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DATE: May 7, 1991

TO: Gary Wells

COPIES TO:

FROM: John Bradford

SUBJECT: **Deposits Within Trucking Distance of Samatosum**

The map shows all Zn-Pb-Ag deposits within 100 km of Samatosum as the crow flies. It includes only deposits with geologically and drill defined reserves or target horizons (not including the Rea/Kamad lenses). No such deposits are known in map sheet 92P across the Louis Creek Fault to the west. (This fault marks the eastern boundary of the Intermontane Belt).

Deposits in the Eagle Bay Assemblage

1. **Homestake**
2. **Lucky Coon/Elsie/King Tut**
3. **Mosquito King/Spar**
4. **Birk Creek**

Deposits in the Shuswap Assemblage

With the exception of the CK, these sedex deposits are all of marginal grade, and wouldn't make the required NSR unless smaller high grade pods could be found. An additional problem with Jordan River, Ruddock Creek and Cottonbelt, is the lack of road access, and rugged topography. Colby seems to be more accessible, and is worth a field visit and further research into ownership, etc.

1. **CK** - see memo by Al Hill.

2. **Ruddock Creek** - 5 Mt, 7.5% Zn, 2.5% Pb

3. **Cottonbelt** - 0.75 Mt, 5% Zn, 6% Pb, 50 g/t Ag

4. **Jordan River (King Fissure)** - 2.6 Mt, 5.6% Zn, 5.1% Pb, 35 g/t Ag.

5. **Colby (Kingfisher Creek)** - <1 Mt, 7% Zn, <1% Pb

TABLE 7. MINERAL OCCURRENCES, MOUNT GRACE AREA

Name Minfile No.	Most Recent Operator	Mineralogy	Deposit Type	Host
COTTONBELT 82M-086	1978 — Cyprus Anvil Mining Corp.; Metallgesellschaft Canada Ltd.	sphalerite, galena, magnetite, pyrrhotite	massive, disseminated; stratabound	calcareous gneiss near base of Unit 6
COMPLEX-McLEOD 82M-125	1978 — Cyprus Anvil Mining Corp.; Metallgesellschaft Canada Ltd.	sphalerite, galena, magnetite, pyrrhotite	massive, disseminated; stratabound	calcareous gneiss near base of Unit 6
COPPER KING 82M-144	1976 — G. Adam (owner)	chalcopyrite	disseminated	quartzite in Unit 6
BLAIS — 1 82M-153	1978 — Cominco Ltd.	galena	disseminated	marble near base of Unit 6
SEYMOUR 82M-155	1978 — Dome Exploration Ltd.	chalcopyrite, galena, sphalerite, magnetite	disseminated	thin quartzite layer in marble in Unit 6
D & R 82M-200	1980 — R.D. Johnson (owner)	molybdenite	disseminated	orthogneiss in Unit 2
BASS	1978 — Cyprus Anvil Mining Corp.; Metallgesellschaft Canada Ltd.	sphalerite, galena, magnetite, pyrrhotite	massive, disseminated; stratabound	calcareous gneiss near base of Unit 6
82M-240	new occurrence	chalcopyrite, magnetite	disseminated, pods	marble-gneiss contact near base of Unit 6
82M-241	new occurrence	chalcopyrite, pyrrhotite, magnetite	small pods	impure marble near base of Unit 6
82M-242	new occurrence	chalcopyrite, magnetite	disseminated, pods	impure marble near base of Unit 6

Services Ltd. then acquired the claims adjoining the original Crown grant and these and others in the area (the Complex and Copper King properties) were remapped and sampled, and covered by magnetometer and induced polarization surveys in the period 1976 to 1978 in a joint venture with Metallgesellschaft Canada Ltd. As well, two holes totalling 517 metres in length were drilled in an attempt to intersect the mineralization in the core of the Mount Grace syncline between the Bass and Cottonbelt showings to the south and the McLeod to the north. It was unsuccessful and only a thin (a few metres) mineralized interval was encountered in the upper, western limb. There has been little subsequent work in the Cottonbelt area.

The small showings in the Blais Creek area (Figure 33) have received little attention. Only a few small pits mark the Seymour and Blais showings, and there is no record of work (other than surface mapping or sampling) in the vicinity of the other occurrences.

COTTONBELT (MI 82M-086)

INTRODUCTION

The Cottonbelt deposit is a thin calcareous layer, containing substantial quantities of galena, sphalerite and magnetite, on the west limb of the Mount Grace syncline. The sulphide-magnetite layer can be traced northward several kilometres where it is referred to as the Bass occurrence, and is repeated on the east limb of the syncline where it is known as the McLeod and Complex showings (Figure 33). These deposits are exposed on the gentle subalpine to tree-covered slopes of Mount Grace, at elevations ranging from approximately 1000 to 1900 metres (3300 to 6300 feet). They are accessible by a well-cut "pack trail" that leads northward from Seymour Arm or by a climb from the Ratchford Creek logging road to the south. The nearest permanent helicopter base is at Revelstoke, 60 kilometres to the south.

Although the general geology of the map area is outlined in Chapters 2 and 3, it is reviewed again as an introduction to the geology of the Cottonbelt deposit.

STRATIGRAPHY

The stratigraphic succession in the vicinity of the Cottonbelt deposit is repeated on both limbs of the Mount Grace syncline. It comprises a thick basal quartzite (Unit 3) that overlies the core paragneiss and orthogneiss, a sequence of calcareous and pelitic schists of Unit 4 (host to the Mount Grace carbonatite), a grey-weathering, white crystalline marble (Unit 5) and dominantly micaceous schist, calc-silicate gneiss and quartzite of Unit 6 (Figure 34). The Cottonbelt layer occurs near the base of Unit 6.

A number of detailed sections through the Cottonbelt deposit is illustrated in Figure 35. Unit 4c, a calcareous section at the top of Unit 4, includes interlayered dark grey, rusty weathering calcareous and micaceous quartzite, quartz-rich micaceous schist, fairly coarse-grained kyanite and sillimanite schist, dark to light green diopside garnet calc-silicate gneiss, and a thin grey-weathering calcite marble layer (*see* section CB4-3, Figure 35). The Mount Grace carbonatite occurs 8 metres below the base of Unit 5. A coarse-grained pegmatite and a fine-grained quartz feldspar orthogneiss occur between the carbonatite and the top of Unit 4. In the drill intersections (Figure 36), hornblende gneiss and a few amphibolite layers occur near the stratigraphic top of Unit 4 and a thin, fine-grained green chlorite amphibole schist layer occurs immediately below the marble of Unit 5. These amphibolite-rich layers are interpreted as basic volcanic flows and tuffs, correlative with massive amphibolites that occur in the Blais Creek section to the north (Unit 4d, Figure 24).

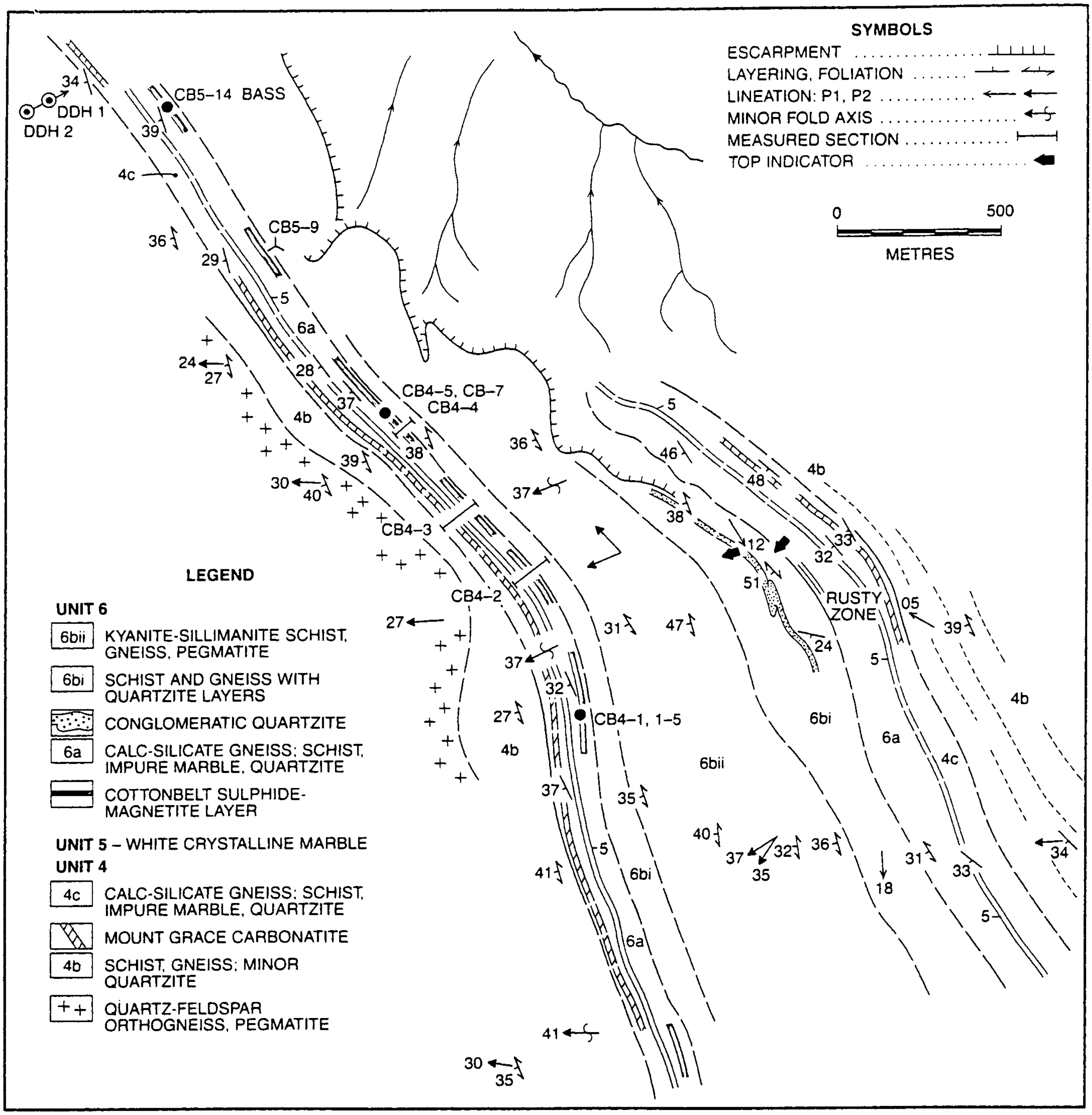


Figure 34. Detailed geology of the Cottonbelt deposit, Mount Grace area, showing sample and measured section localities.

Unit 5, a grey-weathering, white crystalline calcite marble, with thin dolomite and actinolite-rich layers that weather in relief, is 5 metres thick in section CB4-3. It is overlain by a dominantly calcareous succession (Unit 6a) at the base of Unit 6. Unit 6a includes interlayered sillimanite schist and light grey to green scapolite-bearing calc-silicate gneiss, a prominent, crumbly, grey to light brown-weathering impure dolomitic marble, and the Cottonbelt sulphide-magnetite layer. Very thin chert layers occur stratigraphically above the Cottonbelt layer. Calc-silicate gneiss occurs above the sulphide-magnetite layer at the top of Unit 6a in section CB4-3 and CB4-4, but sillimanite schist stratigraphically overlies it in section CB4-2 (Figure 35). Interlayered sillimanite schist, quartz feldspar gneiss, thin chert and impure quartzite layers of Unit 6b overlie Unit 6a.

STRUCTURE

The structure of the Cottonbelt area is dominated by the Mount Grace syncline, an early Phase 1 isoclinal recumbent fold that is draped around the northwestern margin of Frenchman Cap dome (Figures 2 and 3). The youngest rocks in the Cottonbelt area, schist and gneiss of Unit 6a, are

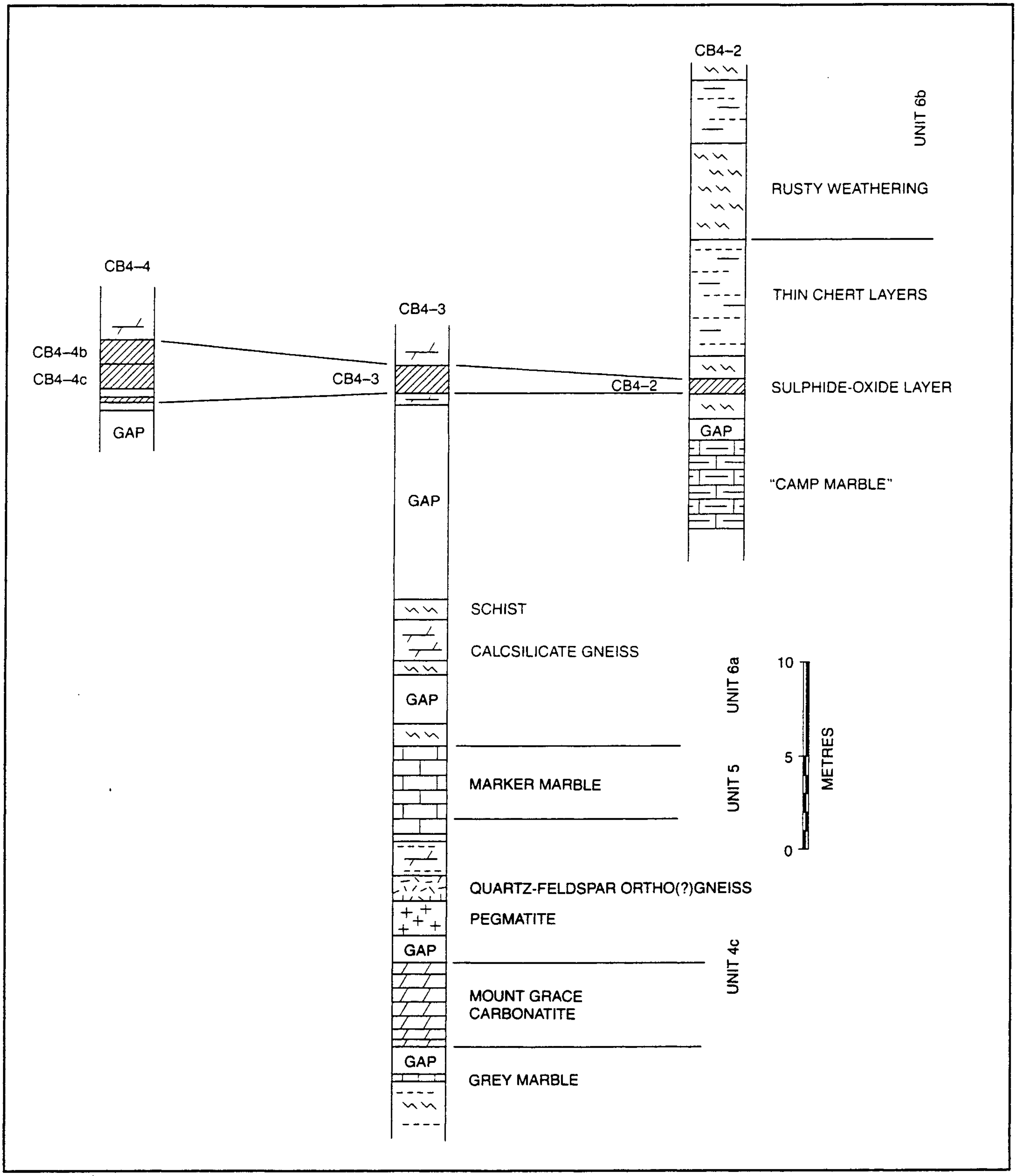


Figure 35. Measured sections through the Cottonbelt deposit; sections are located in Figure 34.

