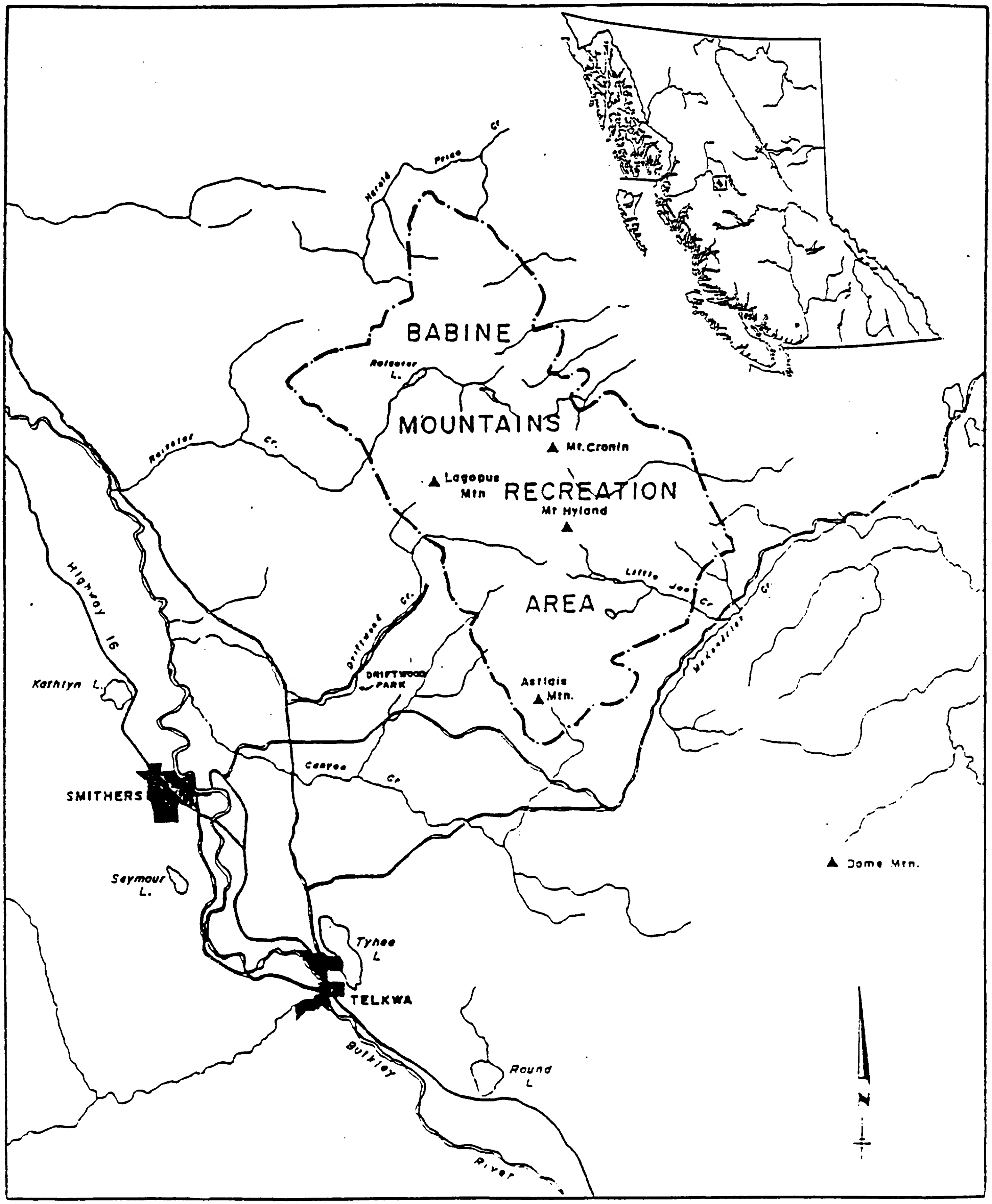


FIGURE 1. Location of the Babine Mountains Recreation Area (parts of 93L/14E,15W and 93M/2W), west-central British Columbia.

terrain that ranges in elevation from 1067 to 2385 metres above sea level. The boundary was designed to exclude most of the peripheral land generally lower than 1370 metres elevation where commercial timber exists, thereby avoiding conflict with the forest industry (Babine Master Plan Study Team, 1991). The boundary at the southern-most part of the recreation area was deliberately positioned to include Astlais ("Big Onion") and "Little Onion" mountains south of Ganokwa Basin, but in doing so unintentionally bisects the Big Onion copper-molybdenum deposit.

The region encompassed by the recreation area is open to continued claim staking and mineral exploration, as provided for in Section 19 of the Mineral Tenure Act. The use of motorized vehicles is strictly prohibited within the Babine Mountains Recreation Area, except under special permit. Snowmobiling, however, retains its special privileges and is still permitted within the Ganokwa Basin.

▪SCOPE OF PRESENT STUDY

The British Columbia Ministry of Environment, Lands and Parks (M.E.L.P.) has expressed their intent to upgrade the Babine Mountains Recreation Area to full Class A provincial park status to provide for increased protection of its natural resources and to establish official park boundaries. Government policy, however, dictates that land will not be excluded from the mineral exploration land-base before the mineral resource potential is thoroughly evaluated. In accordance with the formal request of the M.E.L.P., the Geological Survey Branch (G.S.B.) of the British Columbia Ministry of Energy, Mines and Petroleum Resources has conducted a mineral resource potential study of the recreation area. The field-based component of the project was carried out by a mobile, helicopter-supported 2-person crew during late July and early August, 1991. Office-based research, compilation and writing continued into early 1992.

The program was designed to augment geological mapping and metallogenic studies in the area by MacIntyre *et al.* (1987) and MacIntyre and Desjardins (1988a, b, unpublished data) of the G.S.B.: their geological map and database were the starting points for the project.

Geological mapping of the northern part of the Babine Mountains Recreation Area which was not included in the previous investigation was also completed, including a small region near the headwaters of Harold Price Creek. Regionally extensive belts of pyritic and limonite-stained altered rocks were examined and sampled. Rocks with anomalous precious metal concentrations, as identified by previous studies (MacIntyre and Desjardins, 1988b), were re-examined and sampled.

Stream-sediment and water samples were collected from 39 sites to supplement the existing Regional Geochemical Survey (R.G.S.) data-base for the area. The methods used to collect and analyze the samples were in accordance with standards set by the R.G.S. program.

Field studies also included examination of selected known metallic mineral prospects and deposits and general prospecting in areas of favourable geology. During the program three previously undocumented polymetallic vein occurrences were found: these are informally referred to as the "Silver King Lake", "Rhyolite" and "Little Joe Lake South" showings. These new showings were mapped in some detail and sampled, the results of which are included in the preliminary report of this study (Gaba *et al.*, 1992)

▪PHYSIOGRAPHY AND ACCESS

The Babine Mountains Recreation Area is within the southernmost part of the Skeena Mountains. The Babine Range include the discontinuous system of mountains that occupy the area between the confluence of the Babine River with the Skeena River and the confluence of the Morice and Bulkley rivers. The recreation area covers most of the southern part of the Babine Range, sometimes referred to as the "Cronin Range". To the southwest, beyond the valley of the Bulkley River, lies the Telkwa Range of the Hazelton Mountains and to the east is the Nechaco Plateau (Holland, 1964).

The Babine Range is essentially a series of bedrock ridges that have been glaciated and eroded, and incised by creeks that discharge east to Babine Lake or west to Bulkley River, both eventually draining into the Skeena River. Perennial snowfields and glaciers are present at higher elevations, supplying meltwater to alpine lakes and streams.

Timberline is at about 1500 metres elevation, below which the slopes are heavily timbered with spruce, balsam and poplar.

The main access to the region is the Yellowhead Trans-Canada Highway 16, which contours the Bulkley Valley from Houston through Smithers and north to New Hazelton (Figure 1). The Babine Mountains Recreation Area is accessed from Smithers by means of the Babine Lake Road and gravel four-wheel drive roads, which include the Driftwood Creek, Onion Mountain and Cronin Creek-Higgins Creek roads: access to the interior of the recreation area is restricted through the placement of gates at recreation area boundary. An effective network of hiking trails cross the southern part of the area and include the Silver King Basin-Cronin Creek Trail and the McCabe/Lyons Creek-Little Joe Creek Trail system (see Blix, 1977). The northwest part of the recreation area adjacent to Reiseter Creek is accessed by the Reiseter Lakes Trail, whereas the region to the north and east of Reiseter Lakes has no established trails. Helicopter companies operating out of Smithers that hold a valid Resource Use Permit for commercial flight service within the recreation area provide charter service to more remote regions.

▪ACKNOWLEDGMENTS

Funding for this study was provided by the Ministry of Environment, Lands and Parks (M.E.L.P.). Direction and management were provided by the Ministry of Energy, Mines and Petroleum Resources (M.E.M.P.R.) under W.R. Smyth, Geological Survey Branch (G.S.B.) and G. McLaren, Mineral Policy Branch. W.J. McMillan (G.S.B.) acted as contract administrator.

The author would like to thank P. Desjardins and D. MacIntyre for access to their database and geological maps of the Babine Range, and for their valuable contributions and good company during and after the short but productive field-based component of this study. The author also benefited from discussions, field trips, assistance or materials supplied by: G.P. McLaren, P.Schiarizza, W.R. Smyth, W.J. McMillan, R. Lett, W. Jackaman, S. Cook, M.L. Malott, D.V. Lefebure and D.J. Alldrick (M.E.M.P.R.); H. Markides (M.E.L.P.); T.A. Richards, consultant; P. Peto, B. Aelicks and E. McCrossan of Varitech Resources Limited; J.F. Baker of J.T. Thomas Diamond Drilling; C.J. Sampson, geological consultant; and J. L'Orsa, prospector. Stream sediment samples were collected by J. Gravel, Bonaventure Management Services. T. Brooks and L. Ledoux of Canadian Helicopters in Smithers provided safe and punctual helicopter service during field studies.

CHAPTER 2

GEOLOGICAL SETTING

▪GEOLOGY OF THE BABINE MOUNTAINS RECREATION AREA

The region covered by the Babine Mountains Recreation Area is part of the Stikine Terrane and includes: subaerial to submarine volcanic, volcaniclastic and sedimentary rocks of the Lower to Middle Jurassic Hazelton Group; sedimentary rocks of the Middle to Upper Jurassic Bowser Lake Group and Lower Cretaceous Skeena Group; and calcalkaline continental volcanic-arc rocks of the Upper Cretaceous Kasalka Group. Upper Cretaceous to Lower Tertiary volcaniclastic rocks occur locally (MacIntyre and Desjardins 1988a). Dikes and stocks of intermediate to felsic igneous rocks are Upper Cretaceous to Tertiary in age (Figure 2).

▪STRATIFIED ROCKS

Hazelton Group

The Hazelton Group is a rock assemblage of continental to volcanic island-arc derrivation and is divided into four formations: the Sinemurian or older Telkwa Formation, the Late Sinemurian to Pliensbachian Nilkitkwa Formation, the Toarcian to Bajocian Eagle Peak formation and the Middle Toarcian to Early Callovian Smithers Formation (MacIntyre and Desjardins (1988a, b; Figure 2).

The Telkwa Formation consists of subaerial and submarine pyroclastic rocks and volcanic flows, with minor intercalated sedimentary rocks, and is the thickest and most extensive formation of the Hazelton Group. The Telkwa Formation within the study area comprises dacitic to basaltic flows and pyroclastic rocks, including massive to amygdaloidal basalt. These rocks are conformably to disconformably overlain by shale, siltstone, conglomerate and minor limestone of the Nilkitkwa Formation. Distinctive brick red to maroon ash, crystal and lapilli tuff and related epiclastic rocks (with subordinate amygdaloidal basalt) of the Eagle Peak formation overlies the Telkwa Formation and part of the Nilkitkwa Formation (to which the Eagle Peak formation was previously assigned). The Smithers Formation includes fossiliferous feldspathic sandstone and siltstone representative of a marine transgressive sequence that onlaps older volcanic rocks: this is seen in the Higgins

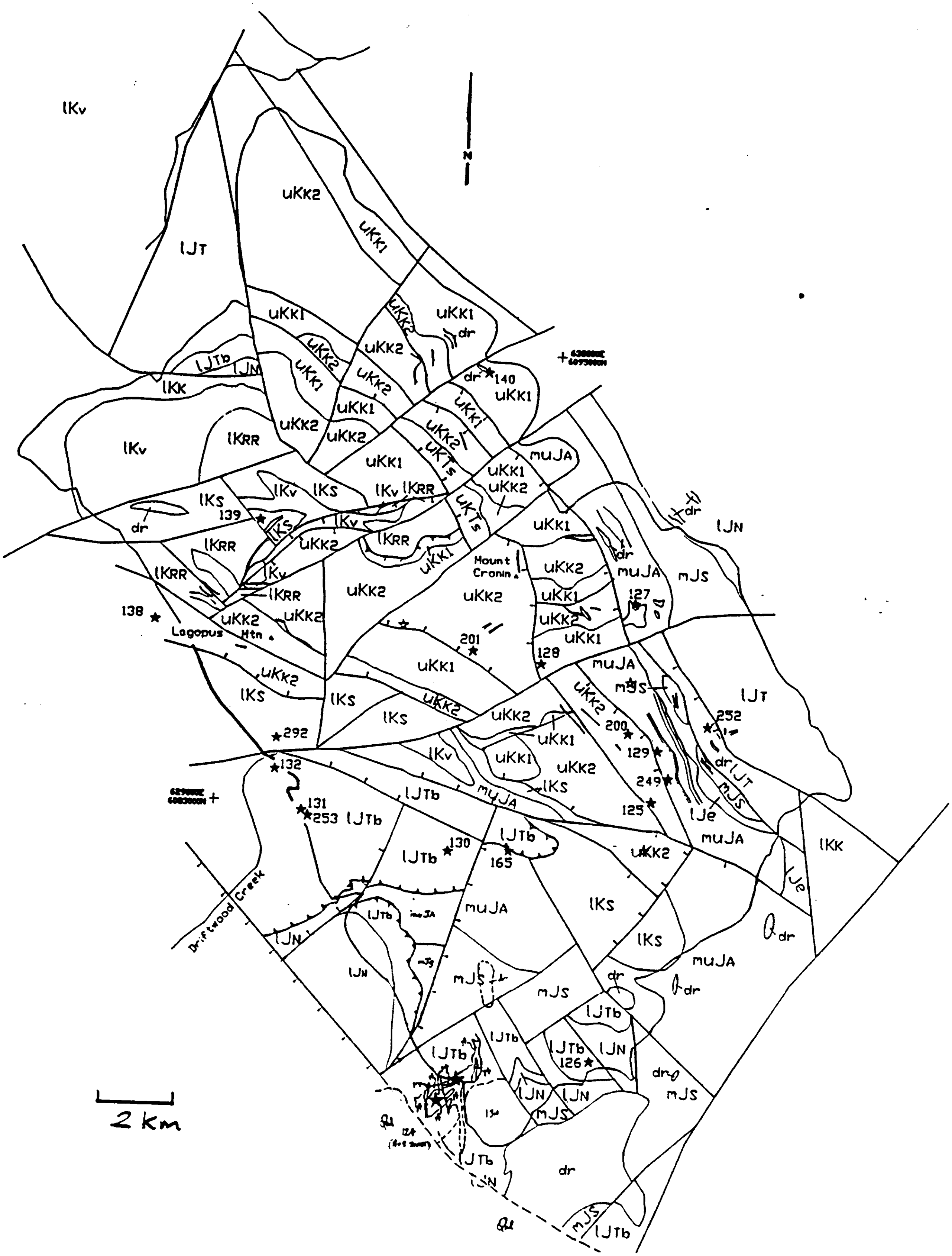


FIGURE 2. Simplified geology of the Babine Mountains Recreation Area and the distribution of mineral occurrences (MINFILE numbers are preceeded by 093L-).

LEGEND

SEDIMENTARY AND VOLCANIC ROCKS

UPPER CRETACEOUS AND LOWER TERTIARY

uKTs	*tuffaceous sandstone*

UPPER CRETACEOUS

KASALKA GROUP

uKK2	*hornblende-feldspar-phyric flows and breccias*
uKK1	*lahars, lapilli tuffs and conglomerate; epiclastic rocks*

LOWER CRETACEOUS

SKEENA GROUP

lKS	*undifferentiated Skeena Group*
lKRR	*Red Rose formation: shale, orange-weathering siltstone well-bedded micaceous wacke and conglomerate*
lKv	*Rocky Ridge formation: green and maroon phyllitic tuff; minor augite-phyric basalt flows; phyllite*
lKK	*Kitsuns Creek formation: quartz-chert-pebble conglomerate, sandstone and shale*

MIDDLE TO UPPER JURASSIC

BOWSER LAKE GROUP

muJA	*Ashman Formation: argillite; sandstone and siltstone*

LOWER TO MIDDLE JURASSIC

HAZELTON GROUP

mJS	*Smithers Formation: fossiliferous feldspathic sandstone, greywacke and siltstone*
lJe	*Eagle Peak formation: red tuffs and basalt flows*
lJN	*Nilkitkwa Formation: conglomerate,siltstone and shale*
lJT	*Telkwa Formation: dacitic to basaltic flows and pyroclastic rocks*
lJTb	*amygdaloidal basalt flows*

INTRUSIVE ROCKS

LATE CRETACEOUS TO EARLY TERTIARY

	*rhyolite intrusions*
qmp	*quartz monzonite porphyry*
dr	*diorite*
qfp	*quartz feldspar porphyry*
qdp	*quartz diorite porphyry*

Creek area where rocks of the Smithers Formation sit disconformably on amygdaloidal basalt flows of the Eagle Peak formation.

Bowser Lake Group

The Bowser Lake Group is a series of marine to nonmarine sedimentary rocks which conformably overlie the Smithers Formation. Rocks of the Bowser Lake Group within the study area are represented by the Ashman Formation of predominantly Callovian age, the lowermost part of the Bowser Lake Group (MacIntyre and Desjardins (1988a, b; Figure 2). The Ashman Formation consists of dark grey siltstone and black argillite, with lesser feldspathic and quartzose sandstone: these rocks are generally phyllitic and tightly folded, and in the absence of fossils are correlated on the basis of stratigraphic position and lithology.

Skeena Group

The Skeena Group is a conformable sequence of Lower Cretaceous marine and nonmarine sedimentary and volcanic rocks divided into the Kitsuns Creek, Rocky Ridge and Red Rose formations (MacIntyre and Desjardins (1988a, b; Figure 2). These rocks generally do not contain age-diagnostic fossils and are assigned to these formations on the basis of lithology and stratigraphic position. These rocks occur as fault-bound blocks or as isolated exposures that unconformably overlie Hazelton Group (and Bowser Lake Group?) rocks throughout the study area. The Kitsuns Creek formation consists of quartz-chert-pebble conglomerate, sandstone and shale; these rocks are Neocomian (?) if correlation with the type locality is valid. These rocks are overlain by green, red and grey andesitic to basaltic augite phyric flows and related pyroclastic rocks of the Rocky Ridge formation. Shale, siltstone, micaceous wacke and conglomerate of the Red Rose formation sit conformably(?) on volcanic rocks of the Rocky Ridge Formation.

Kasalka Group

Rocks of the Kasalka Group form the core of the study area and unconformably or structurally overlie the Skeena Group and older rocks; the Kasalka Group is divided into a lower and upper division (MacIntyre and Desjardins (1988a, b; Figure 2). The lower division (uKK1) includes heterolithic volcanic conglomerate and breccia, volcanic wacke and tuff, feldspar and augite-phyric amygdaloidal and vesicular flows, air-fall lapilli and crystal tuff and associated epiclastic rocks. The upper division (uKK2) is mainly massive flows of hornblende-feldspar phyric andesite with related breccias and subvolcanic intrusions: the contact with volcaniclastic rocks of the lower division is not well exposed but is assumed to be conformable. Rocks of the lower division are probably representative of explosive subaerial volcanism and caldera subsidence, with the upper division a subsequent period of lava eruption and volcanic cone development.

Upper Cretaceous to Lower Tertiary rocks

Two fault-bound panels of bedded tuffaceous and argillaceous rocks northwest of Mount Cronin sit directly on coarse-grained feldspar porphyry (MacIntyre and Desjardins (1988a, b; Figure 2): the contact is an erosional surface and the rocks appear to have been deposited directly onto the porphyry body. These rocks are thought to be Upper Cretaceous or Lower Tertiary in age.

▪PLUTONIC ROCKS

Igneous intrusions within the study area include rhyolite, diorite and granitic rocks (MacIntyre and Desjardins (1988a, b; Figure 2). These are considered to be part of a suite of Middle Eocene igneous rocks known as the Nanika intrusions (Carter, 1981).

Rhyolite and diorite as dykes and plugs cut rocks that fringe the region underlain by Upper Cretaceous volcanic rocks of the Kasalka Group, centered about Mount Cronin. Rhyolite spatially associated with polymetallic veins along the east side of the study area (such as those at the Cronin mine and Lorraine and Rhyolite prospects) is quite commonly deformed within enclosing Jurassic rocks, suggesting an older age than rhyolite associated with the Kasalka Group. Rhyolite north of Lagopus Mountain and east of Mount Cronin cuts foliated Lower and Upper Cretaceous rocks and therefore post-dates mid-Cretaceous folding and shearing.

Several multiphase intrusions occur southeast of Astlais Mountain, including quartz-feldspar porphyry and quartz-diorite porphyry (exposed at the Big Onion copper-molybdenum property), as well as a large body of diorite.

■STRUCTURE

The structural setting of the Babine Range is similar to that of the basin-and-range physiographic province of the southwest United States. The region is dominated by a series of northwest-trending tilted horsts and grabens: downward stepping of blocks occurs towards the northwest, where progressively younger stratigraphic levels are preserved (MacIntyre and Desjardins (1988a, b; Figure 2). Rocks that comprise the fault-bound blocks are characterized by asymmetric to overturned, southeast-plunging open folds that are truncated mainly by northeast-trending high-angle faults.

The earliest phase of deformation was related to regional compression during the Upper Cretaceous, accompanied by folding and uplift. Regional extension is thought to have developed during Upper Cretaceous to Lower Tertiary time, coincident with associated extensive volcanism and stratovolcano development. Compression during Tertiary time caused reverse movement along pre-existing high-angle normal faults, and resulted in upward thrusting and folding of fault blocks. The latest event seems to be the development of major east to northeast-trending faults, also probably of Tertiary age, that truncate and offset the dominant northwest-trending structural fabric of the range (MacIntyre and Desjardins 1988a).

The structural configuration of the region between Mount Cronin and Lagopus Mountain seems to be an artefact of previous volcanic activity during the Upper Cretaceous. The arcuate pattern of inward-tilted block faults spatially coincident with a network of radiating high-angle normal faults may have been the result of volcanic erruption, followed by magma chamber evacuation and collapse (i.e., the formation of a collapse caldera). Dikes of diorite and rhyolite that fringe the centre underlain by Upper Cretaceous volcanic rocks may have been localized along peripheral ring fractures (MacIntyre and Desjardins 1988).

CHAPTER 3

APPRAISAL OF KNOWN RESOURCES

▪EXPLORATION AND MINING: PAST AND PRESENT

Exploration for base and precious metals within the Babine Mountains has been ongoing since the turn of the century (Appendix A). Early efforts were focussed on high-grade silver veins, but access to them was generally difficult. The construction of the Grand Trunk Pacific Railroad line up the Driftwood valley (1910-1914) provided the essential link to economically transport the metal ores to market. Horse trails or rough roads were built to the most promising prospects, and high-grade silver ores were packed out to the railroad at Telkwa and shipped mainly to the smelter at Trail.

By 1950 many of the high-grade deposits had been worked on a small scale and had produced significant quantities of base and precious metals (Table 1). However, at about this time, the extensively developed Cronin mine was complimented by a mill and new mine buildings and began shipping lead and zinc concentrates (also containing considerable gold, silver, copper and cadmium) to Trail, and continued to do so almost every year until it closed in 1974 (Table 1). Significant ore reserves, however, still remain underground at the Cronin mine (Table 2).

The early 1960's saw a resurgence of exploration interest focussed primarily on porphyry copper-molybdenum, particularly at the Big Onion prospect. Considerable work has been done on this property to date, and has outlined important reserves of copper, molybdenum and precious metals (Table 2).

Present-day mineral exploration interest has not diminished: much of the recreation area is covered by mineral claims held in good standing (at the time of writing), and cover all of the previously known mineral prospects and deposits (Figure 3): most of these claims pre-date the establishment of the Babine Mountains Recreation Area. Mineral claim types include: Crown Grants, Reverted Crown Grants, 2 Post and 4 Post claims recorded before the current Mineral Tenure Act of 1988, and 1 Post claims subsequent to the Act. The recreation area is presently open to continued claim staking; mineral exploration requires a permit, with conditions jointly set by the Ministries of Energy, Mines and Petroleum Resources and Environment. Lands and Parks.

