A REVIEW OF METALLIC MINERALIZATION IN THE INTERIOR PLATEAU, CENTRAL BRITISH COLUMBIA (PARTS OF 93B, C AND F)

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KEYWORDS: Economic geology, Interior Plateau, Ootsa Lake Group, Hazelton Group, Capoose batholith, epithermal, porphyry, porphyry-related, gold, silver, copper, molybdenum, zinc, lead.

INTRODUCTION

The mineral deposits component of the Interior Plateau project was conducted in parts of the Fraser and Nechako plateaus between 1992 and 1995. This report summarizes investigations of twenty mineral occurrences that were visited during the project. Field investigations of mineral occurrences, together with property-scale mapping, were conducted at seventeen occurrences located in the Nechako River map area (93F), two in the Anahim Lake map area (93C) and one in the Quesnel map area (93B; Figure 1). Although the project area has no producing mines, the operating Endako molybdenum mine and the recently decommissioned Equity Silver silver-gold-copper mine lie to the north, the closed Blackdome gold mine is located to the south, and the Gibraltar porphyry copper mine is in operation to the east. Also, the Huckleberry porphyry copper deposit is in the mine development stage (Figure 1).

Since its inception, this project has raised the mining industry's awareness of the Nechako Plateau as an area that is under explored. The potential of the region to host different styles of mineral deposits derives from its favourable geology, characterized mainly by Jurassic Hazelton Group and Eocene Ootsa Lake Group volcanic rocks, their coeval intrusions and locally intensive extensional faulting. However, much of the most prospective bedrock is concealed beneath the low, rolling, forested topography, as well as a veneer of glacial till, that is typical of the area.

Until recently only limited exploration had been conducted in the region as it was hampered by poor road access, a lack of significant bedrock exposure and an antiquated geoscience database. The release of data from surveys (*i.e.*, bedrock mapping: Diakow and Webster, 1994; lake sediment geochemistry: Cook and Jackaman, 1994; till geochemistry: Levson and Giles, 1994; and mineral occurrence studies: Schroeter and Lane, 1994), conducted in 1993 by the British Columbia Geological Survey Branch, resulted in a significant increase in staking and exploration in the southern Nechako River map area.

OBJECTIVES

A regional metallogenic synthesis of the Interior Plateau area was initiated by Schroeter and Lane in 1991 and continued under the auspices of the Interior Plateau project. The objectives were to:

- Characterize, classify and compare mineral deposits in the Interior Plateau.
- Promote exploration in the area by developing ore deposit models and exploration criteria.

METHODS

The mineral deposits component of the Interior Plateau project consisted of investigations of more than twenty metallic mineral occurrences. These investigations consisted of the following:

Literature research and compilation: mineral exploration assessment report files, petroleum geology assessment report files and government regional geology maps and reports were compiled for parts of NTS map sheets 93B, 93C and 93F. Lineaments and other structural features were interpreted from a Landsat image of part of NTS 93F and added to the compilation.

Regional geology framework: regional mapping of four 1:50 000-scale map sheets (NTS 93F/02, 03, 06 and 07), conducted by by the British Columbia Geological Survey Branch (Diakow *et al.*, 1997, this volume), provided a regional geologic framework for the area. Specific sections of Eocene stratigraphy were mapped at 1:10 000 scale on the Wolf and Holy Cross epithermal gold prospects.

Mineral occurrence investigations and exploration monitoring: this work consisted of preliminary and follow-up investigations of the styles of mineralization and alteration that characterize the metallic mineral occurrences in the Interior Plateau region. A summary of the occurrences studied is in Table 1. Each occurrence was briefly described based on examination of bedrock showings, trenches, diamond-drill core, regional geologic setting and discussions with company project geologists. Table 2 lists the analyses of grab samples from most of the prospects visited.

Deposit modeling, interpretation and future work: a schematic section depicting the spatial and possible genetic relationships between intrusions and mineralization discussed is shown in Figure 2. Lead isotope "fingerprinting" will be conducted on main phase sulphide-bearing mineralization from most of the prospects and may provide significant new information to aid exploration in the region. Uranium-lead zircon dating of felsic rocks at the Tsacha and Capoose prospects is in progress and will provide additional constraints on the age of mineralization.

EXPLORATION HISTORY

The earliest recorded exploration (1927) in the region resulted in the discovery of several large quartz-molybde-

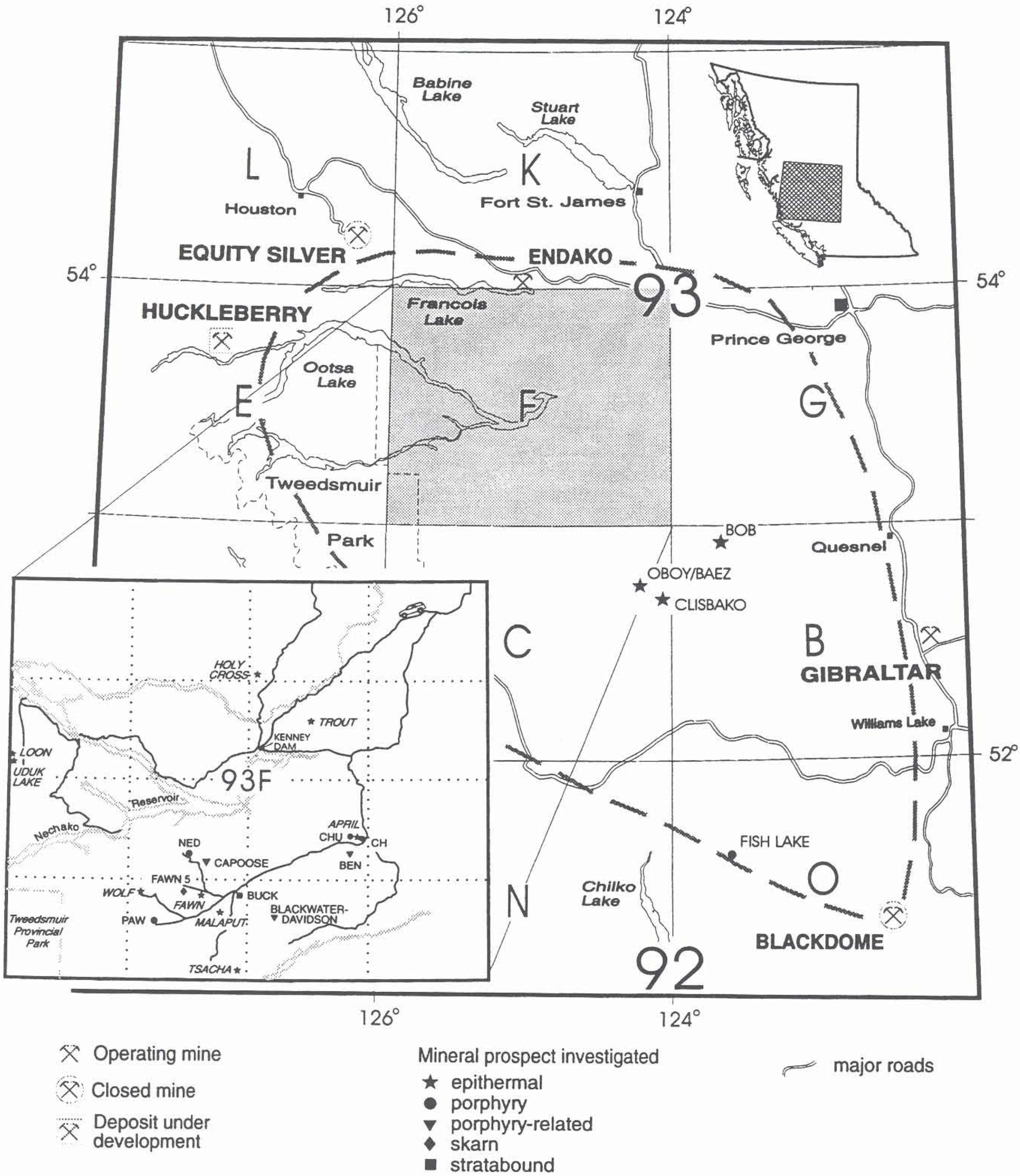

Figure 1. Location of mineralized prospects in central British Columbia investigated during this study.