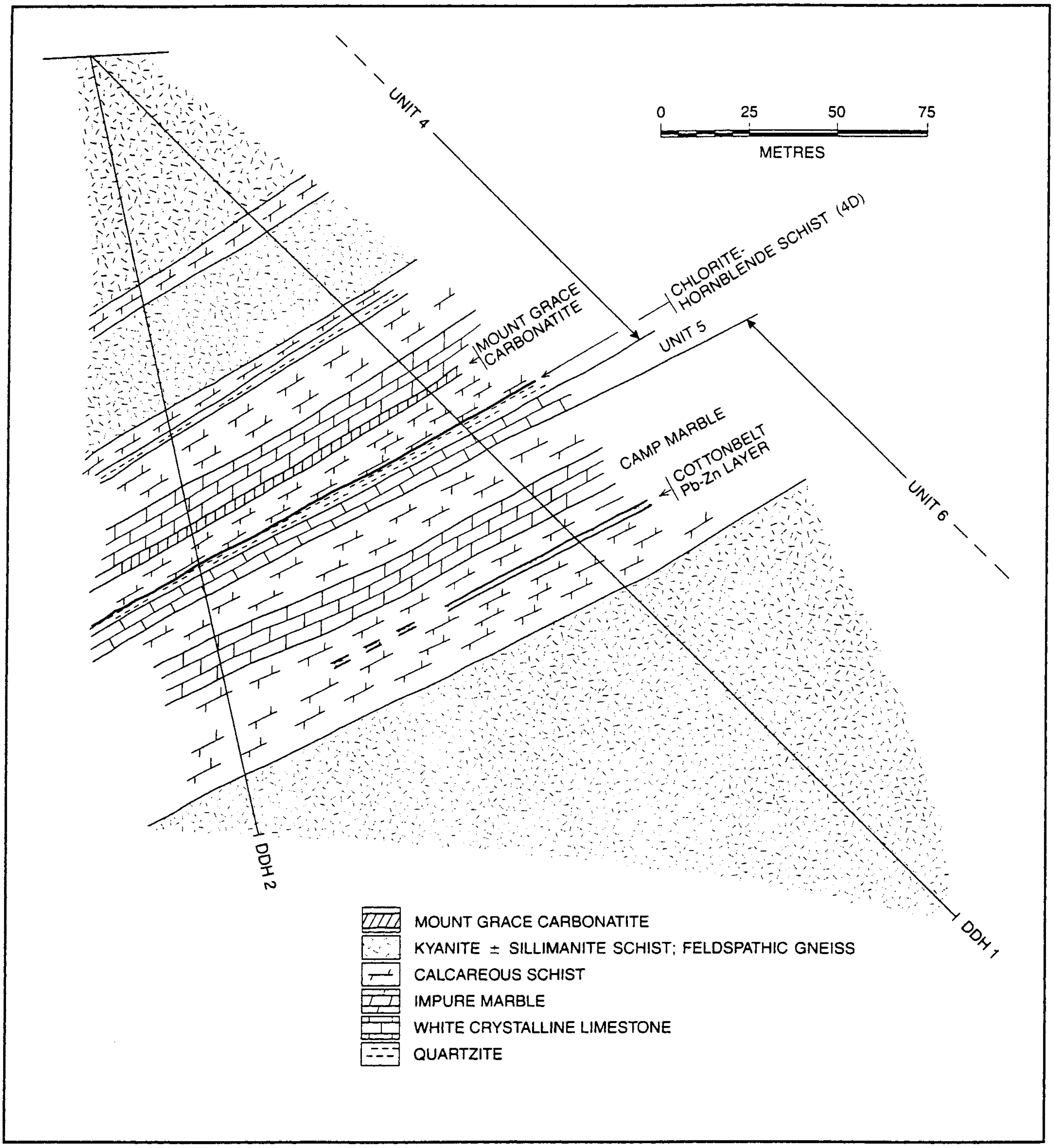


Figure 36. Drill sections through the Cottonbelt deposit, viewed to the north. Note section is structurally inverted on the west limb of the Mount Grace syncline (drill holes are located in Figure 34).

TABLE 8. BASE METAL AND PRECIOUS METAL VALUES OF COTTONBELT SAMPLES

Field No.	Lab. No.	Description	Pb %	Zn %	Au ppm	Ag ppm	Cu %	Cd ppm	Fe %	Mo ppm	Co ppm	Cl ppm
CB4-1	20025	1	4.45	0.27	<1.0	30	0.0125	25	34.4	13	7	
CB4-2	20026	1.5	7.81	0.87	<1.0	78	0.0155	55	18.3	14	8	
CB4-3	20027	1.5	11.25	1.03	<1.0	65	0.0070	60	19.1	16	7	
CB4-4B	20028	1.5	4.18	3.50	<1.0	23	0.0090	170	23.8	10	10	
CB4-4C	20029	1.5	6.75	1.40	<1.0	52	0.0060	87	30.0	6	7	
CB-7	25528	5	0.17	0.52		5	0.014		34.8	3		
CB5-9	25529	5	8.2	3.90		78	0.0025		26.0	<3		
CB5-14	25530*	1.5	3.8	0.20		29	0.0025		35.95	5		
CB1-5	30318	1	5.36	0.11	1	24	0.003	19		<3		27
CB1-5A	30319	1	0.018	0.48	<0.3	<10	0.007	8		<3		<25
CB1-5.1	30320	1	16.4	0.59	4.8	94	0.009	48		<3		<25
CB1-5.3	30321	2	0.68	0.018	<0.3	<10	0.001	29		<3		<25
CB4-2	30322	5	0.72	0.49	0.7	62	0.013	26		<3		27
CB4-2B	30323	3	0.48	0.56	<0.3	<10	0.003	19		<3		100
P13-3	30324	1	0.38	0.70	0.3	<10	0.005	19		<3		48
CB13-5	30325	4	0.05	0.02	0.3	<10	0.002	5		<3		<25
P14	30326	1	0.06	0.69	0.7	<10	0.003	20		<3		39
P14-2	30327	2	0.88	3.76	<0.3	<10	0.002	200		<3		<25
P16-1	30328	1.5	2.40	0.90	<0.3	<10	0.004	20		<3		51
P16-2	30329	1.5	6.82	2.65	0.3	64	0.005	115		<3		72
P17	30330	1.5	0.26	0.75	<0.3	<10	0.003	11		<3		37
P17-2	30331	2	0.77	0.019	<0.3	<10	0.002	6		<3		<25

Description:

1 — Massive magnetite, sulphides with siliceous gangue.
2 — Marble with disseminated sulphides ± magnetite.
3 — Calcareous gneiss with disseminated sulphides ± magnetite.
4 — Black, graphitic schist, minor magnetite, sulphides.
5 — Dark green, massive, siliceous "skarn" with magnetite, sulphides.
* Bass occurrence.

exposed in its core, and the calcareous succession that hosts the Cottonbelt deposit and the Mount Grace carbonatite layer are repeated in its limbs.

Metallgesellschaft Canada Ltd. attempted to drill the Cottonbelt-McLeod sulphide-magnetite layer in the hinge of the Mount Grace syncline (Wellmer, 1978). However, mineral lineations and minor folds indicate that the fold plunges west to southwest (*see* Chapter 3) and its closure is therefore located south of Cottonbelt; hence the two holes drilled (Figure 36) penetrated only the inverted upper limb of the fold.

MINERALIZATION

Introduction

The Cottonbelt sulphide-magnetite layer has been traced or projected on surface for approximately 2.5 kilometres along the upper western limb of the Mount Grace syncline and a thin mineralized interval has been intersected in drill holes a further 2 kilometres to the north. The thickness of the layer varies from 15 centimetres in the drill intersections to a maximum of approximately 3 metres, with average widths of 1 to 2 metres (Plate 31). Geological reserves are estimated at approximately 725 000 tonnes containing 6 per cent lead, 5 per cent zinc and 50 grams silver per tonne. Northwest of Blais Creek, a zone of rusty weathering calcareous schist occurs at approximately the same stratigraphic interval.

The sulphide-magnetite layer in the northeast limb of the Mount Grace syncline, referred to as the McLeod and Complex showings and interpreted to be a fold repetition of the Cottonbelt deposit, is up to 3 metres thick and has been traced approximately 600 metres along strike. It continues for an additional 2200 metres to the southeast as a zone of disseminated pyrrhotite in calcareous gneiss (Kovacik, 1977). It is described in more detail following.

Sulphide-Magnetite Mineralization

Three types of mineralization are evident in the Cottonbelt deposit. The most abundant is massive to crudely banded, dark green, hard, massive olivine-pyroxene-amphibole calc-silicate gneiss containing variable amounts of sphalerite, galena and magnetite, minor pyrrhotite, and traces of chalcopyrite, pyrite, tetrahedrite and molybdenite (Plate 32). Additional gangue minerals include biotite, carbonate and apatite. Sulphides and magnetite are generally medium to coarse grained and may be closely intergrown or segregated into essentially monomineralic layers or magnetite-sphalerite and sphalerite-galena layers a few millimetres thick. In general, however, the rock is massive and layering is only poorly developed. With an increase in silicate content, the mineralized layer becomes lighter coloured and layering is more pronounced. Thin sulphide-magnetite layers, mineralogically similar to the massive layers, occur interbedded

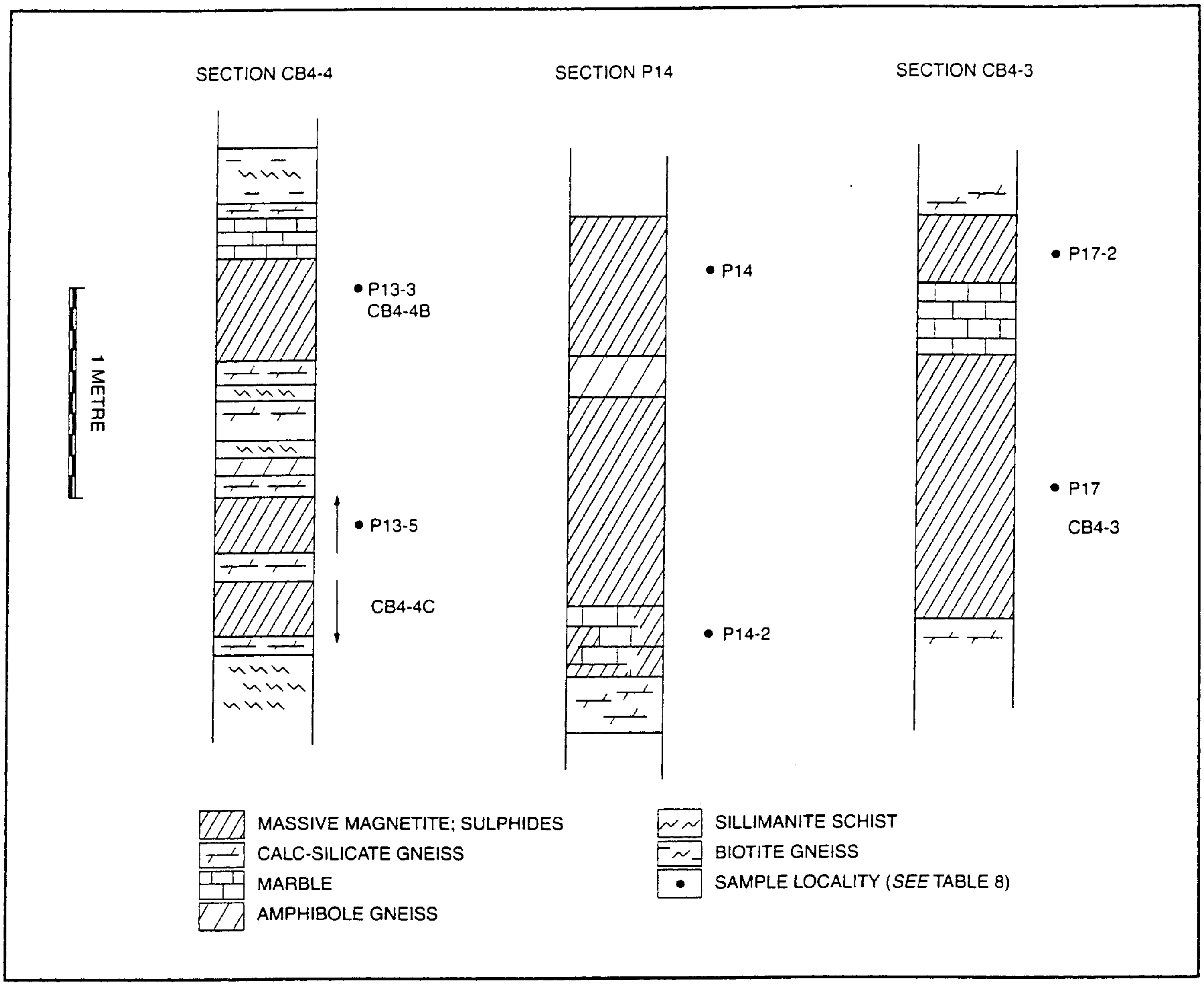


Figure 37. Detailed sections through the Cottonbelt sulphide-magnetite layer and location of analysed samples.

with thin bands of garnet-diopside calc-silicate and sillimanite schist. The third type of mineralization consists of disseminated galena and sphalerite with only minor magnetite and pyrrhotite in a light grey granular marble (Plate 32). Accessory minerals in the marble include garnet, diopside, actinolite and phlogopite.

Detailed sections through the Cottonbelt zone (Figure 37) illustrate the well-layered nature of the deposit, with massive to bedded sulphides and magnetite interlayered with calc-silicate gneiss, sillimanite gneiss, impure marble and amphibolite. Immediate hangingwall and footwall rocks are most commonly calc-silicate gneiss or impure marble. Sillimanite schist or biotite gneiss that commonly overlies the mineralization are invariably separated from the sulphide layer by a thin selvage of amphibolite or calc-silicate gneiss.

Chemical analyses of both chip and selected grab samples of the Cottonbelt layer are shown in Tables 8 and 9. Samples are located in Figure 34 and some are plotted on the sections in Figure 35. Gangue mineralogy and oxide chemistry are discussed in the section following.

Table 8 shows the highly variable tenor of the sulphide-magnetite layer, largely reflecting the variable nature of the samples, including marble and calc-silicate gneiss with disseminated sulphides, magnetite-rich silicates and massive magnetite and sulphides. Lead analyses vary from 0.05 to 16.4 per cent, zinc from approximately 0.02 to 3.9 per cent, and silver from 10 to 94 ppm. Copper is generally low, with only one analysis approaching 1 per cent. Base metal ratios are also highly variable. Pb/Pb + Zn ratios vary from 0.04 to 0.98 with approximately 40 per cent in the range 0.90 to 0.98.