TABLE 1

HISTORICAL METAL PRODUCTION WITHIN THE BABINE MOUNTAINS RECREATION AREA*

MINFILE # (093L)	PROPERTY NAME	PERIOD OF PRODUCTION	ORE MINED (TONNES)	GOLD (grams)	SILVER (grams)	COPPER (kg)	LEAD (kg)	ZINC (kg)	CADMIUM (kg)
125	Silver Pick	1927, 1936, 1938	23	466	209,230	886	420	836	
127	Cronin	1917, 1929, 1951-74	25,838	8,772	8,169,918	10,394	1,367,178	1,517,881	18,012
128	Hyland Basin	1935, 1940	10	342	84,880		3,396	397	
129	Lorraine	1917	6.4		19,448		3,175		
131	Drift	1915-18, 1927, 1971	23		132,779	4,711			
132	Driftwood	1937, 1969	9	93	21,928	109	327	245	
201	Silver King mine	1917, 1927	12	62	41,865	107	3,490	348	
TOTAL			25,921.4	9,735	8,680,048	16,207	1,377,986	1,519,707	18,012

*For details concerning past production see Appendix A

TABLE 2

ESTIMATES OF METAL RESERVES WITHIN THE BABINE MOUNTAINS RECREATION AREA

MINFILE # (093L)	PROPERTY NAME	RESERVES	GOLD (g/t)	SILVER (g/t)	COPPER (%)	LEAD (%)	ZINC (%)	MoS_2 (%)
124	Big Onion	80 to 100 Mt (inferred)[1]			0.42			0.02
		[includes 35 Mt (supergene)][2]	0.064	1.0	0.34			
127	Cronin	42 413 (indicated)[3]						
		}160 349[3]	0.3	428.1		7.11	8.12	
		117 936 (inferred)[3]						
		45 400 (measured geological)[4]	N/A	428.1		8.0	8.0	
		317 000 (indicated)[5]	1.7	354.4		8.0	8.0	
		47 200 (unclassified)[6]	1.7	428	0.16	8	8	

[1]Stock (1977)
[2]McCrossan (1991)
[3]Quin (1987), Table 3 (after E. Livgard, 1972)
[4]Quin (1987), Table 3 (after M.H. Jones, 1977)
[5]Quin (1987), Table 3 (after R.B. Smith, 1984)
[6]MINFILE card for Cronin mine (093L-127)

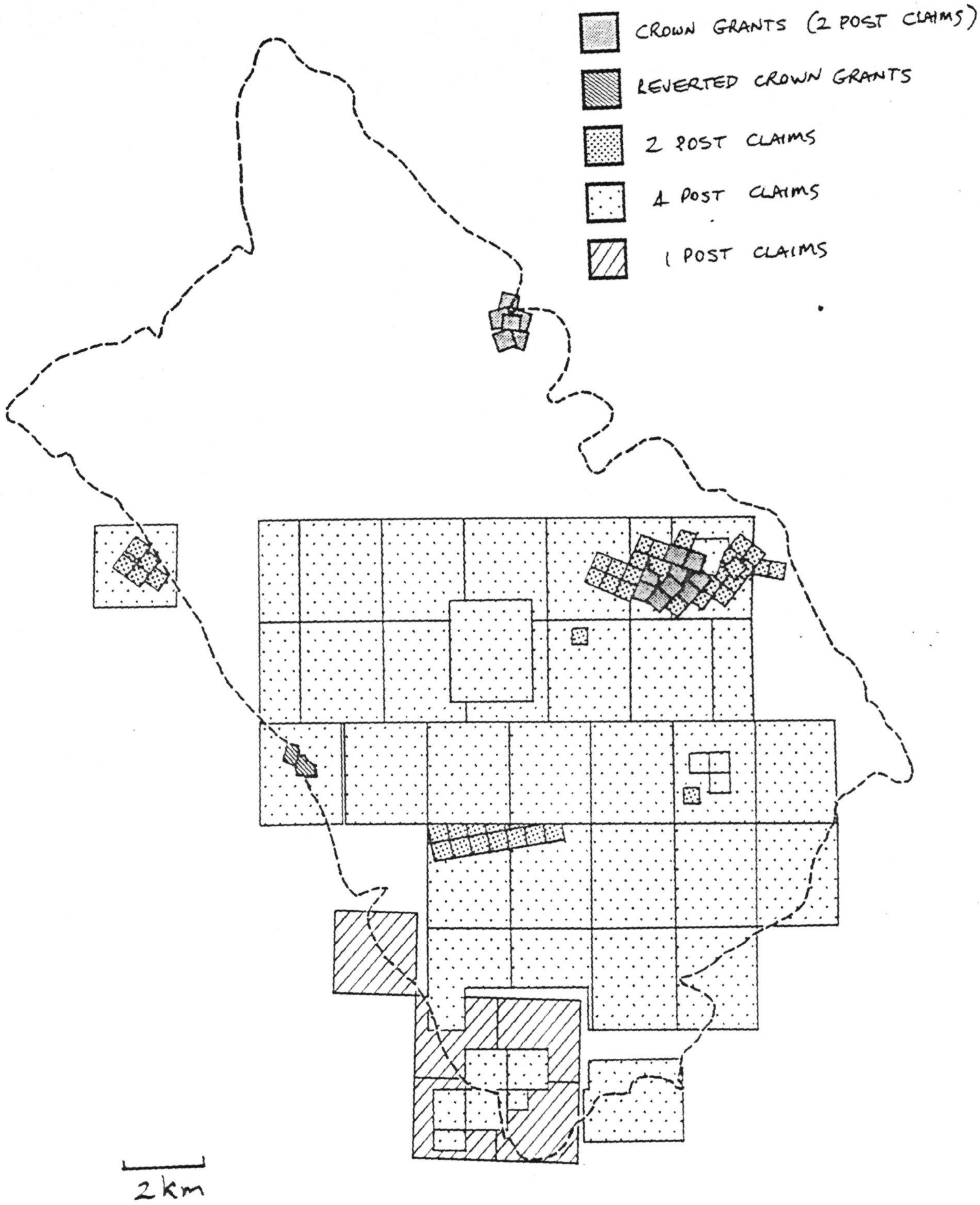


FIGURE 3. Mineral tenure within the Babine Mountains Recreation Area

▪MINERAL DEPOSIT TYPES

Mineral deposits and prospects within and adjacent to the Babine Mountains Recreation Area are of three distinct types: porphyry copper-molybdenum associated with quartz-feldpsar porphyry and quartz diorite intrusions, silver-rich polymetallic veins and basalt-hosted copper-silver veins (Table 3). Certain rocks within the study area have potential to contain polymetallic massive sulphides, similar to those at the Ascot prospect (MINFILE 093L-24) between Mount McKendrick and Dome Mountain. There are no known prospects of this type within the study area, but are nevertheless considered as an important deposit type for mineral resource evaluation of the area (Table 3).

The majority of mineral occurrences are silver-rich polymetallic veins (Table 4), many of which are past-producers and form a belt across the central part of the study area (Figure 4). Basalt-hosted copper-silver veins cluster mainly in the southwest, whereas porphyry copper-molybdenum occurs almost exclusively in the south. The north part of the study area is almost completely devoid of mineral prospects (Figure 4).

Detailed geological descriptions (including production and exploration histories) of all mineral prospects within the Babine Mountains Recreation Area are included in the Ministry of Energy, Mines and Petroleum Resources computerized mineral inventory database (known as MINFILE) for the Smithers mapsheet (NTS 093L). This data is available in hard copy printouts or in digital format (standand ASCII format files) on 5¼ inch floppy diskettes from Crown Publications Incorporated, Victoria, B.C.

TABLE 3

IMPORTANT MINERAL DEPOSIT TYPES WITHIN (AND ADJACENT) TO THE BABINE MOUNTAINS RECREATION AREA

SYMBOL[1]	DEPOSIT TYPE	DIAGNOSTIC METAL ASSEMBLAGE	METALLIC MINERALS	TEXTURES AND STRUCTURES	HOST ROCKS	ALTERATIO
	porphyry Cu-Mo	Cu, Mo; (Au, Ag)	cpy, mo, py, cc, cv	stockwork, breccia, veins, disseminations	quartz-feldspar porphyry (qfp); quartz-diorite porphyry (qdp); diorite (dr)	sericitic, propyliti silicic, argillic
	silver-rich polymetallic veins	Ag, (Au), Pb, Zn; Cd, Cu, (As, Sb)	py, sp, gn, cpy, boul, tet; apy, frei, po, (native Au)	simple to complex multiphase quartz-sulphide veins; massive veins; breccia zones; fracture fillings; replacements; disseminations	rhyolite porphyry, dacite (rh); argillite, phyllite (muJA); andesite porphyry (uKK1, uKK2)	silicic
	basalt-hosted Cu-Ag veins	Cu, Ag, (Au), Pb, Zn	cpy, born, tet; cc, cv, mal, az (sp, gn)	sheeted quartz veins; silicified zones; breccia zones; disseminations; stockwork	amygdaloidal basalt, basaltic tuff, basaltic andesite, volcanic breccia (lJT, lJTb)	propylitic, argillic
	polymetallic massive sulphides[2]	Zn, Pb, Ba, Cu; As	py, sp, gn, ba; tet	strata-bound massive lenses; disseminations; fracture fillings	limy siltstone, felsic tuff; argillite (lJN); amygdaloidal basalt (lJT, lJTb)	

[1]Different deposit types are represented by symbols on Figure 4
[2]Although there are no known polymetallic massive sulphide prospects within the Babine Mountains Recreation Area, this deposit type occurs only 5 kilometres southwest of the study area in similar stratigraphy and is an important mineral deposit type to consider for complete understanding of the mineral resource potential of the region.

Abbreviations: apy = arsenopyrite, az = azurite, ba = barite, born = bornite, boul = boulangerite, cc = chalcocite, cpy = chalcopyrite cv = covellite, frei = freibergite, gn = galena, mal = malachite, mo = molybdenite, po = pyrrhotite, py = pyrite, sp = sphalerite, tet = tetrahedrite.

TABLE 4

KNOWN METALLIC MINERAL OCCURRENCES WITHIN THE BABINE MOUNTAINS RECREATION AREA

MINFILE # (093L)	PROPERTY NAME	DEPOSIT TYPE	COMMODITIES	PROPERTY STATUS
124	Big Onion	porphyry Cu-Mo	Cu,Mo,[Au,Ag]	developed prospect
125	Silver Pick	polymetallic vein	Ag,[Au],Cu,Zn;Pb	past producer
126	Mert	porphyry Cu-Mo	Cu,Mo,[Ag]	showing
127	Cronin	polymetallic vein	Ag,[Au],Pb,Zn;Cd,Cu	past producer
127A	Upper Showing	polymetallic vein	Ag,[Au],Pb,Zn;Cd,Cu	showing
128	Hyland Basin	polymetallic vein	Ag,[Au],Pb;Zn	past producer
129	Lorraine	polymetallic vein	Ag,Pb;Zn,Cu	past producer
130	Jud	basalt-hosted copper-silver vein	Cu,Ag	showing
131	Drift	basalt-hosted copper-silver vein	Cu,Ag;Pb	past producer
132	Driftwood	basalt-hosted copper-silver vein	Ag,[Au],Cu,Pb,Zn	past producer
138	AG	polymetallic vein	Ag,Pb;Zn	showing
139	Reiseter Creek	polymetallic vein	Cu,Pb;Zn	showing
140	Debenture	polymetallic vein	Ag,Pb,Zn	prospect
165	Shamrock	basalt-hosted copper-silver vein	Ag,Cu	showing
200	Silver Saddle	polymetallic vein	Ag,Au,Pb;Cu	showing
201	Silver King mine	polymetallic vein	Ag,[Au],Pb;Zn,Cu	past producer
249	Native	polymetallic vein	Ag,Pb,Zn	showing
252	Fisher	porphyry Cu	Cu	showing
253	Home	basalt-hosted copper-silver vein	Ag;Cu,Pb,Zn	showing
292	Viking	pyrite veinlets	[Ag,Au]	showing
316	Silver King Lake	polymetallic vein	Ag,[Au],Pb,Cu,Zn;Cd	showing
317	Rhyolite	polymetallic vein	Au,Ag,Cu;Pb,Zn,Cd	showing
318	Little Joe Lake South	polymetallic vein	Ag,[Au],Pb,Zn;Cu,Sb	showing

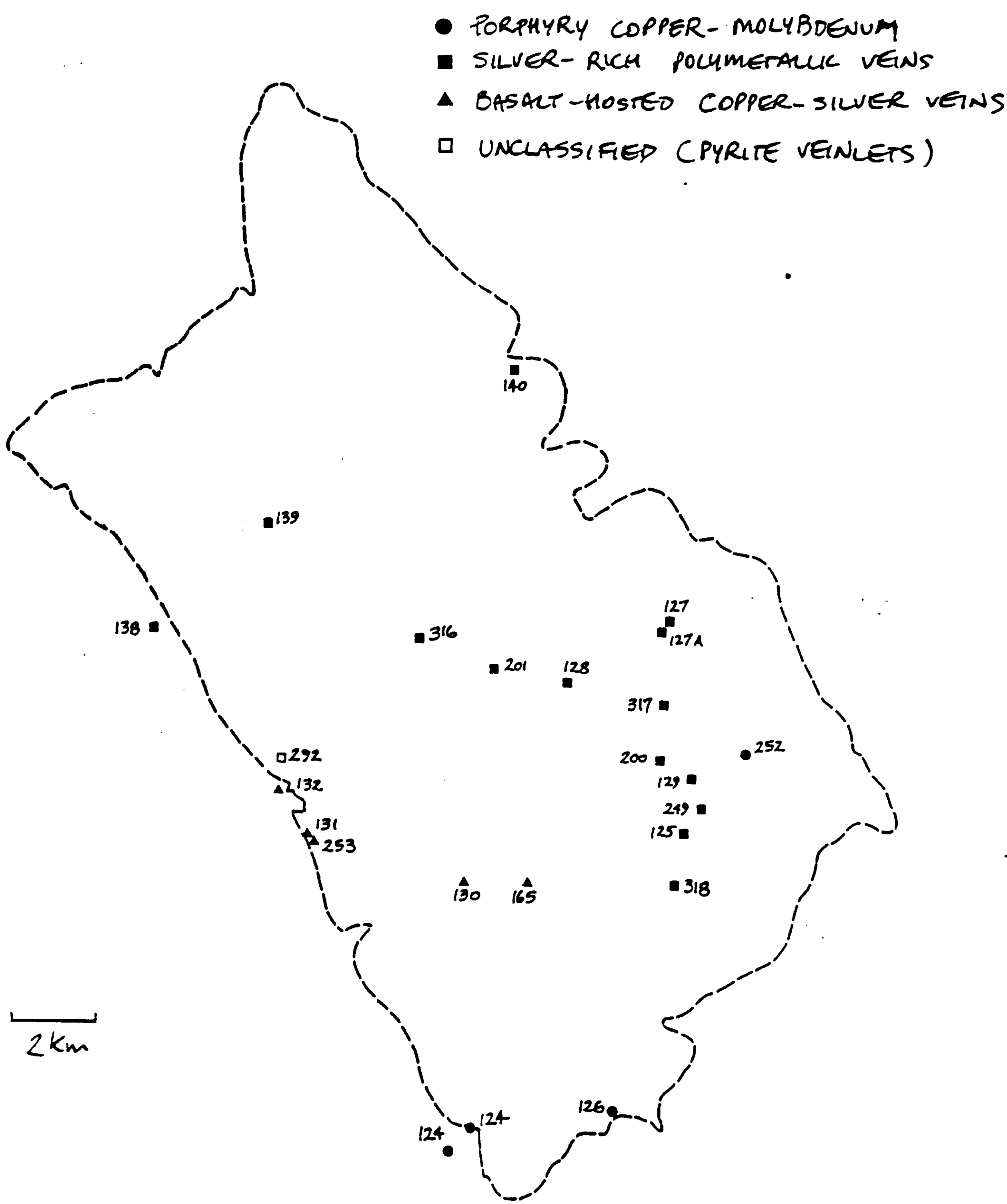


FIGURE 4. Distribution of mineral occurrences within the Babine Mountains Recreation Area according to mineral deposit type (see Table 3).

Porphyry Copper-Molybdenum

Although porphyry copper-molybdenum has not been an historically important mineral deposit type within the study area, it is the most promising mineral deposit type presently being evaluated.

The Big Onion Deposit

The Big Onion prospect, a low-grade large-tonnage calc-alkaline porphyry copper-molybdenum deposit, straddles the southern boundary of the recreation area on south side of Astlais Mountain, 18 kilometres east of Smithers (Figure 4). Access to the property is by the Babine Lake road and a network of four wheel drive roads (established during the 1960's diamond drilling programs) that zig-zag up the creek valley to the shoulder of Astlais Mountain (Figure 5). The main zones of copper and molybdenum mineralization are within the creek valley between 1067 and 1676 metres elevation, with the bulk of the deposit below treeline (approximately 1460 metres elevation). Metal reserve estimates were first calculated by Stock (1977) and utilized 16 712 metres of combined percussion and diamond drill data (Table 2). Subsequent diamond drilling by Varitech in 1991 has been successful in outlining the extent of the supergene (or secondary enrichment) zone as well as the depth of hypogene (or primary) mineralization (McCrossan, 1991). However, much more diamond drilling is required to better define the distribution, grade and tonnage of ore before further development.

Early descriptions of the geology of the Big Onion property include those by Sutherland-Brown (1967) and Schroeter (1977). Mineralization is associated with an irregular northeast-trending stock of quartz-feldspar porphyry (with a core of quartz-diorite porphyry) that intrudes volcanic and sedimentary rocks of the Telkwa and Nilkitkwa formations (Figure 2). The intrusions appear to have been

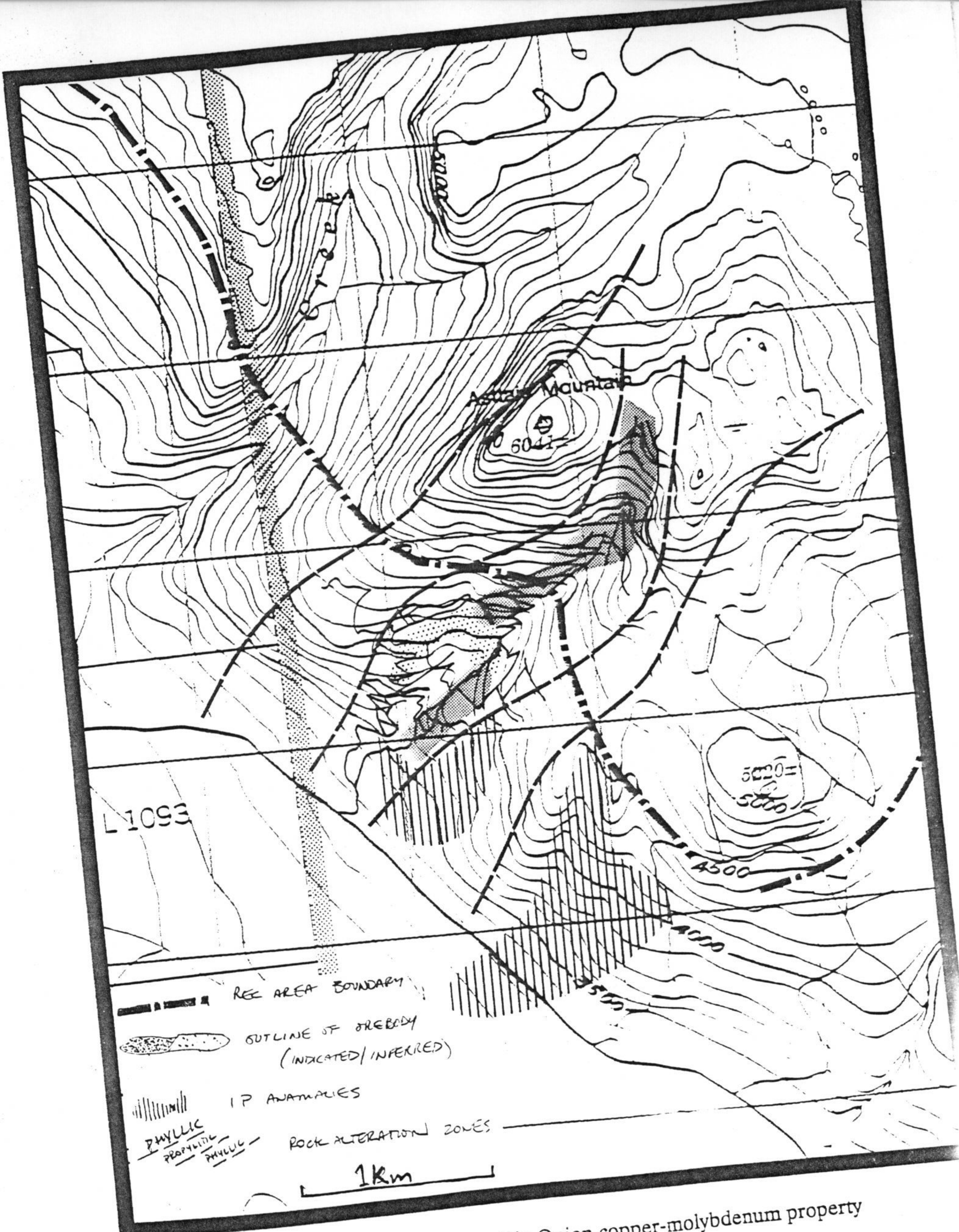


FIGURE 5. Detailed geology of the Big Onion copper-molybdenum property (compiled from Depaoli (1977), Stock (1977) and McCrossan (1991)).

emplacement along a northeast-trending fault, subsequently transected and offset by younger northwest-trending faults. The southwestern extension of the orebody appears to have been truncated and offset by faulting, whereas the northeastern continuation has yet to be fully assessed.

Hydrothermal alteration zones within and peripheral to the ore body are well-developed (Figure 5): the ore zone is coincident with a propylitic zone, characterized by epidote-calcite-chlorite alteration mineral assemblages, and is surrounded by a phyllic zone, defined by sericite and local quartz stockwork (Stock, 1977). Hypogene (or primary) mineralization consists of disseminated and fracture-controlled chalcopyrite and molybdenite, associated mostly with the quartz-feldspar porphyry but also with adjacent altered rocks. Supergene (or secondary enrichment) mineralization, most important at the north part of the ore body, consists of chalcocite and covellite (McCrossan, 1991).

Pyrite is ubiquitous within and adjacent to the deposit and locally attains concentrations of 10 per cent. Oxidation of this pyrite by near-surface groundwater, a natural process, produces sulphuric acid which tends to acidify streams that drain the valley and leach metals from the rocks near the surface.

Because of the lack of exposed rock and the extensive overburden to the south and southeast of the deposit, geophysical techniques, such as induced polarization surveys, have been conducted in the search for additional similar mineralization (Figure 5). The anomaly nearest the Big Onion deposit is interpreted to indicate the presence of sulphide mineral concentrations at depth. The anomaly to the southeast is much more complex, but still indicate the possibility for mineralized intrusive or volcanic rocks (Depaoli, 1977). These anomalies are considered to be viable exploration targets, but have not yet been tested.

Silver-rich Polymetallic Veins

Most of the historical metal production in the study area has come from silver-rich polymetallic veins (Tables 1, 4), with the Cronin being the only deposit large enough to warrant its own milling facilities. Silver-rich polymetallic veins are the most mineralogically complex, and consist usually of two or more base metal sulphide and sulphosalt minerals within a quartz (± carbonate) gangue (Table 3). Metals sought after were primarily silver (contained as a component in some of the metallic minerals), with significant gold, lead, zinc, copper and cadmium.

These veins are commonly discordant to host rocks, irregular in attitude and continuity, and pinch and swell in thickness along their length. These characteristics make economic assessment without underground exploration difficult. In the early days of mining, adits and drifts were put in to follow the veins, and small orebodies were struck where the veins swelled to greater thicknesses. Thus, the very nature of the deposit type dictated the size of orebodies to be found.

The Cronin Mine

The Cronin mine was the most significant historical producer of metals in the study area (Table 1). The extensive polymetallic vein system was accessed over the life of the mine by workings that extend more than 168 metres vertically and about 220 metres laterally: development on 3 mining levels total about 1160 metres of drifts and crosscuts and 366 metres of raises (Livgard, 1973).

The vein system occurs within a northeast-trending zone that cuts through a rhyolite plug or dome and into surrounding sericite schist, as well as argillite, sanstone and conglomerate of the Middle to Upper Jurassic Ashman Formation (Figure 2). The close association of rhyolite with the veins suggests a genetic relationship. Veins are up to 0.6 metres thick and up to 75 metres long (MacIntyre and Desjardins, 1988).

Similar mineralization has been exposed on surface on the Homestake claim to the southwest of the Cronin workings: this showing, known as the Wardell zone or Upper showing is regarded as part of the Cronin vein system. In 1975, a surface diamond drilling program designed to test the open-pit potential of the Upper showing (and presumably extensions of veins from the Cronin workings) succeeded in identifying a small high grade orebody, but no large tonnage was outlined (Quin, 1987). Accessible ore remains underground at the Cronin mine: the wide range in reserve estimates (Table 2) reflects the difficulty in assessing this type of deposit.

Basalt-Hosted Copper-Silver Veins

A less prolific although historically important mineral deposit type are the basalt-hosted copper-silver veins (Table 3). These deposits though generally small are very rich in silver and copper: this is evident by the quantity of silver and copper yielded by the Driftwood deposit from only 23 tonnes of ore (Table 1). Mineralization consists of irregular sheeted quartz veins, stringer zones and breccias, within amygdaloidal basalt and flow-top breccia of the Lower Jurassic Telkwa Formation. The veins contain an abundance of copper- and silver-bearing sulphide and sulphosalt minerals as high grade pods and fracture fillings.

Basalt-hosted copper-silver veins are almost exclusively confined to rocks of the Telkwa Formation and may be referred to as strata-bound deposits: they are likely products of hydrothermal activity related to emplacement of the volcanic rocks which host them. Small and relatively abundant copper-silver vein showings of this type are scattered throughout rocks of the Telkwa Formation in the Telkwa and Babine ranges (D. MacIntyre, Personal Communication, 1991).

Polymetallic Massive Sulphides

As previously stated, there are no known polymetallic massive sulphide occurrences within the Babine Mountain Recreation Area, but is an important deposit type to consider for resource evaluation. Southeast of the study area at the Ascot prospect (MINFILE 093L-24), polymetallic massive sulphides are in limy sedimentary rocks of the Lower Jurassic Nilkitkwa Formation (MacIntyre et al., 1987). The sulphide concentrations, which contain abundant base metals but only a trace of precious metals, occur as massive lenses to disseminations within the sedimentary rocks close to the underlying Lower Jurassic Telkwa Formation basalts. Their strata-bound nature and proximity to volcanic rocks suggests a sedimentary depositional environment close to a volcanic-hydrothermal centre. Comparable rock sequences, present within the study area (Figure 2), might also host similar metal concentrations.

CHAPTER 4

POTENTIAL FOR UNDISCOVERED MINERAL RESOURCES

▪GENERAL STATEMENT

The field-based component of this study gathered information to help assess the potential for undiscovered mineral resources within the recreation area: the data collected augments that from previous studies (e.g., MacIntyre et al., 1987; MacIntyre and Desjardins, 1988a,b). Although the region has been extensively prospected and explored during the past 90 years, there is still the possibility that some mineral wealth has gone undetected during that time. The goal here is to identify areas with significant mineral potential to ensure that the region is thoroughly tested before it is considered for reclassification as park land with no mineral exploration allowed.

The methods used in the field to identify areas of potential exploration interest include: geological mapping; lithogeochemical (rock-chip) sampling of almost all rock types represented in the study area, including zones of altered rocks; stream sediment sampling; and prospecting of regions deemed favourable for mineral deposits based on information gathered from previously published literature and maps, observations in the field, and personal communication with persons engaged or previously engaged in geological fieldwork in the area. Previously published data from geophysical surveys done in the study area were examined and interpreted.

▪GEOLOGICAL MAPPING

Geological mapping is the fundamental starting point for any mineral resource evaluation program. The purpose of geological mapping is not only to document the nature, distribution and stratigraphical order of rocks, as well as their structural configuration, but also to evaluate their relationship to the various mineral resources which they contain. In this way, the location and distribution of mineral deposits are better understood in the context of their host rocks and structural setting within a regional geological framework. Geological mapping thus helps to define the distribution of rocks that are favourable hosts to mineral deposits (Table 3).

This project was fortunate to have access to recent data and maps, produced by a 1:20 000 scale geological mapping program that covered most of the study area (MacIntyre and Desjardins, 1988a, b, unpublished data), as its starting point. Geological mapping during the present study, therefore, was limited to the northern part of the recreation area which was outside of the previous mapping program.

▪LITHOGEOCHEMICAL SAMPLING

A total of 239 rock samples was collected from the study area during previous (MacIntyre and Desjardins 1988a, b, unpublished data) and present investigations (Figure 6). These samples were analyzed for gold, silver, copper, lead, zinc, molybdenum, cadmium, arsenic and antimony (Appendix B). Of these more than half were taken from regionally extensive pyritic and limonite-stained altered rocks that form spectacular red-brown gossans across the central part of the study area (Figure 7). These zones are essentially bleached sericitic schists and phyllites derived from volcanic and sedimentary rocks of the Upper Cretaceous Kasalka Group. The rocks contain abundant disseminated pyrite, much of which has altered to limonite: oxidation of the pyrite to produce sulphuric acid has probably leached much of the original metal content from the rock. The rocks also exhibit breccia textures and are locally veined by quartz or quartz and epidote. The alteration zones, which are a few hundred metres thick, are semicontinuous for several kilometres along a west-northwest strike. They are coincident with shear zones of probable post-Late Cretaceous age that are truncated by northeast-trending Tertiary faults (Figure 2).