TABLE 1
CHARACTERISTIC FEATURES OF MINERAL OCCURRENCES IN THE INTERIOR PLATEAU

Deposit Type *Occurrence (Minfile)*	Ag:Au	Metallic Minerals	Gangue Minerals	Style of Mineralization	Alteration	Age of Mineralization	Hostrock Group: lithologies
Epithermal Au-Ag							
Baez (Oboy - 093C 015)	4 to 100	py,aspy	K-fld,ser,qtz,calc,chl	f-gr. disseminations in and peripheral to veinlets and breccias	potassic, phyllic, silicic, argillic	Eocene	Ootsa Lake: rhyolitic flows, breccias
Bob (093B 054)	1 to 6	py,aspy,sb	qtz,K-fld,clay,chl,calc	disseminations in altered horizons	silicic, argillic, potassic, propylitic	Eocene	Skeena: sandstone, conglomerate, siltstone and argillite cut by qfp dikes
Clisbako (093C 016)	20 to 110	py,marc,aspy	qtz,chal	f-gr. whisps and disseminations in stockwork and breccia zones	silicic	Eocene	Ootsa Lake: rhyolite flows, tuffs, breccias; andesite flows and breccias
Holy Cross (093F 029)	4 to 10	py	qtz,ba	sparsely disseminated in intensely silicified zones	silicic, argillic, hematitic	Eocene	Ootsa Lake: rhyolite dome complexes
Loon (093F 061)	n/a	py	qtz,chal	disseminated, drusy infillings in stockwork and breccia zones	silicic	Eocene	Ootsa Lake: felsic and intermediate flows, tuffs and breccias
Trout (093F 044)	4 to 20	py,Au,el	qtz,ad	rythmically banded quartz-adularia veins and silica-flooded zones	silicic	Eocene	Kasalka(?): polymictic conglomerate and andesitic breccia
Uduk Lake (093F 057)	2 to 60	py	qtz,chal	f-gr. and c-gr. disseminations in stockwork and breccia zones	silicic, argillic	Eocene	Ootsa Lake: rhyolite flows, tuffs and breccias
Wolf (093F 045)	1 to 20	Au,Ag,el,py,cpy	qtz,calc,chal	diss. in banded and bladed veins; microscopic inclusions of Au in py	silicic, argillic	Eocene	Ootsa Lake: rhyolite and high-level intrusions
Yellow Moose (093F 058)	2 to 60	sb,aspy,py,marc,cnb,Au	qtz,chal	f-gr. disseminations and blebs in stockworks and breccias	silicic, argillic	Eocene	Ootsa Lake: rhyolite tuffs, breccia, sandstone
Tsacha (093F 055)	<1 to 50	py,cpy,agt,Au,gln,el,stef	qtz,calc,chal,amth,hem	f-gr. disseminations, colloform banded and bladed veins	silicic, argillic, phyllic	pre-Late Cretaceous	Hazelton: rhyolite flows, ash-flow tuffs
Fawn (093F 043)	7 to 13	py,aspy,pyg	qtz,chal,ba,dol,calc,ser	disseminated in silica flooded breccia and stockwork zones	silicic, argillic	Jurassic (?)	Hazelton: andesitic flows; limy ash, lapilli and block tuffs
Malaput (no Minfile)	n/a	py,sph,gln	qtz,ser,calc	weakly developed stockworks in broad alteration zone	silicic, phyllic	Jurassic (?)	Hazelton: felsic tuffs and/or flows
Au-Ag Base Metal							
April (093F 060)	1 to 400	sph,gln,py,po,aspy,cpy	qtz,chl,calc	c-gr. disseminations to semimassive, crudely banded veins/shears	phyllic, propylitic	Jurassic (?)	Hazelton: tuffaceous/limy siltstones
Ben (093F 059)	15 to 120	aspy,py,po,cpy,gln,sph,mo	qtz,bio	semimassive veins, layered to laminated or foliated	phyllic, potassic	Jurassic (?)	Hazelton: intermediate flows, tuffs
Blackwater-Davidson (093F 037)	15 to 120	sph,py,po,gln,aspy, cpy,tet,bou,marc	qtz,ser,bio	disseminated and fracture controlled and replacements	phyllic, potassic	Late Cretaceous (?)	Hazelton: felsic and intermediate flows and tuffs; siltstone and argillite
Buck-Xmas Cake (093F 050)	>150	sp,py,po,ga,cp	qtz,carb	massive to semimassive sulphide breccia	argillic	Late Cretaceous (?)	Hazelton: rhyolite flows, breccias
Buck-Rutt (093F 050)	>150	sph,py,po	qtz,ser,chl,clay	disseminated, laminated to layered, stratabound	argillic, phyllic, silicic	Late Cretaceous (?)	Hazelton: tuffaceous siltstones, argillites
Capoose (093F 040)	70	sph,gln,py,aspy,cpy, tet,po,pyg,el,Au	qtz,gnt,mus	disseminated, replacement and fracture controlled	phyllic, hornfels	Late Cretaceous	Hazelton: garnetiferous rhyolite sills, hornfels
Au-Cu (-Fe) Skarn							
Fawn 5 (093F 053)	~50	mag,po,py,cpy,aspy,gln	bio,chal,ep,dp,calc	massive to semimassive magnetite disseminated sulphides in metasomalized andesite tuffs	hornfels, calc-silicate metasomatism	Jurassic	Hazelton: andesitic flows, tuffs, fragmentals
Porphyry Mo-Cu							
CH, C (093F 004)	n/a	py,cpy,po,mo	qtz,K-fld,bio,mag	disseminated in veinlets and weakly developed stockworks	silicic, hornfels, potassic, propylitic, phyllic	Eocene (?)	Hazelton: andesite flows, siltstones crowded feldspar porphyry, granodiorite and diorite
Paw (093F 052)	n/a	py,mo,cpy		disseminated and fracture controlled	silicic	Jurassic	Capoose batholith: diorite to granodiorite
Chu (093F 001)	n/a	mo,py,po,cpy	qtz,bio	disseminated and fracture controlled	hornfels, potassic	Jurassic (?)	Hazelton: pyroclastic andesite and siltstone; granodiorite dikes related to the Capoose batholith (?)
Ned (093F 039)	n/a	mo,py,cpy	qtz	disseminated and fracture controlled	silicic	Late Cretaceous (?)	Late Cretaceous (?) quartz monzonite

TABLE 2
ROCK GEOCHEMISTRY OF SELECTED SAMPLES FROM MINERAL OCCURRENCES IN THE INTERIOR PLATEAU

MINERAL OCCURRENCE Sample No.	Au ppb	Ag ppm	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Sb ppm	Ba ppm	Fe %
HOLY CROSS										
94BLA-HC1-2	5	0.3	5	7	21	11	4.8	14	2200	
94BLA-HC1-TR4	42	4	6	305	41	10	6.2	12	4200	
94BLA-HC3-3	<2	0.3	<1	207	16	51	4.5	2.5	2500	
94BLA-HC5-1a	140	16.5	3	3704	25	124	10	15	960	
94BLA-HC6-2	<2	1.3	9	3	32	15	19	100	1700	
94BLA-HC6-6	2730	3.7	19	22	10	4	2.6	7.3	<50	
94BLA-HC7-1	<2	0.3	21	2	8	5	5.8	9.2	1700	
94BLA-HC7-TR7	5	0.6	4	16	61	48	31	23	3100	
94BLA-HC12-8	10	0.9	59	25	343	42	23	23	2200	
TOMMY										
LDI27-1A	2	0.2	<1	5	8	44	9	3	32	
LDI27-1B	461	12.1	1	14	17	27	16	5	25	
LDI27-1C	3740	2	<1	27	156	125	30	3	81	
LDI27-1C	2935	1.4	1	28	164	128	30	<2	82	
LDI27-1D	52	0.4	<1	9	13	34	17	3	87	
LDI27-11A	3342	34.8	<1	25	56	22	8	7	31	
LDI27-11B	2716	34	1	43	126	19	5	6	30	
LDI27-11C	660	26.3	<1	7	6	17	13	3	46	
LDI27-11D	976	11.2	1	9	10	15	30	2	87	
LDI27-11D	952	11.6	1	10	13	16	31	4	91	
LDI27-12	2449	41.8	<1	3	7	7	3	2	54	
MALAPUT										
IWE 8-1A	2	0.2	3	1	92	120	7	2	1326	
IWE 8-1B	6	0.1	<1	121	2	51	10	<2	24	
IWE 8-1C	1	0.3	2	1	90	55	2	4	89	
IWE 8-1	3	0.1	2	3	13	22	<2	3	426	
IWE 3I-5	1	0.1	1	9	6	16	6	4	130	
LDI 22-4	2	0.2	<1	4	<2	77	9	<2	22	
LDI 6-1A	1	0.2	7	107	15	41	<2	<2	60	
LDI 6-1B	1	0.3	9	119	<2	35	<2	2	47	
LDI 6-2	1	0.1	51	101	5	20	<2	<2	33	
LDI 8-5	1	0.1	1	10	3	9	2	5	54	
LDI 8-6	4	0.7	1	5	105	39	<2	5	76	
LDI 12-3	6	0.3	3	36	80	787	18	4	18	
LDI 26-4	20	1.1	<1	13	7	51	<2	3	259	
LDI 37-1	2	0.2	3	10	7	62	4	<2	87	
IWE 3-5	101	6	14	186	321	675	12730	79	14	
TGI 256	1	<0.1	1	4	13	3	<2	<2	11	
IWE 25-2	29	21.3	6	6202	12	294	<2	<2	186	
APRIL										
94BLA-A3	2030	2.9	15	1319	17	54600	22000	24	<50	
BEN										
94BLA-B3	2320	145.9	4	164	2320	379	1600	440	450	
BUCK										
94BLA-BK-1	130	721*	<1	1899	3.8*	12.1*	100	48	-	
TSACHA										
TS94-TO-1	0.93*	46.2	3	412	750	1208	9	16	28	
TS94-TO-2	3.99*	90.5*	3	9	10	18	2	2	163	
TROUT										
TS94-CT-1	2.33*	40.46*	2	11	7	64	5	2	15	
TS94-CT-3	173.45*	591.42*	3	66	18	80	12	4	160	
TS94-CT-7	8.40*	54.17*	2	17	6	36	78	4	20	

TABLE 2 *continued*

UDUK LAKE										
TS94-UL-2	240	2.2	29	5	9	5	336	11	107	
TS94-UL-3	11	0.1	12	6	9	41	244	3	49	
TS94-UL-5	55	9.8	3	10	7	6	80	7	51	
TS94-UL-8	58	3.1	5	6	10	8	93	7	165	
TS94-UL-15	220	2.9	5	2	18	8	224	3	56	
TS94-UL-16	41	0.1	8	2	15	1	85	2	57	
TS94-UL-4	8	0.5	12	28	46	20	10	2	57	
TS94-UL-17	75	2.2	93	4	15	7	100	5	93	
TS94-UL-19	320	3.7	82	7	14	7	410	7	155	
TS94-UL-20	650	8	80	9	14	1	868	26	81	
TS94-UL-23	38	0.7	10	34	27	33	19	2	19	
TS94-UL-25	97	70	27	5	6	1	40	2	212	
94BLA-UL-1	290	8.1	134	9	73	173	847	17	56	
WOLF										
WO-BL93-4	273	0.7	<1	<1	7	4	3	<2	7	
WO-BL93-18	14637	513.5	18	11	12	24	16	<2	8	
WO-BL93-21	255	44.2	1157	5	22	82	780	29	18	
WO-BL93-42	1178	16.9	5	16	254	19	17	48	14	
WO-BL93-47	355	0.6	12	9	15	24	15	2	24	
BLACKWATER-DAVIDSON										
BD-BL93-1	150	0.4	1	86	11	7366	28	6	124	
BD-BL93-2	313	16.5	6	155	35180	3704	<2	18	28	
BD-BL93-10	8	0.8	<1	212	42	62	15	<2	68	
BD-BL93-10B	4	<0.1	1	10	7	7	8	<2	14	
FAWN 5										
FA-BL93-15	411	19.2	19	5972	7	275	37	4	6	
FA-BL93-18	5	0.3	<1	259	4	118	18	<2	116	
FA-BL93-20	3	0.1	<1	2	22	30	10	4	28	44.00

Analysis by instrumental neutron activation or inductively coupled plasma (values are in ppm unless otherwise shown), except where denoted by an asterix(*) which indicates analysis by fire assay with AA or gravimetric finish. For the latter, values are in g/t for gold and silver, and in percent for base metals.

num veins on the Stella property, 10 kilometres southwest of Endako village, 160 kilometres west of Prince George. In 1965, after a lengthy exploration interval, the Endako molybdenum mine opened and continues to operate today. Ore reserves (proven and probable) as of December 31, 1995, were 104 843 000 tonnes averaging 0.077% Mo (Placer Dome Inc., 1995 Annual Report).

The first published regional mapping in the area was conducted by Dr. H.W. Tipper with the Geological Survey of Canada between 1949 and 1952 (Tipper, 1963).

During the 1960s, (in the search for porphyry copper±molybdenum targets) several major mining companies conducted regional reconnaissance stream-sediment sampling programs and/or airborne magnetic surveys over the northern parts of the region. The existing regional geological base map (Tipper, 1963) showed the distribution of intrusions which became the early targets for porphyry exploration programs. By 1969, Rio Tinto Canadian Exploration Limited (Riocanex) and American Smelting and Refining Company (ASARCO) had identified soil geochemical (Cu-Pb-Zn-Mo) and induced polarization anomalies in the area of Chutanli Lake (now CH and Chu occurrences). Riocanex also outlined multi-element geochemical anomalies towards the north end of the Fawnie Range (Capoose prospect). Between 1970 and 1972 Riocanex completed a regional lake-sediment sampling program and identified several multi-element anomalies that were not followed up until 1982. Also, in the early 1970s, Noranda Exploration Company Limited conducted regional stream-sediment surveys and several follow-up induced polarization surveys on claims in the Tetachuck Lake and Chelaslie Arm areas, Nechako Reservoir (iIn the search for porphyry targets). In addition, from the late 1950s to the mid 1980s, several major companies evaluated the region for its hydrocarbon potential (Hickson, (1990). Regional reconnaissance programs for uranium were undertaken from 1970 to the early 1980s.