These metal values and ratios, with relatively high lead and low copper, are more typical of carbonate-hosted than clastic-hosted lead-zinc deposits (Sangster, 1968). However, the unusual gangue mineralogy and chemistry distinguish Cottonbelt from these deposits.

TABLE 9. MAJOR ELEMENT ANALYSES (A) AND TRACE ELEMENT VALUES (B) OF COTTONBELT SAMPLES

TABLE 9A
(in %)

Field No.	Lab. No.	Description	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	P_2O_5
CB1-5	30318	1	14.31	1.55	55.42	6.92	1.46	0.02	0.009	0.08	2.12	0.02
CB1-5A	30319	1	15.25	1.20	61.43	5.92	1.68	0.03	0.020	0.02	2.53	0.02
CB1-5.1	30320	1	9.87	1.84	46.08	6.53	2.74	0.03	0.060	0.04	9.61	0.17
CB1-5.3	30321	2	11.75	4.21	12.33	11.50	26.59	0.04	1.49	0.22	2.40	0.37
CB4-2	30322	5	31.62	2.81	18.72	4.91	1.22	0.04	0.026	0.08	7.98	0.31
CB4-2B	30323	3	48.22	15.98	9.45	4.62	11.46	0.47	5.00	0.56	1.40	0.19
P13-3	30324	1	27.23	1.86	53.56	4.36	0.60	0.03	0.182	0.03	12.08	0.05
P13-5	30325	4	3.03	1.21	47.57	4.14	11.74	0.06	0.153	0.06	11.83	0.09
P14	30326	1	14.60	1.50	61.67	4.94	1.57	0.03	0.080	0.03	13.28	0.11
P14-2	30327	2	12.03	1.69	18.50	4.93	25.44	0.05	0.89	0.08	5.40	0.10
P16-1	30328	1.5	31.29	0.71	53.33	5.30	1.18	0.04	0.021	0.01	9.79	0.07
P16-2	30329	1.5	27.36	1.21	49.79	4.39	1.11	0.05	0.038	0.01	9.62	0.10
P17	30330	1.5	29.69	0.89	53.41	4.95	1.69	0.02	0.182	0.01	10.72	0.05
P17-2	30331	2	6.26	2.99	19.19	4.65	26.79	0.06	0.94	0.13	6.14	0.20

Description:

1 — Massive magnetite, sulphides with siliceous gangue.
2 — Marble with disseminated sulphides ± magnetite.
3 — Calcareous gneiss with disseminated sulphides ± magnetite.
4 — Black, graphitic schist, minor magnetite, sulphides.
5 — Dark green, massive, siliceous "skarn" with magnetite, sulphides.
* Bass occurrence.

TABLE 9B
(in ppm except as noted)

Field No.	Lab. No.	Ti	Ta	Rb	Sr	Ba	F	V	Zr	Mn (%)
CB4-1	20025	625	<30	<5	55	71	300	46	51	7.99
CB4-2	20026	1540	<30	<5	15	33	375	100	103	6.39
CB4-3	20027	390	<30	<5	33	25	260	45	66	6.36
CB4-4B	20028	625	<30	<5	8	40	350	46	49	7.48
CB4-4C	20029	660	<30	<5	40	65	575	200	63	7.86
CB7	25528									6.78
CB5-9	25529									5.13
CB5-14	25530									8.26
CB1-5	30318				<50	449				
CB1-5A	30319				<50	348				
CB1-5.1	30320				57	172				
CB1-5.3	30321				602	726				
CB4-2	30322				<50	84				
CB4-2B	30323				224	1457				
P13-3	30324				<50	172				
P13-5	30325				232	134				
P14	30326				<50	58				
P14-2	30327				542	222				
P16-1	30328				<50	<50				
P16-2	30329				<50	<50				
P17	30330				<50	146				
P17-2	30331				459	310				

GANGUE MINERALOGY AND CHEMISTRY

Major element analyses of the Cottonbelt sulphide-magnetite layer (Table 9A) are highly variable reflecting host rocks that range from impure marble to calc-silicate gneiss. Alkali content is low, generally less than 1 per cent, although one sample of calc-silicate gneiss containing abundant phlogopite, CB4-2B, returned 5 per cent K_2O. CaO varies from approximately 1 per cent in essentially massive sulphide-magnetite samples that have only minor gangue minerals, to greater than 25 per cent in mineralized marbles. A common and distinctive feature of the mineralized layer is the high MnO content, ranging from 1.4 to 13.28 per cent (Table 9A).

Gangue minerals are unusual as they reflect the high manganese content and overprinting of regional metamorphism to upper amphibolite facies. Recognition and identification of these gangue minerals are by standard petrography and X-ray defraction analyses. Silicate minerals include varying proportions of knebelite (a manganiferous olivine), actinolite, diopside and a manganiferous pyroxene, spessartine, biotite and minor secondary chlorite. Ankerite is the dominant carbonate, but minor calcite and kutnahorite, a calcium-manganese carbonate, have also been identified. Accessory minerals include epidote, plagioclase, graphite, gahnite and hematire.

A dark green massive olivine is the dominant silicate gangue mineral in many massive sulphide samples. X-ray defraction analysis indicates it is a manganese fayalite and its optical properties indicate a composition that approximates $(Fe_{56-83}, Mn_{10-24}, Mg_{7-20})_2SiO_4$ (Johnson, 1980a) and, as such, it is called knebelite. Knebelite is a distinctive mineral in metamorphosed iron-manganese deposits. It also occurs as gangue in massive sulphide deposits at the Bluebell silver-lead-zinc deposit in the Kootenay Arc (Höy, 1980b). Pyroxenes include diopside, hedenbergite, a manganese-rich mag-

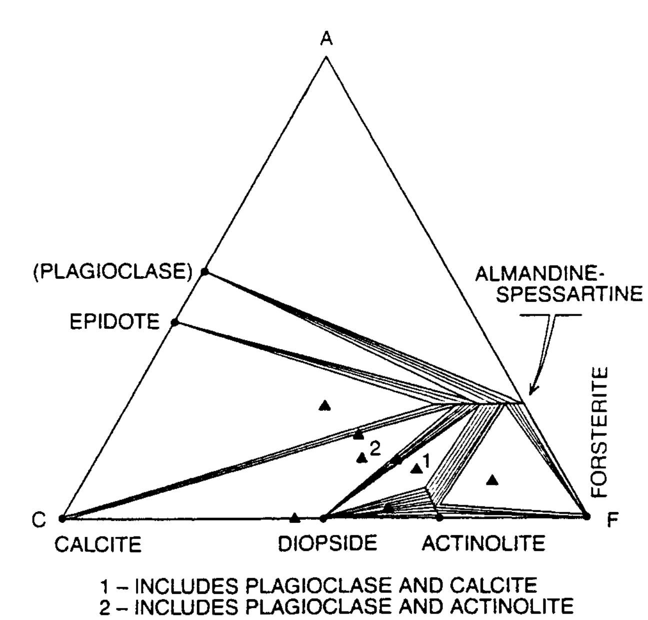


Figure 38. ACF diagram illustrating gangue mineral assemblages, Cottonbelt deposit.

nesium clinopyroxene called kanoite, and less commonly a manganiferous orthopyroxene, eulite (Johnson, 1980a). Kanoite has been recognized in metamorphosed manganese ore in Japan (Kobayashi, 1977) and eulite is reported in some regionally metamorphosed iron-rich sediments (Deer *et al.*, 1978). Actinolite is the dominant amphibole and in some samples is the dominant silicate mineral. Cummingtonite (grunerite?), containing minor manganese, may also be abundant. Porphyroblasts of spessartine-almandine garnet occur in most calc-silicate gneiss host rocks, and biotite occurs as a minor phase in both mineralized impure marble and calc-silicate gneiss. Epidote is uncommon, but was recognized as a minor phase in a mineralized calc-silicate gneiss. Rare plagioclase grains and retrograde chlorite occur in a few samples.

The most common and abundant carbonate mineral associated with the massive sulphides is ankerite. Kutnahorite commonly occurs with ankerite, and calcite is abundant in mineralized marble, but is a minor constituent of the massive sulphide-magnetite mineralization.

Metamorphism

The Cottonbelt mineralized layer has undergone the regional amphibolite grade metamorphism that has affected the country rocks. The prevalent mineral assemblages are graphically displayed on an ACF diagram (Figure 38). These assemblages, and the extensive solid solution among minerals, are diagnostic of amphibolite grades in manganiferous iron formations (Haase, 1982). The compositional ranges depicted on the diagram are schematic but reasonable; they are based on ranges typically occurring in these phases at these metamorphic grades. The diagram, however, only depicts two and three-phase mineral assemblages. The common occurrence of four, and less commonly five-phase assemblages (for example, olivine, amphibole, actinolite, diopside and garnet) is likely the result of extensive solid solution among the minerals and the effect of additional components (such as MnO) in the system.

Depositional Environment

An understanding of the depositional environment is only possible if the original mineralogy of the Cottonbelt layer can be determined. Premetamorphic assemblages are not known as the layer occurs only within rocks of amphibolite grade. This metamorphism has totally recrystallized and annealed the mineral assemblages, masking any original depositional textures. Determination of the pre-metamorphic mineralogy requires comparison with iron formations and sulphide deposits that occur at lower metamorphic grades.

The most common oxide facies of iron formations are hematite and magnetite. Magnetite may be a primary phase (Klein and Buiku, 1977), but is more likely formed during diagenesis (Dimroth and Chauvel, 1973), or during regional metamorphism from a reaction involving siderite or hematite. It is unlikely that magnetite in the Cottonbelt deposit formed from an iron sulphide because other massive sulphide bodies in the Shuswap Complex have retained their sulphide (pyrite-pyrrhotite) assemblages at high metamorphic grades (for example, Jordan River, Fyles, 1970a; Big Ledge, Höy, 1977a). It is assumed, therefore, that magnetite in the Cottonbelt deposit formed early, probably during diagenesis.

The most abundant carbonate in the deposit is ankerite. Ankerite is common in iron formations and is therefore assumed to be formed early and later recrystallized at Cottonbelt. Dolomite is now rare, but was probably more abundant initially, providing a source of magnesium; subsequent metamorphism has converted it and available silica to calcite and calcareous and magnesian silicates. Calcite was undoubtedly present as a primary mineral in the calcite marbles that host disseminated sulphides and magnetite. Kutnahorite, a manganiferous carbonate, may be a metamorphic mineral formed from a reaction involving either a manganese oxide or manganese carbonate such as rhodochrosite with calcite or dolomite.

The two more important sulphide minerals, galena and sphalerite, are common in many unmetamorphosed mineral deposits and are assumed to have been present at Cottonbelt before metamorphism. The metamorphic silicate minerals diopside, actinolite, cummingtonite, knebelite and spessartine formed from reactions between aluminous clays or detrital minerals, calcareous and magnesian carbonates, and manganiferous oxides or carbonates.

In summary, pre-metamorphic minerals are inferred to include dominantly magnetite (or perhaps hematite) and minor pyrite, galena, sphalerite and chalcopyrite. Carbonates included ankerite, probably dolomite, and perhaps a manganese carbonate. Calcite may only have been present in calcareous layers that host disseminated sulphides and magnetite. Clay minerals and perhaps detrital feldspars were the source of aluminum, and silica may have been present as iron silicates such as greenalite or as chert; thin chert layers in adjacent beds suggest some precipitation of silica, but deposition during formation of the sulphide-magnetite layer was

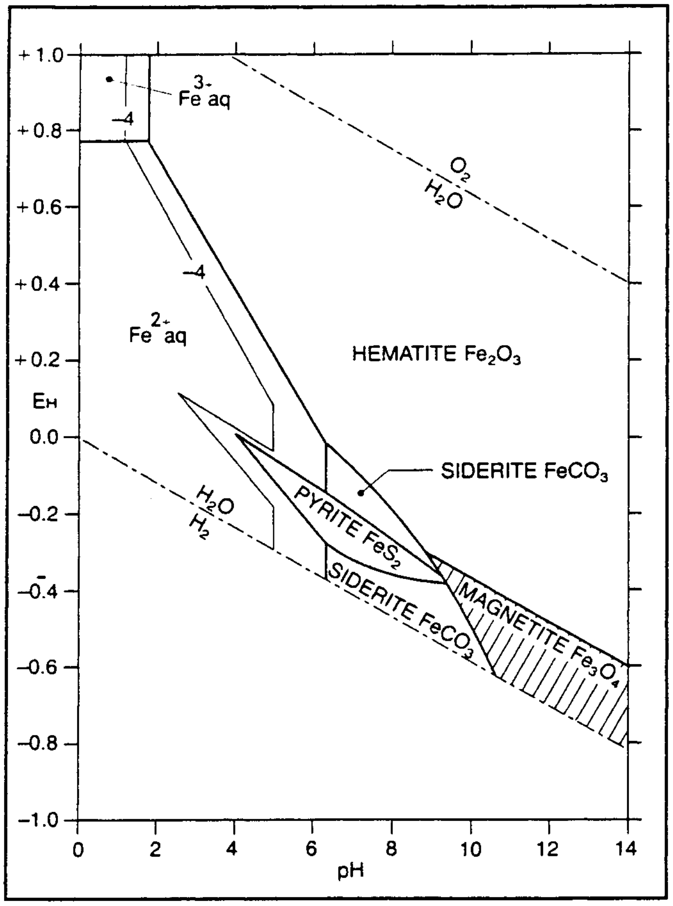


Figure 39. Eh-Ph phase diagram showing stability field of iron phases, Cottonbelt deposit. (after Garrels & Christ, 1977).

minimal as the silica has completely reacted to form metamorphic silicate minerals.

These assemblages may be used to estimate conditions during deposition of the sulphide-magnetite layer. The stability field of magnetite is essentially restricted to a basic, reducing environment (in water at 25°C, 1 atmosphere pressure and in the presence of sulphur; Figure 39). Hematite is stable in a more oxidizing environment. Galena and sphalerite are stable over a larger Eh and Ph range (Garrels and Christ, 1967), a range that overlaps the magnetite field in a basic, reducing environment. Chalcopyrite is the stable copper mineral in this environment and rhodochrosite the stable manganese mineral. The abundance of sphalerite and galena and their association with magnetite therefore suggests deposition in a reducing basin with only a limited supply of sulphur available. As reduction of seawater sulphate is generally considered the primary source of sulphur in stratabound base metal deposits, a restricted basin and hence limited supply of sulphate is inferred.

The succession that hosts the Cottonbelt deposit records a marine transgression over a regional unconformity (*see* Chapter 2). Host rocks were deposited on a shallow marine platform, a sedimentary setting common to many banded iron formations. A shallow, restricted basin within the platform is indicated by the abundance of scapolite, formed by metamorphism of evaporites, and a reducing environment, by graphite. It is therefore concluded that the Cottonbelt sulphide-magnetite layer was deposited directly on the seafloor, in a shallow restricted, perhaps lagoonal basin on a large carbonate-clastic platform.