Most of the samples taken from the pyritic and limonite-stained altered rocks contain only background levels of precious and base metals. However, a previously undocumented polymetallic vein (the Silver King Lake prospect: MINFILE 093L-316; Gaba et al., 1992) was found during the course of sampling as well as twelve samples that contain anomalous metal concentrations (considered to be anomalous by visual inspection of the complete lithogeochemical database) diagnostic of silver-rich polymetallic veins (Table 3). Further examination of smaller alteration zones of this type to the east resulted in the location of additional new polymetallic veins at the Little Joe Lake South prospect (MINFILE 093L-318; Gaba et al., 1992). Thus,

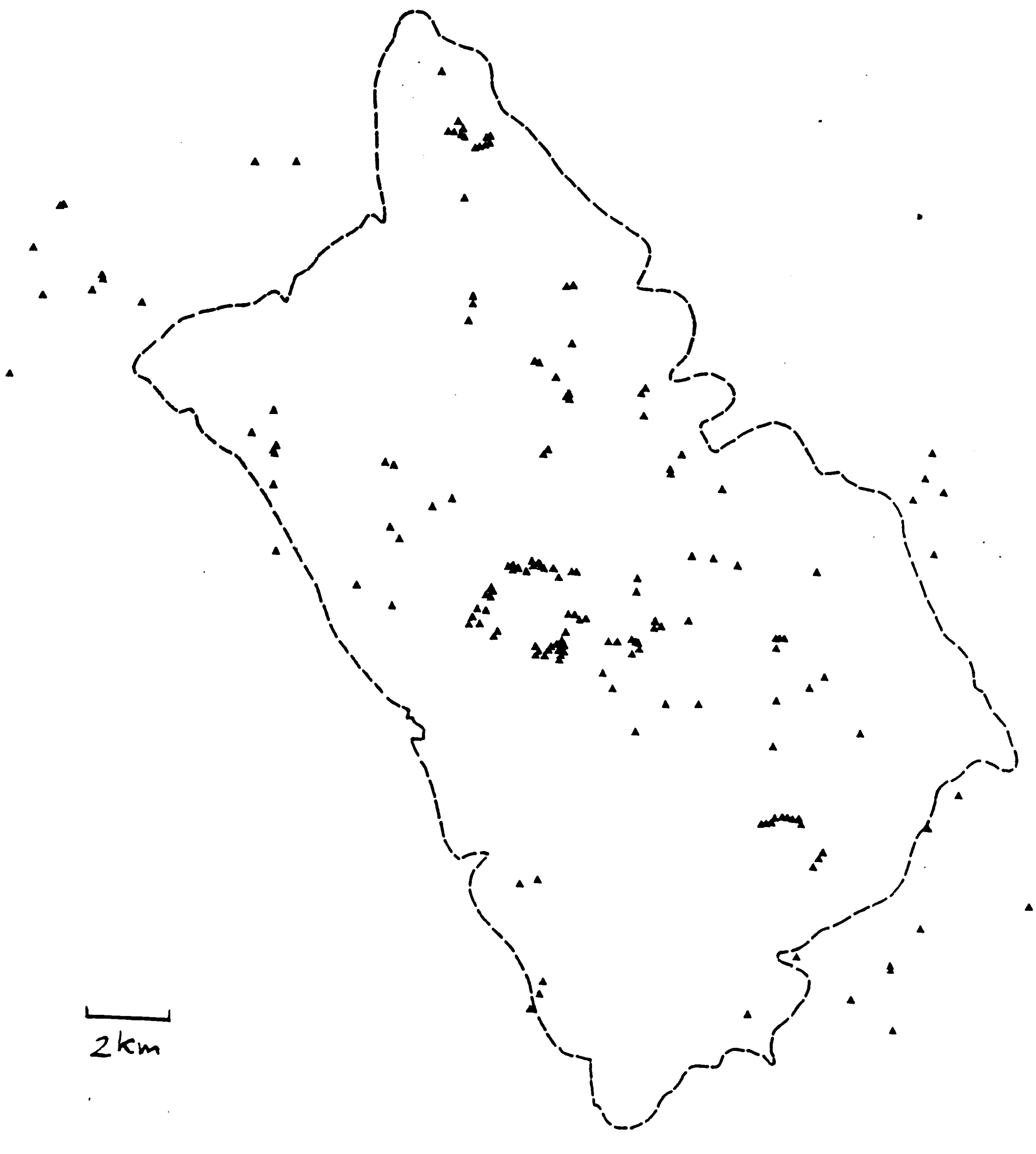


FIGURE 6. Lithogeochemical sample sites.

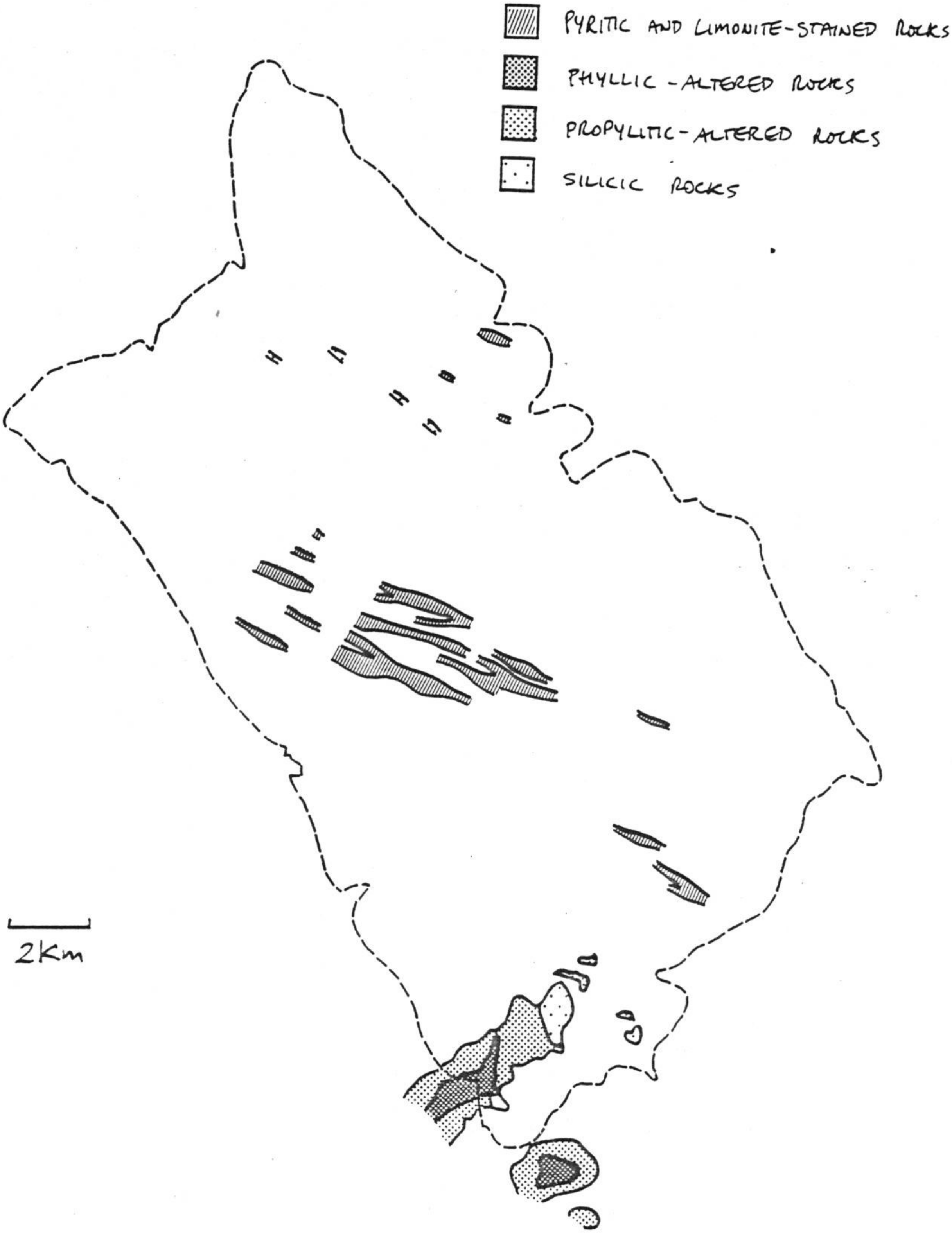


FIGURE 7. Distribution of altered rocks within the Babine Mountains Recreation Area.

the sampling program confirmed the presence of at least scattered base and precious metal concentrations within the altered rocks. These rocks have not been tested at depth by diamond drilling and might contain more significant metals beneath the generally leached rocks exposed at surface.

In the north-central part of the study area, scattered exposures of Kasalka Group volcanic rocks are locally very silicic and might define a fault zone along which silicification has taken place (MacIntyre and Desjardins, 1988). However, no metals of interest are associated with these rocks.

Follow-up examination of a site initially sampled in 1987 (MacIntyre and Desjardins, 1988b) resulted in the location of additional previously undocumented polymetallic veins (Gaba et al., 1992). The veins are similar in character to polymetallic veins of the area, but are unique because of they contain abundant gold (partly as native metal - the only locality so far known within the study area!).

Geological mapping by Stock (1977) on and adjacent to the Big Onion property documents the style and distribution of alteration associated with the deposit (Figure 7). Lithogeochemical sampling (also by Stock (1977)) shows that the distribution of copper and molybdenum is coincident with phyllic alteration associated with the Big Onion deposit. However, only minor metals are associated with phyllic-altered diorite to the southeast. An inherent problem with surface sampling at these types of deposits is the extensive metal leaching that occurs in rocks exposed at or near the surface (as previously discussed).

Samples were also collected regionally from rock outcrop not visibly altered: ten samples returned anomalous metal concentrations diagnostic of silver-rich polymetallic veins, four samples returned anomalous metal concentrations diagnostic of copper-silver veins and three samples returned anomalous metal concentrations diagnostic of polymetallic massive sulphides (Table 3).

▪STREAM SEDIMENT GEOCHEMICAL SURVEY

Stream sediment and water samples were collected from 39 sites throughout the Babine Mountains Recreation Area by J. Gravel (Bonaventure Management Services) and analyzed according to standards set by the Regional Geochemical Survey program of the Ministry of Energy, Mines and Petroleum Resources. This data compliments previously collected data in the area to bring the sample site density to approximately 1 site per 6 square kilometres (Figure 8; Appendix C).

The composition of stream sediments are generally representative of the rocks they were derived from within a drainage basin. However, more than one rock type is typically drained by any particular stream. Prior to statistical analysis of data, each sample is designated as draining a single geological formation (the most dominant within the drainage basin). The data can then be statistically manipulated to provide the mean, median, mode, range, standard deviation and various percentile values for each element according to geological formation (Appendix C). This is necessary because the background concentrations of metals are different for different rock types (anomalous-*looking* values may not necessarily be, and visa versa). In this way, anomalous concentrations of metals (values > 90^{th} percentile = anomalous; values > 95^{th} percentile = very anomalous) are identified, and in most cases the character of the anomalous metal assemblage suggests a mineral deposit type (Table 3) that the drainage basin potentially has (or had) within its bounds.

Some samples from drainage basins where mining-related man-made disturbances are present contain exceedingly large concentrations of metals. These analyses were noted and disqualified from being used as criteria for mineral resource potential evaluation.

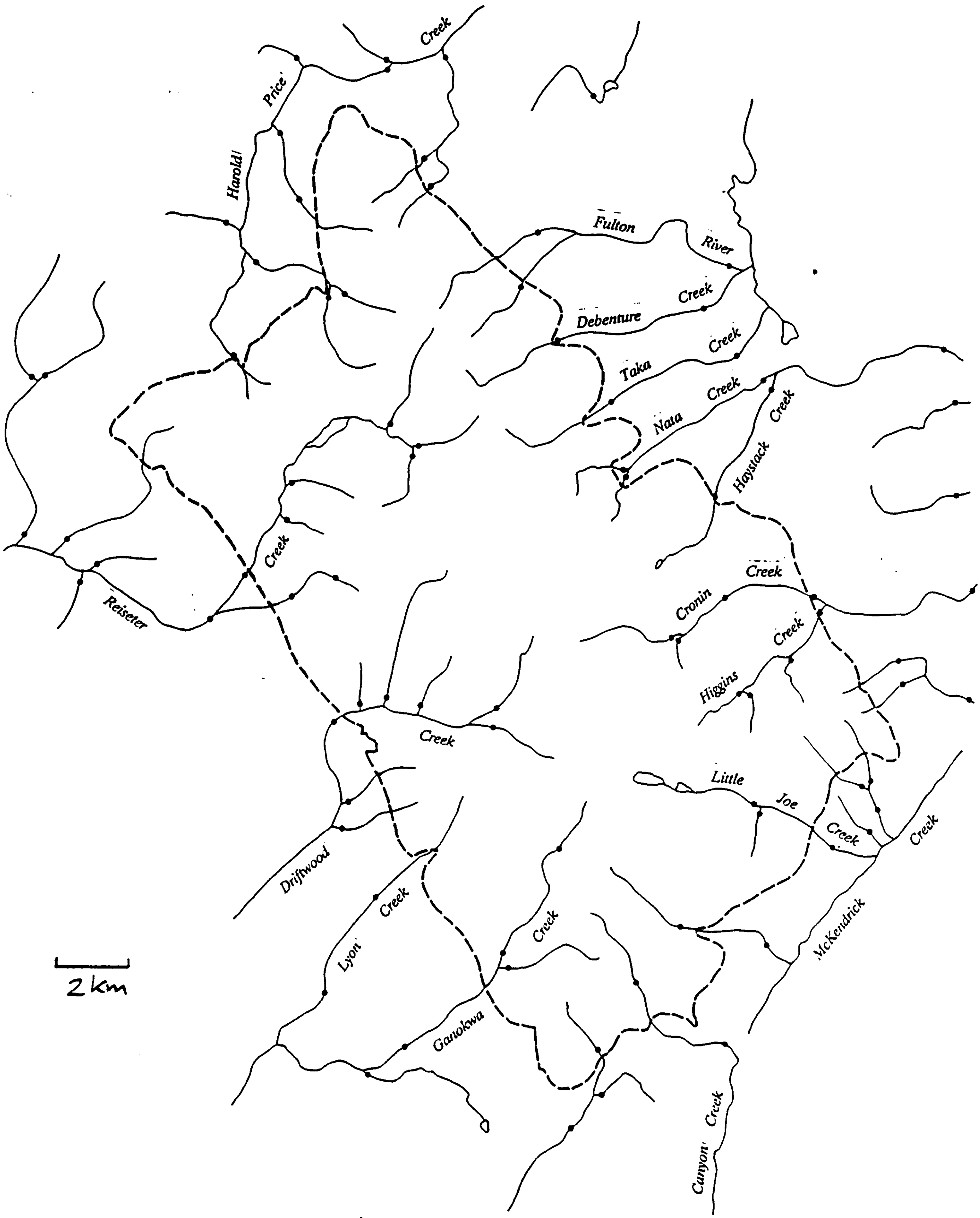


FIGURE 8. Stream sediment sample sites.

▪GEOPHYSICAL SURVEYS

In some areas, geophysical surveys (studies of the Earth by quantitative physical methods, commonly used in the exploration for metallic ores) provide additional information about physical properties of rocks, phenomena beneath the surface, or dominant structural trends which may be important in evaluating the geological favourability of an area. Interpretation of geophysical "anomalies" generally require knowledge of the geological character of the region to understand just what the response means. By using various geophysical techniques, geological formations that are favourable hosts to particular mineral deposit types can be traced beneath overburden or other surface cover and exploration targets outlined (as done by induced polarization geophysical surveys southeast of the Big Onion, see Figure 5).

Regional airborne magnetic surveys (part of a province-wide program by the provincial and federal governments) have been carried out in the study area (Figure 9). The anomalies expressed by the magnetic contours are dependent on the variable magnetic intensities of the underlying rock, and may be due to conditions near, or at unknown depths below the surface.

Just to the northwest of the north end of the study area, a magnetic high is closely adjacent to a magnetic low or depression (Figure 9): this is explained by the presence of a ridge of augite-porphyritic basalt (a rock type with a high magnetic susceptibility) with a steep eastern escarpment (responsible for the adjacent magnetic low).

Another broad anomaly exists just south of the study area and coincides with a stock of diorite. A similar anomaly along the eastern boundary of the study area is not as readily accounted for by the nature of the exposed bedrock: it might indicate a similar stock of igneous rocks at depth.

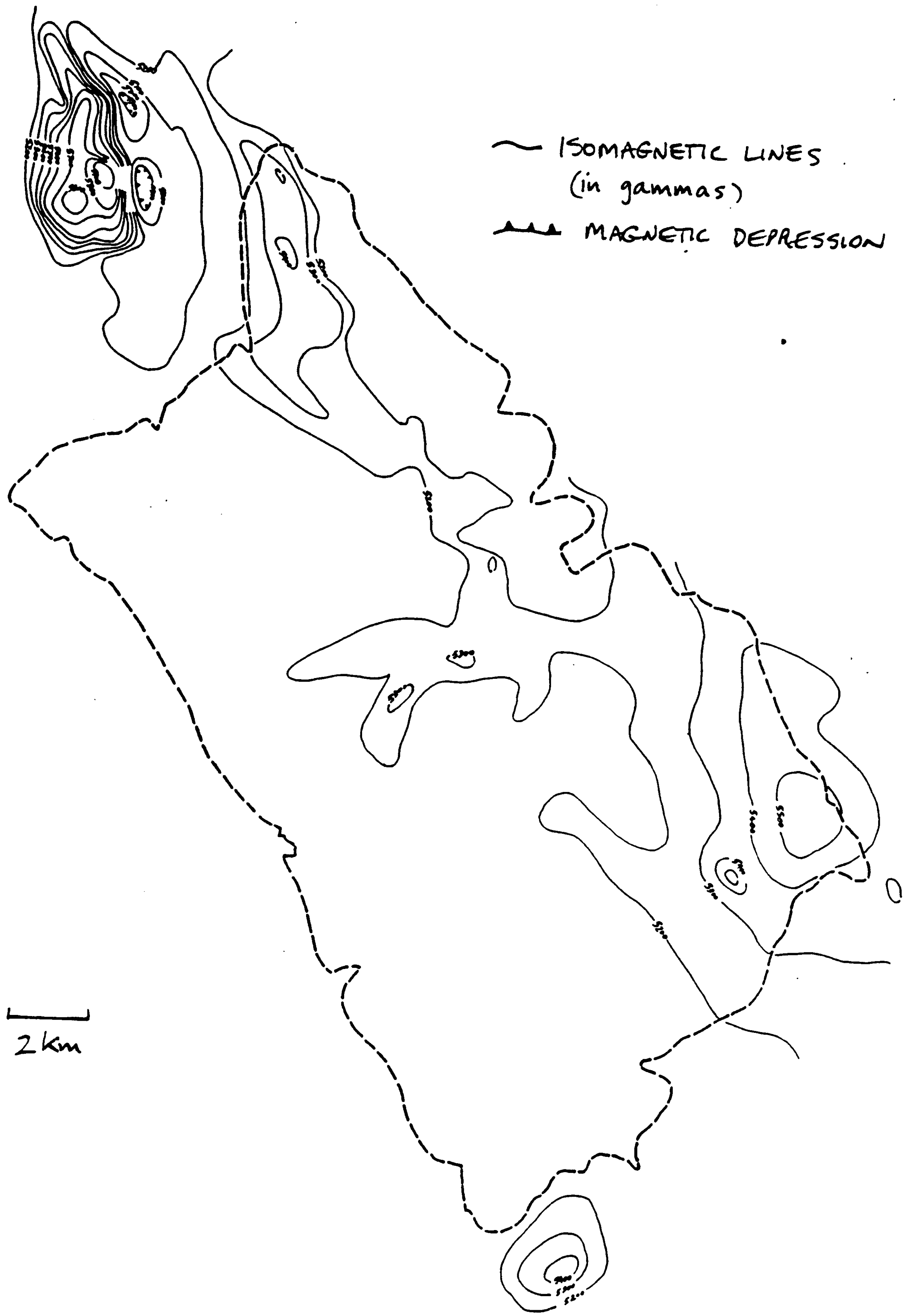


FIGURE 9. Airborne magnetic survey of the Babine Mountains Recreation Area (flight altitude is 300 metres above ground level). Compiled from *British Columbia Ministry of Energy, Mines and Petroleum Resources* (1969a, b, c, d).

Overall, the airborne magnetic survey has not offered any new information with regard to areas which might be favourable for mineral resources.

▪MINERAL RESOURCE POTENTIAL

Mineral Potential Classification

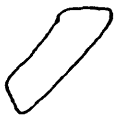
Systematic integration of geological, geochemical and mineral occurrence data is the basis upon which mineral resource potential is determined (McLaren, 1990). Mineral potential is a rating of the likelihood of an area to contain mineral deposits based on the presence of favourable criteria which are diagnostic of the mineral deposit types of concern (see Table 3). Favourable criteria are defined as: the geological setting (as determined by mapping); anomalous concentrations of diagnostic base and/or precious metals in bedrock or stream sediments (as identified by lithogeochemical or stream sediment sampling); and known mineral occurrences (as prospects, past-producers or known resources). Together, the data define areas of low to very high mineral potential for each of the mineral deposit types, which are then combined into a composite mineral resource potential map for the study area.

Mineral Resource Potential: By Deposit Type

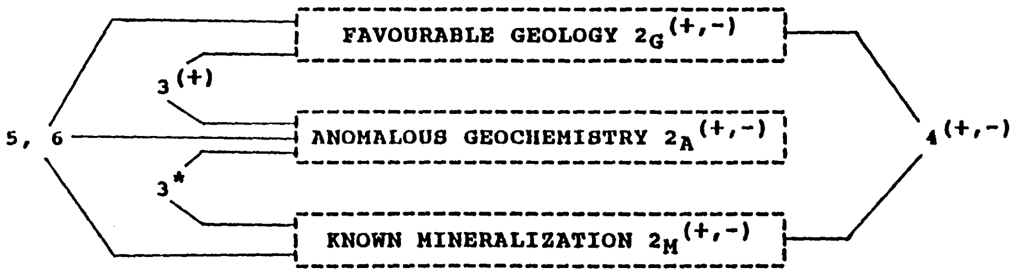
Mineral resource potential has been determined for each of the mineral deposit types within and adjacent to the study area: porphyry copper-molybdenum, silver-rich polymetallic veins, basalt-hosted copper-silver veins, and polymetallic massive sulphides. Summaries of the criteria used to assess each of the deposit types are outlined on tables 5 to 8, and are accompanied by maps (figures 10a to 13a) outlining the areas and ratings of potential for each deposit type as defined by individual favourable criteria.

TABLE 5.

SUMMARY OF CRITERIA USED TO ASSESS PORPHYRY Cu-Mo POTENTIAL

CRITERIA FIELD	OUTLINE/SYMBOL	DESCRIPTION	RATING	AREA OF INFLUENCE
FAVOURABLE GEOLOGY		Late Cretaceous to Early Tertiary quartz-diorite porphyry (qdp), quartz feldspar porphyry (qfp) and diorite (dr)	2_G, $2_G^{\pm}$	outline of rock distributi
		propylitic, sericitic and silicic alteration zones	2_G, $2_G^{\pm}$	outline of rock distributi
ANOMALOUS GEOCHEMISTRY		RGS (stream sediment): Cu±Mo±Au±Ag > 90^{th} percentile	2_A	drainage basin
		" " > 95^{th} percentile	$2_A^{\pm}$	drainage basin
		rock geochemistry: Cu±Mo±Au±Ag - very anomalous	$2_A^{\pm}$	200 metres radius
KNOWN MINERALIZATION		mineral occurrence	2_M, 3^*	500 metres radius
		mineral resource with proven reserves	6	500 to 1000 metres radius

MINERAL POTENTIAL RATING SYSTEMATICS



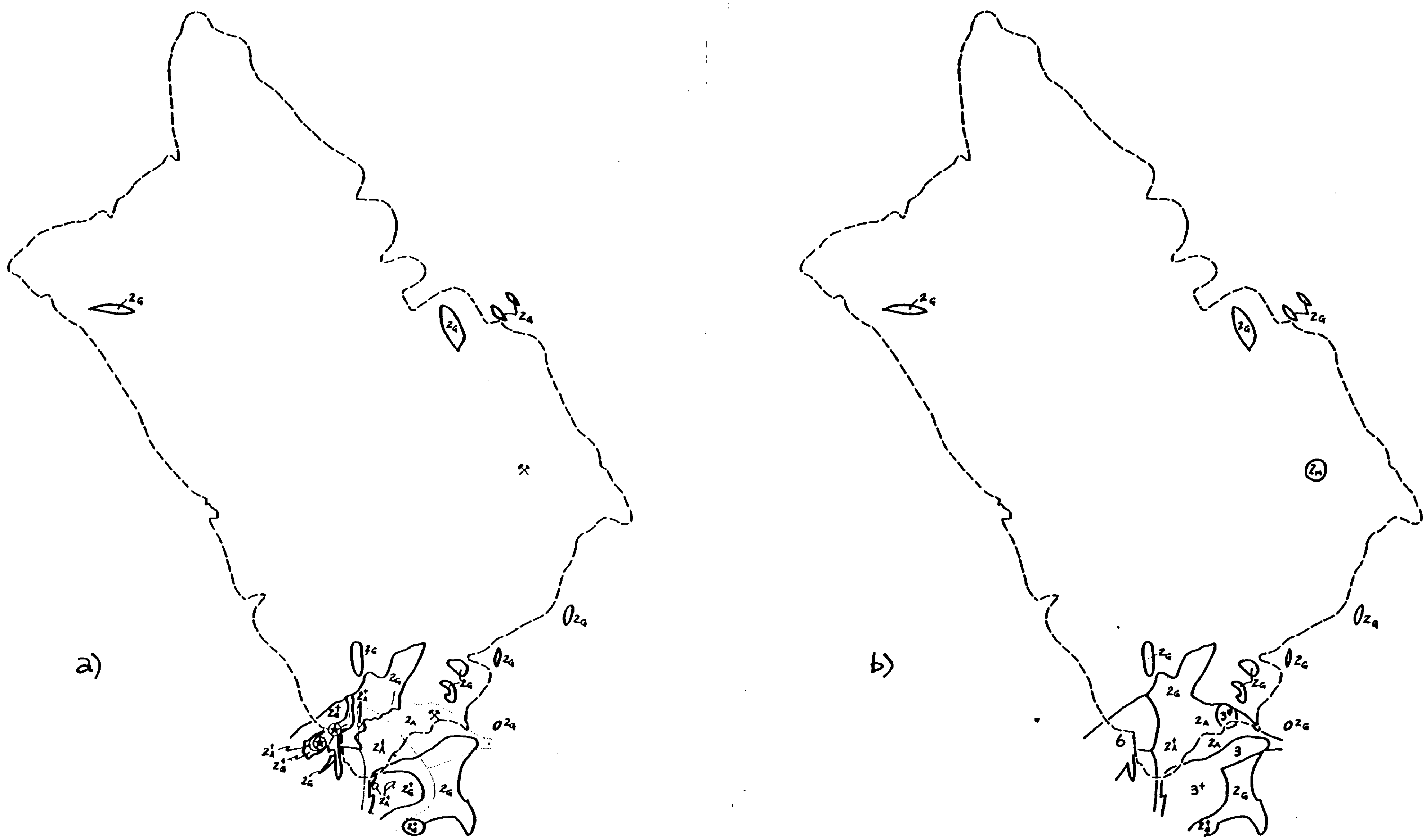
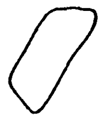
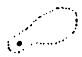


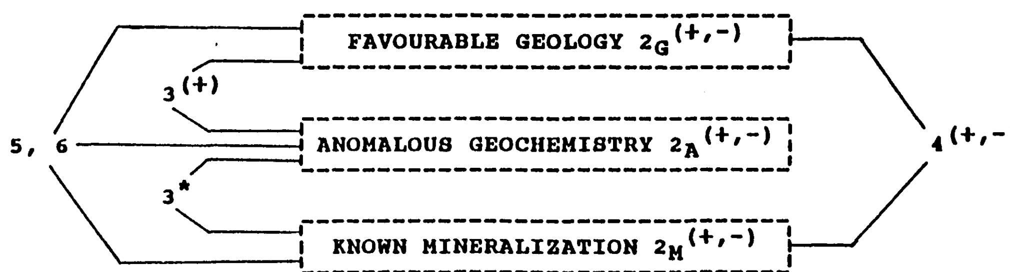
FIGURE 10. Porphyry Cu-Mo potential: a) ratings as defined by individual criteria fields, and b) the final assigned ratings incorporating criteria field overlap.