Exploration waned between 1974 and 1979; only a few programs (*e.g.* by Cities Services Minerals Corporation, Granges Exploration (Canada) Ab. and ASARCO) were undertaken. Access to the area was greatly improved by the completion of the Kluskus-Ootsa forestry road in 1977. In the late 1970s Granges carried out regional geochemical, geological and geophysical surveys, culminating with stak-

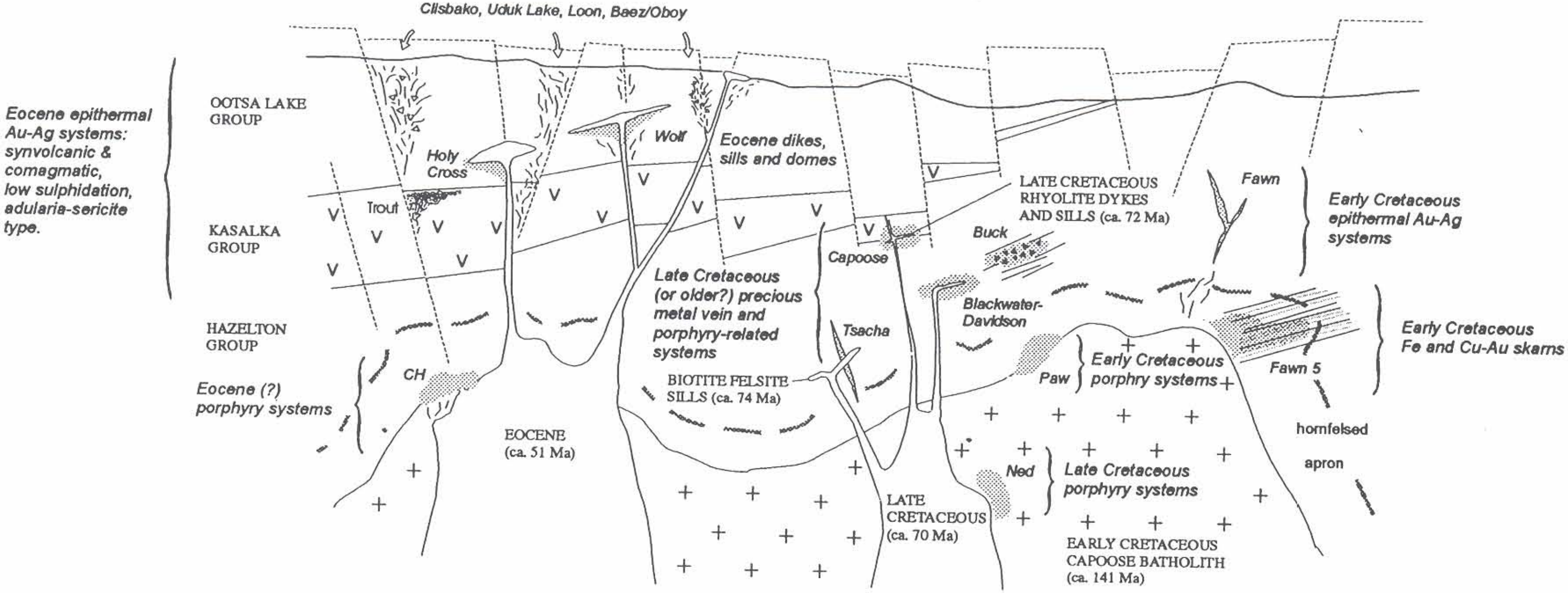

Figure 2. Schematic section showing the location of mineral occurrences and spatially and/or genetically related intrusions. Refer to Table 1 for mineral occurrence characteristics.

ing of the Capoose and Pem (Blackwater-Davidson) polymetallic prospects, and the Ned porphyry copper-molybdenum prospect, in the Fawnie Range.

By 1979 Granges had identified a significant multi-element Ag-Pb-Zn-Au geochemical anomaly on the Capoose property. Subsequent drilling programs over the next four years (1979-1983) resulted in the assessment of a drill-indicated resource of 28 million tonnes grading 37.7 g/t Ag and 0.51 g/t Au (Granges Inc., 1994 Annual Report). In the southern Interior Plateau, Barrier Reef Resources Ltd. discovered the Blackdome gold-silver epithermal bonanza vein deposit in 1979. It was brought into production in 1986 and produced approximately 6955 kilograms (223 600 oz) of gold and 23 640 kilograms (760 000 oz) of silver from 306 000 tonnes of ore milled (Schroeter and Lane, 1991). The mine closed in 1991; however, exploration for additional reserves has resumed.

During the late 1970s Equity Mining Corporation, bought out by Placer Development Ltd. in 1978, outlined a mineable reserve at the Equity Silver polymetallic deposit southeast of Houston. Between 1980 and 1994, the mine produced approximately 80 900 tonnes (178.2 million lb) of copper, 2 075 000 kilograms (66.7 million oz) of silver and 15 903 kilograms (511 296 oz) of gold from more than 32 million tonnes of ore mined at an average grade of 0.34% Cu , 101 g/t Ag and 1.01 g/t Au (Giancola, 1994).

Between 1979 and 1983 Canadian Hunter Exploration Limited, and others, conducted oil and gas exploration programs in the region west of Quesnel. Several deep (3000 m) holes were drilled, primarily on seismic targets, to test for favourable structures.

The very high price of molybdenum at the end of the 1970s was a factor in a few porphyry programs (*e.g.*, Chutanli Lake and Tetachuk Lake areas) in 1980; however, a dramatic fall in the molybdenum price in the early 1980s resulted in a 3-year mine shutdown at Endako, from 1983 to 1985 inclusive, at Endako and essentially terminated exploration for porphyry molybdenum targets, until recently. At the beginning of the 1980s the focus of exploration turned to gold. Several regional stream-sediment surveys were conducted within the project area early in the decade; however, the only significant follow-up property work consisted of diamond drilling programs carried out between 1980 and 1983 on the Capoose polymetallic deposit. Companies with regional and/or property programs in the 1980s included E & B Explorations, Amax Exploration, Dome Exploration, Hudson Bay Exploration and Development, Selco, Long Lac Minerals, JMT Services, Riocanex, BP Minerals, Placer Dome, Abo Oil, Colassal, Cominco, Newmont, Kerr Addison, Mingold, Imperial Metals and Noranda Exploration. The main exploration target was epithermal gold-silver deposits with either bonanza-vein or bulk-mineable potential. The discovery of several such deposits, particularly in Nevada, and the refinement of the epithermal model, provided the impetus for similar exploration in British Columbia. Geochemical programs identified anomalies with gold±mercury±arsenic±antimony±silver, particularly associated with silicification in felsic volcanic rocks of the Eocene Ootsa Lake Group. The most significant prospect, discovered as a result of these regional surveys, is the Wolf epithermal gold-silver deposit. In 1983 Riocanex discovered epithermal mineralization by prospecting around a regional lake-sediment silver-zinc-arsenic-molybdenum anomaly. Riocanex and BP Canada Ltd. also identified several multi-element geochemical anomalies in the Capoose Lake area, similar to those associated with the Capoose prospect.

Follow-up drilling on the Trout, Wolf, Bob, Oboy, Uduk Lake and Rhub-Barb properties in the late 1980s targeted epithermal gold mineralization. An M.Sc. thesis completed at the University of British Columbia by Andrew (1988) describes the Capoose and Wolf deposits in detail.

By the beginning of the 1990s logging activity had provided (and continues to provide) road access into the southern part of the region (to approximately Kilometre 160 along the Kluskus-Ootsa forest service road), south of Vanderhoof. The area south of the West Road (Blackwater) River is accessible from logging roads that extend west from Quesnel and northwest from Williams Lake.

In 1990, Eighty-Eight Resources Ltd. discovered abundant epithermal quartz float in glacial outwash deposits (locally 10 m thick), to the east-southeast of the Oboy epithermal prospect, in an area with no previously recorded staking. This potentially significant new gold-silver discovery, Clisbako, soon caught the attention of a few major companies. At the same time, with the end of operations at the Equity Silver mine to the northwest scheduled for the early 1990s, Equity Silver Mines Ltd. tested the previously explored Chu/CH porphyry prospect, this time for its gold content. In 1991-1992, Placer Dome Inc. tested the CH property for its copper-gold content. In 1991 Metall Mining Corporation optioned the Clisbako property and conducted an airborne geophysical survey. Using the geophysical data together with available satellite imagery, Metall identified what it believed to be a cauldera. Subsequent relatively shallow drilling (*e.g.*, 100 m) over the next two years located several zones of epithermal mineralization; however, they were only weakly anomalous and the option was terminated.

To the north of the West Road River, drilling on the Wolf epithermal prospect by Metall in 1992 demonstrated that the majority of silicified 'lenses' at the Ridge and Pond zones are part of an extensive, gently west-dipping body (2-30 m thick) of silicified hydrothermal breccia with banded and bladed quartz veins containing gold (*i.e.*, bulk mineable potential).

Biogeochemical surveys, principally bark sampling of lodgepole pine, conducted by Metall in 1992 at the Clisbako and Wolf projects, gave encouraging results; other such surveys carried out by the Geological Survey of Canada (Dunn, 1997; this volume) corroborate the usefulness of these surveys in specific areas. Metall also experimented with an induced polarization survey on both properties, apparently with good success.

In 1992, Cogema Resources Inc. carried out reconnaissance mapping (including 1:50 000 scale) in the Interior Plateau region and identified several gold targets. Western Keltic Mines Inc. acquired the Fawn (Gran) and Buck properties. Homestake Canada Inc. explored the Uduk

Lake property in the northwest. During 1992-1993, Granges Inc. drilled its Blackwater-Davidson (Pem) property; results suggest a similar style to the Capoose prospect.

Between 1992 and 1993 Fox Geological Consultants Ltd. conducted regional stream-sediment sampling programs, on behalf of Phelps Dodge Corporation of Canada Ltd., primarily in the area west of Quesnel and northwest of Williams Lake, and staked several claims.

In 1993-1994 Cogema drilled several targets. It closed its office in Vancouver in January, 1995 and its holdings in the Interior Plateau region were subsequently acquired by Phelps Dodge. Regional mapping (1:50 000 scale) by the British Columbia Geological Survey Branch in 1993 (Diakow and Webster, 1994) identified potentially significant gold mineralization at the Tommy showing which was later acquired by Teck Corporation as part of the Tsacha property. Results of regional lake sediment (average density of 1 site per 7.7 km^2) and till geochemical surveys, carried out by the Geological Survey Branch (Cook and Jackaman, 1994; Levson and Giles, 1994), were released in June 1994. Several anomalies were identified which led to a heavy staking in the area. It is estimated that over 700 units were staked over a two month period by eleven companies and individuals. In addition, results of the Geological Survey of Canada airborne radiometric and magnetic survey over much of the area were released in early 1994 (Teskey *et al.*, 1997; this volume). Exploration reached its peak during 1994 with several reconnaissance and drilling programs, all targeted on precious metals.