Volcanism may have been an important factor as the ultimate source of iron and manganese in the deposit and in the generation of a convective hydrothermal system. Basic volcanic rocks occur beneath the projected position of the mineralized horizon north of Blais Creek. The unusually high lead and zinc content, generally characteristic of sedimentary exhalative deposits rather than volcanogenic deposits or iron formations, probably results from scavenging of these metals from the thick underlying accumulation of sedimentary rocks.

Conclusions

The spatial association of base metals with iron formations is commonly recognized in volcanogenic massive sulphide deposits. Less commonly, iron formations have been described as distal equivalents of lead-zinc deposits. In Ireland, the Tynagh iron formation is believed to have formed as an exhalite in the laterally equivalent Waulsortian mud bank deposits during deposition of the Tynagh lead-zinc-copper-barite deposit (Russell, 1975), and in southwestern Quebec, magnetite-rich iron formations are correlative with stratiform lead-zinc deposits in the Grenville Province (Gauthier and Brown, 1986). Stratabound galena-sphalerite-magnetite deposits similar to Cottonbelt, or iron formations enriched in lead and zinc are uncommon. Gamsberg in South Africa is a stratiform sphalerite-galena-magnetite deposit that has undergone amphibolite facies regional metamorphism (Rozendaal and Stumpfl, 1984). The La Union lead-zinc orebody in southeastern Spain (Oen *et al.*, 1975) consists, in part, of disseminated to banded galena, sphalerite and pyrite in a "greenalite-silica/magnetite rock" or banded iron formation (D.J. Alldrick, personal communication, 1986). Alldrick suggests the deposit may be a "primary chemical precipitate" rather than "subvolcanic-hydrothermal" as suggested by Oen *et al.* (*op. cit.*).

The unusual association of magnetite rather than pyrite with galena and sphalerite in this deposit type is a function of conditions in the depositional environment. Magnetite deposition is favoured in a basic, reducing environment as would occur in a restricted, highly saline, shallow-marine or lagoonal basin. Furthermore, the availability of sulphur from reduction of seawater sulphate would also be limited in a restricted basin, tending to support magnetite rather than pyrite formation; available sulphur reacts initially with lead and zinc and only excess sulphur is available to react with iron to form pyrite. In basins more typical of base metal deposition, lower Ph, higher Eh, and an increased availability of sulphur allows deposition of iron sulphides producing the typical pyrite-galena-sphalerite association.

BASS

The Bass occurrence is the northwestern extension of the Cottonbelt layer (Figure 33), and as such is chemically and mineralogically similar to Cottonbelt. An adit at 1615 metres elevation exposes approximately 1.5 metres of massive, siliceous magnetite-sulphide mineralization. It comprises mag-

TABLE 10. ANALYSES OF SAMPLES OF THE McLEOD LAYER AT THE McLEOD ADIT

(*See* Figure 40 for location.)

Sample No.	Mineralization	Pb %	Zn %	Ag g/t	Cu %	Fe %
CB2-C	massive	4.8	0.10	86	0.88	19.8
CB2-D	disseminated	0.88	0.03	16	0.02	19.4

netite, galena, sphalerite, minor pyrrhotite, pyrite and chalcopyrite. Analyses of a selected grab sample (CB5-14, Table 8) returned 3.8 per cent lead and 0.20 per cent zinc. The high iron (36 per cent) reflects the high magnetite content. The hangingwall and footwall are siliceous marble, 30 centimetres thick, then calc-silicate gneiss. The layer strikes 160 degrees and dips 40 degrees west.

McLEOD AND COMPLEX (MI 82M-125)

The McLeod, and its extension to the northwest referred to as the Complex showing, are a repetition of the Cottonbelt layer on the east limb of the Mount Grace syncline. It has been described by various authors, including Boyle (1970), Kovacik (1977) and Shearer (1985); the following description is summarized from these reports.

Mineralization is similar to Cottonbelt, dominantly magnetite with galena, sphalerite, and minor chalcopyrite, pyrrhotite and pyrite in a layer up to several metres thick. In contrast with Cottonbelt, however, the mineralized zone is part of a right-way-up stratigraphic succession that strikes approximately 155 degrees and dips 40 degrees southwest.

The McLeod-Complex layer overlies a white crystalline marble and a fine-grained, rusty weathering biotite schist (Figure 40). Hangingwall rocks include a thin marble band and calc-silicate gneiss followed by more than 30 metres of interlayered biotite schist and calc-silicate gneiss. Elsewhere, biotite schist directly overlies the mineralized layer (Kovacik, 1977).

The mineralization averages 1.5 metres in thickness and can be traced 100 metres southeast of the McLeod adit before it is replaced by disseminated iron sulphides in calc-silicate gneiss (Boyle, 1970; Kovacik, 1977). The disseminated sulphide facies can be traced a further 2200 metres to the southeast. It is not traceable to the northwest, although the footwall limestone continues to Blais Creek (Boyle, 1970).

The most recent extensive sampling of the McLeod-Complex layer, 21 surface chip samples along the exposed length of the zone, returned an average of 5.37 per cent lead, 6.51 per cent zinc and 97 grams silver per tonne across an average width of 1.4 metres (Allen, 1966). Analyses of two samples from the McLeod adit (*see* Figure 40) are summarized in Table 10. More massive magnetite-sulphide mineralization near the base of the layer contains 4.8 per cent lead, 0.1 per cent zinc and 86 grams silver per tonne; a sample of disseminated mineralization in more calcareous gneiss near the top of the layer returned considerably lower values.

COPPER KING (MI 82M-144)

The Copper King deposit is hosted by quartzite of Unit 6 in the core of the Mount Grace syncline, south of the McLeod adit (Figure 33). The quartzite is interlayered with thin beds of marble and micaceous schist. It is underlain by interbedded light grey quartz feldspar paragneiss and micaceous schist and overlain by schist. Mineralization, comprising disseminated chalcopyrite and minor bornite, sphalerite and pyrite, ranges up to 3 metres in thickness and has been traced along strike for at least 300 metres. An adit 50 metres in length driven along a more extensively mineralized portion of the zone was reopened and resampled in 1970 (*see* Boyle, 1970; Table 11); additional analyses of the Copper King mineralization (Allen, 1966) are also presented in Table 11.

SEYMOUR (MI 82M-155)

Mineralization on the Seymour claims was discovered in 1978 during a follow-up exploration program of silt and soil geochemical anomalies (Woodcock and Booth, 1978). It includes a number of small occurrences of sulphides and magnetite within or adjacent to a marble layer south of Blais Creek (Figures 3 and 33). Its stratigraphic position, near the base of Unit 6, and its mineralogy suggest that these occurrences and their extension north of Blais Creek may be distal equivalents of the Cottonbelt and McLeod-Complex layer. Descriptions of the occurrences are taken from Woodcock and Booth (1978); only occurrence 155c (Figure 3) has been visited by the author.

Showing 155a comprises disseminated chalcopyrite in a quartz-marble breccia bed 10 centimetres thick. Observed mineralization is restricted to a number of boulders at the base of a small cliff. A specimen assayed 1.02 per cent copper.

Showing 155b is a 10-centimetre-thick quartzite layer adjacent to a marble bed that contains minor disseminated chalcopyrite. A galena-rich section 2 metres long assayed 16.1 per cent lead and 0.8 per cent zinc.

Showings 155c and **155d** are along a discontinuous lens of coarse-grained magnetite, garnet and hornblende. Showing 155c has a maximum thickness of 30 centimetres and a possible length of 15 metres; a sample across the lens contained 0.05 per cent zinc, 175 ppm copper and 38 ppm lead. Showing 155d is 25 centimetres thick, possibly 10 metres long and assayed 0.04 per cent zinc, 740 ppm copper and trace lead.

TABLE 11. ANALYSES OF THE COPPER KING DEPOSIT [from Allen, 1966 (1); Boyle, 1970 (2)]

Sample No.	Sample Width	Cu %	Ag g/t	Au g/t	Reference
1	~1.5 m	3.95	~3	~0.15	1
2	~1.5 m	4.35	~10	~0.30	1
3	~1.5 m	3.85	~3	~0.15	1
19576	~2.0 m	1.98	~4.5		2
19577	~2.0 m	1.96	~3.0		2
19578	1.5 m	3.55	~6.5		2
19599	2.0 m	0.08	Trace		2

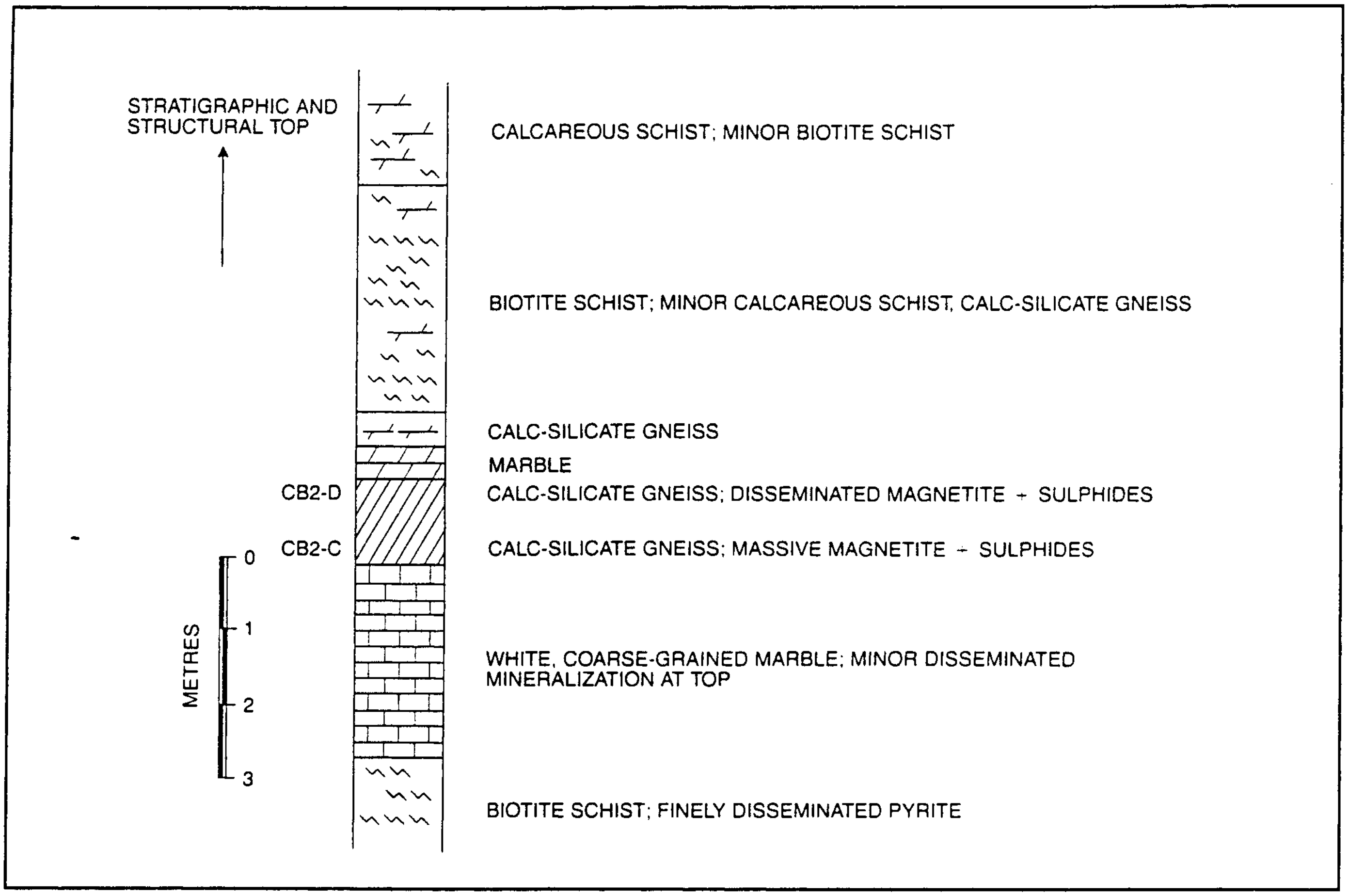


Figure 40. A section through the McLeod layer at the McLeod adit.

Showing 155e is a lens of quartzite 15 centimetres thick and 1 metre long that contains a few coarse grains of chalcopyrite and galena.

BLAIS (MI 82M-153)

The Blais occurrence, and a number of similar occurrences to the northeast (Figure 33), are at approximately the same stratigraphic level as the Seymour showings. Blais consists of a carbonate lens with disseminated galena approximately 15 centimetres thick and up to 20 metres in length (Woodcock and Booth, 1978).

OCCURRENCE CB14-9 (MI 82M-240)

This occurrence consists of magnetite and minor chalcopyrite, marked by conspicuous malachite staining, in a very rusted zone approximately 20 centimetres thick at the contact of a marble and calc-silicate gneiss. A small pit, filled with snow at the time of the author's visit (July 1978), indicates previous exploration of the zone.

OCCURRENCE CB14-12 (MI 82M-242)

This occurrence, approximately 500 metres east of CB14-9 (MI 82M-240, Figure 33), comprises a 15 to 20-centimetre-thick interval of minor chalcopyrite and magnetite mineralization, associated with hornblende, near the top of the coarse-grained white crystalline marble.

OCCURRENCE CB16-2 (MI 82M-241)

Occurrence CB16-2 includes a number of small rusty zones within the coarse crystalline marble. The zones contain chalcopyrite, magnetite and pyrrhotite in a siliceous matrix that includes pyroxene, garnet, amphibole and fayalite, an iron-rich olivine.

D & R (MI 82M-200)

The D & R occurrence consists of minor disseminated molybdenite in a quartz syenite orthogneiss within rocks correlated with core gneisses (Figure 33). It is similar to a small molybdenite showing in syenite orthogneiss in the Perry River area (*see* Chapter 4). The host syenite (Figure 3) has a maximum exposed width of about 200 metres and a strike length of at least 1300 metres. Petrographic descriptions of the syenite (Johnson, 1980b) indicate it consists mainly of feldspar (35 to 55 per cent), perthite (up to 50 per cent), and plagioclase (30 to 50 per cent) with minor biotite and less than 5 per cent quartz. It is conformable with host hornblende and pelitic paragneisses.

Molybdenite mineralization appears to be restricted to an area of approximately 4 square metres near the structural base of the orthogneiss. Three assays of the mineralization returned 0.10 per cent, 0.65 per cent and less than 0.01 per cent MoS_2 (Johnson, 1980a).

SHUSWAP MASSIVE SULPHIDE DEPOSITS

INTRODUCTION

A number of large stratabound lead-zinc deposits occur within dominantly calcareous successions along the margins of Frenchman Cap dome and Thor-Odin nappe to the south (Figure 41). Although a number of these have been extensively explored, there has been no significant production from them. They are thin but very extensive laterally, are commonly structurally complex, and many are in formidable mountainous terrain. These deposits, and others within the complex (Table 12), consist of a single layer of massive to irregularly banded sulphides or a series of lenses generally within thin calcareous or graphitic schist units. They are folded and metamorphosed together with their host rocks.