TABLE 6.

SUMMARY OF CRITERIA USED TO ASSESS POLYMETALLIC VEIN POTENTIAL

CRITERIA FIELD	OUTLINE/SYMBOL	DESCRIPTION	RATING	AREA OF INFLUENCE
FAVOURABLE GEOLOGY		Middle to Upper Jurassic Ashman Formation (muJA) / rhyolite	$2_G^-, 2_G, 2_G^+$	outline of rock distributio
		Upper Cretaceous Kasalka Group (uKK1, uKK2) and associated dikes	2_G^-, 2_G	outline of rock distributio
		pyritic-limonitic alteration zones	2_G, 2_G^+	outline of alteration zones
ANOMALOUS GEOCHEMISTRY		RGS (stream sediment): Ag±Au±Pb±Zn±Cd±Cu±As±Sb > 90th percentile	2_A^-, 2_A	drainage basin
		" " > 95th percentile	2_A, 2_A^+	drainage basin
	⊙	rock geochemistry: Ag±Au±Pb±Zn±Cd±Cu±As±Sb - anomalous	2_A^-, 2_A	200 metres radius
		" " - very anomalous	2_A, 2_A^+	200 metres radius
KNOWN MINERALIZATION	⚒	mineral occurrence	2_M to 5	500 metres radius
	★	past producer	5	500 to 1000 metres radius
	⍟	mineral resource with proven reserves	6	500 to 1000 metres radius

MINERAL POTENTIAL RATING SYSTEMATICS



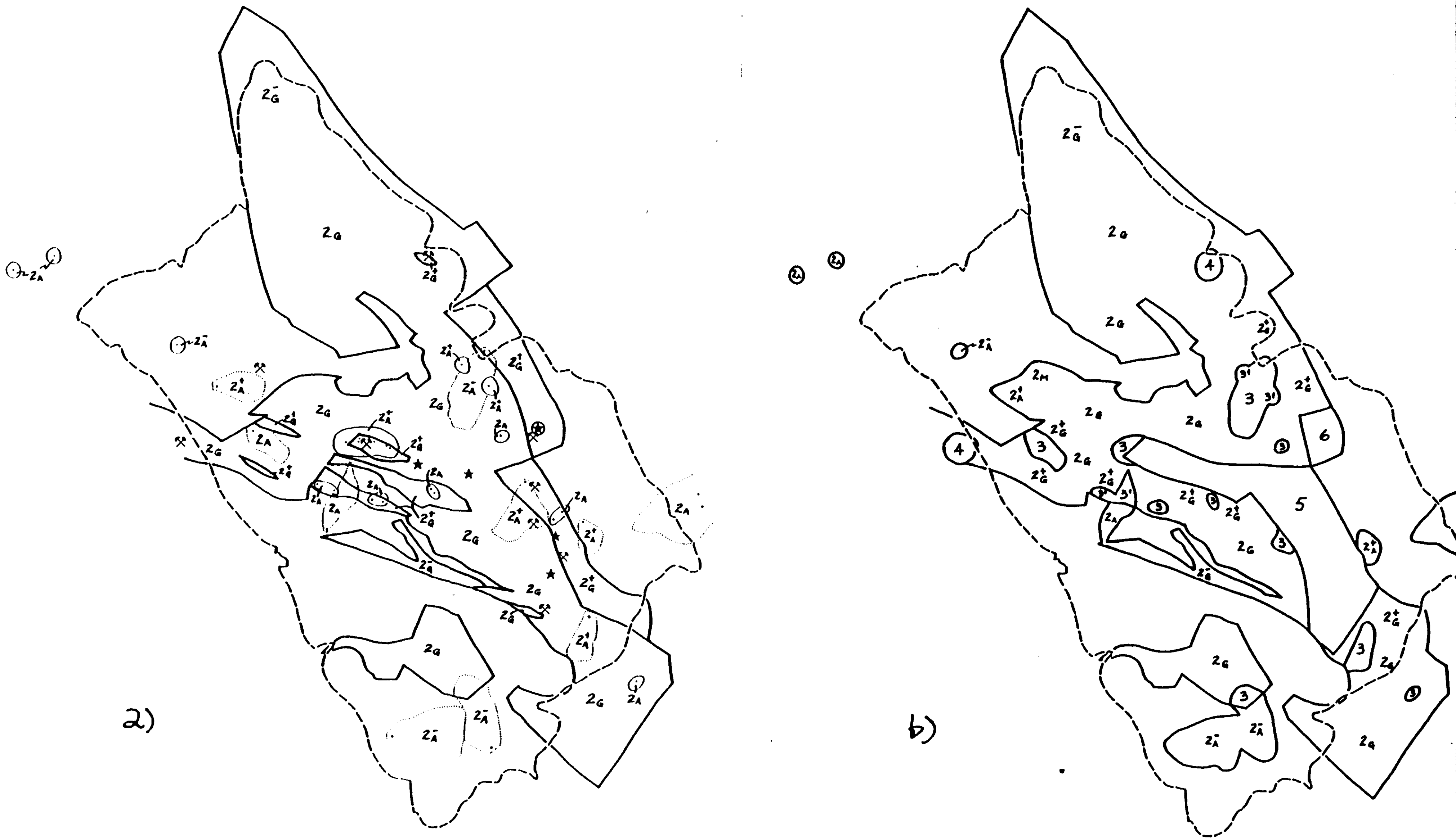
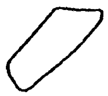


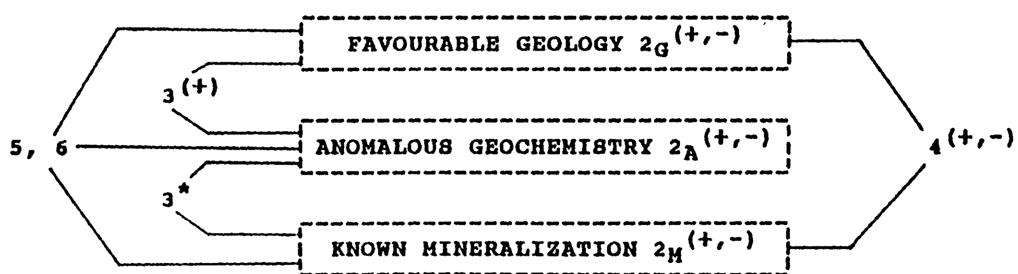
FIGURE 11. Polymetallic vein potential: a) ratings as defined by individual criteria fields, and b) the final assigned ratings incorporating criteria field overlap.

TABLE 7.

SUMMARY OF CRITERIA USED TO ASSESS BASALT-HOSTED Cu-Ag VEIN POTENTIAL

CRITERIA FIELD	OUTLINE/SYMBOL	DESCRIPTION	RATING	AREA OF INFLUENCE
FAVOURABLE GEOLOGY		Lower to Middle Jurassic Telkwa Formation (lJT, lJTb)	$2_G^-, 2_G, 2_G^+$	outline of rock distribution
ANOMALOUS CHEMISTRY		RGS (stream sediment): Cu±Ag±Au±Pb±Zn > 90th percentile	2_A^-	drainage basin
	⊙	rock geochemistry: Cu±Ag±Au±Pb±Zn - very anomalous	2_A^+	200 metres radius
KNOWN MINERALIZATION	⚒	mineral occurrence	within 5	500 metres radius
	★	past producer	5	500 to 1000 metres radius

MINERAL POTENTIAL RATING SYSTEMATICS



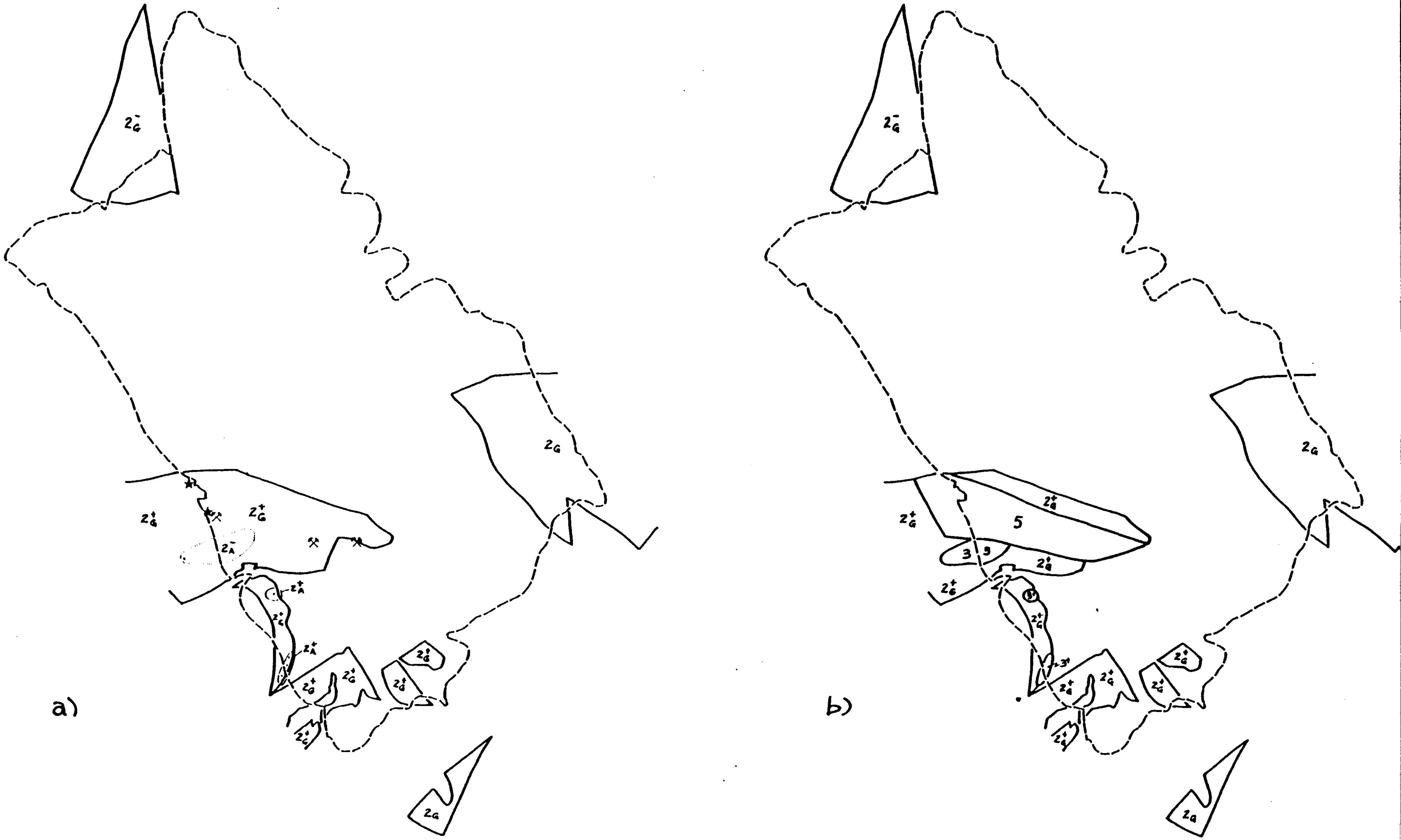


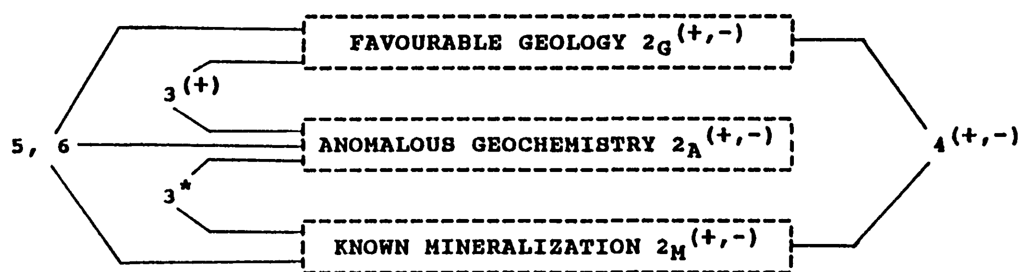
FIGURE 12. Basalt-hosted Cu-Ag vein potential: a) ratings as defined by individual criteria fields, and b) the final assigned ratings incorporating criteria field overlap.

TABLE 8.

SUMMARY OF CRITERIA USED TO ASSESS POLYMETALLIC MASSIVE SULPHIDE POTENTIAL

CRITERIA FIELD	OUTLINE/SYMBOL	DESCRIPTION	RATING	AREA OF INFLUENCE
FAVOURABLE GEOLOGY		Lower Jurassic Nilkitkwa Formation (lJN) and upper parts of the underlying Telkwa Formation (lJT, lJTb)	2_G^-, 2_G, 2_G^+	outline of rock distribut
ANOMALOUS GEOCHEMISTRY	⊙	rock geochemistry: Zn±Pb±Ba±Cu±As - anomalous	2_A^-	200 metres radius
KNOWN MINERALIZATION		no known mineralization of this type within the study area		

MINERAL POTENTIAL RATING SYSTEMATICS



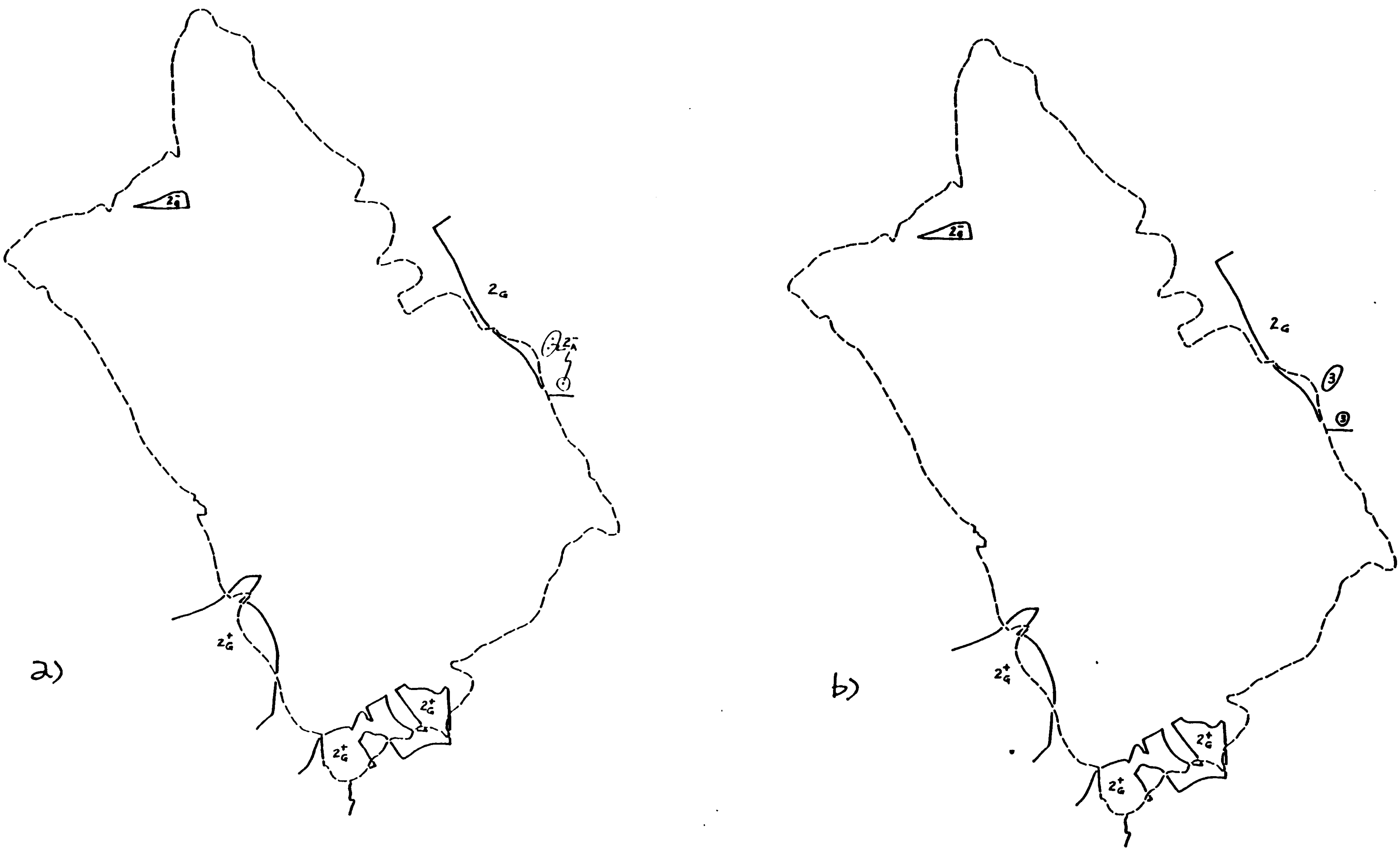


FIGURE 13. Polymetallic massive sulphide potential: a) ratings as defined by individual criteria fields, and b) the final assigned ratings incorporating criteria field overlap.

Areas of favourable geology (which includes favourable host rocks and alteration type) are designated as 2_G^-, 2_G, or 2_G^+. Minus or plus signs are used to indicate less favourable or more favourable data: an example of more favourable data is the overlap area of favourable alteration with favourable geology. The area of influence is the outline of the distribution of favourable rocks or alteration zones.

Areas of favourable geochemistry include sites from which stream sediment samples and lithogeochemical (or rock) samples were taken that contain anomalous concentrations of diagnostic base and/or precious metals. Anomalous stream sediment analyses which are generally greater than the 90th percentile for the specific data group (according to the diagnostic metal assemblage and dominant rock formation within the drainage basin) are designated 2_A^- or 2_A, depending on the number and character of anomalous metals and their individual concentrations; those analyses greater than the 95th percentile are designated 2_A or 2_A^+. The area of influence for anomalous stream sediment analyses is the drainage basin above the site where the sample was collected.

Anomalous rock geochemical analyses (according to the diagnostic metal assemblage) are designated 2_A^-, 2_A, or 2_A^+, depending on how anomalous the analyses are (determined by visual inspection of the regional data set). The area of influence is that which is within a 200 metres radius of the sample site.

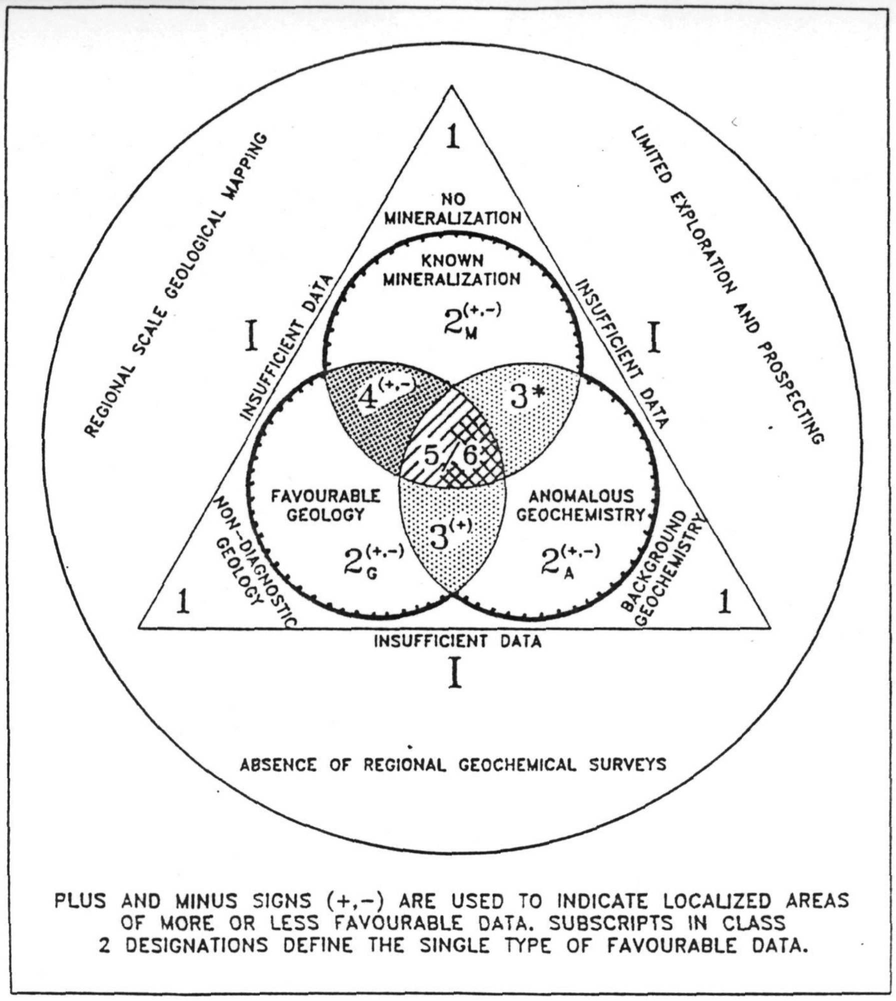
Known mineralization is catagorized according to its degree of significance: mineral occurrences, past-producers and mineral resources with proven reserves. Mineral occurrences are designated as 2_M^-, 2_M or 2_M^+, and the area of influence is that which is within a 500 metres radius of the mineral occurrence location. Past-producers have a much greater degree of significance and are designated as high as 5, with an area of influence of 500 to 1000 metres radius. Mineral resources with proven reserves have the greatest degree of significance and are designated as 6, with an area of influence of 500 to 1000 metres radius: this catagory includes past-producers that still contain mineral reserves.

Areas where favourable criteria overlap indicate a greater degree of confidence, or an increased likelihood for a mineral deposit of a particular type to occur. A higher degree of mineral potential is therefore assigned to the region of overlap: this is shown for each of the mineral deposit types on figures 10 b to 13 b. In areas where favourable geochemistry overlap with areas of favourable geology, the area of overlap is designated as a 3 or 3^+, and for areas where favourable geochemistry overlap with known mineralization, the area of overlap is designated as 3^*: the * represents the presumption that the area is also within favourable geology because of the presence of known mineralization. For areas of overlap between favourable geology and known mineralization, the designation is 4^-, 4, or 4^+ because these data indicate a greater likelihood for the area to contain additional concentrations of metals within a greater area. Mineral potential designations of 5 and 6 indicate areas where all three favourable criteria are present, and are generally assigned to areas which include significant mineral occurrences or deposits, past-producers, or mineral resources with proven reserves. Areas in which no favourable criteria has been identified are designated as 1.

Mineral Resource Potential of the Babine Mountains Recreation Area

Data presented in the mineral potential maps for each mineral deposit type (figures 10 to 13) are superimposed into one final composite mineral resource potential map for the study area (figures 14 and 15). Areas of very high mineral potential (class 6) surround the Big Onion deposit and the Cronin mine: both deposits contain known mineral reserves and potential for development is high.

Larger areas of high mineral potential (class 5) include: the belt of silver-rich polymetallic vein prospects and past-producers through the central part of the study



CLASSIFICATION OF MINERAL POTENTIAL

(AMENDED FROM McLAREN, 1990)

QUALITATIVE DESCRIPTIONS OF MINERAL POTENTIAL CLASSIFICATIONS

Class	Mineral Potential	Description
6	Very High	Known deposits with identified resources in the ground. Favourable supporting data from all three sources; high degree of confidence in designation. Continued exploration highly probable; potential for mine development is high.
5	High	Known occurrences in highly favourable metallogenic environment. Supporting data from all three sources; high degree of confidence in designation. May include known deposits or past producing mines with unknown resources in the ground. Future exploration highly probable.
4	Moderate to high	Known or indicated mineral resources in favourable geological environment. Supporting data from these two sources specifically; moderate degree of confidence in designation. Future exploration to be expected.
3	Moderate to high	Favourable geological and geochemical environment, but significant mineral occurrences lacking. Supportive data from these two sources; moderate degree of confidence in designation. Future exploration likely, particularly if near areas of higher potential.
2	Moderate	Supporting data from one of three sources, usually geological or geochemical; areas generally lack sufficient prospecting to identify mineralization. Moderate to low degree of confidence in designation. Reconnaissance exploration to be expected. Good potential for upgrading of classification.
1	Low	Current data is non–diagnostic for favourable metallogenic environment. Moderate to high degree of confidence in designation. Little likelihood for future exploration for deposit types considered.
I	Indeterminate	Current data is either outdated or insufficiently detailed for a reasoned determination of mineral potential. High degree of confidence in designation. Future exploration to be expected in portions of the area.

FIGURE 14. Classification of mineral resource potential (after McLaren (1990)).

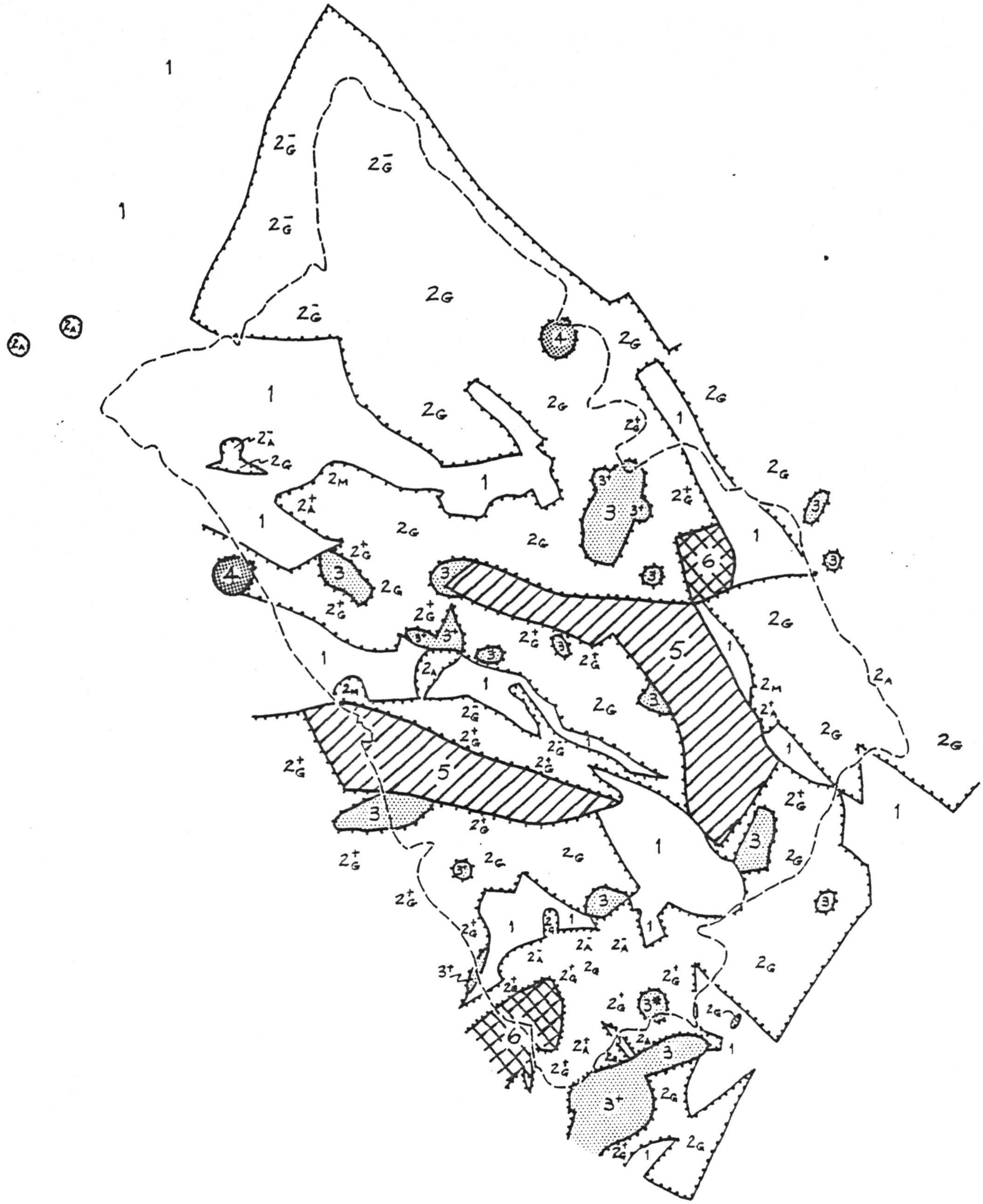


FIGURE 15. Mineral resource potential of the Babine Mountains Recreation Area (see Figure 14).

area; and the cluster of basalt-hosted copper-silver vein prospects and past-producers in the central-eastern part of the study area. Future exploration within these areas is highly probable.