Table 3 lists the exploration methods that led to the discovery of mineral occurrences in the study area.

REGIONAL GEOLOGIC SETTING

The Nechako and Fraser plateaus encompass an area that extends southward from the Skeena Arch and westward from the structural contact of Stikine Terrane with the Cache Creek Terrane. They are bounded to the west and south by the Coast Plutonic Complex. The region is underlain by rocks of the Stikine Terrane comprised of remnants of superposed island arcs and associated marine sequences that are assigned to the Lower Permian Asitka, the Upper Triassic Stuhini and the Lower and Middle Jurassic Hazelton groups.

During Middle Jurassic (Bajocian) time, terrane accretion caused structural onlap of the Cache Creek Terrane onto Stikinia and led to formation of the Bowser Basin. This event also coincided with the abrupt end of widespread volcanism associated with the development of the Hazelton arc. In Callovian time, uplift of the Skeena Arch separated the Bowser Basin in the north from its counterpart, the Nechako Basin in the south (Tipper and Richards, 1976). Initial deposits in these basins consisted primarily of shale, indicative of starved basin conditions. Succeeding chert-dominated coarse clastic deposits mark a marine regression and fluvial-deltaic sedimentation that apparently ended locally in Kimmeridgian time.

During Early Cretaceous time, shallow-marine sediments of the Skeena Group were deposited. Upper Cretaceous calcalkaline volcanic rocks, represented in central Stikinia by the Kasalka Group, stratigraphically overlie the Skeena Group and mark the construction of a continental margin arc. This volcanism remained active until latest Late Cretaceous time.

Robust continental arc magmatism was re-established during Middle and Late Eocene time with eruption of the Ootsa Lake and Endako groups. The Miocene and Pliocene Chilcotin Group is stratigraphically above the Endako Group. It forms a broad lava plateau, covering much of south-central British Columbia, dominated by alkali olivine basalt.

LITHOSTRATIGRAPHY

Recent bedrock geological mapping has focused on the southern half of the Nechako River map area (NTS 93F), and much of the following discussion applies specifically to the geology and mineral occurrences in this region. However, several mineral occurrences (*i.e.,* Eocene epithermal gold-silver deposits that are similar to Eocene occurrences studied in the Nechako River map area) were investigated farther to the south (NTS 93C) and brief descriptions of the rocks that host those occurrences are included here.

The Fawnie and Nechako ranges in the southern Nechako River map area are tectonically uplifted blocks in which Mesozoic rock units predominate. They include mainly volcanic and sedimentary strata that broadly correlate with parts of the Stuhini, Hazelton, Bowser Lake, Skeena and Kasalka groups (*see* Table 1 in Diakow *et al.*, 1997, this volume). Stratigraphy in the southern Nechako River map area comprises rare Upper Triassic marine sedimentary rocks at the base, succeeded by two sequences of interlayered volcanic and volcaniclastic sedimentary rocks containing fossils that range in age from early Toarcian to early Bajocian. Early Jurassic volcanism (Toarcian to Aalenian?) is exclusively rhyolitic in composition; it contrasts with a younger (Bajocian), dominantly basaltic event. Both sequences record island arc volcanism and associated intra-arc clastic sedimentation. Early Callovian marine siltstone and shale are sporadically exposed, and contain chert-bearing conglomerate interbeds that become more prevalent eastward from the Fawnie Range towards the Nechako Range. These deposits are interpreted to record initial transport of chert-rich detritus shed into the Nechako basin from highstanding Cache Creek Terrane to the east. Widely separated exposures of andesitic and dacitic volcanic rocks in the study area yield radiometric dates suggestive of eruptive episodes during Late Jurassic (*ca.* 152 Ma), Jura-Cretaceous (*ca.* 144 Ma) and Late Cretaceous time (*ca.* 65 to 70 Ma). With the exception of the youngest event, which may represent waning Kasalka Group volcanism, contemporaneous magmatism corresponding with the older events is sporadically preserved in central Stikinia, recorded locally by the Netalzul volcanics of the Bowser Lake Group, and the Francois Lake intrusions, respectively.

Strata of Cenozoic age in the study area include the Ootsa Lake, Endako and Chilcotin groups. During Early Eocene time the Ootsa Lake Group, characterized by

TABLE 3
DISCOVERY METHODS FOR SELECTED PROSPECTS IN THE INTERIOR PLATEAU PROJECT AREA

Property	Deposit Type	Discovered By:	Year	Discovery Method	Current Owner
April	Mesothermal vein?	Granges Expl. Ab.	1982	Regional geochemical stream sediment sampling: Zn-Ag anomalies followed by prospecting and grid-based soil sampling	Placer Dome
Baez	Epithermal Au	Phelps Dodge	1992	Reconnaissance stream sediment and soil sampling, rock sampling, geophysics, diamond drilling	Phelps Dodge
Ben	Mesothermal vein	BHP-Utah		Reconnaissance exploration for volcanogenic massive sulphide mineralization in Hazelton Group rocks	BHP - Utah
Blackwater-Davidson (Pem)	Porphyry-related Au-Ag	Granges Expl. Ab.	1973	Reconnaissance silt sampling: Pb-Zn-Ag stream sediment anomalies led to subsequent soil sampling & staking of the Pem claim	Granges
Buck (Range)	Mesothermal vein?	BP Minerals Ltd.	1981	Reconnaissance geochemical sampling and prospecting outlined several base metal - silver anomalies; trenching and rock sampling followed	Western Keltic Mines
Capoose	Porphyry-related Ag-Au	Rio Tinto Canadian Expl. Ltd.	<1969	Reconnaissance stream and lake sediment sampling; follow-up prospecting, soil and rock sampling, trenching and diamond drilling	Granges
CH (C)	Porphyry Cu-Au	Rio Tinto Canadian Expl. Ltd.	<1969	Reconnaissance lake sediment sampling (and interpretation of federal government regional aeromagnetic survey); follow-up I.P. and magnetometer surveys in conjunction with bedrock mapping over favourable geology of Jurassic Hazelton Group intruded by Chutanli Lake monzonitic stocks	Placer Dome
Chu	Porphyry Cu	ASARCO Inc.	1969	Reconnaissance stream sediment anomalies led to the discovery of copper and molybdenum mineralization in outcrop	Orvana
Clisbako	Epithermal Au	Eighty-Eight Res.	1990	Prospecting and rock sampling; trenching and diamond drilling; biogeochemistry	Eighty-Eight
Fawn (Gran)	Epithermal Au-Ag	BP Minerals Ltd.	1982	Reconnaissance geochemical sampling and prospecting in an area of favourable garnet alteration, and Pb lake sediment anomaly, outlined a broad base metal-silver anomaly; trenching, geophysics and diamond drilling confirmed orientation and width	Western Keltic Mines
Fawn 5	Skarn Fe, Skarn Cu-Au	BP Minerals Ltd. B.C. Geological Survey	1983 1993	Reconnaissance mapping and sampling on the margin of the Capoose batholith	Western Keltic Mines Ltd.
Holy Cross	Epithermal Au	Noranda	1987	Prospecting and rock chip sampling of silica-flooded rhyolite followed by trenching	Kennecott
Loon	Epithermal Au	Mingold Resources Inc.	1988	Reconnaissance exploration; prospecting; traced mineralized float boulders up- ice to their source	Hudson Bay
Ned	Porphyry Mo-Cu	Granges Expl. Ab.	1975	Reconnaissance stream and lake sediment sampling; follow-up soil sampling outlined an area of anomalous Mo-Cu	none
Oboy	Epithermal Au	Rio Algom Exploration Inc.	1985	Reconnaissance soil and stream sediment Ag-As anomalies	Phelps Dodge
Paw	Porphyry Mo-Cu	Perry Grunenberg	1993	Prospecting new logging roads	Perry Grunenberg
Tsacha (Tommy)	Epithermal Au	B.C. Geological Survey	1993	Regional mapping crew discovered and sampled auriferous epithermal quartz vein and stockwork mineralization	Teck
Trout	Epithermal Au	Kerr Addison Mines Ltd.	1984	Reconnaissance exploration; prospecting, mapping & sampling	Phelps Dodge
Uduk Lake	Epithermal Au	Amax Exploration	1980	Reconnaissance mapping; soil and rock geochemistry, geophysics and trenching	Pacific Comox / Pioneer Metals
Wolf	Epithermal Au	Rio Algom Expl. Inc.	1983	Anomalous silver lake-sediment anomaly followed by soil and rock sampling, biogeochemistry, geophysics, trenching and diamond drilling.	Lucero
Yellow Moose	Epithermal Au	Newmont Expl. of Canada Ltd.	1987	Structural interpretation of Landsat image data followed by reconnaissance prospecting; traced stibnite-bearing float up-ice to its bedrock source	Phelps Dodge

subaerial high-potassium, calcalkaline rhyolitic and less voluminous andesitic rocks, formed an extensive volcanic province in south and central British Columbia. The Endako Group is also a sequence of high-potassium andesitic flows that have compositional continuity with volcanic rocks of the Ootsa Lake Group. Their source is believed to be volcanic centres that lay to the north of the uplifted region, as they thin dramatically southward, overlying progressively older rocks along the northern flank of the ranges. During the Neogene, alkaline shield volcanoes erupted extensive sheets of basaltic flows assigned to the Chilcotin Group.

Three main plutonic suites are recognized cutting layered rocks in the study area. They include Jura-Cretaceous quartz monzonite of the Capoose batholith, Late Cretaceous felsic sills and dikes, and Eocene granodiorite and dioritic stocks.

DEPOSIT DESCRIPTIONS AND CLASSIFICATION

Many of the following mineral prospects have previously been discussed (Diakow and Webster, 1994; Schroeter and Lane, 1992, 1994; Lane and Schroeter, 1995). Prospects are grouped, firstly, by deposit type and, secondly, by assumed age of mineralization. In most cases the age of mineralization is uncertain and an interpreted age, based on field relationships, is reported. Prospect locations are shown on Figure 1 and the information in the text is summarized in Table 1.

EPITHERMAL GOLD OCCURRENCES

Epithermal precious metal mineralization has been documented in many localities throughout the Interior Plateau. Of the twelve epithermal occurrences studied and summarized in this report, nine (Bob, Clisbako, Holy Cross, Loon, Oboy, Trout, Uduk Lake, Wolf and Yellow Moose) occur in Eocene (or younger) strata and three (Fawn, Malaput and Tsacha) are hosted by Lower or Middle Jurassic volcanic rocks. Seven of the Eocene occurrences are hosted by felsic volcanic rocks assigned to the Eocene Ootsa Lake Group, one is in polymictic conglomerate and andesitic breccia, found locally at the base of the Ootsa Lake Group or Upper Cretaceous Kasalka Group, and one is hosted by Lower Cretaceous Skeena Group clastic rocks. The three older deposits are hosted by intermediate to felsic volcanic rocks of the Hazelton Group. A lack of geochronology data for a large majority of the deposits hinders a more exact interpretation of their ages.