The Cottonbelt and Jordan River deposits are in paragneiss that overlies core gneiss of Frenchman Cap dome. Ruddock Creek, located approximately 40 kilometres north of Cottonbelt (Figure 41), is also within a highly deformed, dominantly calcareous succession that structurally overlies the Cottonbelt and Jordan River succession. Big Ledge, loeated 60 kilometres south of Revelstoke, along the southern margin of Thor-Odin nappe, is within a paragneiss succession that correlates approximately with the Cottonbelt succession. Other stratabound lead-zinc deposits within the Shuswap Complex include Colby and CK: the Rift deposit north of Revelstoke is similar to the Shuswap deposits although it occurs just east of the Columbia River fault.

JORDAN RIVER (MI 82M-001)

A sulphide-rich layer less than a metre to 6 metres in thickness forms part of the lithological sequence in the Jordan River area (Fyles, 1970a) on the southern margin of Frenchman Cap dome (Figure 41). On the Jordan River (King Fissure) property, it is exposed in the limbs and hinge of the tight south to southeast-plunging Copeland synform. Reserves in the south limb have been calculated as 2.6 million tonnes containing 5.1 per cent lead, 5.6 per cent zinc and 35 grams silver per tonne (*see* Fyles, *op. cit.*).

The mineralized bed consists most commonly of a "fine-grained intimate mixture of sphalerite and pyrrhotite with conspicuous eye-shaped lenses of grey, watery quartz and scattered grains of pyrite and galena" (Fyles, *op. cit.*, page 41). Locally, it is well layered and includes minor pods and lenses of calc-silicate gneiss, schist, marble or barite. It is within a calcareous succession of calc-silicate gneiss, micaceous schist, marble and quartzite, and is structurally overlain by a quartzite-rich succession followed by a sillimanite gneiss unit.

Correlation of this succession along the western margin of Frenchman Cap dome (Höy and McMillan, 1979; Höy and Brown, 1981) indicates that the Jordan River sulphide layer lies within Unit 6 at approximately the same stratigraphic level as the Cottonbelt deposit (*see also* Figure 8).

RUDDOCK CREEK (MI 82M-083)

Ruddock Creek (Figure 41) is a sulphide layer up to 15 metres thick that comprises interlayered calcareous quartzite, marble and minor schist with one or more layers or lenses of locally contorted sulphides and quartz, and lenses of fluorite and barite (Fyles, 1970a). It is exposed or projected several kilometres in strike length. Locally it has been thickened in the hinge of a Phase 1 isoclinal syncline and here it is referred to as the E showing. Estimated reserves in the E showing by Falconbridge Nickel Mines Ltd. are approximately 5 million tonnes containing 2.5 per cent lead, 7.5 per cent zinc and trace silver. Mineralization consists of massive sphalerite, pyrrhotite, galena, pyrite and minor chalcopyrite that commonly contains rounded quartz eyes, and as scattered grains of galena and sphalerite in marble, calcareous quartzite and fluorite (Fyles, *op. cit.*).

The sulphide layer is in a succession of calcareous schist, quartzite and impure marble above the Monashee décollement and autochthonous cover succession that hosts Cottonbelt. Although its age is unknown, it has been tentatively correlated with the Hadrynian Windermere Group (R.L. Brown, personal communication, 1985). The succession is highly deformed, metamorphosed to amphibolite grade, and extensively invaded by pegmatite.

BIG LEDGE (MI 82LSE-012)

Big Ledge is a stratabound zinc deposit contained in mantling gneisses of Thor-Odin dome, 60 kilometres south of Revelstoke (Figure 41) (Reesor and Moore, 1971; Read, 1979). It is hosted by a rusty weathering, calcareous graphitic schist interlayered with calcareous quartzite, calc-silicate gneiss and marble (Höy, 1977a). Within the schist, referred to as the "Ledge", are lenses of massive, medium to coarse-grained pyrite or pyrrhotite with variable amounts of dark sphalerite. Sulphides are also disseminated throughout the schist, and occur in discontinuous laminations 1 to 2 millimetres thick and in small fractures crosscutting the layering and foliation (Höy, 1977a).

TABLE 12. STRATABOUND LEAD-ZINC DEPOSITS IN THE SHUSWAP COMPLEX

Name	Estimated Reserves*	Deposit Type	Dominant Host Rocks
Cottonbelt	0.7; 6% Pb, 5% Zn, 50 g/t Ag	stratabound layers	calcareous gneiss
Jordan River	2.6; 5.1% Pb, 5.6% Zn, 35 g/t Ag	stratabound layers, lenses	calcareous gneiss, barite
Ruddock Creek	~5.0; 2.5% Pb, 7.5% Zn, tr Ag	stratabound lenses, layers	marble, quartzite, barite
Big Ledge	6.5; 4% Zn	disseminated, lenses	graphitic schist
Colby	~1.0; 7% Zn, <1% Pb	disseminated, lenses	marble, quartzite, calcareous gneiss
CK	?	stratabound layer	calcareous gneiss
Rift	?; 29% Zn, 5% Pb	stratabound layer, lenses	calcareous gneiss

* In million tonnes.

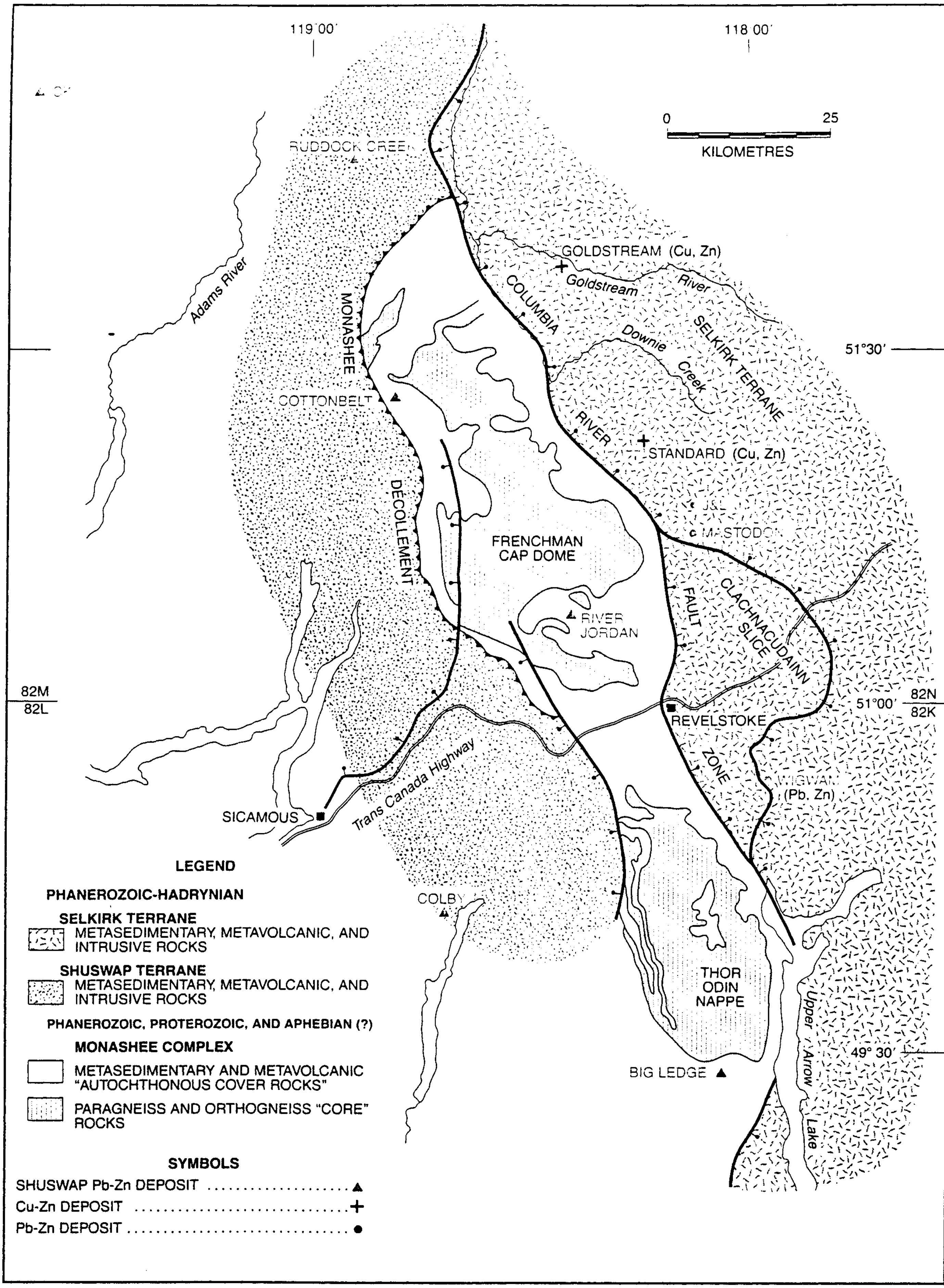


Figure 41. Tectonic setting and location of Shuswap deposits, southeastern British Columbia.

TABLE 13. ANALYSES OF MINERALIZED SAMPLES FROM THE COLBY DEPOSIT

Sample No.	Rock Type	Zn %	Pb %	Cu %	Cd %	Ag ppm	Au ppm	Showing
14311	marble	5.8	0.11	tr	tr	<3	<0.3	Central
14312	quartzite	22.1	6.6	0.015	0.025	<3	<0.3	Central
14313	marble	0.34	0.04	tr	—	<3	<0.3	Central
14314	marble	6.3	0.27	tr	tr	<3	<0.3	Central
14315	marble	7.7	0.70	tr	tr	<3	<0.3	Central
14316	marble	11.3	0.98	tr	tr	<3	<0.3	Mile 12
14317	marble	5.3	0.49	tr	tr	<3	<0.3	Mile 12
14318	quartzite	1.58	0.12	0.015	tr	<3	<0.3	Central
14319	marble	0.88	0.06	0.015	<0.005	<3	<0.3	Central
14320	marble	7.2	0.31	0.015	tr	<3	<0.3	Central
16269	calc-silicate gneiss	1.3	0.2	0.007	0.002	3	<0.3	Central
16270	marble	3.3	0.3	0.005	0.002	4	<0.3	Mile 12
16271	marble	8.9	0.96	0.005	0.006	3	<0.3	Central
16272	quartzite	8.5	8.5	0.01	0.02	5	<0.3	Central
16273	marble	7.1	0.25	0.007	0.001	3	<0.3	Central

The "Ledge" layer can be traced or projected for a distance of over 10 kilometres. It is within a succession of thin-bedded quartzite, marble and calcareous and pelitic schist that structurally overlies core gneisses. Although its age is not known, it is correlated with a similar succession hosting both the Jordan River and Cottonbelt deposits on the margins of Frenchman Cap dome, and with Eocambrian platformal rocks in the Kootenay Arc to the east (Wheeler, 1965; Reesor and Moore, 1971; Höy, 1977a). Read (1979) has suggested, however, that these mantling rocks may correlate with the Late Proterozoic Purcell Supergroup.

COLBY (MI 82ESW-062) (KINGFISHER, BRIGHT STAR)

Colby is located 48 kilometres by road east of Enderby (Figure 41). It is a stratabound lead-zinc deposit in marble, quartzite and calc-silicate gneiss units of the Monashee Group. These units have been traced 6 kilometres on the Colby property, with mineralization restricted to five zones (Höy, 1977b).

Mineralization consists of dark, medium-grained sphalerite with varying amounts of pyrrhotite, pyrite and minor galena disseminated through a medium to coarse-grained white calcite marble. The marble is structurally overlain by calc-silicate gneiss that contains crude layers or irregular zones of sphalerite, pyrrhotite, pyrite and minor galena. Dark sphalerite and pyrrhotite are also concentrated in thin layers in overlying quartzite or disseminated throughout the quartzite. Galena is more abundant in quartzite than in the marble, but is nearly always subsidiary to sphalerite. Sulphide concentration in the quartzite varies from widely scattered individual sphalerite and pyrrhotite grains to almost massive sphalerite-pyrrhotite-(±galena pyrite). Assays of selected samples from the mineralized zones are given in Table 13.

CK (MI 82M-137)

The CK property includes a number of lead-zinc showings located between Ritchie Creek and Raft River, 37 kilometres north of Vavenby (Figure 41). The most important showing, the New showing, is a sulphide layer generally less than 1 metre thick that appears to be continuous, with perhaps minor structural breaks and offsets, for a distance of at least 1300 metres (Höy, 1979b). It consists of massive sphalerite and pyrrhotite, minor galena and trace chalcopyrite. Gangue quartz, diopside, calcite, amphibole and plagioclase are common and fluorite and vesuvianite occur locally.

Assays of selected samples from the New showing, the Main Boulder zone approximately 1 kilometre to the northwest, and the North and Mist showings 4 kilometres to the north, are shown in Table 14. Average grades of the massive sulphide layer and immediate wallrocks, reported by Cominco Ltd., range from 1 to 3 per cent lead and 5 to 15 per cent zinc.

The sulphide layer is hosted by a calcareous succession, structurally underlain by hornblende gneiss and amphibolite and overlain by quartz feldspar gneiss and pelitic schist. The calcareous succession includes calc-silicate gneiss, white marble layers up to several tens of metres thick and micaceous schist and gneiss. It is invaded by pegmatite and granitic gneiss.

RIFT (MI 82M-190)

Rift is a stratiform zinc-lead-(copper-silver) massive sulphide showing located approximately 100 kilometres north of Revelstoke (Figure 41) (Gibson and Höy, 1985). Although it is east of the Columbia River fault, within the Selkirk allochthon, it is included in a description of Shuswap occurrences because of its similarity to these deposits.

TABLE 14. ANALYSES OF MINERALIZED SAMPLES FROM THE CK DEPOSIT

Showing	Sample Type	Pb %	Zn %	Fe %	Cu ppm	Cd ppm
Main Boulder	grab sample	1.45	5.8	—	—	—
Main Boulder	grab sample	4.50	27.1	—	—	—
Main Boulder	grab sample	6.31	23.37	7.76	247	252
Main Boulder	0.6-metre chip	4.88	23.45	14.34	423	260
New	0.6-metre chip	4.19	25.20	12.24	408	255
New	0.6-metre chip	4.41	21.85	20.84	568	203
North	0.6-metre chip	0.81	8.95	19.44	515	87
Mist	0.6-metre chip	2.66	20.70	11.33	512	230

TABLE 15. BASE METAL ANALYSES OF MASSIVE SULPHIDE LENSES AND HOST ROCKS, RIFT SHOWING

Sample No.	Pb %	Zn %	Cu %	Lithology
84R-10	5.75	29.3	0.017	upper massive sulphide lens
84R-9C	13.9	25.1	0.009	main massive sulphide lens
84R-8F	6.83	31.7	0.067	main massive sulphide lens
84R-8E	7.01	31.3	0.067	main massive sulphide lens
84R-9B	0.048	0.012	0.018	siliceous, calcareous schist
84R-9A	9.01	23.9	0.039	lower massive sulphide lens
84R-8C	5.00	26.8	0.032	lower massive sulphide lens
84R-8B	0.015	0.074	0.021	chert, quartzite, siliceous schist

The Rift sulphide layer is within a 400-metre-thick, largely schistose zone between two massive calcite and dolomite marble units. The lower marble is underlain by graphitic and calcareous schist and greater than 900 metres of predominantly grit and laminated chlorite schist. This succession has been traced southward (G. Gibson, personal communication, 1987) and correlated with the succession hosting the Goldstream massive sulphide deposit, and is therefore tentatively assigned to the Lower Paleozoic Hamill or Lardeau Groups.