Areas of high to moderate mineral potential (class 4) surround mineral prospects that are within a favourable geological environment, and further exploration is to be expected.

Areas of moderate to high mineral potential (class 3) indicate favourable geology and geochemistry: future exploration for undiscovered mineral resources is likely, particularly for areas near known mineralization.

Areas of moderate mineral potential (class 2) require further examination to upgrade the mineral potential rating: reconnaissance exploration is to be expected.

Areas of low mineral potential (class 1) indicate: a lack of sufficiently detailed information for the area, or rocks that are not likely hosts of metallic mineral deposits. Present information does not provide much encouragement for future exploration.

CHAPTER 5

CONCLUDING REMARKS

▪90 YEARS OF EXPLORATION: ARE THERE STILL UNDISCOVERED MINERAL RESOURCES?

A mineral resource potential study such as this attempts to summarize the geological database as it is presently known. Examination and analysis of exposed bedrock does not always yield information on possible resources stored at depth:

only explorationists have the tools (such as geophysical instruments and diamond drills) to test for mineral potential below the surface.

Surface prospecting and sampling during the course of this study revealed three rather significant (previously undocumented) polymetallic vein prospects (Gaba et al., 1992). During the present economic climate, prospects such as these (and others in the study area) might not be pursued by the mining industry, but with changes in economic circumstances or exploration strategies in the future, may be looked at as viable exploration targets: this is exemplified by the history of exploration at the Big Onion property (Appendix A).

Regionally extensive belts of pyritic and limonite-stained altered rocks, mainly within the central part of the study area (Figure 7), contain scattered anomalous concentrations of base and/or precious metals (as determined by lithogeochemical sampling). A plausible reason for the lack of more widespread metals within the altered rocks may be that pre-existing metals have been leached from the rocks by near-surface groundwater acidified by the natural oxidation of pyrite. Proper evaluation of these rocks, therefore, require diamond drilling in order to test the rocks at depth beneath the possibly metal-deficient capping of iron-rich altered rocks.

▪THE BIG ONION DEPOSIT: PART OF BRITISH COLUMBIA'S MINERAL RESOURCE INVENTORY

A known resource of copper and molybdenum (with accessory gold and silver) continues to be evaluated at the Big Onion property. Further exploration serves not only to better constrain the grade and distribution of indicated ore, but also to expand on possible ore in favourable peripheral environments. The proximity of the Big Onion orebody to the town of Smithers is advantageous in keeping down the cost of exploration and development. At the same time, if development were to proceed, Smithers would undoubtedly feel positive economic repercussions from the project. Under these circumstances it would be illogical to alienate the Big Onion deposit from future exploration, and possibly development.

▪THE BOUNDARY QUESTION: EQUITABLE MULTI-USE LAND MANAGEMENT

The present boundary of the Babine Mountains Recreation Area generally follows the 1370 metre (4500 foot) elevation contour. This boundary location was designed to exclude lower elevation areas where commercial timber exists, thereby avoiding conflict with the forest industry (Babine Master Plan Study Team, 1991). In addition, exceptions to recreation area rules were made for snowmobile use in the Ganowkwa Basin, a rapidly expanding recreation that attracts many people from out-of-town and boosts the local economy during the winter months. However, oblivious to the mining industry's interests, the recreation area boundary cuts through the middle of the Big Onion deposit, the most promising mineral property presently being explored within the recreation area.

Equitable multi-use land management (in an ideal situation) requires that all parties with interests in the lands occupied by a recreation area would have equal input into the design of the final plan. From the mining industry's standpoint, the recreation area (or other future designation) boundary should be so designed as to exclude the Big Onion deposit and a sufficiently large region peripheral to the prospect to protect mining interests and future exploration access to a known metal resource. Further, it is proposed that the northern boundary be extended so as to include a comparably-sized territory of alpine meadows and wetlands to complement the "wide variety of wilderness environments" within the Babine Mountains Recreation Area.

REFERENCES

Babine Master Plan Study Team (1991): Babine Mountains Recreation Area Master Plan Background Report; unpublished report prepared for the *B.C. Ministry of Environment, Lands and Parks*, 79 pages.

Blix, E. (1977): Trails to Timberline; Northern Times Press, Terrace, B.C., 197 pages.

British Columbia Ministry of Energy, Mines and Petroleum Resources (1969a): Harold Price Creek; Aeromagnetic Map 5243G, scale 1:63 360.

British Columbia Ministry of Energy, Mines and Petroleum Resources (1969b): Morice Town; Aeromagnetic Map 5244G, scale 1:63 360.

British Columbia Ministry of Energy, Mines and Petroleum Resources (1969a): Driftwood Creek; Aeromagnetic Map 5318G, scale 1:63 360.

British Columbia Ministry of Energy, Mines and Petroleum Resources (1969a): Smithers; Aeromagnetic Map 5319G, scale 1:63 360.

British Columbia Ministry of Energy, Mines and Petroleum Resources, Annual Reports (1898-1968).

British Columbia Ministry of Energy, Mines and Petroleum Resources, Geology, Exploration and Mining in British Columbia (1969-1988).

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

Dawson, G.M. (1881): Report on an Exploration From Port Simpson on the Pacific Coast, to Edmonton on the Saskatchewan, 1879; *in* Report of Progress for 1879-80, *Geological Survey of Canada*, Report B, 177 pages

Depaoli, G.M. (1977): Geophysical Report on the Cote Option; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 6363, 11 pages plus maps.

Gaba, R.G., Desjardins, P.J. and MacIntyre, D.G. (1992): Mineral Potential Investigations in the Babine Mountains Recreation Area; *in* Geological Fieldwork 1991, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1992-1, pages 93-101.

Holland, S.S. (1964): Landforms of British Columbia, A Physiographic Outline; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 48.

L'Orsa, J. (1990): A History of the Babine Mountains Recreation Area; unpublished report prepared for the *B.C. Ministry of Environment, Lands and Parks*, 29 pages.

Livgard, E. (1973): The Cronin Mine; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Property File, unpublished company report, 24 pages.

MacIntyre, D.G., Brown, D., Desjardins, P. and Mallett, P. (1987): Babine Project (93L/10,15); *in* Geological Fieldwork 1986, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1987-1, pages 201-222.

MacIntyre, D.G. and Desjardins, P. (1988a): Babine Project; *in* Geological Fieldwork 1987, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1988-1, pages 181-194.

MacIntyre, D.G. and Desjardins, P. (1988b): Geology of the Silver King - Mount Cronin Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1988-20.

McCrossan, E. (1991): Drilling Report on the Big Onion Property; report draft for Varitech Resources Limited, 25 pages.

McLaren, G.P. (1990): A Mineral Resource Assessment of the Chilko Lake Planning Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 81, 117 pages.

Morice, A.G. (1904): The History of the Northern Interior of British Columbia, 1660 to 1880, William Briggs, Toronto.

Palmer, A.R. (1983): The Decade of North American Geology 1983 Geologic Time Scale; *Geology*, Volume 11, pp.503-504.

Quin, S.P. (1987): Cronin Mine Project: Summary Report for the 1987 Exploration Program for Southern Gold Resources; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 16721, 36 pages.

Schroeter, T.G. (1977): Big Onion; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geology in British Columbia 1975, pages 66-67.

Stock, G.C. (1977): Geological and Rock Geochemical Report on the Big Onion Area Claims; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 6364, 13 pages plus maps.

Sutherland-Brown, A. (1967): Big Onion; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Minister of Mines Annual Report for 1966, pages 83-86.

APPENDIX A

Chronologic History of Exploration and Mining in the Babine Mountains Recreation Area (1866-1991)

1866 Construction of the Collins Overland Telegraph line (Western Union Telegraph Company) along the Watsonquah River, shortly thereafter renamed the Bulkley River after Colonel Bulkley (Engineer-in-Chief of the operation).

1878 H.J. Cambie, Canadian Pacific Railway, in connection with explorations of proposed railway routes briefly reviewed the Bulkley Valley and its agricultural possibilities.

1879 G.M. Dawson, Geological Survey of Canada, made an exploratory trip across the Babine Range up the Suskwa River and over the height of land to Babine Lake.

1898 The Collins Overland Telegraph trail along the Bulkley Valley was used as a route to the Klondike gold fields by a rush of prospectors; copper-gold veins and coal seams reported from the region.

1903 Assessment work reported from the *Eldorado* claim (Harvey Mountain area)

1905 W.F. Robertson, Provincial Mineralogist, explored the region and visited mineral claims on Harvey Mountain; discovery of the *Dibble (or Babine-Bonanza)* veins by prospectors from Hazelton; claims staked in Ganokwa Basin.

1906 W.W. Leach, Geological Survey of Canada, began scientific geological examinations (1906-1910).

1908 Prospecting and exploratory work done on at least 25 mineral properties within the Babine Range, with the hopes that the construction of a line of the Grand Trunk Pacific Railroad would be built throughout the length of the Bulkley Valley.

1909 The railway now assured, miners flock in and considerable work is done on more than 20 mineral prospects; surface and underground work (drifting) on the *Pack Train (or Drift)* property (by P. Harvey); the *Dibble (or Babine-Bonanza)* group is acquired by the Babine-Bonanza Mining Company (J. Cronin and Associates) and work begins.

1910 Construction on railway (1910-1914); extensive underground work on *Babine-Bonanza* - considerable interest in this silver property draws attention to the region.

1911 Considerable work done on existing mineral properties, particularly the *Babine-Bonanza* - trails from Telkwa, Morricetown, and Hudson Bay Ranch (on Driftwood Creek) to the *Babine-Bonanza* area in use; about 42 new claims recorded.

1912 Fourty-eight new claims recorded.

1913 Town of Smithers founded; silver-lead veins on the *Debenture* group explored by drifting (by Ritzins and Morton); 71 new claims recorded.

1914 Underground development continued on the *Debenture* (by Ritzins and Morton) and the *Babine-Bonanza* property; 46 new claims recorded.

1916 Seventy-two new claims recorded.

1917 A sleigh road linking the *Babine-Bonanza* to the railway at Telkwa is completed (with a grant from the Mines Development Fund) and 79 tons of hand-cobbed silver-lead ore are brought out (to date 762 metres of shafts and tunnels had been put in - all work was by hand as no machinery was on the site); 6 tonnes of silver-lead ore produced from the *Victoria (or Lorraine)* group; 6 tonnes of high grade silver ore shipped from the *Silver King* property.

1918 The *Cimbria (or Big Onion)* group is staked (by A. Elmsted and Associates); underground development at the *Victoria* group (by P.J. Higgins); 23 tonnes of hand-cobbed silver-copper ore brought out (1915-1918) from *Harvey (or Drift)* group (by C.G.

Harvey and W.J. Larkworthy); surface and underground exploration (drifting) at the *Social (or Jud)* group (by A.P. McCabe and P. McPhee).

1919 Construction of the McCabe trail to the *Social* group and the Harvey Mountain trail to the *Harvey* group (both built with grants from the Mines Development Fund); underground development at the *Harvey* (by C.G. Harvey and W.J. Larkworthy) and *Silver King* groups, and continued work at the *Babine-Bonanza* property.

1920 Extensions were added to the McCabe trail (with grants from the Mines Development Fund): the Silver King Basin trail to the *Silver King* group, and a trail to the *Victoria (or Lorraine)* group (now part of the Little Joe trail); underground development at the Babine-Bonanza property (by Babine-Bonanza Mining and Milling Company).

1921 Underground development continued at the *Babine-Bonanza*, *Driftwood* (by J.T. Driscoll), *Harvey* and *Silver King* (by P.J. Higgins) groups.

1922 Underground development commenced at the *Hyland Basin* (by M. Cain and T. King) and *Little Joe (or Silver Pick)* (by M. Cain and T. King) groups; continued underground development at the *Silver King* (by W. Foley and E. Lee), *Victoria* (by P.J. Higgins) and *Social* groups.

1923 Underground development continued at the *Babine-Bonanza*, *Hyland Basin* (by J.F. Duthie) and *Little Joe* (by M. Cain and T. King) groups.

1924 G. Hanson, Geological Survey of Canada, carried out the first systematic geological mapping of the southern Babine Range, including mineral prospect examination; continued underground work at the *Silver King* (by P.J. Higgins), *Victoria* (by P.J. Higgins), *Rainbow (or Driftwood)*, *Hyland Basin* (by J.F. Duthie) and *Little Joe* (by M. Cane and T. King) groups.

1925 Underground development continued at the *Silver King* (by P.J. Higgins and Associates), *Hyland Basin* (by Gale and Milligan), *Harvey* (by C.G. Harvey) and *Little Joe* (by M. Cain and T. King) groups; J. Cronin, manager of the *Babine-Bonanza* property dies of injuries received in 1923 when his horse fell as he was riding.

1926 Construction of the Little Joe Creek trail (built with a grant from the Mines Development Fund) now linked the *Little Joe* group with the *Babine-Bonanza* sleigh road; underground development continued at the *Silver King*, *Hyland Basin*, *Victoria*, *Silver Saddle*, *Little Joe* and *Harvey* (by C.G. Harvey) groups.

1927 Six tonnes of hand-sorted silver ore shipped from the *Silver King* property; 9 tonnes of silver ore was taken out of the *Little Joe* property; 4.5 tonnes of silver-copper ore was shipped from the *Harvey* property; underground development (drifting) at the *Cimbria (or Big Onion)* group (by A. Elmsted).

1928 Underground operations resume at the *Babine-Bonanza* group; continued underground development (drifting) at the *Victoria* group (by Lorraine Copper-Silver Mines Limited).

1929 A new trail from the Little Joe Creek trail to the *Victoria* group is built; underground work continues at the *Victoria* (by Lorraine Copper-Silver Mines Limited), *Rainbow*, *Harvey* (by Consolidated Mining and Smelting Company of Canada), and *Little Joe* properties; continued underground development at the *Babine-Bonanza* property and 27 tonnes of hand-sorted silver-lead ore shipped (by Babine-Bonanza Metals Limited); trenching on the *Silver Saddle* property (by A.T. Harrer and B.F. Messner).

1930 Underground development continues at the *Rainbow*, *Silver King* (by Omineca Silver King Mining Company Limited), *Victoria* (by Lorraine Copper-Silver Mines Limited) and *Babine-Bonanza* groups.

1931 Underground work continues at the *Babine-Bonanza*, *Silver King* (by Omineca Silver King Mining Company Limited), *Victoria* (by Lorraine Copper-Silver Mines Limited) and *Little Joe* (by T. King) groups.

1932 Work continued at the *Rainbow* and *Cimbria* (by A. Elmsted and B. Mueller) groups.

1935 Six tonnes of hand-sorted silver ore packed out of the *Hyland Basin* property.

1936 Nine tonnes of hand-sorted silver ore packed out of the *Silver Pick (or Little Joe)* property (by J.J. Herman).

1937 Nine tonnes of hand-sorted silver ore packed out of the *Skookum (by Silver King)* group (by J. Baker); 9 tonnes of hand-sorted gold-silver-copper ore packed out from the *Rainbow* group (by F.H. Johnson).

1938 Five tonnes of hand-sorted silver ore shipped from the *Little Joe* property (by A. Elmsted).

1939 Camp construction at the *Silver King* prpoerty (by La Marr Gold Mines Limited).

1940 Surface and underground work at the *Silver King* group (by La Marr Gold Mines Limited); 4 tonnes of hand-sorted silver ore shipped from the *Hyland Basin* group (by H.W. Agnew and Associates).

1947 Surface work done on the *Babine-Bonanza* (by Cronin Babine Mines Limited).

1948 Underground and surface diamond drilling at the *Babine-Bonanza*, and a 112 kilogram sample sent for metallurgical tests.

1950 Construction began on a new road between the *Babine-Bonanza* group and the recently completed Chapman Lake road (now known as the Babine Lake road), with plans for installing a mill on the property.

1951 The new road is completed, many of the new mine buildings are constructed and 55 tonnes of previously stockpiled ore is shipped from the *Babine-Bonanza* property; surface work continued at the *Lorraine* (by Yellowknife Gold Mines Limited) and *Hyland Basin* (by Yellowknife Gold Mines Limited) properties.

1952 Parts of the *Cronin (or Babine-Bonanza)* property are rehabilitated, a road from the mine to the mill site is built and several buildings completed, including a 36 tonne-per-day mill (by New Cronin Babine Mines Limited); 3185 tonnes of ore were milled (lead and zinc concentrates containing silver, gold, lead, zinc and cadmium were shipped to the Trail smelter), but operations cease by the year end due to low base metal prices.

1956 Work resumes at the *Cronin mine*, including underground development and 3811 tonnes of ore milled.

1957 Underground work at the *Cronin mine* continued, and 5370 tonnes of ore milled.

1958 A road was built up Higgins Creek joining the *Lorraine* property to the *Cronin mine* road; some underground work was done at the *Lorraine*; the *Cronin mine* was leased from New Cronin Babine Mines Limited by P. Kindrat, and with his family operated the mine each summer until 1972 when it was sold to Hallmark Resources: 112 tonnes of unmilled ore and 8 tonnes of lead concentrate were shipped from the *Cronin mine*.

1959 Seventy-four tonnes of lead concentrate and 60 tonnes of zinc concentrate are shipped from the *Cronin mine*.

1960 Seventy-two tonnes of lead concentrate and 60 tonnes of zinc concentrate are shipped from the *Cronin mine*.

1961 Seventy-three tonnes of lead concentrate and 84 tonnes of zinc concentrate are shipped from the *Cronin mine*.

1962 Three hundred and sixty-three tonnes of ore is mined at the *Cronin mine*, but none is shipped.

1963 Continued underground development and exploration (diamond drilling) at the *Cronin mine*, and shipment of 25 tonnes of lead concentrate and 33 tonnes of zinc concentrate.

1964 Continued underground development and exploration (diamond drilling) at the *Cronin mine*, and shipment of 41 tonnes of lead concentrate and 72 tonnes of zinc concentrate; underground development and camp construction at the *Debenture* group (by Native Mines Limited); trenching, geophysics, and diamond drilling at the *Astlais (or Big Onion)* property (by Noranda Exploration Company Limited).

1965 Continued underground development at the *Cronin mine*, and shipment of 99 tonnes of lead concentrate and 138 tonnes of zinc concentrate.

1966 Eighty-three tonnes of lead concentrate and 124 tonnes of zinc concentrate are shipped from the *Cronin mine*; continued underground development and exploration (diamond drilling) at the *Lorraine* property (by Native Mines Limited); bulldozer stripping and road building, geophysics and diamond drilling at the *Big Onion* property (by Texas Gulf Sulphur Company); geochemical sampling and trenching at the *Rainbow (or Driftwood)* property (by Reindeer Mines Limited).

1967 Fifty-one tonnes of lead concentrate and 76 tonnes of zinc concentrate milled from ore mined from surface pit and underground are shipped from the *Cronin mine* (by Kindrat Mines Limited); continued exploration (diamond drilling) at the *Big Onion* property (by Texas Gulf Sulphur Company); road construction and trenching on the *Mert* group (northeast of the *Big Onion* property) (by Tro-Buttle Exploration Limited); geochemical sampling on the *Debenture* property (by Wanda Mines and Exploration Limited).

1968 Continued surface exploration at the *Mert* group (by Tro-Buttle Exploration Limited) and the *Rainbow* group (by D.W. Small and Associates).

1969 Twenty-two tonnes of lead concentrate and 25 tonnes of zinc concentrate milled from ore from surface pit and old dumps are shipped from the *Cronin mine*; 13.5 tonnes of high-grade copper-silver ore was shipped from the *Rainbow* property (by J. Millhouse).

1970 H. Tipper, Geological Survey of Canada, began reconnaissance geological mapping in the Smithers map area (1969-1970); seventy-nine tonnes of lead concentrate and 94 tonnes of zinc concentrate were shipped from the *Cronin mine* (some surface exploration was also done); continued surface exploration (geophysics and geochemistry) at the *Big Onion* (by Blue Rock Mining Corporation Limited); continued surface exploration (geophysics) on the *Mert* group (by Tro-Buttle Exploration Limited); trenching and diamond drilling on the *Jud (or Social)* group (by Rockwell Resources Limited).

1971 Eighty-three tonnes of lead concentrate and 113 tonnes of zinc concentrate milled from ore from surface pit and underground are shipped from the *Cronin mine*; underground mapping at the *Drift (or Harvey)* group and 4.5 tonnes of high-grade silver-copper ore are shipped out (by Driftwood Mines Limited).

1972 Continued underground development at the *Cronin mine*, and shipment of 69 tonnes of lead concentrate and 74 tonnes of zinc concentrate; bulldozer trenching on the *Drift* property (by Driftwood Mines Limited).

1973 Construction of tailings disposal area, upgraded camp facilities, mill rehabilitation, surface exploration (exposing the new *Upper showing* and continued underground development at the *Cronin mine*, and shipment of 78 tonnes of lead concentrate and 73 tonnes of zinc concentrate (by Hallmark Resources Limited).

1974 Continued underground development at the *Cronin mine*, and shipment of 36 tonnes of lead concentrate and 64 tonnes of zinc concentrate; continued exploration (geophysics and diamond drilling) at the *Big Onion* (by Canadian Superior Exploration Limited).

1975 Surface diamond drilling (to test the open-pit potential of the *Upper showing*) and surface and underground surveying at the *Cronin mine* (by Coca Metals Limited); surface diamond and percussion drilling and geochemical surveys at the *Big Onion* property (by Canadian Superior Exploration Limited).

1976 Surface diamond and percussion drilling, geochemical surveys and geological mapping at the *Big Onion* property (by Canadian Superior Exploration Limited); trenching on *Driftwood (or Rainbow)* group (by P.J. Huber and L.B. Warren).

1977 Geochemical surveys, geological mapping and geophysics done at the *Big Onion* property (by Canadian Superior Exploration Limited); geochemical surveys on the *Driftwood (or Rainbow)* group (by Petra Gem Explorations Limited); trenching on the *Native* group (by J.M. Hutter); geological mapping and underground sampling at the *Cronin mine* (by Hallmark Resources Limited).

1981 Surface diamond drilling at the *Silver King* property (by Silver Hill mines); underground sampling at the *Cronin mine* (by Hallmark Resources Limited).

1983 Underground sampling and surface diamond drilling at the *Cronin mine* (by Goldsil Mining and Milling Incorporated): this work confirmed and improved reserves previously known.

1984 Establishment of the Babine Mountains Recreation Area by Order-In-Council #676, under management of the Ministry of Parks; trenching at the *AG (or Silver Box)* property (by Van Silver Holdings Limited).

1985 Underground exploration (drifting) at the *Silver King* property (by Silver Hill Mines).

1986 D. MacIntyre, P. Desjardins and others, British Columbia Geological Survey Branch, carry out geological mapping and mineral deposit studies in the southern Babine Range.

1987 Geological mapping, geochemical sampling and geophysical surveys done on the *Cronin mine* property (by Southern Gold Resources Limited); geochemical sampling at the *Big Onion* property (by Noranda Exploration Company Limited).

1988 The Mineral Tenure Act becomes effective and makes provisions for exploration within recreation areas: work done outside a claim (access, etc.) is subject to both a Ministry of Parks Resource Use Permit and a Mines Act approval. Any work within a claim must be authorized under a Mines Reclamation Permit containing conditions agreeable to both Ministries. Later in the year Order-In-Council #151 is passed, protecting all mineral claims located within a recreation area from forfeiture for a period of one year after the date a Resource Use Permit is issued under the Park Act; geophysical surveys done on the *Cronin mine* property (by Southern Gold Resources Limited).

1991 Order-In-Council #151 was rescinded by Order-In-Council #185 which gives title holders until 31 October, 1992 to comply with section 25 of the Mineral Tenure Act: this was necessary because of problems in the issuance of Resource Use Permits; surface diamond drilling on the *Big Onion* property (by Mindoro Corporation and Varitech Resources Limited).

Sources of information: British Columbia Ministry of Mines Annual Reports (1898-1968); Geology, Exploration and Mining in British Columbia (1969-1988); Morice (1904); L'Orsa (1990); unpublished Assessment Reports and other company reports.

APPENDIX B

Lithogeochemical Analyses

Rock-chip samples collected from the study area in 1986, 1987 and 1988 (sample numbers 1 to 119) were analyzed by the Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch Analytical Sciences Laboratory. Samples were jaw crushed, split and then ring pulverized in a tungsten-carbide mill. Ag, Cu, Pb, Zn, Mo, As and Sb were determined by atomic absorption spectrophotometry. Au was determined by fire assay/atomic absorption finish, in part by Acme Analytical Laboratories, Vancouver, B.C.

Rock-chip samples collected in 1991 (samples 120 to 243) were processed as above and analyzed by the Analytical Sciences Laboratory for Ag, Cu, Pb, Zn and Cd by atomic absorption spectrophotometry. In addition, Au, Mo, As and Sb were determined by neutron activation by Actlabs, Ancaster, Ontario; samples for which large gold concentrations were encountered were re-analysed by classic fire assay and atomic absorption finish by Chemex Laboratories Limited, North Vancouver, B.C.

All elements are expressed in parts per million, except gold which is in parts per billion. Detection limits are as follows:

Element	Method	Detection Limit (ppm)
Au (1986)	fa/aas	17 (ppb)
Au (1987)	fa/aas	20 (ppb)
Au (1988)	fa/aas	1 (ppb)
Au (1991)	na	5 (ppb)
Au (1991)	fa/aas	1 (ppb)
Ag (1986)	aas	0.6
Ag (1987)	aas	0.5
Ag (1991)	aas	0.5 (samples 120-158)
Ag (1991)	aas	0.4 (samples 159-243)
Cu	aas	2
Pb (1986-88)	aas	5
Pb (1991)	aas	4
Zn	aas	2
Mo (1986-88)	aas	5
Mo (1991)	na	5
Cd	aas	0.5
As (1986)	aas	20
As (1988)	aas	50
As (1991)	na	2
Sb (1986)	aas	5
Sb (1991)	na	0.2

Abbreviations: aas = atomic absorption spectrophotometry, fa/aas = fire assay/ atomic absorption spectrophotometry, na = neutron activation.