Hostrocks for the Eocene prospects generally consist of quartz-phyric flow-banded rhyolite and associated fragmental rocks. Spatially and genetically related hypabyssal intrusions crop out at the Wolf occurrence. Structures, both regional and local, are commonly subvertical and northerly trending, although they vary in orientation from northwest to northeast and are probably related to east-west Eocene extension (Diakow and Webster, 1994). Veins and breccia zones typically have northerly trends. In areas of limited exposure, coincident geophysical (I.P., magnetic and EM) and multi-element geochemical (soil and till) anomalies also commonly have northerly trending patterns.

Mineralization is predominantly structurally controlled and is characterized by broad zones of generally weak to moderate argillic alteration within which quartz and/or chalcedony (±adularia) comprise intensely silicified zones, banded veins, stockworks and breccias. Illite and montmorillonite comprise the clay mineralogy at one prospect (Clisbako) and are indicative of low-temperature epithermal systems. Other common gangue minerals include barite, potassium feldspar, sericite, calcite and chlorite.

The epithermal mineral occurrences are typically of the sulphide-poor, adularia-sericite type. Pyrite is the most common sulphide, but is not always present, and locally ranges up to several volume percent. Locally it is accompanied by trace amounts of marcasite, arsenopyrite, stibnite and/or cinnabar. Native gold, electrum and argentite have been identified at several of the prospects.

Hostrocks for suspected Early Cretaceous epithermal precious metal occurrences are Hazelton Group andesitic flows and pyroclastic rocks. Two of the three occurrences are within the thermal aureole of the *circa* 148 Ma Capoose batholith. Mineralization at the Fawn and Malaput prospects is confined to east-trending siliceous and/or sericite and clay-altered zones that contain chalcedonic quartz and traces of pyrite±arsenopyrite±sphalerite±galena±pyrargyrite. The Tsacha prospect consists of northerly trending auriferous, banded quartz-calcite veins that are cut by Late Cretaceous felsite sills.

Prospects discovered to date have both bulk-mineable and bonanza-vein potential.

EOCENE EPITHERMAL GOLD-SILVER OCCURRENCES

Uduk Lake (MINFILE 93F 057) - 93F/12W

The Uduk Lake epithermal gold-silver prospect is located approximately 70 kilometres south-southwest of Burns Lake. The Duk claims cover a broad (2 km wide) area of hydrothermally altered rhyolitic to dacitic rocks of the Ootsa Lake Group. Outcrop on the property is sparse, however, bedrock is commonly within 1 or 2 metres of the surface. A zone of clay and silica-altered rhyolite, in angular float and outcrop, measuring about 600 by 200 metres, occurs in the southwestern part of the property.

Several junior companies explored the ground during the middle and late 1980s. A few modest diamond drilling programs tested silica stockwork zones with gold values in the range of 0.02 to 1.45 g/t (Allen and MacQuarrie, 1985). Soil and rock geochemical surveys, carried out in 1993, outlined six gold-silver-arsenic anomalies (Dunn, 1993) that were trenched in 1994. The trenches exposed moderately to intensely clay-altered rhyolite flows and tuffs. Weak silicification is accompanied by a quartz-chalcedony±sulphide stockwork that locally grades into a more sulphide-rich, black-matrix breccia containing angular rhyolite clasts that are rimmed with thin layers of chalcedony. Pyrite is the only sulphide mineral observed and occurs mainly in vein, stockwork and breccia zones and less commonly as weak disseminations in altered rhyolite. It is present in trace amounts ranging up to 5% locally. Five of the six trenches sampled were anomalous in gold. Results included a 6-metre section grading 1.4 g/t Au and an entire 42-metre trench averaging 0.41 g/t Au. Grab samples typically grade over 1 g/t Au and assays as high as 5.7 g/t Au have been recorded (Tupper and Dunn, 1994).

Loon (MINFILE 93F 061) - 93F/12W

The Loon epithermal gold prospect is located immediately north of the Uduk Lake prospect. It was discovered by prospecting which located mineralized boulders that were traced up-ice to their source. Subsequent soil sampling outlined a strong silver anomaly oriented at 020º with a strike length of more than 300 metres. Trenching of the anomaly yielded results grading up to 0.2 g/t Au and 4.5 g/t Ag (Taylor, 1990). Coincident induced polarization and resistivity anomalies were drill tested in 1994; intervals of chalcedonic breccia in variably clay and silica-altered Ootsa Lake volcanics were intersected, but were barren or only weakly anomalous (Gal, 1994).

The hostrocks and mineralization are similar to the Uduk Lake property (*i.e.*, pyritic quartz veins, stockworks and chalcedonic breccia zones within broader zones of intensely clay-altered, quartz-phyric and flow-banded rhyolite to dacite flows, tuffs and breccias of the Ootsa Lake Group). Pyrite occurs as very fine to fine-grained rims on clasts and in veinlets within chalcedonic breccias, and as fine to medium-grained subhedral crystals in vuggy cavities.

Clisbako (MINFILE 93C 016) - 93C/09E

The Clisbako epithermal gold-silver prospect has been previously described by Schroeter and Lane (1992). Its work history has been documented in assessment reports by Dawson (1991) and Heberlein (1992a, b). The area was recently mapped in some detail by the Geological Survey of Canada (Metcalfe and Hickson, 1994 and 1995).

Epithermal mineralization is hosted by several north to northeast-trending structures that cut a sequence of Eocene volcanic rocks. They consist mainly of rhyolite flows and breccias, amygdaloidal andesite flows, and rhyolitic and dacitic tuffs. These rocks form an arcuate highland that have been interpreted to be the remnants of a caldera (Metcalfe *et al.*, 1997, this volume).

In 1991, airborne radiometric, magnetic and electromagnetic surveys were flown over the area, and a field program consisting of trenching, mapping and sampling was conducted over the altered zones. A nineteen-hole, 3020-metre diamond drilling program followed (Heberlein, 1992a). In 1992, an induced polarization survey identified several chargeability and resistivity anomalies; these were tested by an eleven-hole, 1360-metre diamond drilling program. Assays of core samples exceeding 1.0 g/t Au were uncommon (Heberlein, 1992b).

Alteration is characterized by broad zones of moderately to intensely clay-altered rock that is cut by silica±pyrite (marcasite) stockworks. Near structures, zones of pervasive silicification predominate. Banded drusy quartz and dark grey chalcedony (±pyrite and/or marcasite) veins and silicified zones contain the highest gold and silver values. Assays of selected grab samples range from 0.05 to 0.76 g/t Au and 5.0 to 15.8 g/t Ag and all have anomalous arsenic, mercury and, to a lesser extent, antimony. Illite and montmorillonite comprise the clay mineralogy (Schroeter and Lane, 1992) and are indicative of a low-temperature regime that is consistent with an epithemal setting.

Baez (Oboy - MINFILE 93C 015, 016) - 93C/9E, 16E

The Baez property, including the Oboy prospect, is 125 kilometres west of Quesnel. It adjoins the western boundary of the Clisbako property (Schroeter and Lane, 1992). The property is underlain by a sequence of poorly exposed rhyolites, dacites, andesites and basalts of the Eocene Ootsa Lake Group. Rhyolitic tuffs, flows and breccias are the main hostrocks for mineralization (Goodall, 1994).

The Baez claims were staked in 1992 and 1993 as a result of reconnaissance stream-sediment sampling (Goodall, 1994). In 1993, soil sampling on four grids outlined several multi-element (Ag-As-Sb-Au-Hg) anomalies. In 1994 approximately 50 line-kilometres each of soil sampling and induced polarization surveys were carried out. Prospecting, mapping and diamond drilling followed. One of the targets is a north-trending multi-element soil geochemical anomaly 800 metres wide by 1800 metres long, coincident with airborne electromagnetic and resistivity anomalies and a pronounced magnetic lineament. Mineralized sections of core from the 1994 drilling program consist of bleached and clay-altered, fractured dacite and andesite. The fractures are filled with fine-grained silica and cored by fine-grained subhedral pyrite and/or marcasite. Pyrite, as 2-millimetre and smaller euhedral cubes, is also disseminated throughout the wallrock. The total pyrite content is estimated at 1 to 2%. Pervasive chlorite-calcite alteration, typical of the Baezeko River area, is widespread. Drilling has shown oxidation extends to depths of approximately 30 metres.

The Oboy epithermal gold prospect is about 8 kilometres west of the main target area on the Baez property. Outcrop is sparse in this area, however core from 1987 drilling on the Camp zone (Cann, 1987) displays hostrock lithologies comprising pale green (bleached) flow-banded andesite and green and purple mottled felsic to intermediate pyroclastic breccia of the Ootsa Lake Group. Argillic alteration is moderate to intense and imparts a chalky texture to the rocks. Mineralization consists of 2% to 5% fracture-controlled, fine-grained pyrite in a gangue of drusy quartz, calcite and chlorite. Disseminated, epigenetic pyrite cubes up to 2 millimetres across are present throughout.

Bob (MINFILE 93B 054) - 93B/13E

Mineralized rocks at the Bob prospect are silica and potassium feldspar altered and consist of three pyrite-bearing auriferous zones, with or without arsenopyrite. These mineralized horizons are in Lower Cretaceous Skeena Group clastic sedimentary rocks, above, in and below a low-angle, sheared contact between conglomerate and sandstone. The sedimentary rocks generally trend north-northeast and dip 20° to 50° to the southeast. They are cut by north and west-trending steeply dipping fracture systems and intruded by narrow clay and sericite-altered quartz feldspar porphyry dikes and/or sills. Potassium-argon whole-rock analysis from one of these intrusions yielded a date of 54.9±2.0 Ma (Brown, 1986). A whole rock K-Ar date of 64.8±2 Ma was derived from sandstone that hosts the mineralization (Brown, 1986). The genetic relationship of the porphyry dikes and sills to mineralization is unknown. The mineralized zones are 3 to 30 metres thick and assays typically average about 0.3 g/t Au (Brown, 1985). The zones are also anomalous in mercury, arsenic, antimony and silver. They are overlain by, or in fault contact with, basaltic and rhyolitic breccia of probable Eocene age.

Wolf (MINFILE 93F 045) - 93F/03W

The Wolf prospect, located approximately 130 kilometres southwest of Vanderhoof, is a low sulphidation, adularia-sericite epithermal gold-silver deposit with potential for bonanza and bulk-mineable mineralization.

Hostrocks are flow-banded and quartz-phyric rhyolitic flows and tuffs of the Ootsa Lake Group and a genetically related feldspar porphyry sill (Figure 3). Whole-rock K-Ar dates of 47 to 49 Ma from rhyolite and the sill suggest they may be comagmatic (Andrew, 1988). The rhyolites locally overlie polymictic conglomerate that is interpreted to locally mark the base of the Ootsa Lake Group. Elsewhere, the rhyolites unconformably overlie andesitic flows and epiclastic rocks of the Hazelton Group. Minor west-side-down movement along northerly trending structures that dissect exposures of the Ootsa Lake Group probably took place post-Early Eocene and are manifestations of the extensional tectonic regime that existed during that time. Hypabyssal sills and dikes preserved at Wolf, but not found elsewhere in the vicinity, suggest that the prospect may have been a small volcanic centre.