The Rift showing consists of a number of thin layers of massive sphalerite, pyrite, pyrrhotite and galena exposed for approximately 25 metres of strike length in a steep-sided creek gully; the thickest of the layers is about 2 metres thick. These layers are separated by schistose, quartz-rich and somewhat calcareous rocks with disseminated sulphides. A second massive sulphide zone, the "upper showing", is exposed approximately 90 metres stratigraphically above the main showing. Intervening rocks include calcareous schists and thin marble bands, overlain by more pelitic schists.

The massive sulphide layers are irregularly laminated on a <1 to 10-centimetre scale. Sphalerite is commonly the most abundant sulphide; pyrrhotite is abundant in the southern part of the gully exposure, whereas pyrite predominates to the north (Hicks, 1982). Galena averages from 5 to 8 per cent, and chalcopyrite and arsenopyrite occur in trace amounts. Prominent gangue minerals in the massive sulphide layers include quartz, muscovite, calcite, and minor amounts of clinozoisite. Thin calc-silicate and quartz-rich gangue layers, with variable amounts of disseminated sulphides, occur within the sulphide bands.

Chemical analyses of the massive sulphide layers reflect the high sphalerite content with zinc ranging from 24 to 32 per cent (Table 15). The weighted average of 25 chip samples is 29.75 per cent zinc, 5.28 per cent lead and 0.03 per cent copper (Hicks, 1982). Precious metal values range from 0.06 to 0.25 gram gold per tonne and 0.3 to 10 grams silver per tonne in seven grab samples collected by J.M. Leask (personal communication, 1980). Gold and silver values for the six massive sulphide samples analysed in this study (Table 15) were below the utilized detection limits of 0.3 and 10 grams per tonne respectively.

SUMMARY — SHUSWAP MASSIVE SULPHIDE DEPOSITS

A number of features of Shuswap deposits have been summarized by Fyles (1970a):

(1) The deposits comprise thin, but regionally extensive, sulphide-rich layers in a well-layered platformal succession of dominantly carbonate, schist and quartzite. The host is generally a calcareous schist.

(2) The deposits consist dominantly of pyrrhotite and sphalerite, with minor galena and pyrite. Magnetite is the abundant iron phase at Cottonbelt.

(3) The deposits are part of the enclosing stratigraphic succession and have been metamorphosed and deformed along with it.

Shuswap deposits represent highly deformed and metamorphosed examples of the "exhalative sedimentary group" of base metal deposits of Hutchinson (1980). Host rocks range from calcareous schist and gneiss (Cottonbelt) to dominantly graphitic schist (Big Ledge) within a well-layered and heterogeneous succession that includes relatively pure crossbedded quartzite, grey crystalline marble, hornblende gneiss, and abundant pelitic and calcareous schist and gneiss. Sulphides are presumed to have been deposited with the enclosing calcareous shales in restricted shallow marine basins in a platform environment. They are hosted by clastic rocks but also have features typical of "carbonate-hosted" deposits (in particular, the "Remac" type of Sangster, 1970), such as their association with clean carbonates and their occurrence in a shallow marine platformal environment (Hutchinson, 1980). They are transitional between the "clastic-hosted" and "carbonate-hosted" types, supporting the statement by Hutchinson (1980, page 665) that there are no distinct boundaries between these deposit types.

Shuswap deposits contrast with lead-zinc deposits in the Kootenay Arc to the south (Fyles, 1970b; Höy, 1982). Kootenay Arc deposits include the Bluebell, Duncan and Wigwam deposits and deposits in the Salmo camp (Figure 41). They are hosted by a relatively pure, but locally dolomitized, silicified and brecciated Lower Cambrian carbonate unit. Although deformation may be intense, the regional metamorphism is generally greenschist facies.

MINNOVA INC

MEMORANDUM

DATE: April 24, 1991.

TO: I. Pirie, J. Bradford

FROM: A. Hill

SUBJECT: CK PROPERTY -- An evaluation based on a review of Rea Gold's data and reports.

Summary:

The property contains a thin, stratiform Zn-Pb deposit that has been traced fairly continuously for over 20 km of strike length, but rarely exceeds 1 metre in thickness. Grades are fairly consistent at 15% zinc, 3% lead, 8 grams/tonne silver, 300 ppm copper, and <10 ppb gold. Several vigorous exploration campaigns, (Rio Tinto, Cominco, Rea Gold/Minorex) have failed to find areas of significant structural or primary thickening. The probability of finding economic mineralization on the property is considered to be low, with the exploration of the property fairly complete.

Property History:

1973 - Prospector Andy Horne discovered sulphide boulders in a creek valley, staked claims, and several hand trenches were completed.

1974 - Claims dealt to Sicintine Minerals who optioned it to Rio Tinto, and carried out an airborne EM/Mag survey, geochem, prospecting and 4 ddh's.

1975 - Rio Tinto performed large-scale grid geochem, mapping, and limited ground Mag and IP surveys. Three ddh's were completed, then the option was terminated and returned to Sicintine.

1976 - Sicintine conducted a small program of backhoe trenching in the Main Boulder showing area with no success, and the property was returned to the prospector.

1977 - Cominco examined the property and an agreement with the owner was signed.

1978 - Cominco performed prospecting, geochem (600 samples), mapping, cat trenching, IP (38km), Mag (30km), VLF (22km), and drilling (20 holes, 2114m).

1979 - Cominco continued property-wide mapping, geochem (8000 samples!), IP (4km), and drilling (18 holes, 2768 metres).

1980 - Cominco did local detailed mapping, geochem (2000 samples), IP (12km), and drilling (15 holes, 1277m). **Note: Cominco data was not available for examination during this study.**

1981-85 - Cominco held the property, but it lay dormant until it was returned to A. Horne in 1985.

1986 - Property acquired by Rea Gold/Verdstone Gold based on evaluation report by D. Blanchflower of Minorex Consulting. Blanket geochem was performed over the southern half of the property, along with road building and trenching.

1987 - Rea Gold performed drill program on the "New Showing" (11 holes, 1373m), geochem (1269 samples), mapping, and additional drilling property-wide (84 holes, 6975m).

1988 - Rea Gold switched consultants to Dolmage Cambell & Assoc. and performed 20km of IP, backhoe trenching, and 24 ddh's (3754.4 m).

In all, this work represents a total of 18,500 metres of drilling in 180 holes, over twelve thousand soil samples, 100km of IP, and 40 km of Mag.

Property Geology:

The CK property (331 units), lies about 43 km NE of Clearwater, B.C. and is entirely underlain by the rocks of the Shuswap Metamorphic Complex. Early Cambrian amphibolite grade metasediments and orthogneiss host the mineralization, which is developed at the transition between platformal carbonates (marble and calc silicate rocks), and a more pelitic sequence (biotite almandine gneiss). The mineralized horizon has been affected by the same deformational events as the enclosing strata, and is frequently intruded by younger granite pegmatite intrusions (see strat. column).

Twelve main showing areas are present on the property (see attached list and map). The showings in the south half of the property are usually thin, poorly developed, badly truncated by pegmatites and have low potential. In the northern portions of the property the mineralization is thin (<<1m) and isoclinally folded in the nose of the regional scale Raft Synform. Drill testing over a maximum dip length of 500 metres failed to provide any indications that structural thickening has occurred here. The only remaining showing is also the best, and is described below.

"New" Showing:

The New Showing, in the centre of the claim block, represents the most significant massive sulphide occurence on the property. The mineralization is traceable along surface for 1300m, but "may be discontinuous". It attains a maximum width of 5m for short distances (up to 25 m?), where small scale fold structures have produced thickenings. These folds do not appear large enough, or persistent enough to significantly thicken the sulphide layer any more than that already observed.

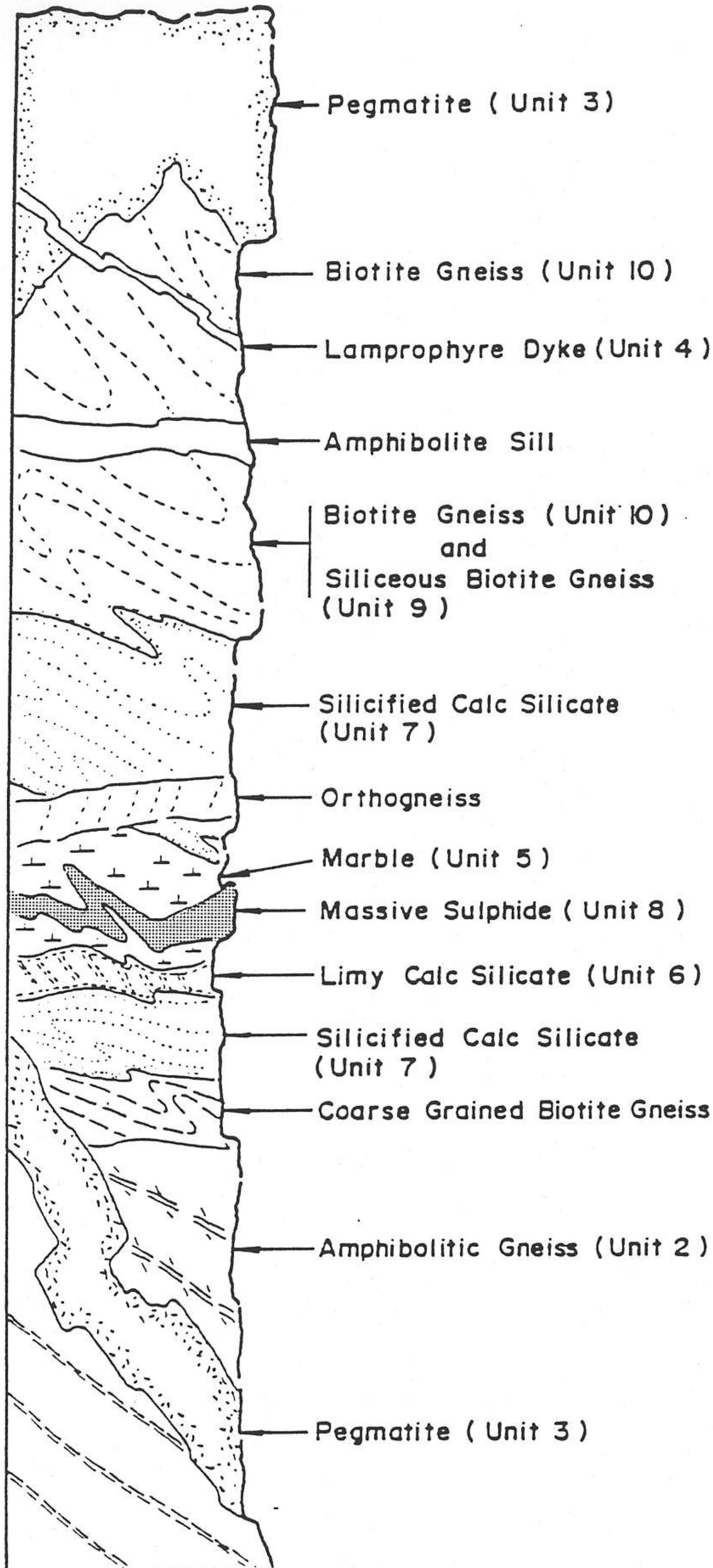
The massive sulphides are dominated by red-brown, fine grained equigranular sphalerite, with disseminated galena. Bedding (relict) is well defined, with very little alteration on either the footwall or hangingwall sides. Disseminated Pb/Zn is occasionally present within the marble units when in close proximity to the massive mineralization. Pyrrhotite (10-15%) is the dominant gangue sulphide, with lesser pyrite in fractures, and qtz-feldspar-diopside-calc silicates-carbonate comprising the remainder of the rock.

Pegmatites truncate the stratigraphy, and probably account for at least 25% by volume. This is considerably lower than the average density on the rest of the property.

From an unweighted average of 83 diamond dril intersections, the zone contains 14.5% Zn, 2.36% Pb, 8.0 g/t Ag with very low levels in gold and copper, over an average width of 1.16 metres. Strike length is "semi-continuous" for 1300m but the horizon has seldom been traced more than 100m steeply down dip. Local zinc grades as high as 33.3% are noted, with many above 25%. Although grade relations are relatively easy to estimate within this zone, tonnage relations are not. The drill sections show that continuity both along strike and down dip is difficult to predict, with numerous irregular shaped pegmatite intrusions, and structural complications clouding the picture.

Conclusions:

Although the area contains considerable stratiform Zn/Pb massive sulphides, they do not appear to attain economic thicknesses. The potential for any new discoveries on the property has been exhausted by systematic exploration, using modern techniques and modelling. Further work on these claims is not warranted.



J. Oliver

LEGEND

SHUSWAP METAMORPHIC COMPLEX

10	Biotite Gneiss
9	Siliceous Biotite Gneiss
8	Sulphide Mineralization
7	Siliceous Calc-Silicate
6	Limy Calc-Silicate
5	Marble
4	Lamprophyre Dyke
3	Pegmatite
2	Amphibolite
1	Hornblende Garnet Dyke

To accompany a report by J.L. Oliver

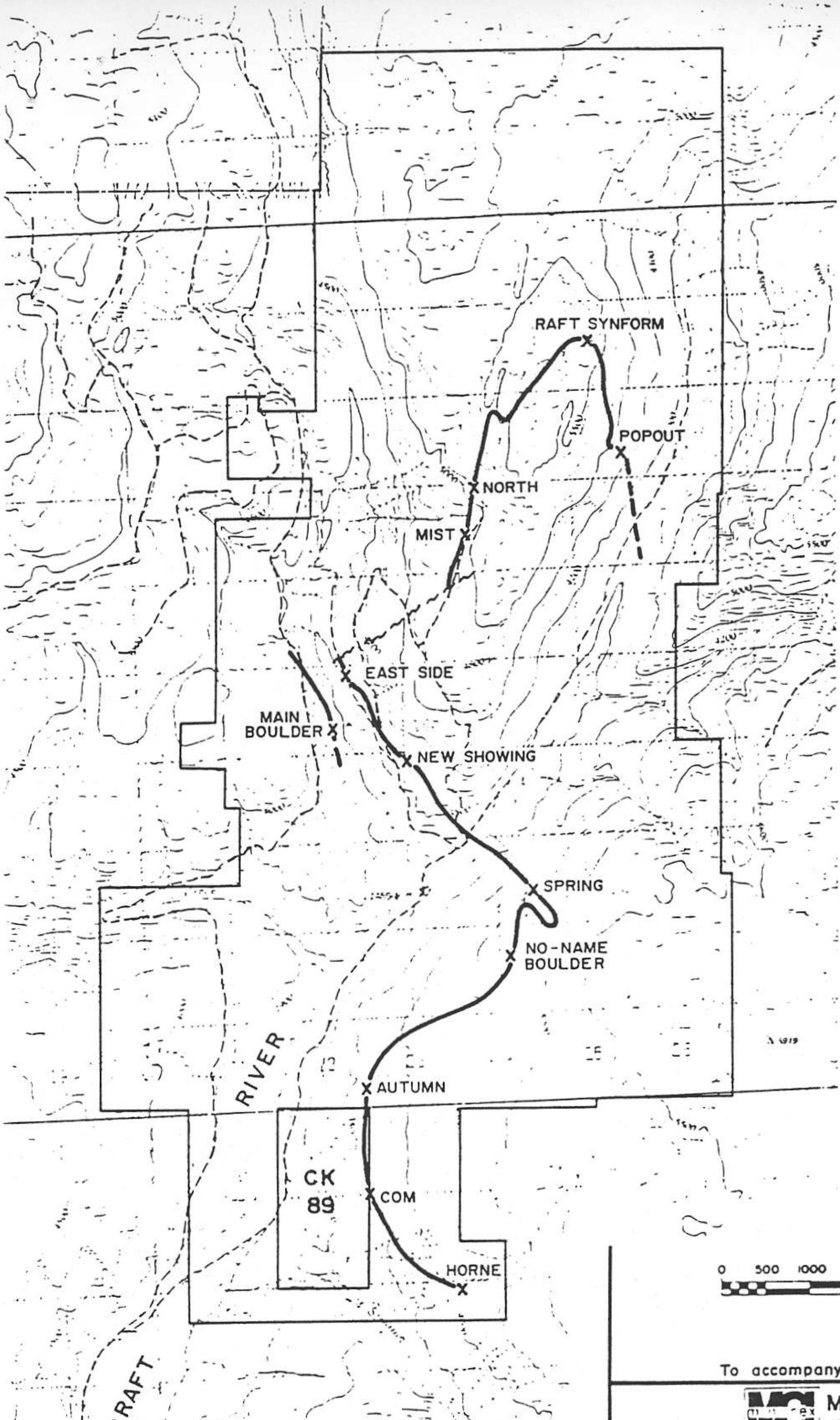
MINOREX CONSULTING LTD
GEOLOGICAL CONSULTANTS, VANCOUVER, B.C.