NUMBER	MAP	ID	UTME	UTMN	AU	AG	CU	PB	ZN	MO	CD	AS	SB	SAMPLE
1	93L15	DM86-16	643343	6076894	-17	-10.0	11.00	6.00	38.00	3	-	-20.0	-10.0	ALTERED VOLCANIC ROCK (FLOAT)
2	93L15	PD86-70	640806	6078547	-17	-10.0	13.00	11.00	51.00	6	-	-20.0	-10.0	ALTERED SILTSTONE
3	93L15	PD86-106-3	639696	6077050	-17	-10.0	34.00	12.00	70.00	4	-	35.0	-10.0	ALTERED FELSIC TUFF
4	93L15	PD86-310	634580	6077560	105	1.0	25.00	31.00	123.00	-5	-	290.0	-5.0	ALTERED VOLCANIC ROCK
5	93L15	PD86-312	634485	6077253	137	-0.6	20.00	18.00	452.00	-5	-	-25.0	-5.0	ALTERED VOLCANIC ROCK
6	93L15	PD86-313	634287	6076865	-20	-0.6	146.00	7.00	61.00	-5	-	-25.0	-5.0	ALTERED VOLCANIC ROCK
7	93L15	DM87-52	634435	6093371	-20	-0.5	23.00	12.00	50.00	-	-	-	-	LIMONITIC/PYRITIC SCHIST
8	93L15	DM87-71	636271	6091672	40	0.8	9.00	5.00	20.00	-	-	-	-	QUARTZ VEIN
9	93L15	DM87-80	638332	6089968	650	420.0	2200.00	8.00	107.00	-	-	-	-	LIMONITIC SCHIST (MAL)
10	93L15	DM87-92	637657	6086782	-20	-0.5	17.00	8.00	112.00	-	-	-	-	LIMONITIC SCHIST
11	93L15	DM87-93	633948	6085553	-20	0.5	13.00	42.00	113.00	-	-	-	-	QUARTZ VEIN
12	93L15	DM87-94	633934	6085891	-20	-0.5	9.00	12.00	72.00	-	-	-	-	LIMONITIC SCHIST
13	93L15	DM87-99	632735	6086206	-20	-0.5	2.00	8.00	4.00	-	-	-	-	LEACHED SCHIST
14	93L15	DM87-113-2	634426	6092178	-20	-0.5	26.00	51.00	69.00	-	-	-	-	LIMONITIC TUFF
15	93L15	DM87-113-3	634426	6092178	-20	-0.5	37.00	18.00	56.00	-	-	-	-	LIMONITIC TUFF
16	93L15	DM87-118	639763	6083909	-20	-0.5	7.00	25.00	40.00	-	-	-	-	QUARTZ VEIN (FLOAT)
17	93L15	DM87-131-1	643885	6079468	494	-0.5	6.00	-5.00	393.00	-	-	-	-	SILICIC VOLCANIC ROCK
18	93L15	DM87-131-2	643885	6079468	-20	-0.5	3.00	-5.00	12.00	-	-	-	-	SILICIC VOLCANIC ROCK
19	93L15	MC87-1	634550	6085600	-20	-0.5	19.00	-5.00	111.00	-5	-	-	-	LIMONITIC SCHIST
20	93L15	MC87-2	634600	6085650	-20	-0.5	27.00	23.00	108.00	7	-	-	-	LIMONITIC SCHIST
21	93L15	MC87-3	634700	6085850	-20	-0.5	10.00	12.00	70.00	10	-	-	-	LIMONITIC SCHIST
22	93L15	MC87-4	634700	6085850	-20	-0.5	50.00	16.00	71.00	-5	-	-	-	LIMONITIC SCHIST
23	93L15	MC87-5	634720	6086300	-20	-0.5	52.00	11.00	50.00	5	-	-	-	LIMONITIC SCHIST
24	93L15	MC87-6-1	635000	6086300	-20	-0.5	41.00	20.00	65.00	-5	-	-	-	LIMONITIC SCHIST
25	93L15	MC87-6-2	635150	6086570	-20	-0.5	18.00	21.00	64.00	5	-	-	-	LIMONITIC SCHIST
26	93L15	MC87-7-2	635950	6086200	-20	-0.5	41.00	15.00	114.00	-5	-	-	-	LIMONITIC SCHIST
27	93L15	MC87-7-3	635700	6086200	-20	-0.5	30.00	11.00	59.00	-5	-	-	-	LIMONITIC SCHIST
28	93L15	MC87-8-1	637000	6086650	-20	-0.5	17.00	12.00	61.00	7	-	-	-	LIMONITIC SCHIST
29	93L15	MC87-8-2	637000	6086650	20	-0.5	48.00	10.00	55.00	-5	-	-	-	LIMONITIC SCHIST
30	93L15	MC87-8-4	637000	6086650	-20	-0.5	13.00	18.00	58.00	-5	-	-	-	LIMONITIC SCHIST
31	93L15	PD87-264-2	640800	6085219	-20	0.4	20.00	91.00	230.00	-	-	-	-	LIMONITIC SCHIST
32	93L15	PD87-270	637231	6084602	80	-0.4	210.00	7.00	10.00	-	-	-	-	LIMONITIC TUFF
33	93L15	PD87-277	636545	6083910	-20	-0.4	15.00	10.00	66.00	-	-	-	-	ALTERED ANDESITE
34	93L15	PD87-282	634821	6086702	-20	-0.4	27.00	13.00	63.00	-	-	-	-	ALTERED ANDESITE
35	93L15	PD87-284	634668	6086694	50	-0.4	13.00	17.00	24.00	-	-	-	-	PYRITIC SCHIST
36	93L15	PD87-287	634426	6087614	-20	0.5	17.00	22.00	33.00	-	-	-	-	PYRITIC SCHIST
37	93L15	PD87-290	634238	6087860	130	-0.4	8.00	18.00	69.00	-	-	-	-	PYRITIC SCHIST
38	93L15	PD87-330-2	634254	6094783	-20	-0.5	23.00	37.00	99.00	-5	-	-	-	PYRITIC SCHIST
39	93L15	PD87-331-1	634317	6094816	90	-0.5	28.00	56.00	85.00	-	-	-	-	ALTERED ANDESITE
40	93L15	PD87-372-4	636959	6090176	-20	-0.5	32.00	13.00	150.00	-	-	-	-	SILICIC/LIMONITIC SCHIST
41	93L15	PD87-372-6	636959	6090176	-20	-0.5	24.00	15.00	64.00	-	-	-	-	LIMONITIC SCHIST
42	93L15	PD87-376-4	637378	6090779	-20	4.0	3600.00	758.00	557.00	-	-	-	-	LIMONITIC SCHIST (CPY, MAL)
43	93L15	PD87-383-2	637668	6088342	-20	0.6	8.00	13.00	62.00	-	-	-	-	LIMONITIC QUARTZ VEIN
44	93L15	PD87-385	638217	6088304	-20	0.7	6.00	15.00	66.00	-	-	-	-	RHYOLITE
45	93L15	PD87-388-1	639065	6088218	-20	3.0	106.00	123.00	335.00	-	-	-	-	SERICITIC/LIMONITIC SCHIST
46	93L15	PD87-388-2	639065	6088218	90	-0.5	3.00	8.00	32.00	-	-	-	-	QUARTZ VEIN
47	93L15	PD87-402	633715	6088009	-20	2.0	20.00	93.00	38.00	-	-	-	-	PYRITIC SCHIST
48	93L15	PD87-403-2	633344	6088119	-20	0.8	13.00	62.00	47.00	-	-	-	-	PYRITIC ANDESITE
49	93L15	PD87-403-3	633344	6088119	-20	0.5	2.00	12.00	12.00	-	-	-	-	SILICIC ANDESITE
50	93L15	PD87-404	633214	6087767	-20	0.6	15.00	33.00	63.00	-	-	-	-	PYRITIC SCHIST
51	93L15	PD87-405-2	633118	6087805	-20	-0.5	2.00	10.00	3.00	-	-	-	-	SILICIC VOLCANIC ROCK
52	93L15	PD87-409	632768	6087284	-20	-0.5	9.00	10.00	90.00	-	-	-	-	PYRITIC SCHIST
53	93L15	PD87-410	632642	6087111	-20	-0.5	28.00	12.00	112.00	-	-	-	-	ALTERED PYRITIC ANDESITE
54	93L15	PD87-411	632430	6086713	-20	-0.5	15.00	12.00	22.00	-	-	-	-	LIMONITIC SCHIST
55	93L15	PD87-412	632312	6086482	-20	-0.5	11.00	15.00	56.00	-	-	-	-	ALTERED BASALT
56	93L15	PD87-413-1	632212	6086303	-20	-0.5	13.00	12.00	47.00	-	-	-	-	QUARTZ VEIN
57	93L15	PD87-413-2	632212	6086303	-20	-0.5	10.00	12.00	214.00	-	-	-	-	SERICITIC/LIMONITIC SCHIST
58	93L15	PD87-421-4	630400	6088200	-20	-0.5	24.00	22.00	155.00	18	-	-	-	LIMONITIC SCHIST
59	93L15	PD87-421-6	630400	6088200	-20	-0.5	21.00	12.00	36.00	-5	-	-	-	LIMONITIC SCHIST
60	93L15	PD421-7	630400	6088200	-20	-0.5	8.00	11.00	25.00	5	-	-	-	LIMONITIC SCHIST
61	93L15	PD87-421-8	630400	6088200	-20	-0.5	12.00	18.00	52.00	-5	-	-	-	LIMONITIC SCHIST
62	93L15	PD87-425	631000	6088900	-20	-0.5	13.00	13.00	42.00	-5	-	-	-	PYRITIC SCHIST
63	93L15	PD87-426	631700	6089300	-20	-0.5	15.00	11.00	39.00	-5	-	-	-	PYRITIC SCHIST
64	93L15	PD87-428-3	633878	6090672	-20	-0.5	26.00	13.00	84.00	-5	-	-	-	LIMONITIC SCHIST
65	93L15	PD87-429-1	633879	6090609	-20	-0.5	41.00	101.00	141.00	5	-	-	-	LIMONITIC SCHIST
66	93L15	PD87-458-4	631969	6094379	-20	-0.5	19.00	19.00	63.00	-5	-	-	-	PYRITIC SCHIST
67	93L15	PD87-459	631913	6094233	-20	-0.5	35.00	19.00	54.00	-5	-	-	-	QUARTZ VEIN
68	93L15	PD87-460-2	631888	6094163	-20	-0.5	31.00	12.00	81.00	8	-	-	-	ALTERED TUFF
69	93L15	PD87-480	629380	6087149	-20	-0.5	15.00	16.00	80.00	5	-	-	-	ALTERED TUFF
70	93L15	PD87-484-2	630103	6090150	-20	1.0	6.00	130.00	70.00	-5	-	-	-	QUARTZ VEIN
71	93L15	PD87-484-4	630103	6090150	-20	0.5	21.00	47.00	135.00	5	-	-	-	PYRITIC SILTSTONE
72	93L15	PD87-489	635695	6085373	-20	-0.5	19.00	16.00	54.00	9	-	-	-	LIMONITIC SCHIST
73	93L15	PD87-491-2	635832	6084936	-20	-0.5	21.00	10.00	76.00	-5	-	-	-	ALTERED TUFF
74	93L15	PD87-506-4	636379	6087668	-20	-0.5	4.00	13.00	105.00	6	-	-	-	ALTERED ANDESITE
75	93L15	PD87-506-5	636379	6087668	-20	-0.5	3.00	9.00	32.00	15	-	-	-	ALTERED VOLCANIC ROCK (FLOAT)
76	93L15	PD87-510-2	636838	6086520	-20	-0.5	7.00	73.00	19.00	6	-	-	-	LIMONITIC SCHIST
77	93L15	PD87-510-3	636838	6086520	-20	-0.5	33.00	12.00	58.00	-5	-	-	-	LIMONITIC SCHIST
78	93L15	PD87-514	636319	6086198	120	-0.5	7.00	54.00	21.00	5	-	-	-	SILICIC VOLCANIC ROCK
79	93L15	PD87-533-2	640757	6088258	-20	1.0	90.00	29.00	240.00	-5	-	-	-	ALTERED RHYOLITE
80	93L15	PD87-539-3	639910	6086528	1410	2.0	59.00	15.00	79.00	-5	-	-	-	PY-RHYOLITE (RHYOLITE SHOWING)
81	93L15	PD87-539-4	639910	6086528	4320	2.0	37.00	25.00	90.00	-5	-	-	-	PY SCHIST (RHYOLITE SHOWING)
82	93L15	PD87-545-1	636365	6092412	-20	0.5	51.00	12.00	102.00	-5	-	-	-	SERICITIC/PYRITIC SCHIST
83	93L15	PD87-545-4	636258	6092297	-20	-0.5	38.00	16.00	78.00	8	-	-	-	LIMONITIC SCHIST
84	93L15	PD87-545-5	636258	6092297	-20	-0.5	35.00	18.00	110.00	-5	-	-	-	LIMONITIC SCHIST
85	93L15	PD87-560	641142	6085644	-20	-0.5	4.00	17.00	226.00	-5	-	-	-	QUARTZ VEIN
86	93L15	PD87-570	642173	6084281	-20	0.5	23.00	27.00	75.00	-5	-	-	-	LIMONITIC SCHIST
87	93L15	PD87-583-4	640223	6084971	-20	-0.5	5.00	-5.00	16.00	-5	-	-	-	LIMONITIC SCHIST
88	93L14	DMA88-14-2	627159	6089343	1	0.5	8.00	13.00	10.00	-	-	-50.0	-15.0	QUARTZ VEIN
89	93L14	DMA88-17	627233	6087847	1510	59.0	286.00	5100.00	5900.00	-	-	1100.0	320.0	QUARTZ VEIN (AG SHOWING)
90	93L15	DMA88-44	643885	6079468	21	-0.5	30.00	54.00	310.00	-8	-	-	-25.0	ALTERED VOLCANIC ROCK
91	93L15	DMA88-45	643163	6078388	2	-0.5	33.00	5.00	68.00	-8	-	-	-25.0	ALTERED VOLCANIC ROCK

92	93L14	MCU88-3	627111	6090226	1	-0.5	2.00	42.00	23.00	-	-	-50.0	-15.0	QUARTZ VEIN
93	93L14	MCU88-4	627155	6091231	1	-0.5	117.00	9.00	220.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
94	93L14	MCU88-5	627212	6090224	1	-0.5	3.00	7.00	12.00	-	-	-50.0	-15.0	QUARTZ VEIN
95	93M03	MCU88-6	626231	6097211	8	-0.5	47.00	34.00	108.00	-	-	140.0	-15.0	SANDSTONE
96	93M03	MCU88-7	627243	6097442	1	-0.5	37.00	17.00	80.00	-	-	-50.0	-15.0	SANDSTONE
97	93L15	PDE88-2	642217	6077572	3	-0.5	3.00	7.00	31.00	-	-	-50.0	-15.0	QUARTZ VEIN
98	93L15	PDE88-3-1	643156	6078466	1	-0.5	17.00	10.00	86.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
99	93L15	PDE88-3-2	643885	6079468	29	-0.6	12.00	9.00	87.00	-	-	-	-	SILTSTONE
100	93L15	PDE88-12-2	643884	6081941	1	-0.5	59.00	5.00	148.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
101	93L15	PDE88-19	644656	6082808	2	-0.5	2.00	39.00	60.00	-	-	-50.0	-15.0	QUARTZ VEIN
102	93L15	PDE88-86	643704	6088761	1	-0.5	197.00	15.00	148.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
103	93L15	PDE88-90-1	643087	6089985	2	-0.5	34.00	29.00	218.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
104	93L15	PDE88-96	643366	6090511	2	-0.5	143.00	7.00	50.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
105	93L15	PDE88-99	643854	6090217	1	-0.5	7.00	15.00	138.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
106	93L14	PDE88-166	626559	6090623	2	-0.5	59.00	14.00	74.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
107	93L14	PDE88-184	623637	6093727	1	-0.5	22.00	13.00	77.00	-	-	-50.0	-15.0	SANDSTONE
108	93L14	PDE88-190	622353	6093935	1	-0.5	73.00	48.00	78.00	-	-	-50.0	-15.0	SANDSTONE
109	93L14	PDE88-192	622612	6094203	2	-0.5	52.00	9.00	120.00	-	-	-50.0	-15.0	ALTERED VOLCANIC ROCK
110	93L14	PDE88-193	622656	6094235	4	-0.5	150.00	165.00	253.00	-	-	72.0	-15.0	QUARTZ VEIN
111	93L14	PDE88-198	621528	6096058	4	-0.5	26.00	17.00	82.00	-	-	-50.0	-15.0	SILTSTONE
112	93L14	PDE88-199	621497	6096013	112	-0.5	17.00	24.00	68.00	-	-	-50.0	-15.0	QUARTZ VEIN
113	93L14	PDE88-209	620858	6094923	2	-0.5	40.00	17.00	118.00	-	-	-50.0	-15.0	SILTSTONE
114	93L14	PDE88-213	621133	6093758	6	2.0	2300.00	17.00	248.00	-	-	-50.0	337.0	QUARTZ VEIN
115	93L15	PDE88-264-3	643503	6091209	14	0.6	9.00	3.00	24.00	-	-	-	-25.0	TUFF
116	93L14	PTE88-129	620505	6091751	-	1.0	14.00	60.00	33.00	-	-	-50.0	-15.0	QUARTZ VEIN
117	93L15	APE88-2	643885	6079468	37	-0.6	3.00	5.00	27.00	-	-	-	-	SILTSTONE
118	93L15	APE88-3	643885	6079468	33	-0.6	4.00	5.00	29.00	-	-	-	-	SILTSTONE
119	93L15	APE88-4	643885	6079468	37	-0.6	5.00	7.00	147.00	-	-	-	-	SILTSTONE
120	93M02	BGA91-1	631158	6098542	6	-0.5	19.00	7.00	60.00	-5	-0.3	8.0	5.5	ALTERED ANDESITE
121	93M02	BGA91-2	630995	6098571	-5	-0.5	32.00	7.00	63.00	-5	-0.3	5.0	1.6	ALTERED ANDESITE
122	93M02	BGA91-3	631331	6098470	-5	-0.5	28.00	3.00	88.00	-5	-0.3	3.0	0.4	LIMONITIC ANDESITE
123	93M02	BGA91-4	631391	6098419	-5	-0.5	8.00	11.00	131.00	-5	0.4	9.0	14.0	ALTERED ANDESITE
124	93M02	BGA91-5	631381	6098647	-5	-0.5	46.00	9.00	133.00	7	0.4	25.0	0.6	LIMONITIC ANDESITE
125	93M02	BGA91-6	631224	6098838	5	-0.5	9.00	8.00	85.00	5	-0.3	10.0	19.0	QUARTZ-VEINED ANDESITE
126	93M02	BGA91-7	631711	6098203	-5	-0.5	49.00	8.00	81.00	-5	-0.3	8.0	2.6	LIMONITIC ANDESITE
127	93M02	BGA91-8	631711	6098203	-5	-0.5	13.00	13.00	33.00	-5	-0.3	4.0	1.6	ALTERED ANDESITE
128	93M02	BGA91-9	631710	6098203	-5	-0.5	24.00	12.00	50.00	-5	-0.3	8.0	2.3	EPIDOTE-ALTERED ANDESITE
129	93M02	BGA91-10	631818	6098217	-5	-0.5	27.00	8.00	72.00	-5	-0.3	3.0	0.5	ANKERITE-VEINED ANDESITE
130	93M02	BGA91-11	631917	6098244	-5	-0.5	6.00	12.00	132.00	-5	-0.3	9.0	33.0	QTZ-ANK VEINED ANDESITE
131	E3M02	BGA91-12	632048	6098281	-5	-0.5	12.00	11.00	145.00	-5	0.3	2.0	1.9	LIMONITIC ANDESITE
132	93M02	BGA91-13	632033	6098357	-5	-0.5	122.00	14.00	52.00	-5	1.7	5.0	5.1	LIMONITIC ANDESITE
133	93M02	BGA91-14	632077	6098490	-5	-0.5	6.00	8.00	58.00	-5	-0.3	6.0	14.0	CHLORITIC ANDESITE
134	93M02	BGA91-15	631983	6098457	5	-0.5	57.00	10.00	112.00	-5	-0.3	4.0	0.6	LIMONITIC ANDESITE
135	93L15	BGA91-16	636832	6086736	10	-0.5	12.00	18.00	12.00	-5	-0.3	16.0	3.1	LIMONITIC SCHIST
136	93L15	BGA91-17	636878	6086495	-5	-0.5	17.00	15.00	25.00	-5	-0.3	12.0	1.5	SERICITIC/PYRITIC SCHIST
137	93L15	BGA91-18	636429	6086130	-5	-0.5	8.00	7.00	16.00	-5	-0.3	9.0	1.9	LIMONITIC QUARTZ VEIN

138	93L15	BGA91-19	636432	6086131	-5	-0.5	14.00	10.00	168.00	-5	-0.3	25.0	5.0	PYRITIC SCHIST
139	93L15	BGA91-20	636419	6086047	-5	-0.5	2.00	7.00	13.00	-5	0.3	5.0	1.1	LIMONITIC QUARTZ VEIN
140	93L15	BGA91-21	636424	6086045	-5	-0.5	16.00	9.00	49.00	-5	-0.3	6.0	3.5	SERICITE SCHIST
141	93L15	BGA91-22	636476	6085986	-5	-0.5	24.00	15.00	19.00	-5	-0.3	10.0	6.1	PYRITIC SCHIST
142	93L15	BGA91-23	636345	6085887	-5	-0.5	21.00	10.00	30.00	-5	-0.3	31.0	2.3	PYRITIC SCHIST
143	93L15	BGA91-24	636290	6085898	-5	-0.5	35.00	35.00	49.00	5	-0.3	34.0	6.0	PYRITIC SCHIST
144	93L15	BGA91-25	634341	6085951	-5	-0.5	4.00	3.00	8.00	-5	0.4	15.0	1.0	QUARTZ VEIN
145	93L15	BGA91-26	633932	6085950	-5	-0.5	14.00	15.00	93.00	-5	-0.3	15.0	0.9	LIMONITIC SCHIST
146	93L15	BGA91-27	633892	6085838	-5	-0.5	12.00	5.00	34.00	-5	-0.3	15.0	8.1	LIMONITIC SCHIST
147	93L15	BGA91-28	633984	6085800	-5	-0.5	19.00	7.00	22.00	-5	-0.3	5.0	1.8	LIM-ANK QUARTZ VEIN
148	93L15	BGA91-29	634040	6085794	12	-0.5	20.00	7.00	61.00	-5	-0.3	14.0	2.4	LIMONITIC SCHIST
149	93L15	BGA91-30	634145	6085734	-5	-0.5	39.00	21.00	136.00	-5	-0.3	27.0	8.8	LIMONITIC SCHIST
150	93L15	BGA91-31	634269	6085957	-5	-0.5	9.00	9.00	20.00	-5	-0.3	23.0	1.7	LIMONITIC-SILICIC SCHIST
151	93L15	BGA91-32	634214	6085731	-5	-0.5	9.00	7.00	33.00	-5	-0.3	6.0	4.4	LIMONITIC-SILICIC SCHIST
152	93L15	BGA91-33	634290	6085828	-5	0.7	9.00	240.00	76.00	-5	-0.3	38.0	6.4	BLEACHED PHYLLITE
153	93L15	BGA91-34	634378	6085868	-5	-0.5	7.00	-3.00	16.00	-5	-0.3	13.0	0.5	LIMONITIC QUARTZ VEIN
154	93L15	BGA91-35	634412	6085837	-5	-0.5	11.00	25.00	50.00	-5	-0.3	44.0	6.2	LIMONITIC SCHIST
155	93L15	BGA91-36	634488	6085838	-5	-0.5	28.00	25.00	65.00	-5	-0.3	59.0	4.7	LIMONITIC SCHIST
156	93L15	BGA91-37	634569	6085794	-5	-0.5	11.00	16.00	166.00	-5	-0.3	47.0	3.4	LIMONITIC-SILICIC PHYLLITE
157	93M02	BGA91-38	631508	6096903	26	-0.5	12.00	18.00	68.00	-5	-0.3	23.0	3.8	SILICIC ANDESITE
158	93M02	BGA91-39	630785	6100080	-5	-0.5	17.00	6.00	46.00	-5	-0.3	4.0	0.9	CARBONATE-ALTERED ANDESITE
159	93L15	BGA91-40	634835	6087778	8	0.4	16.00	23.00	170.00	-5	-0.3	26.0	2.9	LIMONITIC ANDESITE
160	93L15	BGA91-41	634733	6087833	-5	-0.4	10.00	6.00	11.00	-5	0.3	7.0	1.1	QUARTZ VEIN (SPEC)
161	93L15	BGA91-42	634735	6087832	-5	-0.4	12.00	3.00	193.00	-5	3.4	8.0	1.6	QUARTZ VEIN (SPEC)
162	93L15	BGA91-43	634721	6087834	-5	-0.4	11.00	3.00	10.00	-5	0.3	8.0	1.1	QUARTZ VEIN (SPEC)
163	93L15	BGA91-44	633948	6087892	11	16.0	564.00	15900.00	370.00	-5	13.0	11.0	12.0	SILVER KING LAKE SHOWING/VEIN
164	93L15	BGA91-45	633879	6087943	-5	-0.4	18.00	21.00	41.00	-5	-0.3	37.0	1.7	LIMONITIC SCHIST
165	93L15	BGA91-46	633850	6087885	-5	-0.4	14.00	9.00	40.00	-5	0.3	36.0	2.1	LIMONITIC SCHIST
166	93L15	BGA91-47	633779	6087869	-5	0.4	20.00	12.00	59.00	-5	-0.3	72.0	2.4	LIMONITIC/PYRITIC SCHIST
167	93L15	BGA91-48	633891	6088163	-5	1.3	17.00	11.00	15.00	7	-0.3	53.0	5.0	PYRITIC RHYOLITE
168	93L15	BGA91-49	633891	6088163	-5	-0.4	19.00	12.00	17.00	8	-0.3	35.0	3.1	PYRITIC RHYOLITE
169	93L15	BGA91-50	633787	6087950	-5	0.4	34.00	15.00	13.00	-5	-0.3	120.0	1.5	PYRITIC/LIMONITIC ANDESITE
170	93L15	BGA91-51	633700	6087986	-5	1.2	24.00	17.00	10.00	9	-0.3	230.0	5.1	LIMONITIC SCHIST
171	93L15	BGA91-52	633214	6087881	-5	-0.4	17.00	5.00	107.00	-5	-0.3	170.0	1.3	PYRITIC/LIMONITIC ANDESITE
172	93L15	BGA91-53	633876	6087957	-5	-0.4	21.00	-3.00	83.00	-5	-0.3	10.0	0.7	RIBBONED QUARTZ VEIN
173	93L15	BGA91-54	632725	6087242	-5	-0.4	25.00	14.00	69.00	-5	-0.3	28.0	1.9	SERICITE-CHLORITE SCHIST
174	93L15	BGA91-55	632626	6087143	-5	-0.4	20.00	9.00	140.00	-5	-0.3	34.0	4.8	CHLORITE-SERICITE SCHIST
175	93L15	BGA91-56	632677	6087083	9	-0.4	16.00	8.00	100.00	-5	-0.3	62.0	11.0	PYRITIC ANDESITE
176	93L15	BGA91-57	632629	6086751	-5	-0.4	16.00	9.00	70.00	-5	-0.3	28.0	1.2	PYRITIC SCHIST
177	93L15	BGA91-58	632597	6086698	-5	-0.4	22.00	8.00	86.00	-5	-0.3	23.0	1.3	PYRITIC SER-CHLOR SCHIST
178	93L15	BGA91-59	632472	6086430	-5	-0.4	9.00	11.00	7.00	-5	-0.3	22.0	3.0	PYRITIC SERICITE SCHIST
179	93L15	BGA91-60	632486	6086351	-5	-0.4	19.00	8.00	84.00	-5	-0.3	21.0	1.7	PYRITIC SERICITE SCHIST
180	93L15	BGA91-61	634406	6092181	-5	-0.4	25.00	8.00	41.00	5	-0.3	17.0	0.6	SILICIC ANDESITE
181	93L15	BGA91-62	634399	6092090	5	-0.4	17.00	8.00	62.00	-5	-0.3	4.0	-0.2	SILICIC ANDESITE
182	93L15	BGA91-63	634054	6092575	-5	-0.4	25.00	11.00	51.00	-5	-0.3	3.0	0.3	SILICIC ANDESITE
183	93L15	BGA91-64	633673	6092915	-5	-0.4	68.00	11.00	110.00	-5	-0.3	8.0	0.4	SILICIC ANDESITE