Extensive areas of silicification, brecciation and veining occur in three topographic highs. Alteration and mineralization are characterized by banded and bladed quartz-chalcedony veins and hydrothermal breccias within variably silicified and clay-altered sulphide-poor zones. At the main area (Ridge and Pond zones), silicification, veining and brecciation are concentrated at the base of a gently west-dipping hypabyssal feldspar porphyry sill. Veins are typically oriented north or northeast, parallel to small-displacement block faults. Two continuous chip samples from trenches on the Ridge zone averaged 8.49 g/t Au and 42.2 g/t Ag over 7.5 metres (Cann, 1984) and 2.69 g/t Au and 14.0 g/t Ag over 26.5 metres (Heberlein, 1992c). Selected grab samples yielded assays up to 78 g/t Au. The planar zone, defined by drilling in 1992, has a minimum strike length of 300 metres, extends down dip for more than 240 metres, and averages 7.6 metres in thickness (Dawson, 1995). The layer averages between 1 and 2 g/t Au over its thickness.

In 1994, a nine-hole, 1333-metre diamond drilling program, designed to test several induced polarization and biogeochemical anomalies identified during 1993 surveys (Love, 1994), peripheral to known mineralization, produced disappointing results.

Trout (MINFILE 93F 044) - 93F/10W

The Trout epithermal precious metal occurrence is located 60 kilometres southwest of Vanderhoof. The Discovery or Main zone crops out in a swampy valley bottom southwest of Swanson Creek. The area is underlain by mottled maroon and green polymictic conglomerate overlying volcanic breccia of either Late Cretaceous (Kasalka Group?), or Eocene (basal Ootsa Lake Group) age. The cobble-sized clasts consist of locally derived rounded sedimentary, volcanic and intrusive lithologies. They are cemented by finely banded chalcedonic quartz-adularia veins up to 8 centimetres wide. The banded chalcedonic quartz occurs in shades of pale brown to cream to clear. Many veins also contain drusy cavities and bladed textures (quartz pseudomorphs after barite or calcite).

Visible sulphides are rare in the veins, but traces of disseminated pyrite are common in the hostrocks. Very fine grained to microscopic pyrite, gold and argentite occur in distinct grey bands less than 1 millimetre thick, and within tabular lead-grey features, 0.5 millimetre wide by up to 2 millimetres long within bands of white translucent fine-grained quartz, that are perpendicular to clast margins. Sampling in trenches across the Discovery zone returned assays of up to 19.5 g/t Au over 5 metres (Schmidt, 1987). Selected grab samples assayed over 170 g/t Au (*see* Table 2).

Hydrothermal fluids were apparently channeled along a gently southwest-dipping contact between underlying volcanic breccia and overlying conglomerate. The hangingwall of the zone is flooded with silica and quartz-adularia veins while the footwall is pervasively silicified to about 1 metre below the contact. Distinct veinlets in the underlying volcanic breccia are dominantly oriented 050/80°SE.

Yellow Moose (MINFILE 093F 058) - 93F/06E

The Yellow Moose property is located south of Arrow Lake, approximately 20 kilometres west of Kenney Dam.

The Arrow showing is on the southeast shore of the lake and was not examined. It is reported to consist of drusy quartz veins and chalcedonic quartz flooding in siliceous rhyolite and arkosic sandstone that are cut by coarse-grained stibnite veins with accessory pyrite, marcasite and cinnabar (Bohme, 1988). The showing carries negligible gold or silver values.

The Gus zone consists of diffuse silicification and minor quartz-chalcedony veining in brecciated rhyolite and crystal to crystal-lapilli tuff. Northeast-trending mineralized zones, consisting of narrow veins, stockworks and breccias contain 1 to 2% fine-grained disseminated arsenopyrite, stibnite and pyrite. Assays up to 0.8 g/t Au have been reported (Bohme, 1988). Clay alteration of hostrocks is pervasive. Late fractures are coated with iron and manganese oxides.

A third zone, an induced polarization anomaly designated the IPA zone, and the Gus showing, were evaluated by a six-hole, 626-metre diamond drilling program in 1994. Drilling outlined a northeast-trending, weakly mineralized zone that dips moderately to the east (K. Schimann, personal communication, 1994).

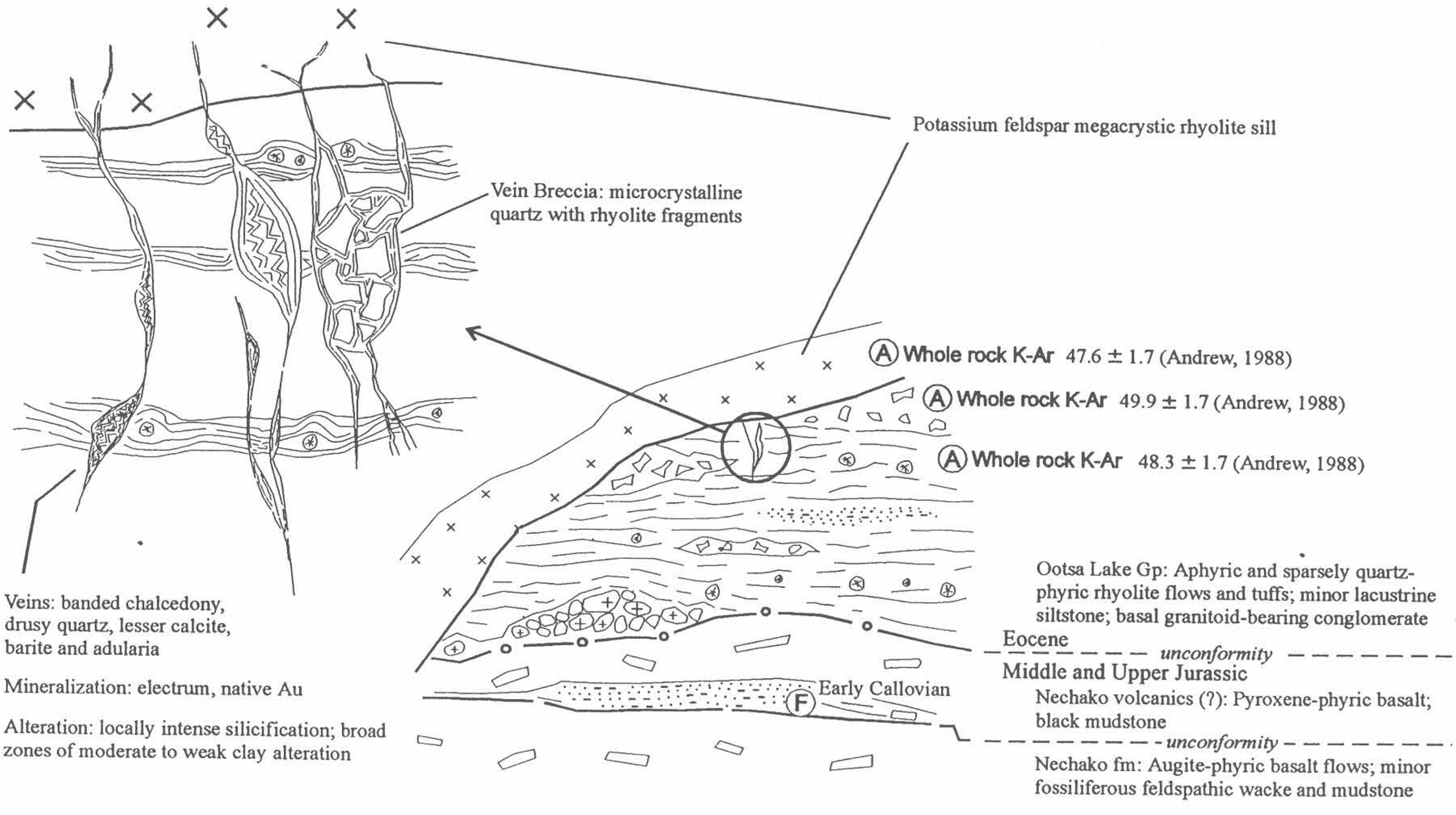

Figure 3. Schematic stratigraphic section of the wolf volcanic-hosted epithermal precious metal vein deposit (after original sketch by L.J Diakow).

Holy Cross (MINFILE 93F 029) - 93F/15W

The Holy Cross epithermal gold prospect is located about 33 kilometres south of Fraser Lake. Prospecting and chip sampling of silica-flooded rhyolite, exposed in a series of northwest-trending knotts, led to the discovery of several zones anomalous in gold. Subsequent exploration included geochemical, magnetometer and induced polarization surveys, geological mapping and the excavation of 26 trenches (Donaldson, 1988; Barber, 1989).

The oldest rocks are Hazelton Group andesitic crystal tuffs and plagioclase-phyric flows which are metasomatically altered to a fine-grained, mottled pale pink and green rock. They are intruded by a biotite quartz monzonite plug that has yielded a U-Pb zircon date of 169.3±0.3 Ma (Lane, 1995). Upper Cretaceous and younger strata unconformably overlie rocks of the Hazelton Group. Chert-pebble conglomerates, tentatively assigned to the Lower Cretaceous Skeena Group, are conformably overlain by hornblende-phyric andesite flows. These flows have yielded a preliminary K-Ar date, on hornblende, of 70.3±3.0 Ma (R.M. Friedman, personal communication, 1995). Maroon to purple andesitic volcanic flows, possibly from the base of the Eocene Ootsa Lake Group, unconformably overlie the Cretaceous rocks. These are in turn overlain by maroon to pale-coloured rhyolite flows and breccias assigned to the mid-Eocene Ootsa Lake Group. Andesite to basalt flows of the Late Eocene Endako Group and related diorite to gabbro plugs and necks form resistant knobs.

Two styles of mineralization have been recognized on the property. Zones of brecciated and intensely silicified rhyolite locally contain up to 1% fine-grained, disseminated pyrite; a zone of massive grey crystalline silica in trench 88-1 averaged 2.64 g/t Au and 9.7 g/t Ag across 2 metres (Donaldson, 1988). Zones of banded hematitic quartz veins and clear drusy quartz stockwork are weakly anomalous or barren. The veins and pervasively silicified zones are commonly enveloped by weakly to moderately clay-altered and bleached wallrock. Manganese oxides limonite and hematite commonly coat fractures. Pervasive hematitic alteration has stained andesites and rhyolites dark maroon or purple peripheral to the bleached zones. Sulphidization appears to be a post-hematite event and has resulted in the development of up to 4% disseminated cubic pyrite with bleached envelopes.

EARLY CRETACEOUS OR OLDER EPITHERMAL GOLD-SILVER OCCURRENCES

Fawn (MINFILE 93F 043) - 93F/03E

Epithermal gold-silver mineralization at the Fawn prospect consists of silicified breccia with sulphide-bearing stockworks and veins within a zone of iron carbonate and sericite alteration. Hostrocks are andesitic flows, lapilli tuffs, ash tuffs and argillaceous sedimentary rocks of the Hazelton Group. Locally intense metasomatism overprints the sub-greenschist grade regional metamorphic minerals in the volcanic rocks, resulting in zones of biotite hornfels and skarnification. Sulphide-bearing felsic dikes, of suspected Eocene age, cut the Hazelton stratigraphy.