REA GOLD CORPORATION &
VERDSTONE GOLD CORPORATION
VANCOUVER, BRITISH COLUMBIA

CK
STRATIGRAPHIC COLUMN

CK PROPERTY
KAMLOOPS MINING DIVISION, B.C.

Date: February, 1988	Scale: Not To Scale
Technical Work By: J. Oliver	Map No.: 4



0 500 1000 2000 3000 4000 5000 metres

To accompany a report by Jim L. Oliver, Feb. 1988

MINOREX CONSULTING LTD.
GEOLOGICAL CONSULTANTS, KAMLOOPS, B.C.

REA GOLD CORPORATION &
VERDSTONE GOLD CORPORATION
VANCOUVER, BRITISH COLUMBIA

MINERAL OCCURRENCE PLAN

CK PROPERTY

KAMLOOPS MINING DIVISION, B.C.

Technical work by	JIM L. OLIVER	NTS	82M/13E
Drawn by	B. McLEOD	Scale	1:50,000
Date	FEBRUARY, 1988	Figure No	5

List of other showings:

NO NAME: 4 holes (Rea 1987) No local bedrock source. No favourable stratigraphy. (Oliver)

AUTUMN: 5 holes (Rea 1987). 0.275 bed. Pegmatites. 50m max strike length. (Oliver)

HORNE: 1 hole (Rea 1987). 25m or less strike length. Less than 1m true thickness. Truncated by large pegmatite bodies. Thick carbonates to east within Stratton Creek Canyon.

NORTH STRAT: 31 holes (Cominco and Rea). 2 bands - 13.16% Zn, 4.51 gpt Ag, 1.32% Pb over 0.705m. Flat dips. Truncated by pegmatites and series of dextral faults. Oliver says no.

MAIN BOULDER SHOWING: At least ~~12~~ 15 holes (Rio, Cominco, Rea). No more than 200m strike length and most probably boulder train. Trenches were good. ddh never hit. (Oliver)

EAST SIDE SHOWING: 6 holes (Rea--DC)Mineralized horizon brtoken and discontinuous due to pegmatites and faulting. No contunity with New Showing found. (Dolmage Campbell)

MIST AND NORTH SHOWINGS: 4 holes (Rea-DC). Westerly limb of isoclinal fold. Geophysical anomaly bounded to west by surface showings. Mineralized horizon dips to east. Geochem and geophysical anomalies. 1 to 2 km strike contuity--4% to8% Zn, 0.1 to 0.4m thick. DC drilling indicates no structural thickening downdip within 300 - 500m of surface. ENE major fault limits southerly extension. (Dolmage Campbell)

SPRING: Truncated to southeast by pegmatites. Deep talus and large pegmatites to north.

RAFT SYNFORM: 8 holes (3 Cominco, 5 Rea-DC). Calc silicate Low geochem anomaly corresponds to IP and resistivity low. Little outcrop. Units are repeated but don't thicken over 500m of dip. Calc silicate unit from Raft Synform extends 3 km southeast along west side of Raft River where it is cut off by ENE major fault. (Dolmage Campbell)

RAFT RIVER VALLEY: 1 hole (Rea-DC) to test resistivity low. No go. Biotite gneiss only.

EAST OF RAFT RIVER VALLEY: Biotite gneiss and granite only.
POPOUT: Mineralized horizon in calc silicate bluff. No drilling. Geophysics not encouraging. (Dolmage Campbell)

LEAD–ZINC DEPOSITS

By Trygve Höy

GEOLOGY OF THE RIONDEL AREA

(82F/15)

Reconnaissance mapping of the area between the Riondel map-area (Höy, 1974) and the Duncan Lake area (Fyles, 1964) was initiated in August 1975. This mapping indicates that:

(1) The 'Loki' and 'Powder Creek' stocks (Höy, 1974) are apophyses of the 'Fry Creek batholith.'

(2) The isoclinal 'Phase 2' folds described in the Riondel area continue northward to the southern limit of the Fry Creek batholith.

More detailed mapping, tentatively scheduled for the 1976 field season, will more closely outline structures in this area, and may allow correlation of these structures with those in the Duncan Lake area. This mapping will also outline the Badshot marble, the host rock for most of the lead-zinc mineralization in the Kootenay Arc.

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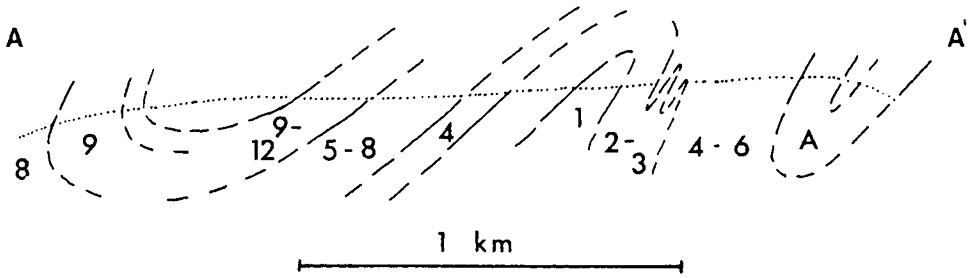
BIG LEDGE (82L/8E)

INTRODUCTION

The Big Ledge is a stratabound zinc deposit contained in the Mantling gneisses of the Thor-Odin gneiss dome. It is located 60 kilometres south of Revelstoke and approxi-



LEGEND

ORTHOGNEISS, PEGMATITE

AMPHIBOLITE, HORNBLENDE GNEISS; MINOR GARNET-BIOTITE GNEISS

GARNET–BIOTITE±SILLIMANITE GNEISS; BIOTITE SCHIST

QUARTZITE

CALC–SILICATE GNEISS; SILICEOUS MARBLE

MARBLE

SYMBOLS

SCHISTOSITY, GNEISSOSITY ATTITUDE

MINOR FOLD AXIS

MINERAL LINEATION

ANTIFORM

LAYERING ATTITUDE

SYNFORM

Figure 2. Vertical cross-section, Big Ledge area.

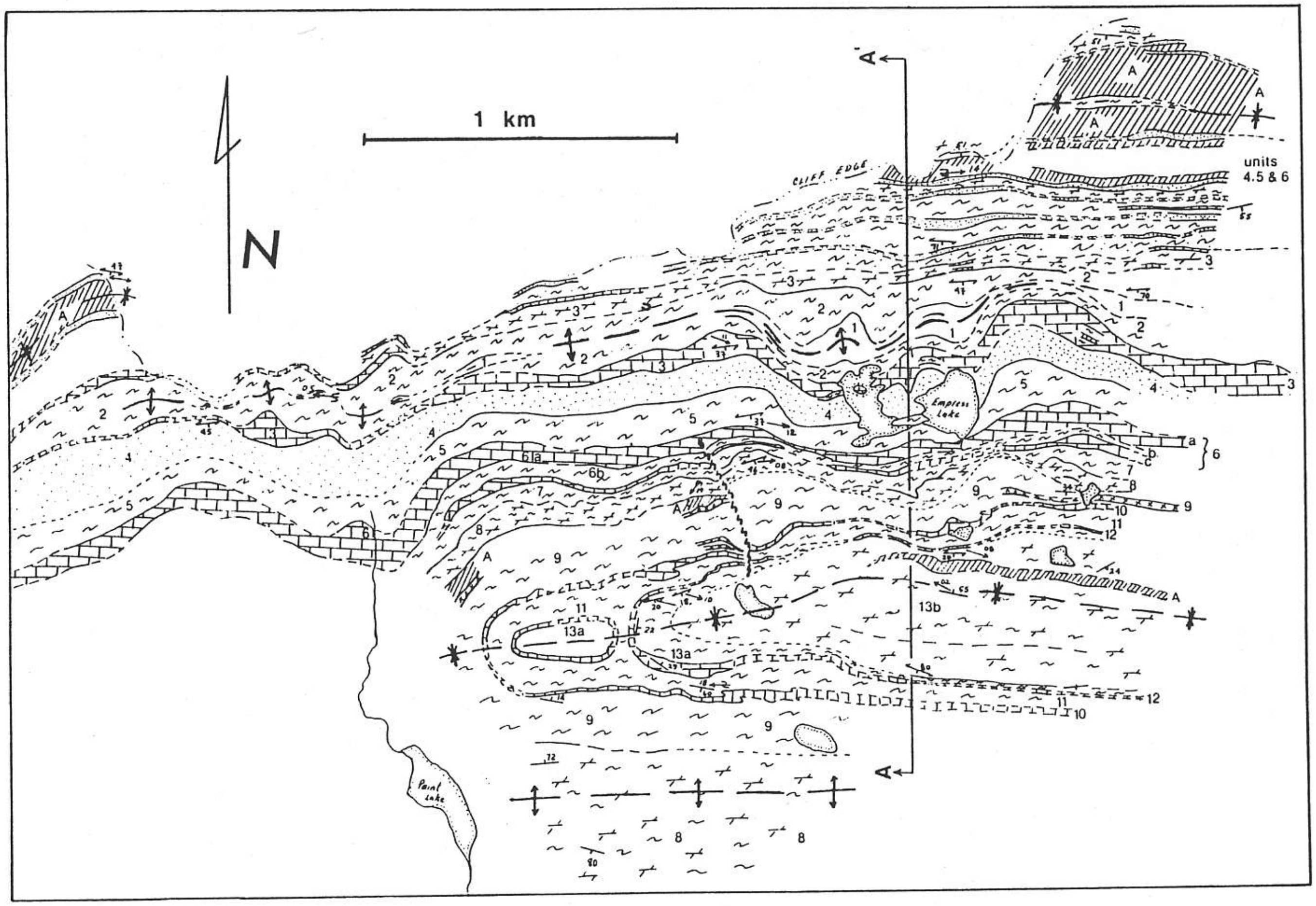


Figure 1. Geology of the Big Ledge deposit (for legend, *see* Fig. 2).

mately 8 kilometres west of Upper Arrow Lake, between North Forstall Creek and Ledge Creek.

The property has a history of exploration dating back to the late 1920's. Early work by The Consolidated Mining and Smelting Company of Canada, Limited consisted of trenching, some underground work, and about 1 035 metres of diamond drilling. Between 1947 and 1953, 6 100 metres of drilling was done on the property and from 1964 to 1966, approximately 3 960 metres of drilling as well as some geological mapping and geochemical and magnetometer surveying was carried out.

This report summarizes the results of five days on the western part of the property in July 1975. The assistance of Mr. James Milne while in the field is greatly appreciated.

REGIONAL GEOLOGY

The Thor-Odin gneiss dome is one of a series of gneiss domes spaced approximately 80 kilometres apart along the eastern edge of the Shuswap Complex. A central Core zone in the dome consists of gneissic and migmatitic rocks. This zone is surrounded by a heterogeneous assemblage of metasedimetary rocks of the Mantling zone and Fringe zone, the latter containing abundant pegmatite and lineated quartz monzonite (Reesor and Moore, 1971). The Big Ledge deposit is located south of the Core zone, in an east-west-trending succession of metasedimentary rocks.

LOCAL GEOLOGY

The detailed succession of metasedimentary rocks in the area of the Big Ledge deposit is apparent from the map (Fig. 1). In general the succession includes an extremely heterogeneous mixture of schist and gneiss, quartzite, calc-silicate gneiss, marble, and amphibolite. A rusty-weathering calcareous schist, mixed with calcareous quartzite and minor calc-silicate gneiss and marble, hosts the Big Ledge sulphide mineralization. It is overlain by medium to coarse-grained garnet schist and sillimanite gneiss (unit 2), a zone of interlayered marble and gneiss (unit 3), and a very prominent pure to feldspathic quartzite (unit 4).

Overlying the quartzite are interlayered biotite-garnet gneiss, marble, and calc-silicate gneiss (units 5 to 12), which in turn are overlain by calc-silicate gneiss of unit 13. A number of amphibolite layers occur throughout the stratigraphic succession, the most prominent being a massive to layered amphibolite in the core of a synform to the north of the Big Ledge horizon.

The structure of the map-area (Fig. 1) is dominated by a series of east-west-trending open to moderately tight folds. These are inclined to the south (Fig. 2) and plunge variably to the east and west. The Big Ledge 'horizon' is in the core of one of these folds, a moderately tight, southward inclined antiform.

Very pronounced north-northwest-trending air photo lineaments transect the map-area. There is little if any apparent offset associated with these structures, although layering attitudes are sometimes disrupted across them.

MINERALIZATION

Showings of pyrrhotite, pyrite, and sphalerite occur along a horizon (unit 1), known as the Ledge, for a distance of over 5 kilometres (Assessment Reports 12 and 66). The mapping of the most western part of the Ledge horizon (Fig. 1) indicates that it is in the core of an antiform. Here the Ledge is not a distinct layer, but rather a succession of rocks folded back on itself.

Sulphide mineralization in the Ledge horizon most commonly consists of massive coarse-grained pyrrhotite and sphalerite with minor pyrite, and less commonly, of finer grained disseminated sulphides.

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FX, FC, COLBY (82L/10)

INTRODUCTION

The Colby Mines Ltd.'s property is located 48 kilometres by road east of Enderby, 15 kilometres north of the Shuswap River and just east of Kingfisher Creek. The property straddles a low northeast-trending hill between Kingfisher Creek and a tributary of Kingfisher Creek to the southeast. Mineralization consists of sphalerite, pyrite, pyrrhotite, and minor galena in marble, quartzite, and calc-silicate gneiss units. These units have been traced 7 kilometres over the length of the property, with mineralization restricted to five zones: (1) the Mile 8 showing, (2) the Dakota zone, (3) the Central zone, (4) the Cominco showing, and (5) the Mile 12 showing (Fig. 3).