184	93L15	BGA91-65	633518	6092959	-5	-0.4	24.00	8.00	60.00	-5	-0.3	18.0	2.3	SILICIC ANDESITE
185	93L15	BGA91-66	639757	6081859	8	-0.4	18.00	8.00	90.00	-5	-0.3	5.0	1.5	PYRITIC ANDESITE
186	93L15	BGA91-67	639870	6081851	-5	-0.4	47.00	14.00	225.00	-5	4.1	3.0	0.7	RIBBONED QUARTZ VEIN
187	93L15	BGA91-68	639921	6081862	-5	-0.4	17.00	5.00	44.00	-5	-0.3	2.0	0.8	LIMONITIC QUARTZ VEIN
188	93L15	BGA91-69	639981	6081885	-5	-0.4	14.00	5.00	36.00	-5	0.3	-2.0	1.6	LIMONITIC QUARTZ VEIN
189	93L15	BGA91-70	640046	6081934	-5	-0.4	8.00	8.00	54.00	-5	-0.3	4.0	0.9	LIMONITIC QUARTZ VEIN
190	93L15	BGA91-71	640090	6081979	-5	-0.4	5.00	9.00	28.00	-5	0.3	2.0	1.4	LIMONITIC QUARTZ VEIN
191	93L15	BGA91-72	640119	6082007	-5	-0.4	18.00	17.00	35.00	-5	-0.3	10.0	1.7	LIMONITIC QUARTZ VEIN
192	93L15	BGA91-73	640313	6082042	-5	0.4	19.00	18.00	163.00	-5	1.0	3.0	3.9	LIMONITIC SCHIST
193	93L15	BGA91-74	640522	6082037	5	10.0	66.00	4050.00	3800.00	-5	22.0	8.0	220.0	74-77 LITTLE JOE LAKE S VEINS
194	93L15	BGA91-75	640521	6082031	-5	0.4	16.00	18.00	163.00	-5	0.6	-2.0	20.0	QUARTZ VEIN
195	93L15	BGA91-76	640521	6082032	-12	32.0	163.00	25300.00	1350.00	-5	10.0	-2.0	1400.0	QUARTZ VEIN
196	93L15	BGA91-77	640522	6082034	-5	0.6	4.00	16.00	39.00	-5	-0.3	3.0	2.5	QUARTZ VEIN
197	93L15	BGA91-78	640246	6082036	-5	-0.4	20.00	15.00	60.00	-5	-0.3	14.0	1.9	QUARTZ VEIN
198	93L15	BGA91-79	640356	6082007	-5	-0.4	16.00	39.00	66.00	-5	0.5	-2.0	2.3	LIMONITIC QUARTZ VEIN
199	93L15	BGA91-80	640387	6082013	-5	-0.4	3.00	27.00	23.00	-5	0.3	-2.0	1.7	LIMONITIC QUARTZ VEIN
200	93L15	BGA91-81	640414	6082028	-5	-0.4	3.00	11.00	15.00	-5	0.3	3.0	1.5	LIMONITIC QUARTZ VEIN
201	93L15	BGA91-82	640471	6082032	-5	-0.4	11.00	19.00	71.00	-5	-0.3	4.0	4.2	82-90 LITTLE JOE LAKE S VEINS
202	93L15	BGA91-83	640515	6082028	-38	17.0	413.00	18300.00	10700.00	-7	60.0	110.0	4100.0	QUARTZ VEIN
203	93L15	BGA91-84	640516	6082030	-36	28.0	73.00	18000.00	2650.00	-9	22.0	-8.0	5600.0	QUARTZ VEIN
204	93L15	BGA91-85	640575	6082018	-5	-0.4	4.00	15.00	34.00	-5	-0.3	4.0	2.1	QUARTZ VEIN
205	93L15	BGA91-86	640575	6082018	12	0.6	15.00	30.00	83.00	10	0.5	15.0	3.1	QUARTZ VEIN
206	93L15	BGA91-87	640575	6082018	-5	0.4	19.00	63.00	70.00	-5	0.4	4.0	1.7	QUARTZ VEIN
207	93L15	BGA91-88	640573	6082017	-5	0.4	53.00	66.00	22.00	-5	0.3	3.0	3.4	QUARTZ VEIN
208	93L15	BGA91-89	640573	6082017	-5	-0.4	3.00	66.00	57.00	-5	0.3	-2.0	2.3	QUARTZ VEIN
209	93L15	BGA91-90	640516	6082034	-5	95.0	112.00	82500.00	1400.00	-5	11.0	-2.0	580.0	QUARTZ VEIN
210	93L15	BGA91-91	641351	6081206	-2	0.4	2.00	5.00	10.00	2	-0.3	1.0	0.3	LIMONITIC QUARTZ VEIN
211	93L15	BGA91-92	641348	6081205	-2	-0.4	3.00	6.00	29.00	1	-0.3	6.5	1.0	PYRITIC RHYOLITE
212	93L15	BGA91-93	641265	6081092	-2	-0.4	3.00	5.00	26.00	3	-0.3	1.5	0.4	RIBBONED QUARTZ VEIN
213	93L15	BGA91-94	641143	6080872	-2	-0.4	5.00	15.00	33.00	2	-0.3	10.0	2.1	QUARTZ VEIN
214	93L15	BGA91-95	640697	6082011	26	11.0	53.00	6000.00	3550.00	4	31.0	2.9	8.7	95-103 LITTLE JOE LAKE S VEINS
215	93L15	BGA91-96	640697	6082011	15	6.0	110.00	1800.00	34000.00	-1	300.0	2.0	6.7	QUARTZ VEIN
216	93L15	BGA91-97	640694	6082012	-2	0.4	9.00	228.00	98.00	4	1.5	2.1	2.7	QUARTZ VEIN
217	93L15	BGA91-98	640705	6081949	-2	2.0	10.00	687.00	470.00	-1	3.0	1.9	5.8	QUARTZ VEIN
218	93L15	BGA91-99	640706	6081950	2	6.0	36.00	869.00	1200.00	-1	3.7	18.0	0.0	QUARTZ VEIN
219	93L15	BGA91-100	640706	6081950	5	3.5	69.00	168.00	730.00	-1	2.9	6.1	40.0	QUARTZ VEIN
220	93L15	BGA91-101	640705	6081950	-2	-0.4	3.00	20.00	135.00	2	1.0	5.1	2.6	QUARTZ VEIN
221	93L15	BGA91-102	640706	6081951	2	1.4	7.00	38.00	43.00	-1	0.3	5.7	5.0	QUARTZ VEIN
222	93L15	BGA91-103	640718	6081944	52	26.0	337.00	2500.00	26000.00	3	140.0	77.0	110.0	QUARTZ VEIN
223	93L15	BGA91-104	639844	6086250	4	-0.4	24.00	5.00	133.00	3	0.3	7.8	0.4	QUARTZ VEIN
224	93L15	BGA91-105	639843	6086250	23	-0.4	4.00	3.00	47.00	-1	-0.3	310.0	-0.1	CHLOR-ANK QUARTZ VEIN
225	93L15	BGA91-106	639824	6086498	-2	-0.4	5.00	6.00	53.00	-1	-0.3	12.0	0.8	RHYOLITE
226	93L15	BGA91-107	639910	6086507	2	-0.4	15.00	9.00	134.00	0	0.6	22.0	1.3	RHYOLITE
227	93L15	BGA91-108	640061	6086515	5370	12.0	213.00	54.00	68.00	-6	0.3	62000.0	36.0	108-111 RHYOLITE SHOWING VEINS
228	93L15	BGA91-108FA			3950	0.0	0.00	0.00	0.00	0	0.0	0.0	0.0	FIRE ASSAY OF BGA91-108
229	93L15	BGA91-109	640055	6086518	7390	7.0	555.00	33.00	138.00	-6	2.0	100000.0	8.6	SULPHIDE-QUARTZ VEIN

230	93L15	BGA91-109FA			94900	0.0	0.00	0.00	0.00	0	0.0	0.0	0.0	FIRE ASSAY OF BGA91-109
231	93L15	BGA91-110	640056	6086501	10200	38.0	273.00	138.00	28.00	-10	-0.3	99000.0	30.0	SULPHIDE-QUARTZ STOCKWORK
232	93L15	BGA91-110FA			13200	0.0	0.00	0.00	0.00	0	0.0	0.0	0.0	FIRE ASSAY OF BGA91-110
233	93L15	BGA91-111	640055	6086500	9860	36.0	10900.00	50.00	1200.00	-4	24.0	31000.0	98.0	SULPHIDE VEIN (FLOAT)
234	93L15	BGA91-111FA			10500	0.0	0.00	0.00	0.00	0	0.0	0.0	0.0	FIRE ASSAY OF BGA91-111
235	93L15	BGA91-112	634303	6080162	12	-0.4	27.00	5.00	54.00	-1	-0.3	70.0	0.7	SILTSTONE
236	93L15	BGA91-113	633846	6080017	17	0.4	1700.00	3.00	9.00	3	-0.3	14.0	0.3	QUARTZ VEIN
237	93L15	BGA91-114	638013	6084724	2	0.4	7.00	15.00	32.00	-5	-0.3	8.4	1.1	RHYOLITE
238	93L15	BGA91-115	630242	6086717	-2	-0.4	13.00	6.00	52.00	-5	-0.3	7.8	1.5	LIMONITIC SCHIST
239	93L15	BGA91-116	632855	6086163	-2	-0.4	67.00	16.00	30.00	4	-0.3	160.0	5.0	SERICITE SCHIST
240	93L15	BGA91-117	638042	6084726	5	0.4	6.00	30.00	31.00	7	-0.3	49.0	2.7	PYRITIC RHYOLITE
241	93L15	BGA91-118	632857	6086158	-2	-0.4	15.00	38.00	88.00	-5	-0.3	27.0	16.0	SERICITIC SCHIST
242	93L15	BGA91-119	630255	6086730	-2	-0.4	12.00	6.00	133.00	-1	-0.3	11.0	2.7	SERICITIC SCHIST
243	93L15	BGA91-120	641251	6081112	7	-0.4	34.00	20.00	79.00	-1	-0.3	11.0	2.7	PYRITIC SCHIST

APPENDIX C

Stream Sediment Geochemical Analyses

A reconnaissance stream sediment (and water) geochemical survey was conducted in the Babine Mountains Recreation Area from August 23 to 25, 1991 by J. Gravel of Bonaventure Management Services. A total of 39 streams were sampled: methods used to collect and analyze the sediment samples were in accordance with standards set by the RGS program of the Ministry of Energy, Mines and Petroleum Resources. This data compliments previously released RGS data in 1983 (Hazelton Map Sheet NTS 93M: Geological Survey of Canada Open File 1000) and 1986 (Smithers Map Sheet NTS 93L: Geological Survey of Canada Open File 1361).

Geological formations listed for each sample site (FORM) are those which are the dominant bedrock type within each drainage basin. Statistical manipulation of data utilized the Geological Survey Branch Environmental Geology Section's "Geochemical Applications Software Package".

Samples collected in 1991 were analysed by Chemex Labs Limited, North Vancouver (atomic absorption spectrophotometry) and Actlabs Activation Laboratories limited, Ancaster, Ontario (neutron activation). All elements are expressed in parts per million, except gold which is in parts per billion. Analytical methods and detection limits for elements determined are as follows:

METHODS AND SPECIFICATIONS FOR ROUTINE RGS SUITE OF ELEMENTS

Element	Detection Limits	Sample Weight	Digestion Technique	Determination Method	
Cadmium Cobalt Copper Iron Lead Manganese Nickel Silver Zinc	0.2 ppm 2 ppm 2 ppm 0.02 pct 2 ppm 5 ppm 2 ppm 0.2 ppm 2 ppm	1 g	3 ml HNO_3 let sit overnight, add 1 ml HCl in 90°C water bath, for 2 hrs. cool, add 2 ml H_2O, wait 2 hrs.	A A S	atomic absorption spectrophotometry using air- acetylene burner and standard solutions for calibration, background corrections made for Pb, Ni, Co, Ag, Cd
Molybdenum	1 ppm	0.5 g	Al added to above solution		
Barium Vanadium Chromium	10 ppm 5 ppm 5 ppm	1 g	HNO_3 - HCl - HF taken to dryness, hot HCl added to leach residue		
Bismuth Antimony	0.2 ppm 0.2 ppm	2 g	HCl - $KClO_2$ digestion, KI added to reduce Fe, MIBK and TOPO for extraction	A A S - H	organic layer analyzed by atomic absorption spectrophotometry with background. correction
Tin	1 ppm	1 g	sintered with NH_4I, HCl and ascorbic acid leach	A A S	atomic absorption spectrophotometry
Arsenic	1 ppm	0.5 g	add 2 ml KI and dilute HCl to 0.8M HNO_3 - 0.2M HCl	A A S - H	2 ml borohydride solution added to produce AsH_3 gas which is passed through heated quartz tube in the light path of atomic absorption spectrophotometer
Mercury	10 ppb	0.5 g	20 ml HNO_3 - 1 ml HCl	A A S - F	10% stannous sulphate added to evolve mercury vapour, determined by atomic absorption spectrometry
Tungsten	1 ppm	0.5 g	K_2SO_4 fusion, HCl leach	C O L O R	colorimetric: reduced tungsten complexed with toluene 3, 4 dithiol
Fluorine	40 ppm	0.25 g	$NaCO_3$ - KNO_3 fusion, H_2O leach	I O N	citric acid added and diluted with water, fluorine determined with specific ion electrode
Uranium	0.5 ppm	1 g	nil	N A D N C	neutron activation with delayed neutron counting
LOI	0.1 pct	0.5 g	ash sample at 500°C	G R A V	weight difference
pH - water	0.1 pH unit	25 ml	nil	G C E	glass - calomel electrode system
U - water	0.05 ppb	5 ml	add 0.5 ml fluran solution	L I F	place in Scintrex UA-3
F - water	20 ppb	25 ml	nil	I O N	fluorine ion specific electrode

ADDITIONAL ELEMENTS ANALYZED BY INAA

Element	Detection Limit	Element	Detection Limit
Gold	2 ppb	Molybdenum	1 ppm
Antimony	0.1 ppm	Nickel	10 ppm
Arsenic	0.5 ppm	Rubidium	5 ppm
Barium	100 ppm	Samarium	0.5 ppm
Bromine	0.5 ppm	Scandium	0.5 ppm
Cerium	10 ppm	Sodium	0.1 pct
Cesium	0.5 ppm	Tantalum	0.5 ppm
Chromium	5 ppm	Terbium	0.5 ppm
Cobalt	5 ppm	Thorium	0.5 ppm
Hafnium	1 ppm	Tungsten	2 ppm
Iron	0.2 pct	Uranium	0.2 ppm
Lanthanum	5 ppm	Ytterbium	2 ppm
Lutetium	0.2 ppm	Zirconium	200 ppm

MAP	ID	UTME	UTMN	FORM	PH	ZN	CU	PB	NI	CO	AG	MN	MO	CD	V	BI	AU	SB	AS
93L15	861185	641126	6075322	mJS	6.9	110	50	14	20	13	0.2	800	1	0.1	-40	-1.0	6	3.9	71.0
93L15	861186	642732	6077961	muJA	6.8	117	34	10	48	14	0.1	840	1	0.1	32	-1.0	1	2.1	18.0
93L15	861187	644141	6080852	muJA	6.9	110	29	13	40	13	0.1	600	1	0.1	34	-1.0	14	2.4	14.0
93L15	861188	644141	6080852	muJA	6.8	122	32	14	40	13	0.1	660	1	0.1	32	-1.0	11	1.5	12.0
93L15	861189	645246	6081453	lK	6.6	113	25	18	19	10	0.1	710	1	0.1	34	-1.0	1	2.8	20.0
93L15	861194	648285	6085038	lJ	6.6	89	7	7	16	6	0.1	550	1	0.1	32	-1.0	3	0.9	12.0
93L15	861195	637147	6072713	dr	6.9	121	48	15	18	9	0.1	680	5	0.1	40	-1.0	11	2.9	50.0
93L15	861244	632510	6074962	lJ	7.1	84	23	6	21	9	0.1	590	1	0.1	38	-1.0	1	1.6	31.0
93L15	861245	629750	6075930	lJ	7.4	91	23	6	20	13	0.3	510	1	0.1	47	-1.0	1	1.2	12.0
93L15	861246	631562	6079201	lJ	7.5	137	34	11	19	13	0.1	780	1	0.2	64	-1.0	2	2.6	13.0
93L15	861255	648334	6088615	lJ	7.3	257	23	92	19	11	0.3	640	1	2.4	35	-1.0	20	4.8	51.0
93L15	861256	648334	6088615	lJ	7.2	285	27	102	20	12	0.8	640	1	2.5	34	-1.0	7	4.3	54.0
93L15	861257	647306	6093500	lJ	7.0	108	19	18	20	15	0.1	2000	1	0.1	42	-1.0	2	1.5	9.0
93L15	861258	647019	6094951	lJ	7.2	88	18	9	21	13	0.1	350	1	0.1	42	-1.0	1	1.8	8.0
93L15	861259	647329	6090881	lJ	7.0	78	17	9	13	10	0.1	940	1	0.1	45	-1.0	1	1.4	9.0
93L15	861260	641733	6093793	lJ	7.1	95	21	14	26	10	0.2	510	1	0.1	39	-1.0	2	2.3	8.0
93L15	861262	642035	6093444	lJ	7.0	115	27	11	16	11	0.2	520	1	0.1	42	-1.0	2	4.1	16.0
93L15	861263	643861	6087366	lJ	6.5	204	30	36	18	13	0.3	1100	1	0.6	30	-1.0	30	2.2	10.0
93L15	861264	643515	6087847	lJ	6.8	806	49	532	26	14	3.0	720	1	9.3	26	-1.0	75	27.5	60.0
93L15	861265	640332	6087188	muJA	6.9	235	53	212	34	17	3.7	680	1	1.4	28	-1.0	610	18.5	40.0
93L15	861266	631757	6074007	lJ	7.4	95	270	9	25	29	0.1	6200	4	0.1	33	-1.0	2	0.9	18.0
93L15	861374	634509	6084392	lK	6.9	825	42	66	92	31	0.7	6200	1	6.7	34	-1.0	12	3.8	30.0
93L15	861375	634540	6083999	muJA	7.0	92	33	15	23	13	0.2	580	1	0.1	34	-1.0	1	1.8	10.0
93L15	861376	632497	6084718	uKK	6.8	138	36	19	27	16	0.4	760	2	0.7	22	-1.0	1	1.3	30.0
93L15	861377	630090	6083781	uKK	6.9	266	37	24	38	18	0.3	2200	1	1.9	29	-1.0	1	2.2	14.0
93L15	861400	635284	6076780	mJS	7.3	180	38	15	22	11	0.5	1200	1	0.8	39	-1.0	5	2.8	57.0
93L15	861424	640649	6094427	uKK	6.9	85	17	13	24	10	0.1	260	1	0.6	37	-1.0	1	0.9	4.0
93L15	861425	640272	6095874	uKK	7.7	82	20	14	23	12	0.1	530	1	0.9	43	-1.0	2	1.2	4.0
93L15	861602	634660	6076937	mJS	7.4	119	24	9	23	11	0.1	480	1	0.1	39	-1.0	1	1.8	33.0
93L15	861782	628800	6087600	uKK	6.9	100	29	11	30	13	0.1	700	2	0.1	25	-1.0	1	0.5	13.0
93L15	861783	631787	6092167	uKK	-1.0	80	23	15	22	11	0.1	630	1	0.1	34	-1.0	1	1.8	11.0
93L15	861784	631897	6091701	lK	6.8	94	26	14	32	14	0.1	890	1	0.1	35	-1.0	1	1.3	12.0
93L15	861786	628299	6089650	lK	7.3	98	34	11	48	14	0.1	720	1	0.1	33	-1.0	1	1.1	17.0
93L14	861780	627432	6094650	lK	8.0	110	29	9	41	12	0.1	570	1	0.1	35	-1.0	1	2.7	9.0
93L14	861946	621217	6093650	lK	8.3	93	40	11	31	14	0.1	700	1	0.1	43	-1.0	1	1.6	9.0
93L14	861947	621715	6093595	lK	7.9	119	49	12	52	17	0.1	800	1	0.1	40	-1.0	5	1.6	10.0
93L14	861948	621175	6089069	lK	8.2	105	42	12	43	14	0.1	740	1	0.1	42	-1.0	1	1.3	10.0
93L14	861949	623429	6088320	uKK	7.6	94	27	15	34	11	0.1	640	1	0.1	38	-1.0	1	3.0	29.0
93L14	861951	622489	6087707	lK	-1.0	95	36	14	22	13	0.1	800	1	0.1	42	-1.0	1	2.7	17.0
93L14	861954	626073	6086660	uKK	7.6	100	29	20	33	11	0.1	740	1	0.1	30	-1.0	1	2.5	29.0
93L14	861955	626073	6086660	uKK	7.4	104	30	21	34	12	0.1	840	1	0.1	33	-1.0	1	3.0	33.0
93M02	833170	637199	6102202	mJS	6.9	109	17	4	32	15	0.2	679	1	-1.0	-1	-1.0	2	3.0	25.0
93M02	833173	632803	6103051	uKK	7.4	90	26	5	34	16	0.1	855	1	-1.0	-1	-1.0	3	4.1	20.0
93M02	833174	631079	6102828	uKK	7.5	83	28	6	22	15	0.1	763	1	-1.0	-1	-1.0	3	6.4	23.0
93M02	833175	631201	6102501	uKK	7.6	116	50	6	60	20	0.1	833	1	-1.0	-1	-1.0	5	5.5	40.0
93M02	833176	628900	6102600	uKK	7.8	66	24	6	15	16	0.1	838	1	-1.0	-1	-1.0	3	7.4	18.0
93M02	833177	628200	6101000	lJ	7.7	106	44	5	39	20	0.1	878	1	-1.0	-1	-1.0	2	4.7	23.0
93M03	833178	626900	6098200	lJ	7.5	86	36	6	28	17	0.1	866	1	-1.0	-1	-1.0	5	2.2	13.0
93M02	833179	635906	6098342	uKK	7.5	68	27	5	27	15	0.1	827	1	-1.0	-1	-1.0	2	6.3	16.0
93M02	833180	641102	6097244	uKK	7.6	80	19	8	26	13	0.1	720	1	-1.0	-1	-1.0	2	4.3	14.0
93L15	911002	0	0	lJ	7.6	144	40	20	21	16	0.2	1450	1	0.2	31	0.2	27	4.0	89.0
93L15	911003	0	0	muJA	7.5	372	43	105	42	15	1.7	1150	1	2.4	34	0.1	12	7.0	36.0
93L15	911004	0	0	lJ	7.6	165	18	12	5	9	0.1	1700	1	0.1	19	0.1	2	5.0	8.0
93L15	911005	0	0	lJ	8.0	140	37	19	16	9	1.5	1000	4	0.5	49	0.4	8	7.0	70.0
93L15	911007	0	0	lJ	7.5	160	27	17	13	9	0.2	910	1	0.6	54	0.3	2	6.0	54.0
93L15	911008	0	0	lJ	8.1	160	29	15	13	9	0.1	920	1	0.6	52	0.3	2	5.0	54.0
93L15	911009	0	0	lJ	7.7	106	23	10	21	11	0.1	920	1	0.1	51	0.1	2	4.0	27.0
93L15	911010	0	0	lJ	7.4	124	22	18	16	11	0.1	1150	1	0.2	50	0.1	3	5.0	44.0
93L15	911011	0	0	lJ	7.4	128	23	13	16	11	0.1	1100	1	0.3	47	0.2	2	5.0	32.0
93L15	911012	0	0	dr	8.0	125	53	16	17	14	0.1	1200	6	0.2	55	0.3	2	7.0	50.0
93L15	911013	0	0	mJS	8.0	140	60	13	12	11	0.1	1200	3	0.2	40	0.5	4	9.0	240.0
93L15	911014	0	0	mJS	8.1	148	40	17	22	13	0.1	1600	1	0.1	38	0.1	10	8.0	140.0
93L15	911015	0	0	lK	-1.0	212	49	25	37	32	0.1	1200	1	0.4	19	0.4	5	6.0	43.0
93L15	911016	0	0	lK	8.3	94	17	15	19	13	0.1	880	1	0.1	22	0.1	4	5.0	43.0
93L15	911017	0	0	lJ	8.4	140	43	30	17	14	0.1	870	1	0.4	63	0.1	2	8.0	56.0
93L15	911018	0	0	lJ	8.5	140	48	10	17	17	0.1	885	1	0.1	55	0.1	2	5.0	20.0
93L15	911019	0	0	muJA	7.6	110	33	5	26	13	0.1	1200	1	0.1	32	0.1	2	4.0	39.0
93L15	911020	0	0	muJA	7.7	125	27	6	43	15	0.1	1400	1	0.1	30	0.1	2	3.0	32.0
93L15	911022	0	0	muJA	7.5	202	55	11	95	35	0.1	1550	1	0.1	28	0.1	2	10.0	16.0
93L15	911023	0	0	uKK	7.4	175	43	16	55	22	0.1	1600	1	0.3	23	0.2	2	4.0	18.0
93L15	911024	0	0	uKK	7.6	290	55	190	32	15	12.0	970	1	1.7	28	0.1	3	3.0	18.0
93L15	911025	0	0	muJA	7.6	174	58	13	85	23	0.1	1800	1	0.5	33	0.1	184	16.0	35.0
93L15	911026	0	0	muJA	7.5	97	25	13	23	14	0.1	880	1	0.1	50	0.1	2	4.0	22.0
93L15	911027	0	0	uKK	7.6	102	30	31	28	14	0.1	760	1	0.1	52	0.1	2	3.0	15.0
93L15	911028	0	0	uKK	7.5	112	33	27	30	14	0.1	845	1	0.1	53	0.1	4	3.0	15.0
93L15	911029	0	0	uKK	7.6	118	30	16	26	14	0.1	1150	1	0.1	38	0.1	2	5.0	17.0
93L15	911030	0	0	uKK	7.5	128	31	23	30	15	0.1	1300	1	0.1	43	0.1	2	5.0	18.0
93L15	911031	0	0	uKK	7.9	120	40	38	25	17	0.1	900	1	0.4	45	0.8	2	5.0	15.0
93L15	911032	0	0	uKK	8.0	56	25	11	19	13	0.1	560	1	0.1	28	0.1	3	4.0	10.0
93M02	911033	0	0	uKK	7.4	87	22	6	23	12	0.1	1500	1	0.1	57	0.1	2	3.0	17.0
93M02	911034	0	0	uKK	7.5	80	22	7	22	12	0.1	710	1	0.1	67	0.1	2	4.0	13.0
93L15	911035	0	0	uKK	7.8	85	21	10	19	14	0.1	1200	1	0.1	38	0.1	6	4.0	16.0
93L15	911037	0	0	lJ	6.1	100	28	9	22	13	0.1	870	1	0.1	39	0.1	2	4.0	23.0
93M03	911038	0	0	lJ	8.0	75	22	8	22	13	0.1	740	1	0.1	40	0.1	2	4.0	18.0
93M03	911039	0	0	uKK	8.0	87	33	5	32	19	0.1	870	1	0.1	45	0.1	2	3.0	44.0
93L15	911040	0	0	uKK	7.8	106	28	10	33	16	0.1	1000	1	0.1	36	0.1	2	2.0	17.0
93L15	911042	0	0	lK	8.1	104	40	8	25	16	0.1	610	1	0.1	20	0.2	11	9.0	120.0
93L14	911043	0	0	lK	7.8	115	40	9	42	14	0.1	1200	1	0.1	37	0.1	2	4.0	40.0
93L15	911044	0	0	uKK	7.6	145	50	30	20	14	0.1	1700	1	0.3	32	0.2	2	3.0	24.0
93L14	911045	0	0	lK	8.0	95	27	11	41	12	0.1	630	1	0.1	45	0.1	2	2.0	10.0

Stream Sediment Geochemical Analyses:

Statistical Summary of Data by Geological Formation:

Element Statistics

Variable - pH (pH)

Number of Values - 82

Units -

Detection Limit - 0.1

Analytical Method - GCE

	All	lJ	uKK	lK	muJA
N	82	26	26	12	10
N > DL	82	26	26	12	10
Missing	3	0	1	2	0
Mean	7.46	7.36	7.52	7.68	7.30
Median	7.50	7.40	7.60	7.90	7.50
Mode	7.60	7.40	7.60	8.00	7.50
Range	2.4	2.4	1.2	1.7	0.9
St Dev	0.48	0.54	0.32	0.62	0.35
Coef Var	0.064	0.074	0.043	0.080	0.048
Log Mean	0.872	0.866	0.876	0.884	0.863
Geo Mean	7.44	7.34	7.51	7.66	7.29
Log StDv	0.028	0.032	0.019	0.036	0.021
Log CVar	0.032	0.037	0.022	0.041	0.025
Percntls					
Minimum	6.1	6.1	6.8	6.6	6.8
10th	6.8	6.6	6.9	6.6	6.8
20th	6.9	7.0	7.4	6.8	6.9
30th	7.3	7.1	7.5	7.3	6.9
40th	7.4	7.2	7.5	7.8	7.0
50th	7.5	7.4	7.6	7.9	7.5
60th	7.6	7.5	7.6	8.0	7.5
70th	7.6	7.5	7.6	8.0	7.5
80th	7.9	7.7	7.8	8.2	7.6
85th	8.0	7.7	7.8	8.2	7.6
90th	8.0	8.0	7.8	8.3	7.6
95th	8.2	8.4	8.0	8.3	7.7
98th	8.3	8.4	8.0	8.3	7.7
99th	8.4	8.5	8.0	8.3	7.7
Maximum	8.5	8.5	8.0	8.3	7.7

(Summary statistics not calculated for formations with fewer than ten values.)