Diamond-drill holes intersected silicified breccia within zones of clay, sericite and iron carbonate altered wallrock. One intersection graded 2.02 g/t Au and 25.2 g/t Ag over 8.1 metres (Baknes and Awmack, 1994a). The breccia zone has a true thickness of about 7 metres, strikes east and dips 60º to the north. Breccia zones consist of grey, silicified and brecciated lapilli tuff. Sulphide content is about 1% consisting mostly of pyrite. Fine-grained needles of arsenopyrite, possible sphalerite and an unknown steel-grey mineral (pyrargyrite?) occur in trace amounts. Dominant gangue minerals are quartz, chalcedony, calcite (late-stage post-sulphide). Quartz-lined drusy cavities are common and contain rhombs of white dolomite and euhedral blades of barite.

Tsacha (MINFILE 93F 055) - 93F/03E

In 1993 a Geological Survey Branch regional mapping party discovered an auriferous epithermal quartz vein system in the Tommy Lakes area (Diakow and Webster, 1994). The area is underlain primarily by rhyolitic ash flows and variably welded tuffs. They are intruded by felsic to intermediate dikes and sills. The veins crop out on hummocky, moss-covered knobs.

In 1994 a program consisting of soil geochemistry, prospecting, trenching and rock chip sampling was conducted. In 1995, a 35-hole, 5200-metre diamond drilling program, focused on the main or Tommy vein, tested the vein system over a strike length of 650 metres and 150 metres down dip (J. Pautler, personal communication, 1995). The Tommy vein trends north, dips vertically and is up to 8 metres wide. It is intruded by a biotite-phyric felsite sill that has yielded a preliminary U-Pb zircon date of 73.8+2.9/-0.1 Ma (R.M. Friedman, personal communication, 1995). Surface sampling across the vein has returned assays up to 61.9 g/t Au and 292.5 g/t Ag over 1.5 m (Pautler, 1995).

The Tommy vein consists of massive clear to milky white crystalline quartz and subordinate calcite with locally developed colloform bands of pale grey chalcedonic quartz, adularia and rare amethyst. Metallic mineral content of the vein system is typically less than 1% and includes traces of chalcopyrite, pyrite, stephanite, argentite, galena, native gold (and/or electrum), specularite and magnetite (J. Pautler, personal communication, 1995). Vague bands of earthy hematite and sparse malachite are minor vein constituents. Vein textures include brecciation, banding and drusy cavities. Massive vein quartz-carbonate is commonly flanked by stringer, stockwork and/or breccia zones. Wallrock alteration is inconsistent and patchy. Narrow, locally intense zones of silicification abruptly give way to broad zones of weak clay alteration that may be stained a brick-red colour due to pervasive earthy hematite. Clay and sericite alteration is sporadic.

Several other quartz veins and stockwork zones parallel the Tommy vein. Potential for discovery of additional veins is excellent.

Malaput - 93F/03E

The Malaput showing, discovered by Geological Survey Branch mappers in 1993 (Diakow and Webster, 1994), consists of weak sulphide mineralization (traces of pyrite, sphalerite and galena) in an east-trending zone of quartz and sericite-altered felsic bedded tuffs. The rock is pale greenish white and displays rare primary textures including lapilli-sized lithic fragments, quartz eyes and an east-trending weakly developed fabric that may be relict flow banding. Locally the rock exhibits a well developed silica stockwork locally with crystalline barite. Sphalerite and galena are associated with crosscutting calcite veinlets. Fractures are coated with earthy hematite and/or pyrolusite. Pyritic tuffs, fine-grained sedimentary rocks and pyroxene-bearing volcanic flows crop out to the north.

SKARN MINERALIZATION

Fawn 5 (MINFILE 93F 053) - 93F/03E

Two types of skarn mineralization were identified along the western margin, and within the thermal aureole, of the Jura - Cretaceous Capoose batholith. Both occur on the Fawn 5 claim.

Andesitic pyroclastics and limy tuffs of the Hazelton Group locally exhibit extensive hornfelsing and local development of garnet-pyroxene-epidote (±wollastonite±actinolite) infiltration skarn. These effects extend more than 5 kilometres from the western edge of the batholith. Iron skarn consists of massive to semimassive magnetite in a gangue consisting mainly of garnet, pyroxene and epidote. A grab sample from the iron skarn occurrence graded 44% Fe with negligible precious and base metal values. Copper-gold skarn consists of 1% finely disseminated pyrite and traces of disseminated chalcopyrite, pyrrhotite and arsenopyrite in strongly epidote-altered andesitic tuffs. A grab sample from this new occurrence graded 0.6% Cu, 0.4 g/t Au and 19 g/t Ag.

The potential for future discoveries of skarn mineralization, within the metasomatically altered envelope surrounding the batholith, is excellent.

VEIN AND PORPHYRY-RELATED DEPOSITS

Several prospects studied are classified here as either "subvolcanic", as described by Panteleyev (1992), or peripheral veins. They are hosted, all or in part, by Jurassic Hazelton Group strata. They exhibit fracture-controlled, disseminated, semimassive to massive and/or replacement styles of mineralization. The principle sulphides are pyrite, arsenopyrite, sphalerite, chalcopyrite and galena. Mineralization is spatially, and perhaps, genetically associated with felsic sills, dikes or plugs of at least Late Cretaceous age. At two of the prospects (April and Ben), mineralized veins are parallel to the fabric in foliated tuffaceous felsic volcanic hostrocks. These rocks are truncated by an Eocene granitic body (the CH pluton).

Capoose (MINFILE 93F 040) - 93F/06

The Capoose precious and base metal prospect is located 2 kilometres north of Fawnie Nose in the Fawnie Range, approximately 110 kilometres southeast of Burns Lake. The deposit is just east of the Capoose batholith (Figure 4) within and adjacent to garnet-bearing rhyolite dikes and sills that intrude thermally altered Middle and Upper Jurassic volcanic and sedimentary rocks. The hostrocks are pervasively kaolinized and sericitized, defining broad zones of moderate to intense phyllic alteration. Sulphide minerals, mainly pyrite, sphalerite, galena, chalcopyrite and arsenopyrite, occur as disseminations and as aggregates adjacent to, or intergrown with, garnet (Andrew, 1988). Sulphide veinlets and fracture fillings are also present. Tetrahedrite, pyrrhotite, pyrargyrite, electrum, native gold and cubanite occur as inclusions within the more common sulphides (Schroeter, 1981). Sulphide-garnet aggregates are commonly enveloped by quartz and fine-grained muscovite (Andrew, 1988). Diamond drilling outlined a geological resource of 28.3 million tonnes grading 36 g/t silver and 0.3 g/t Au (Granges Exploration Ltd., 1987).

The Capoose prospect resembles a low-grade porphyry-style deposit; however, the age of mineralization is equivocal. The mineralized and phyllically altered rhyolite sills were originally assigned a Late Cretaceous age based on whole-rock K-Ar dates (Andrew, 1988). However, new preliminary U-Pb zircon dates (R.M. Friedman, personal communication, 1995), from samples collected in 1995, suggest that there were two distinct ages of sill emplacement. A rhyolite sill, containing 3 to 5% metasomatic garnet, yielded a date of 140.7±0.6 Ma, suggesting that it may be related to the emplacement of the Capoose batholith. A locally mineralized, garnet-bearing rhyolite sill and dike complex (and contemporaneous rhyolitic extrusives), that cuts the former, yielded Late Cretaceous ages (*ca.* 72 Ma). We consider mineralization to be associated with this Late Cretaceous intrusive event.

Blackwater-Davidson (Pem - MINFILE 93F 037) - 93F/02W

The Blackwater-Davidson prospect is located approximately 7 kilometres northeast of Mount Davidson, about 160 kilometres south of Vanderhoof. Outcrop on the property is sparse and most of the information has been obtained from diamond drilling and geophysical surveys.

Stream sediment lead-zinc-silver anomalies, from a survey conducted in 1973, led to staking. Follow-up geochemical and geophysical surveys were conducted intermittently from 1977 to 1984. Diamond drilling between 1985 and 1987 identified two areas of mineralization, the Silver and Gold zones in an area of high resistivity, flanked by a zone of high chargeability that is coincident with a base metal - silver soil anomaly. Additional diamond drilling was carried out in 1992 and 1994.

Hostrocks are Hazelton Group felsic (rhyolitic to dacitic) and mafic (andesitic to trachyandesitic) volcanics as well as argillites, greywackes, sandstones and siltstones. A series of block faults may explain the repetition of rock units observed in diamond-drill core.

The Gold zone is a structurally controlled east-trending, steeply dipping zone up to 70 metres wide with a strike length of 300 metres (Allen, 1992). Disseminated and shear-hosted sulphides, consisting mainly of pyrite and sphalerite, subordinate pyrrhotite and traces of galena, arsenopyrite and chalcopyrite, occur in felsic lapilli tuffs, breccias and flows that are affected primarily by phyllic

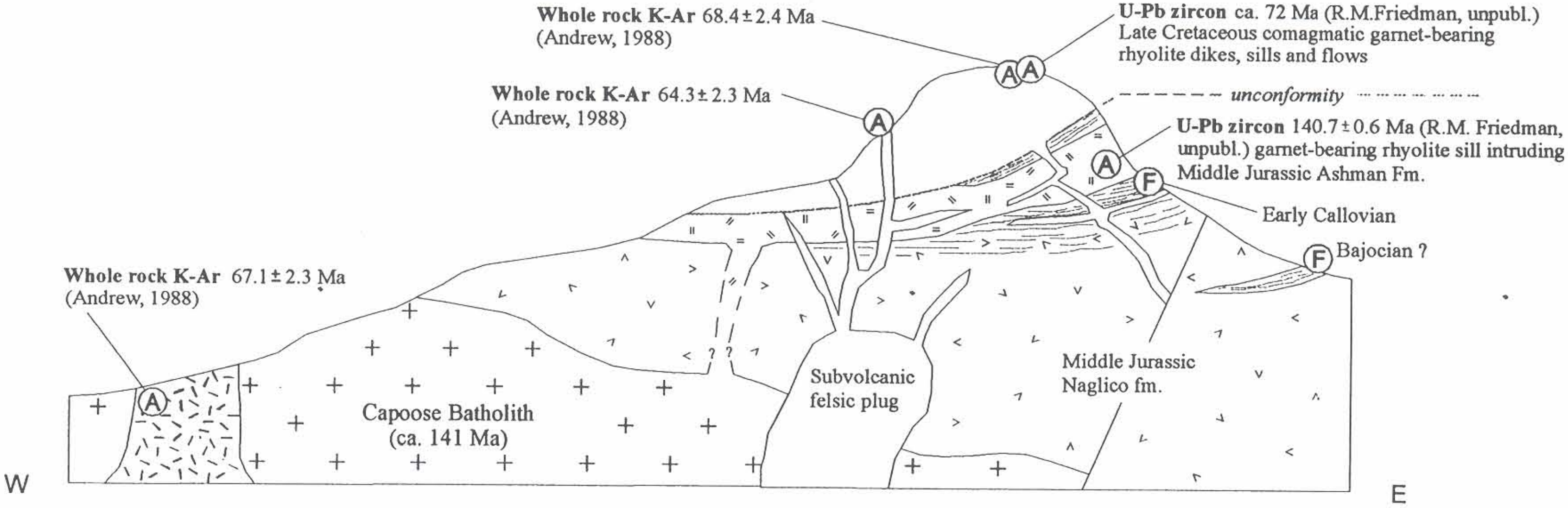

Figure 4. Diagramatic section of the Capoose porphyry-related bulk tonnage Ag (+/- Au) deposit. Mineralization is related to a series of Late Cretaceous rhyolitic dikes and sills that intrude Middle Jurassic rocks and an Early Cretaceous rhyolite sill (modified after original sketch by L.J.Diakow).