Since acquiring the property in 1973, Colby Mines Ltd. has carried out linecutting, trenching, and some stripping; magnetometer, electromagnetic, and geochemical surveys; geological mapping; and approximately 1 830 metres of diamond drilling.

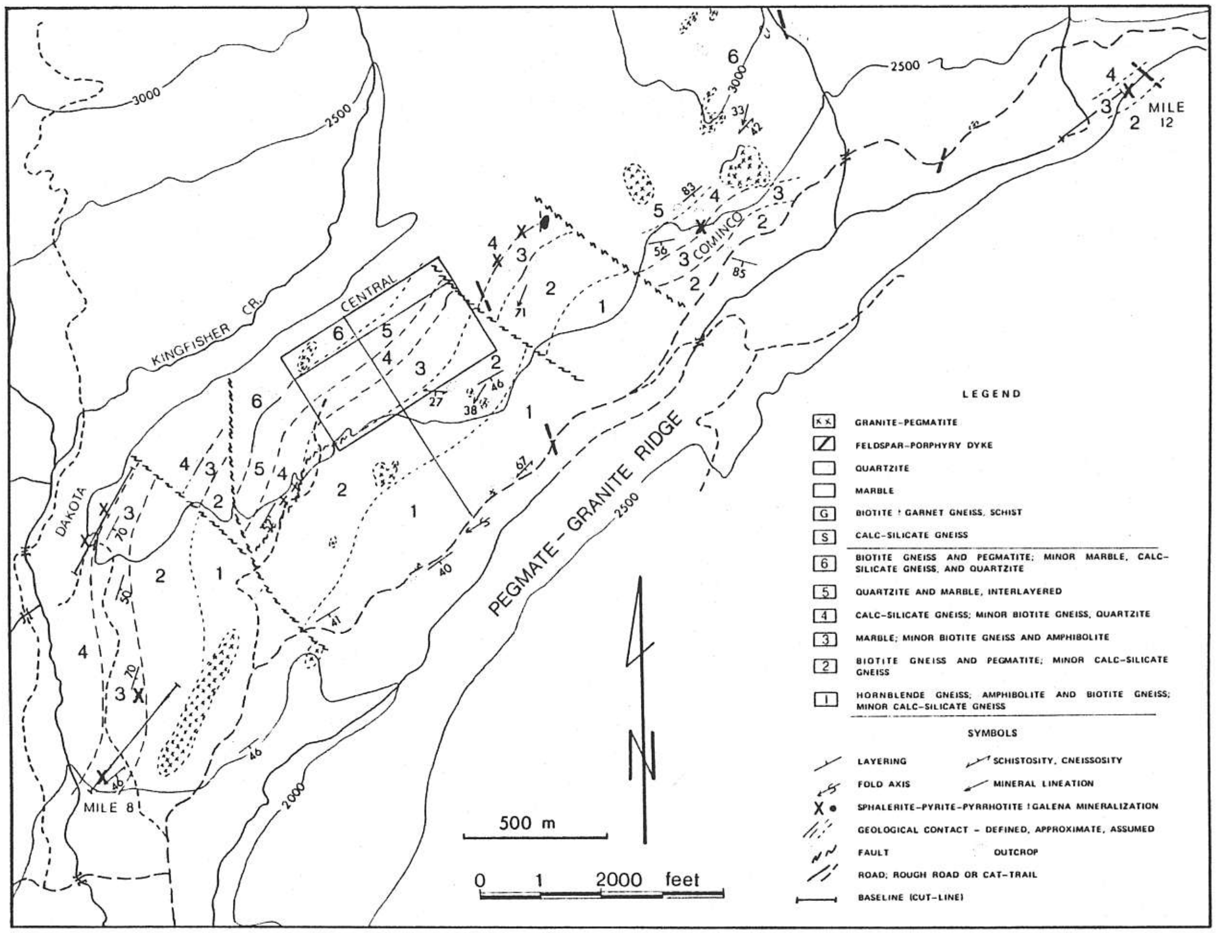

Figure 3. Geology of the Colby Mines area.

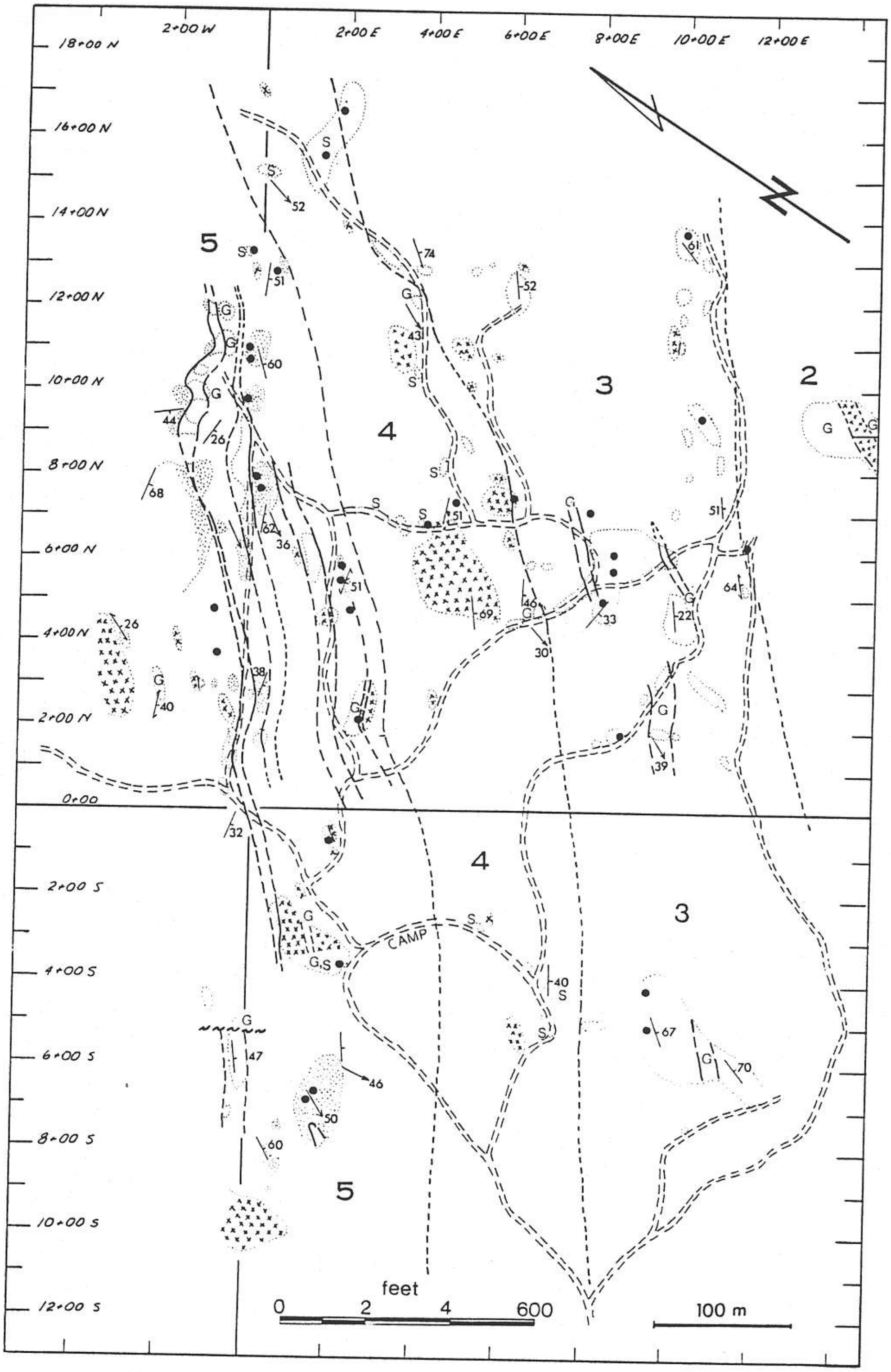

Figure 4. Geology of the Central zone, Colby Mines area (for legend, *see* Fig. 3).

GEOLOGY

Regional Setting

The property is within the Shuswap Complex, a belt of high-grade metamorphic rocks in the Columbian orogen of southeastern British Columbia. The area has been mapped on a regional scale by Jones (1959) and is on the eastern edge of a large area studied by Okulitch (1974). These authors assign rocks in the area to the Monashee Group, a heterogeneous package of probable Proterozoic and Early Paleozoic age comprising granitoid gneiss, augen gneiss, sillimanite-bearing schist, and prominent marble and quartzite layers.

Local Geology

Rocks within the map-area have been divided into six metamorphic units and two intrusive units. The sequence of metamorphic units may represent an originally conformable package of sedimentary rocks, though it is not known whether unit 1 or unit 6 is the older.

Unit 1, exposed in road cuts along the southeastern edge of the property, consists of hornblende gneiss, garnet-biotite gneiss, and some calc-silicate gneiss. The hornblende gneiss grades to amphibolite with increasing amphibole content. It consists of interbanded dark amphibole-rich layers with lighter feldspar and calc-silicate-rich layers.

Unit 2 consists of rusty weathering garnet-biotite-sillimanite gneiss and minor amounts of calc-silicate gneiss. Granite-pegmatite bodies, up to several hundred metres in diameter, commonly intrude unit 2.

Unit 2 is underlain by unit 3, a massive white marble up to several hundred metres thick. The marble consists of coarse-grained calcite with minor amounts of diopside, dolomite, tremolite, and/or quartz. Included in the marble are a number of discontinuous layers of garnet-biotite gneiss and hornblende gneiss. The most significant mineralization in the Central zone, and all the mineralization in the Mile 12 and Mile 8 showings are hosted by unit 3.

Unit 4 is a heterogeneous unit comprised predominantly of calc-silicate gneiss, but including rusty weathering to clean white marble, garnet-biotite gneiss, minor quartzite, and minor amphibolite. The calc-silicate gneiss is generally fairly coarse grained, light grey-green in colour, and composed of diopside-quartz or diopside-actinolite-quartz with varying amounts of feldspar, calcite, epidote, and/or garnet. The quartzite is commonly calcareous and contains scattered diopside grains throughout. The calc-silicate gneiss, quartzite, and marble of unit 4 host sulphide mineralization in the Central zone as well as in the Dakota and Cominco zones. This unit is not exposed at the Mile 8 or Mile 12 showings.

Mineralization

Mineralization in the Colby area is restricted to five main zones. These are called the Mile 8 showing, the Dakota zone, the Central zone, the Cominco showing, and the Mile 12 showing (Fig. 3). All but the Cominco showing have a clearly marked grid cut and flagged across them.

Mineralization in marbles consists of dark, medium-grained sphalerite, with varying amounts of pyrrhotite and minor pyrite disseminated through a medium to coarse-grained white calcite matrix. Galena is also common, though much finer grained and more widely scattered.

Mineralized quartzites almost invariably contain calcareous minerals as an accessory. Dark sphalerite with pyrrhotite is generally concentrated in thin layers or defines the foliation in the quartzite. Galena is more common than in the marbles, though it is always less concentrated than sphalerite. Very commonly the mineralization in the quartzites has been concentrated in the hinge zones of minor folds, and less commonly in local brecciated zones.

Mineralization in calc-silicate gneiss shows gradational features between that in marble and that in quartzite. Sphalerite, pyrrhotite, pyrite±galena may be evenly distributed through a coarse-grained calcite-diopside rock or may tend to concentrate in layers in a more quartz-rich rock.

In general, mineralized sections in quartzites are of lower grade but are more continuous along strike with the layering than those in marbles. Discontinuous high-grade pods are common in the marbles.

Mile 8 Showing

Sulphide mineralization in marble (unit 3) is exposed intermittently for a distance of 130 metres along layering strike at the Mile 8 showing. The maximum exposed width of the mineralized zone is approximately 2 metres. Two 'grab' samples from a small pit assayed: (1) lead, .04 per cent; zinc, .34 per cent and (2) lead, .70 per cent; zinc, 7.7 per cent.

The next outcrops of marble, approximately 300 metres to the north, contain two small mineralized pods.

Dakota Zone

Mineralization in the Dakota zone is in calcareous quartzite of unit 4. A quartzite intermittently exposed over a length of approximately 400 metres contains spotty sphalerite and galena along its contacts with calc-silicate gneiss and marble. The mineralized sections are generally of low grade and are narrow with a maximum width of 1 to 2 metres.

Central Zone

Mineralization in the Central zone is in marble of unit 3 and calc-silicate gneiss and quartzite of units 4 and 5.

One of the largest mineralized sections in the marble of the Central zone occurs at approximately 6 + 00 N – 8 + 00 E (Fig. 4) where a zone up to 3 metres wide and 15 metres in length contains coarse-grained sphalerite and pyrrhotite. A .65-metre chip sample from this zone assayed: .31 per cent lead and 7.2 per cent zinc; and a 'grab' sample: .27 per cent lead and 6.3 per cent zinc. Approximately 30 metres to the north a trench exposes siliceous and very rusty marble with minor mineralization, and 15 metres to the south, mineralized blocks of marble are exposed in a blast pit.

Calcareous quartzite grading to siliceous calc-silicate rock of unit 4 is mineralized at 7 + 00 N – 4 + 00 E and 15 + 50 N – 1 + 50 E. Both occurrences appear to be fairly restricted in size.

Three of the quartzite layers of unit 5 are mineralized. Outcroppings of the central of these layers (Fig. 4) indicate that in this layer the mineralization has a strike length of at least 170 metres with widths varying from less than 1 metre to 6 metres. Drill hole data suggest that this zone may be continuous with a zone approximately 400 metres to the south where diamond-drill hole 73-3 intersected a 40-metre thick mineralized section grading approximately 3.5 per cent zinc and 1.5 per cent lead. A 20-metre section in this zone averaged 4 per cent zinc and 1.8 per cent lead.

Cominco Showing

A trenched area 1,300 metres east of the Central zone exposes three mineralized zones which have been called the Cominco showings. These zones are less than 1 to 2.5 metres in width and a maximum of 8 metres in length. Mineralization consists of dark sphalerite, pyrite, pyrrhotite, and minor galena in a diopside-rich, rusty weathering marble. This marble is believed to be within unit 4, just to the north of the contact with the marble of unit 3.

Mile 12 Showing

A small outcrop of marble of unit 3 is well mineralized through its entire exposed width (2 metres). The length of the mineralized zone is unknown. Two 'grab' samples from this zone assayed: (1) .98 per cent lead and 11.3 per cent zinc; (2) .49 per cent lead and 5.3 per cent zinc.

SUMMARY

Mineralization on the Colby property consists of sphalerite, pyrrhotite, minor pyrite, and minor galena in three distinct lithologic units. These include a massive white marble (unit 3), calc-silicate gneiss (unit 4), and calcareous quartzite (units 4 and 5). These units extend the length of the map-area, but are offset by four northwest-trending strike slip faults. Large areas underlain by units 3, 4, and 5 are covered by overburden and have not been adequately tested.

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