Element Statistics

Variable - Zinc (Zn)

Number of Values - 85

Units - ppm

Detection Limit - 2

Analytical Method - AAS

	All	uKK	lJ	lK	muJA
N	85	27	26	14	10
N > DL	85	27	26	14	10
Missing	0	0	0	0	0
Mean	139.2	111.5	148.5	162.3	163.4
Median	110.0	94.0	108.0	104.0	117.0
Mode	95.0	80.0	140.0	94.0	110.0
Range	769	234	731	732	280
St Dev	117.73	54.49	140.34	193.14	87.61
Coef Var	0.846	0.489	0.945	1.190	0.536
Log Mean	2.081	2.013	2.098	2.098	2.169
Geo Mean	120.4	102.9	125.5	125.3	147.4
Log StDv	0.196	0.164	0.210	0.253	0.197
Log CVar	0.094	0.082	0.100	0.120	0.091
Percntls					
Minimum	56	56	75	93	92
10th	82	68	84	93	92
20th	88	80	88	94	97
30th	95	83	95	95	110
40th	100	87	100	98	110
50th	110	94	108	104	117
60th	116	100	128	105	125
70th	125	112	140	113	174
80th	144	120	144	115	202
85th	165	138	160	119	235
90th	204	145	165	212	[illegible]
95th	266	266	[illegible]	212	372
98th	372	266	257	825	372
99th	806	290	806	825	372
Maximum	825	290	806	825	372

Element Statistics

Variable - Copper (Cu)

Number of Values - 85

Units - ppm

Detection Limit - 2

Analytical Method - AAS

	All	uKK	lJ	lK	muJA
N	85	27	26	14	10
N > DL	85	27	26	14	10
Missing	0	0	0	0	0
Mean	35.4	30.5	37.4	35.4	39.0
Median	30.0	28.0	23.0	36.0	33.0
Mode	23.0	22.0	23.0	40.0	33.0
Range	263	38	263	32	33
St Dev	28.19	9.89	48.59	9.48	12.32
Coef Var	0.796	0.324	1.300	0.268	0.316
Log Mean	1.497	1.465	1.454	1.533	1.572
Geo Mean	31.4	29.1	28.4	34.1	37.3
Log StDv	0.192	0.132	0.268	0.130	0.134
Log CVar	0.128	0.090	0.184	0.085	0.085
Percntls					
Minimum	7	17	7	17	25
10th	19	20	18	17	25
20th	23	22	19	26	27
30th	25	24	22	27	29
40th	27	27	23	34	33
50th	30	28	23	36	33
60th	34	29	28	40	34
70th	40	33	34	40	43
80th	43	37	40	42	53
85th	48	40	43	42	55
90th	50	43	44	49	55
95th	55	[illegible]	49	49	[illegible]
98th	58	50	49	49	58
99th	60	55	270	49	58
Maximum	270	55	270	49	58

Element Statistics

Variable - Lead (Pb)

Number of Values - 85

Units - ppm

Detection Limit - 2

Analytical Method - AAS

	All	uKK	lJ	lK	muJA
N	85	27	26	14	10
N > DL	85	27	26	14	10
Missing	0	0	0	0	0
Mean	26.4	20.9	36.0	16.8	40.3
Median	13.0	13.0	11.0	12.0	13.0
Mode	6.0	6.0	9.0	11.0	13.0
Range	528	185	527	58	207
St Dev	64.23	34.97	102.59	14.82	67.28
Coef Var	2.435	1.674	2.847	0.883	1.670
Log Mean	1.145	1.121	1.156	1.145	1.238
Geo Mean	14.0	13.2	14.3	14.0	17.3
Log StDv	0.367	0.352	0.424	0.233	0.521
Log CVar	0.320	0.314	0.366	0.203	0.421
Percntls					
Minimum	4	5	5	8	5
10th	6	5	6	8	5
20th	8	6	7	9	6
30th	9	7	9	11	10
40th	11	10	9	11	11
50th	13	13	11	12	13
60th	14	15	13	12	13
70th	16	16	17	14	13
80th	19	24	19	15	15
85th	24	27	20	18	105
90th	31	30	30	25	105
95th	92	[illegible]	92	25	[illegible]
98th	190	38	92	66	212
99th	212	190	532	66	212
Maximum	532	190	532	66	212

Element Statistics
Variable - Nickel (Ni)
Number of Values - 85
Units - ppm
Detection Limit - 2
Analytical Method - AAS

	All	uKK	lJ	lK	muJA
N	85	27	26	14	10
N > DL	85	27	26	14	10
Missing	0	0	0	0	0
Mean	29.0	28.9	19.7	38.9	45.9
Median	24.0	27.0	19.0	37.0	40.0
Mode	22.0	22.0	16.0	19.0	23.0
Range	90	45	34	73	72
St Dev	15.76	9.97	6.19	18.59	24.92
Coef Var	0.544	0.345	0.314	0.478	0.543
Log Mean	1.414	1.439	1.272	1.550	1.612
Geo Mean	25.9	27.5	18.7	35.5	40.9
Log StDv	0.199	0.132	0.157	0.187	0.214
Log CVar	0.141	0.092	0.124	0.121	0.133
Percntls					
Minimum	5	15	5	19	23
10th	16	19	13	19	23
20th	19	22	16	22	23
30th	21	23	16	25	26
40th	22	25	17	32	34
50th	24	27	19	37	40
60th	26	28	21	41	42
70th	32	32	21	42	43
80th	37	33	22	43	48
85th	41	34	25	48	85
90th	43	34	26	52	85
95th	55	55	28	52	95
98th	85	55	28	92	95
99th	92	60	39	92	95
Maximum	95	60	39	92	95

(Summary statistics not calculated for formations with fewer than ten values.)

Element Statistics
Variable - Cobalt (Co)
Number of Values - 85
Units - ppm
Detection Limit - 2
Analytical Method - AAS

	All	uKK	lJ	lK	muJA
N	85	27	26	14	10
N > DL	85	27	26	14	10
Missing	0	0	0	0	0
Mean	14.4	14.6	13.0	16.1	17.2
Median	14.0	14.0	13.0	14.0	14.0
Mode	13.0	14.0	13.0	14.0	13.0
Range	29	12	23	22	22
St Dev	4.86	2.90	4.49	6.72	6.94
Coef Var	0.337	0.199	0.346	0.417	0.404
Log Mean	1.140	1.155	1.092	1.182	1.212
Geo Mean	13.8	14.3	12.3	15.2	16.3
Log StDv	0.124	0.084	0.134	0.145	0.139
Log CVar	0.109	0.073	0.123	0.123	0.114
Percntls					
Minimum	6	10	6	10	13
10th	10	11	9	10	13
20th	11	12	9	12	13
30th	12	13	11	13	13
40th	13	14	11	14	14
50th	14	14	13	14	14
60th	14	15	13	14	15
70th	15	16	13	14	15
80th	16	16	15	16	17
85th	17	17	16	17	23
90th	19	18	17	[illegible]	23
95th	23	20	20	31	35
98th	31	20	20	32	35
99th	32	22	29	32	35
Maximum	35	22	29	32	35

Element Statistics
Variable - Silver (Ag)
Number of Values - 85
Units - ppm
Detection Limit - 0.2
Analytical Method - AAS

	All	uKK	lJ	lK	muJA
N	85	27	26	14	10
N > DL	12	3	5	1	2
Missing	0	0	0	0	0
Mean	0.38	0.56	0.30	0.14	0.63
Median	0.10	0.10	0.10	0.10	0.10
Mode	0.10	0.10	0.10	0.10	0.10
Range	11.9	11.9	2.9	0.6	3.6
St Dev	1.39	2.29	0.61	0.16	1.19
Coef Var	3.604	4.090	2.023	1.122	1.887
Log Mean	-0.839	-0.883	-0.797	-0.940	-0.690
Geo Mean	0.14	0.13	0.16	0.11	0.20
Log StDv	0.390	0.418	0.376	0.226	0.587
Log CVar	-0.465	-0.473	-0.472	-0.241	-0.851
Percntls					
Minimum	0.1	0.1	0.1	0.1	0.1
10th	0.1	0.1	0.1	0.1	0.1
20th	0.1	0.1	0.1	0.1	0.1
30th	0.1	0.1	0.1	0.1	0.1
40th	0.1	0.1	0.1	0.1	0.1
50th	0.1	0.1	0.1	0.1	0.1
60th	0.1	0.1	0.1	0.1	0.1
70th	0.1	0.1	0.2	0.1	0.1
80th	0.2	0.1	0.2	0.1	0.2
85th	0.2	0.1	0.3	0.1	1.7
90th	0.3	0.1	0.3	0.1	1.7
95th	1.5	0.4	1.5	0.1	3.7
98th	3.0	0.4	1.5	0.7	3.7
99th	3.7	12.0	3.0	0.7	3.7
Maximum	12.0	12.0	3.0	0.7	3.7

Element Statistics
Variable - Manganese (Mn)
Number of Values - 85
Units - ppm
Detection Limit - 5
Analytical Method - AAS

	All	uKK	lJ	lK	muJA
N	85	27	26	14	10
N > DL	85	27	26	14	10
Missing	0	0	0	0	0
Mean	1046.8	928.2	1105.7	1189.3	1068.0
Median	845.0	833.0	870.0	740.0	880.0
Mode	1200.0	760.0	510.0	800.0	580.0
Range	5940	1940	5850	5630	1220
St Dev	884.08	408.57	1102.91	1454.94	421.32
Coef Var	0.845	0.440	0.997	1.223	0.394
Log Mean	2.954	2.932	2.955	2.958	2.997
Geo Mean	899.2	854.3	902.6	908.2	994.1
Log StDv	0.209	0.180	0.240	0.259	0.175
Log CVar	0.071	0.062	0.081	0.087	0.058
Percntls					
Minimum	260	260	350	570	580
10th	560	560	510	570	580
20th	640	640	550	630	600
30th	720	720	720	700	680
40th	763	760	780	720	840
50th	845	833	870	740	880
60th	880	845	910	800	1150
70th	1000	900	940	880	1200
80th	1200	1150	1100	890	1400
85th	1200	1200	1150	1200	1550
90th	1600	1500	1450	1200	1550
95th	1800	1700	2000	1200	1800
98th	2200	1700	2000	6200	1800
99th	6200	2200	6200	6200	1800
Maximum	6200	2200	6200	6200	1800

Element Statistics
Variable - Molybdenum (Mo)
Number of Values - 85
Units - ppm
Detection Limit - 1
Analytical Method - AAS

	All	uKK	lJ	lK	mJA
N	85	27	26	14	10
N > DL	7	2	2	0	0
Missing	0	0	0	0	0
Mean	1.2	1.1	1.2	1.0	1.0
Median	1.0	1.0	1.0	1.0	1.0
Mode	1.0	1.0	1.0	1.0	1.0
Range	5	1	3	0	0
St Dev	0.85	0.27	0.82	0.00	0.00
Coef Var	0.695	0.248	0.662	0.000	0.000
Log Mean	0.044	0.022	0.046	0.000	0.000
Geo Mean	1.1	1.1	1.1	1.0	1.0
Log StDv	0.157	0.080	0.164	0.000	0.000
Log CVar	3.560	3.652	3.557	0.000	0.000
Percntls					
Minimum	1	1	1	1	1
10th	1	1	1	1	1
20th	1	1	1	1	1
30th	1	1	1	1	1
40th	1	1	1	1	1
50th	1	1	1	1	1
60th	1	1	1	1	1
70th	1	1	1	1	1
80th	1	1	1	1	1
85th	1	1	1	1	1
90th	1	1	1	1	1
95th	3	2	4	1	1
98th	4	2	4	1	1
99th	5	2	4	1	1
Maximum	6	2	4	1	1

(Summary statistics not calculated for formations with fewer than ten values.)

Element Statistics
Variable - Cadmium (Cd)
Number of Values - 76
Units - ppm
Detection Limit - 0.2
Analytical Method - AAS

	All	lJ	uKK	lK	mJA
N	76	24	21	14	10
N > DL	21	7	8	2	3
Missing	9	2	6	0	0
Mean	0.51	0.67	0.39	0.59	0.50
Median	0.10	0.10	0.10	0.10	0.10
Mode	0.10	0.10	0.10	0.10	0.10
Range	9.2	9.2	1.8	6.6	2.3
St Dev	1.35	1.90	0.52	1.76	0.78
Coef Var	2.619	2.831	1.360	2.968	1.569
Log Mean	-0.719	-0.684	-0.684	-0.827	-0.677
Geo Mean	0.19	0.21	0.21	0.15	0.21
Log StDv	0.475	0.508	0.453	0.502	0.544
Log CVar	-0.662	-0.744	-0.663	-0.608	-0.804
Percntls					
Minimum	0.1	0.1	0.1	0.1	0.1
10th	0.1	0.1	0.1	0.1	0.1
20th	0.1	0.1	0.1	0.1	0.1
30th	0.1	0.1	0.1	0.1	0.1
40th	0.1	0.1	0.1	0.1	0.1
50th	0.1	0.1	0.1	0.1	0.1
60th	0.1	0.1	0.1	0.1	0.1
70th	0.2	0.2	0.3	0.1	0.1
80th	0.4	0.4	0.6	0.1	0.5
85th	0.6	0.5	0.7	0.1	1.4
90th	0.8	2.6	0.9	0.4	[illegible]
95th	1.9	2.4	1.7	0.4	2.4
98th	2.4	9.3	1.9	6.7	2.4
99th	6.7	9.3	1.9	6.7	2.4
Maximum	9.3	9.3	1.9	6.7	2.4

Element Statistics
Variable - Vanadium (V)
Number of Values - 76
Units - ppm
Detection Limit - 5
Analytical Method - AAS

	All	lJ	uKK	lK	mJA
N	76	24	21	14	10
N > DL	76	24	21	14	10
Missing	9	2	6	0	0
Mean	38.4	42.2	38.1	34.4	33.5
Median	38.0	42.0	37.0	35.0	32.0
Mode	34.0	42.0	38.0	34.0	34.0
Range	48	45	45	26	22
St Dev	10.33	11.05	11.83	8.51	6.24
Coef Var	0.269	0.262	0.310	0.248	0.186
Log Mean	1.569	1.610	1.562	1.521	1.519
Geo Mean	37.1	40.7	36.5	33.2	33.1
Log StDv	0.119	0.123	0.131	0.124	0.071
Log CVar	0.076	0.076	0.084	0.082	0.047
Percntls					
Minimum	19	19	22	19	28
10th	26	26	23	19	28
20th	30	32	28	22	28
30th	33	35	29	33	30
40th	34	39	32	34	32
50th	38	42	37	35	32
60th	40	42	38	35	33
70th	42	47	43	40	34
80th	45	50	45	42	34
85th	50	51	52	42	34
90th	52	55	53	43	34
95th	55	63	57	43	50
98th	63	64	67	45	50
99th	64	64	67	45	50
Maximum	67	64	67	45	50

Element Statistics
Variable - Bismuth (Bi)
Number of Values - 38
Units - ppm
Detection Limit - 0.2
Analytical Method - AAS

	All	uKK	lJ
N	38	13	11
N > DL	6	1	2
Missing	47	14	15
Mean	0.17	0.17	0.16
Median	0.10	0.10	0.10
Mode	0.10	0.10	0.10
Range	0.7	0.7	0.3
St Dev	0.15	0.19	0.10
Coef Var	0.863	1.141	0.628
Log Mean	-0.861	-0.884	-0.847
Geo Mean	0.14	0.13	0.14
Log StDv	0.244	0.262	0.227
Log CVar	-0.284	-0.296	-0.268
Percntls			
Minimum	0.1	0.1	0.1
10th	0.1	0.1	0.1
20th	0.1	0.1	0.1
30th	0.1	0.1	0.1
40th	0.1	0.1	0.1
50th	0.1	0.1	0.1
60th	0.1	0.1	0.1
70th	0.1	0.1	0.2
80th	0.2	0.1	0.2
85th	0.2	0.2	0.2
90th	0.3	0.2	0.3
95th	0.4	0.2	0.3
98th	0.5	0.8	0.4
99th	0.8	0.8	0.4
Maximum	0.8	0.8	0.4

Element Statistics
Variable - Gold (Au)
Number of Values - 85
Units - ppb
Detection Limit - 1
Analytical Method - FA-NA

	All	uKK	1J	1K	muJA
N	85	27	26	14	10
N > DL	64	20	22	7	8
Missing	0	0	0	0	0
Mean	13.9	2.3	7.8	3.4	83.0
Median	2.0	2.0	2.0	1.0	2.0
Mode	2.0	2.0	2.0	1.0	2.0
Range	609	5	74	11	609
St Dev	68.88	1.23	15.79	3.74	193.63
Coef Var	4.949	0.543	2.023	1.090	2.333
Log Mean	0.457	0.299	0.494	0.337	0.848
Geo Mean	2.9	2.0	3.1	2.2	7.0
Log StDv	0.507	0.221	0.494	0.409	0.974
Log CVar	1.110	0.738	1.001	1.214	1.150
Percntls					
Minimum	1	1	1	1	1
10th	1	1	1	1	1
20th	1	1	2	1	1
30th	2	2	2	1	2
40th	2	2	2	1	2
50th	2	2	2	1	2
60th	2	2	2	2	2
70th	3	2	2	4	12
80th	5	3	5	5	14
85th	6	3	8	5	184
90th	12	3	20	11	184
95th	27	[illegible]	30	[illegible]	[illegible]
98th	75	5	30	12	610
99th	184	6	75	12	610
Maximum	610	6	75	12	610

(Summary statistics not calculated for formations with fewer than ten values.)

Element Statistics
Variable - Antimony (Sb)
Number of Values - 47
Units - ppm
Detection Limit - 0.1
Analytical Method - INAA

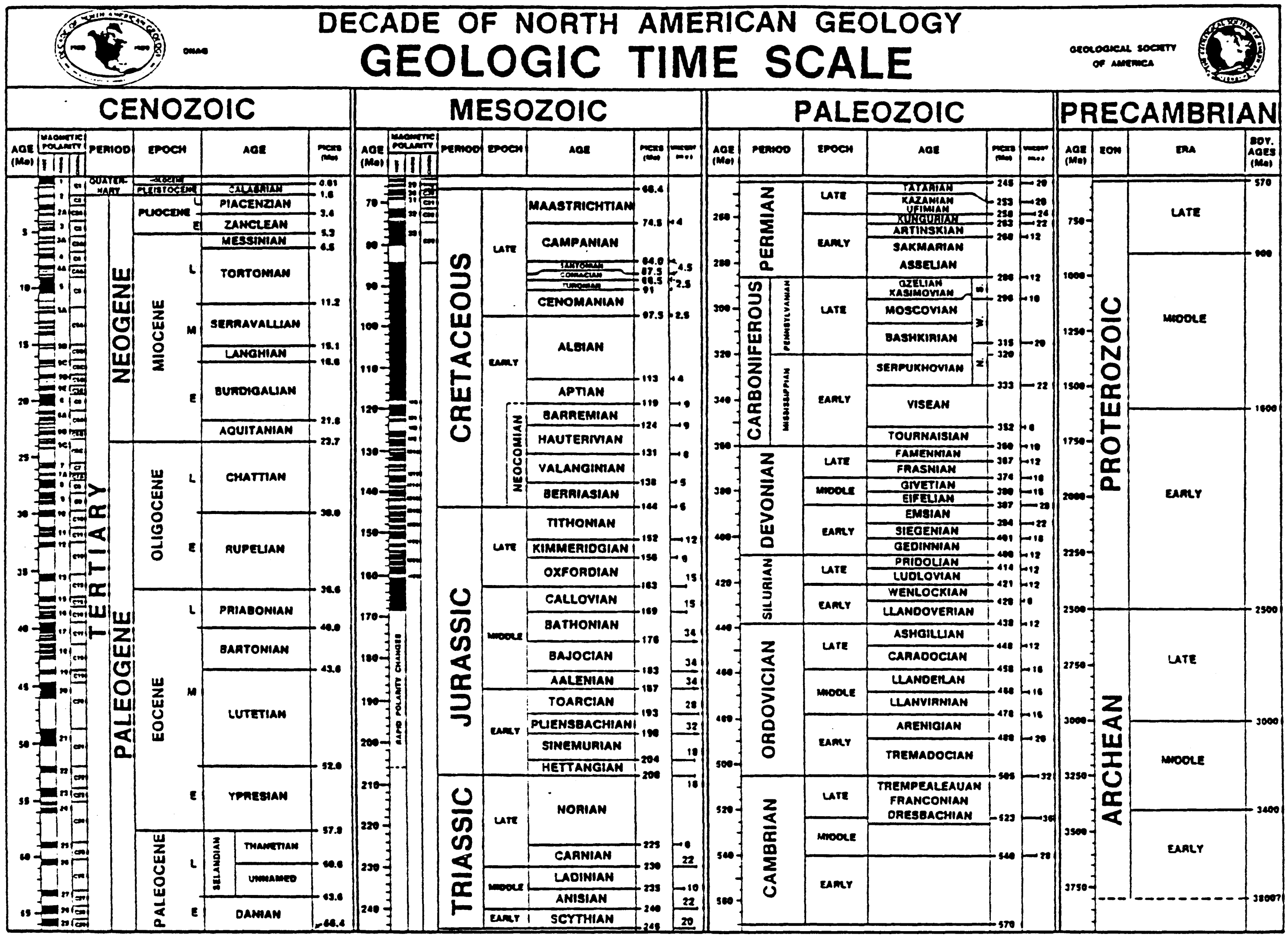
	All	uKK	1J
N	47	19	13
N > DL	47	19	13
Missing	0	0	0
Mean	5.13	4.21	4.92
Median	4.30	4.00	5.00
Mode	4.00	3.00	4.00
Range	14.0	5.4	5.8
St Dev	2.51	1.42	1.47
Coef Var	0.489	0.336	0.299
Log Mean	0.669	0.602	0.673
Geo Mean	4.66	4.00	4.71
Log StDv	0.186	0.144	0.137
Log CVar	0.279	0.240	0.204
Percntls			
Minimum	2.0	2.0	2.2
10th	3.0	3.0	2.2
20th	3.0	3.0	4.0
30th	4.0	3.0	4.0
40th	4.0	4.0	4.0
50th	4.3	4.0	5.0
60th	5.0	4.0	5.0
70th	5.5	4.3	5.0
80th	7.0	5.0	5.0
85th	7.0	5.5	6.0
90th	8.0	6.3	7.0
95th	9.0	[illegible]	[illegible]
98th	10.0	7.4	8.0
99th	16.0	7.4	8.0
Maximum	16.0	7.4	8.0

Element Statistics
Variable - Arsenic (As)
Number of Values - 47
Units - ppm
Detection Limit - 0.5
Analytical Method - INAA

	All	uKK	1J
N	47	19	13
N > DL	47	19	13
Missing	0	0	0
Mean	36.98	19.47	36.69
Median	23.00	17.00	27.00
Mode	18.00	15.00	23.00
Range	232.0	34.0	81.0
St Dev	40.32	8.59	24.28
Coef Var	1.090	0.441	0.662
Log Mean	1.434	1.260	1.473
Geo Mean	27.18	18.20	29.73
Log StDv	0.310	0.153	0.302
Log CVar	0.216	0.122	0.205
Percntls			
Minimum	8.0	10.0	8.0
10th	13.0	13.0	8.0
20th	15.0	15.0	16.0
30th	17.0	15.0	20.0
40th	18.0	16.0	23.0
50th	23.0	17.0	27.0
60th	27.0	17.0	32.0
70th	39.0	18.0	44.0
80th	44.0	20.0	54.0
85th	50.0	23.0	56.0
90th	56.0	24.0	70.0
95th	120.0	40.0	70.0
98th	140.0	44.0	89.0
99th	240.0	44.0	89.0
Maximum	240.0	44.0	89.0

APPENDIX D

Geological Time Scale (from Palmer, 1983)



LIST OF FIGURES

FIGURE 10. Porphyry Cu-Mo potential: a) ratings as defined by individual criteria fields, and b) the final assigned ratings incorporating criteria field overlap.

FIGURE 11. Polymetallic vein potential: a) ratings as defined by individual criteria fields, and b) the final assigned ratings incorporating criteria field overlap.

FIGURE 12. Basalt-hosted Cu-Ag vein potential: a) ratings as defined by individual criteria fields, and b) the final assigned ratings incorporating criteria field overlap.

FIGURE 13. Polymetallic massive sulphide potential: a) ratings as defined by individual criteria fields, and b) the final assigned ratings incorporating criteria field overlap.

FIGURE 14. Classification of mineral resource potential (after McLaren (1990)).

FIGURE 15. Mineral resource potential of the Babine Mountains Recreation Area (see Figure 14).

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