Figure 4. Diagramatic section of the Capoose porphyr-related bulk tonnage Ag(±Au) deposit. Mineralization is related to a series of Late Cretaceous rhyolitic dikes and sills that intrude Middle Jurassic rocks and an Early Cretaceous rhyolite sill (modified after original sketch by L.J. Diakow).

and argillic alteration. The best diamond-drill intersections from the Gold zone graded 14.28 g/t Au over 6.3 metres (Zbitnoff, 1988) and 0.72 g/t Au over 47.5 metres (Allen, 1993). The Silver zone is a relatively flat-lying body up to 70 metres thick that contains an estimated 6 million tonnes grading 37 g/t silver and 0.05 g/t gold (Allen, 1993).

Buck (MINFILE 93F 050) - 93F/03E

The Buck property, located about 120 kilometres southwest of Vanderhoof, covers two known mineralized showings (Baknes and Awmack, 1994b). The Rutt showing, a stratabound zone of sphalerite, pyrrhotite and pyrite is exposed in several hand-excavated trenches and outcrops along a northerly trend for about 400 metres. One trench exposes rusty weathering, carbonate and sericite-altered tuffaceous and argillaceous siltstones with 1 to 2% fine-grained disseminated and stratiform pyrite and less than 1% pyrrhotite and blackjack sphalerite. Bedded sedimentary rocks strike north-northeast and dip gently to the east. The Christmas Cake showing, exposed in two small hand-excavated trenches, is about 350 metres southeast of the Rutt zone. It occurs in a felsic volcanic breccia within 75 metres of a north-trending quartz feldspar porphyry dike, 200 to 300 metres wide. The showing consists of semimassive to massive sulphides in a breccia, where intergrowths of sulphide minerals (sphalerite+pyrite+chalcopyrite+galena) comprise the matrix for angular fragments of rhyolite. A grab sample from one of the trenches assayed 721 g/t Ag, 12.1% Zn and 3.8% Pb.

April (MINFILE 93F 060) - 93F/07E

The April showing is located approximately 100 kilometres southwest of Vanderhoof and 2 kilometres north of Chutanli Lake. It consists of a lens or vein of massive to semimassive sulphide hosted by Lower Jurassic tuffaceous siltstone near the contact with an Eocene granitic stock.

The sulphide lens is steeply dipping and trends 320º, subparallel to bedding. It is exposed over a 15-metre length and varies in width from 0.3 to 1.8 metres. Sulphides are mainly pyrite, pyrrhotite, sphalerite, arsenopyrite and galena. Assays from a three-hole diamond drilling program conducted in 1984 include 2.95 g/t Au, 4.0 g/t Ag and 0.77% Zn over 0.57 metre; and 1.4 g/t Au, 573.5 g/t Ag, 15.96% Zn and 15.83% Pb over 0.3 metre (Zbitnoff and Williams, 1985).

Ben (MINFILE 93F 059) - 93F/07E

The Ben precious metal occurrence is located about 105 kilometres southwest of Vanderhoof and 5 kilometres north of Tatelkuz Mountain. Mineralized outcrops were discovered during reconnaissance exploration for volcanogenic massive sulphide deposits in 1991 (Wesa and St. Pierre, 1992).

Precious and base metal mineralization occurs in three closely spaced showings (Hooter, Shawn and Creek) hosted by foliated intermediate flows, related pyroclastics and siltstones of the Hazelton Group. These rocks are intruded by plutons of at least two ages: a Jura-Cretaceous(?) monzonite that is locally hornfelsed and displays a crude foliation, and the CH stock, a 51.8±1.0 Ma (U-Pb zircon) biotite-hornblende granodiorite that truncates the older foliated rocks. The foliation trends northwesterly and dips steeply to the southwest. Hazelton rocks are commonly hornfelsed near contacts with the intrusions and contain up to several percent biotite which gives the rock a brown to purplish cast.

Mineralization appears to parallel foliation trending 140° to 150° and consists of disseminated to locally semimassive quartz-sulphide veins or seams containing arsenopyrite, pyrite and pyrrhotite, with or without chalcopyrite and galena. A 3.0-metre chip sample across one mineralized zone assayed 0.7 g/t Au, 95 g/t Ag and 0.2 % Pb (Wesa and St. Pierre, 1992). These zones are also anomalous in arsenic, zinc, antimony and bismuth.

PORPHYRY DEPOSITS

Bedrock exposure is very limited in the vicinity of known porphyry prospects and age data are limited. Despite this we consider the possibility for future discoveries of porphyry-style deposits to be excellent. Much more work is required in order to understand the three prospects that are summarized below.

CH (MINFILE 93F 004) - 93F/07E

The CH porphyry prospect is located 100 kilometres south-southwest of Vanderhoof and straddles the Kluskus-Ootsa forest service road. Exploration programs, carried out from 1969-1975, 1980-1985 and 1991-1992, identified porphyry copper-gold and peripheral precious-base metal vein mineralization (*see* under April occurrence). The CH prospect occurs at the margin of the mid-Eocene CH granodiorite stock: however, its genetic relationship to the intrusion is not known.

Early trenching programs uncovered fracture-controlled pyrite-chalcopyrite and magnetite in hornfelsed intermediate volcanic and fine-grained sedimentary rocks of the Hazelton Group. Later diamond drilling intersected hornfelsed volcanic and tuffaceous sedimentary rocks cut by crowded feldspar porphyry and monzonite to diorite plugs. Mineralization in drill core consists 1 to 2% disseminated and fracture-controlled pyrite, traces of chalcopyrite and molybdenum and magnetite in both intrusive and volcanic-sedimentary rocks near the contact.

Ned (MINFILE 93F 039) - 93F/06E

The Ned showing consists of several small exposures of quartz monzonite of the Capoose batholith, 2.5 kilometres southeast of Capoose Lake. It is close to a Late Cretaceous(?) granodiorite (Andrew, 1988) of unknown extent. A strong molybdenum-copper soil anomaly and coincident induced polarization anomalies overly an area that is, with the exception of the showing, entirely overburden covered.

Siliceous veins, up to 25 centimetres wide, cut the intrusion and contain coarse-grained molybdenite flakes, up to 10 millimetres across, concentrated along vein margins as a selvage. Traces of molybdenite and rare chalcopyrite are disseminated throughout the quartz monzonite. Pyrite is more abundant and occurs along fractures. A chip sample across 5 metres graded 0.046 % MoS_2 and 0.03 % Cu with negligible gold and silver (Shear, 1978).

Percussion drilling on the Ned, 'A' and 'J' claims, in 1978 and 1979, intersected weakly mineralized biotite quartz diorite of the Capoose batholith. Drill holes averaged up to 0.02% MoS_2 over their entire length. Individual assays graded as high as 0.091% MoS_2 over 3 metres, and 0.044% MoS_2 and 0.15% Cu over 3 metres (Shear, 1978, 1979).

Paw (MINFILE 93F 052) - 93F/03W

The Paw porphyry copper-molybdenum showing is located along the Kluskus-Malaput road about 5 kilometres southeast of the Wolf prospect. Sparse outcrops of granodiorite to diorite, presumably part of the Capoose batholith, host 3 to 4% fracture-controlled and disseminated pyrite with traces of molybdenite and chalcopyrite. Little work has been done on the prospect, but the showing suggests that more porphyry-style mineralization may occur in the area.

SUMMARY

Three ages of plutonism have been documented in the Interior Plateau. They are Jura-Cretaceous (*ca.* 148 to 141 Ma), Late Cretaceous (*ca.*74 - 65 Ma) and Eocene (*ca.* 51 Ma).

The oldest event is related to the emplacement of the Capoose batholith which is spatially associated with porphyry (Paw), skarn (Fawn 5) and epithermal vein (Fawn) showings. They occur in metasomatically altered Jurassic Hazelton Group volcanic rocks on the western margin of the batholith. The thermal aureole of the Capoose batholith locally extends more than 5 kilometres from the margin of the intrusion. The Ned porphyry Mo-Cu prospect is hosted by quartz monzonite of the batholith, but is also close to a probable Late Cretaceous(?) intrusion.

Late Cretaceous felsic dikes and sills, that intrude Middle and Upper Jurassic intermediate volcanic and sedimentary rocks, are interpreted to be the source of mineralization at the Capoose porphyry-related silver (±gold) deposit. Late Cretaceous intrusions may also be associated with similar mineralization at the Blackwater-Davidson precious and base metal prospect and with porphyry molybdenum-copper mineralization (*e.g.*, Ned). The Tsacha epithermal vein deposit is cut by a Late Cretaceous felsic sill, establishing a minimum age for the prospect.

Eocene (or younger) epithermal precious metal prospects (*e.g.*, Wolf) comprise the majority of known metallic mineral occurrences in the region. Most are hosted by Eocene Ootsa Lake Group felsic volcanic rocks and are related to east-west extensional tectonism.

Precious metal bearing quartz-chalcedony (± calcite, adularia and barite) veins, stockworks and breccia zones are typically low-sulphide systems (*e.g.*, Clisbako) and display classic epithermal textures such as banded veins and drusy cavities. Base metal content is generally low, suggesting that the systems developed near the paleosurface (at depths of *ca* 1 km). Hostrocks are typically intensely fractured and brecciated. Barren or weakly anomalous silica, sericite and clay-altered wallrocks typically envelope the mineralized zones.

Porphyry-style Cu-Au-Mo mineralization (CH) occurs close to the Eocene CH pluton.

The Miocene and younger plateau basalts of the Endako and Chilcotin groups, so far as we know, contain no metallic mineralization, but may have some potential for industrial minerals.

Most of the known mineral occurrences were discovered by prospecting areas with regional lake or stream-sediment geochemistry anomalies. Exploration in the Interior Plateau is hampered by extensive glacial till cover and till prospecting has proven to be an effective method for locating mineralization.

Information from regional mapping, regional and case study geochemical surveys and mineral deposit studies have encouraged mineral exploration in the Interior Plateau region. A metallogenic model has been proposed for the area and is continuing to evolve as more information is collected. A close liaison with industry geologists has resulted in a better understanding of the geological and mineralizing processes in the region.

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