Geology of the Ruby Silver and Goldy Pb-Zn-Ag Properties, Lardeau District, Southeastern British Columbia

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Abstract

The mineral deposits of the Kootenay Arc have been of economic interest since the turn of the century. Many of the lead-zinc deposits such as the H.B., Duncan, and mines near Metalline Falls, U.S.A. fit models of the Mississippi Valley type. However, lead-zinc occurrences which are located in the northern part of the Kootenay Arc (east and north of Trout Lake) in lower Paleozoic rocks are not readily explained by a Mississippi Valley type origin. The Ruby Silver occurrence examined in this thesis is intimately associated with limestones, sideritic carbonates, and clastics of lower Paleozoic age. Geological and mineralogical study of this property shows that there is good evidence for a distal volcanogenic origin. It is believed that this interpretation adds substantially to the economic and exploration potential of the property and area in general.

ACKNOWLEDGEMENTS

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INTRODUCTION

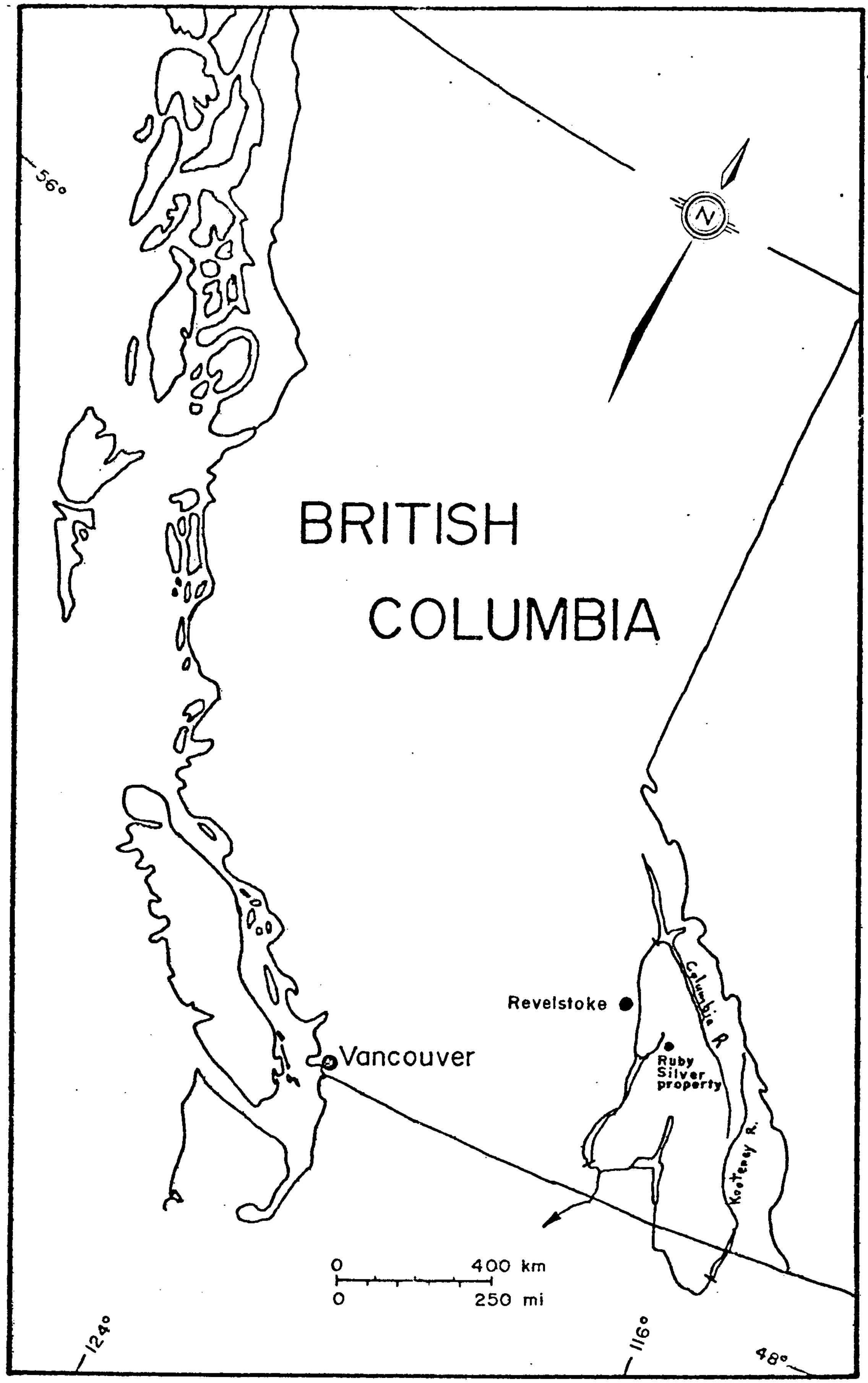
Purpose:

This geologic and mineralographic study gives a better understanding of the Ruby Silver, Goldy, and related properties and suggests a genesis of deposition for the mineralization. This aids in developing exploration parameters which are a substantial asset in the aquisition of further capital through option agreements with major mining groups.

Location and Physiography:

Ruby Silver and Goldy properties[1] (Figs. 3 and 4) are located 14 miles north of Cambourne, B.C. and straddle the northern spur of Goldsmith Mountain, Southeast of the confluence of Boyd Creek and the Incommapleaux River. Geographically, the property is in the northern part of the Badshot Range which is within the Selkirk Mountains. These mountains are extremely rugged. Relief is of the order of 7000 feet vertically with the highest mountains approaching 9000 feet. Steep- faced cirques, knife-edged ridges, and cliffs over 300 feet in height are common above elevation of 4000 feet.

[1] .Map Coordinates are 50° 52' 30" N. Lat. and 117° 34' 10" W. Long. (NTS map 82 k/13).



56°
N
BRITISH
COLUMBIA
Revelstoke
Columbia R.
Ruby
Silver
property
Vancouver
Kootenay R.
0
400 km
0
250 mi
124°
116°
48°

Fig. 3

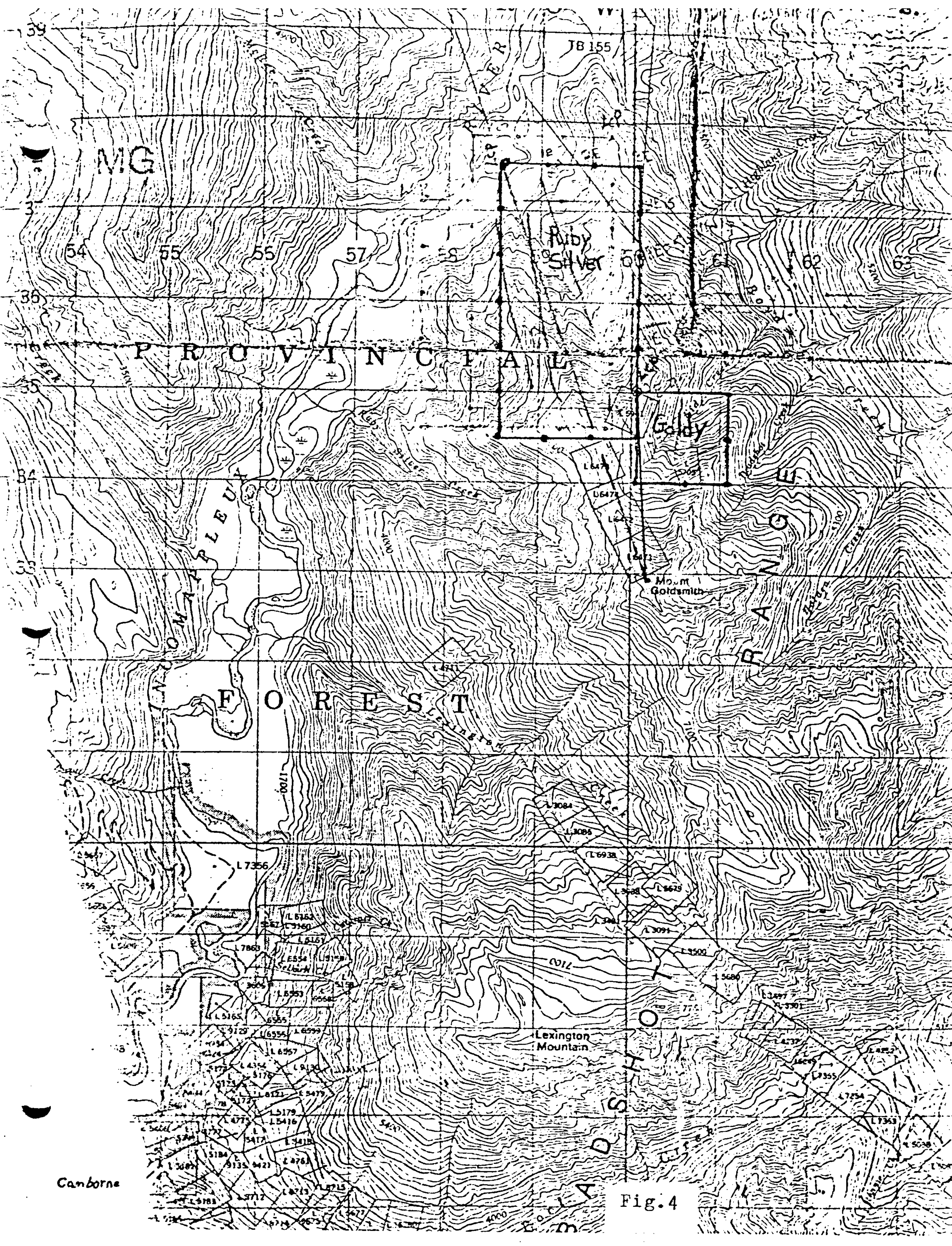

Ruby Silver
Goldy
Mount Goldsmith
Lexington Mountain
PROVINCIAL
FOREST
RANGE
Camborne
TB 155
L 7356

Fig.4

Climate and Vegetation:

Climatologically, the property is within the Interior Wet Belt where precipitation exceeds an average of 40 inches per year. Vegetation is thick and lush in the river and creek bottoms; cedar trees up to 12 feet in diameter are common. Ferns and devils club constitute a large portion of the underbrush. At higher elevations much of the rock is bare of overburden and a typical alpine flora is present. Winters, in the area are usually severe and bring many feet of snowpack.

Access:

The property can be reached by jetboat on the Incommapleaux River from Cambourne, B.C. (Fig. 4). At this point,a steep but good trail commences a 3500 foot climb up a narrow ridge, then drops 500 feet to the main showing. The property can be visited by helicoptor; a good heliport is located on this same narrow ridge at an elevation of 5000 feet, leaving a 200 foot climb before descending the 500 feet to the main showing.

Background:

Discovery of the initial showing on this property was in the summer of 1906. It was found by following mineralized float found in a wash at the mouth of Goldsmith Creek back to its source. The Consolidated Mining and Smelting Company optioned the property in the summmer of 1913 but little work was done before 1914. The advent of World War I halted exploration on the property. Ground became open until 1973 when it was staked by the Leask Syndicate. Their claims lapsed in the fall of 1977 but were restaked in the spring of 1978; these claims lapsed on May 28th, 1979. On May 29th, 1979, eighteen units were located using the modified grid system (Fig. 4). Detailed mapping and prospecting commenced in the first part of June,1979 and continued until the end of July, 1979. An additional four units comprising the Goldy group were tied on to the existing group July 21st, 1979 (Fig. 4).

REGIONAL GEOLOGY

General Statement:

Ruby Silver and Goldy claim groups are located in the Lardeau portion of the Kootenay Arc. Regional geology was compiled by Peter Read for the Geological Survey of Canada at a scale of 1:250,000.

The project area of this study lies within a series of lower Paleozoic sedimentary and volcanic rocks of the Lardeau Group which is underlain by the Badshot Formation and Hamill Group. These regional units are described below.

Hamill Group (Lower Cambrian)

Hamill group comprises a thick sequence of quartzitic rocks beneath the Badshot Formation. One member, the Marsh Adams Formation outcrops north of Boyd Creek where it contacts the Battle Range Batholith disconformably. The Marsh Adams Formation consists of quartzite, micaceous quartzite and phyllite. This is overlain by the Mohican Formation which consists of phyllite and limestone.

Badshot Formation (Lower Cambrian)

Badshot Formation overlies the Mohican Formation conformably. Badshot lithogy consists mainly of light grey, thick bedded to massive micritic limestone. Lenses of marble are observed within the limestone and commonly contain black argillacious material. Algal pellets and Archeocyathids have been found in several locations by Dr. James T. Fyles (1964). The northern extent of the Badshot Formation is just north of the confluence between Boyd Creed and the Incommaplueaux River. It has thinned down to a few tens of feet at this point from a thickness of over 900 feet southeast of Duncan Lake.

Lardeau Group (Lower Paleozoic)

Lardeau Group overlies the Badshot limestone and includes a great thickness of sedimentary and volcanic rocks. This sequence is unfossiliferous and highly deformed. Detailed stratigraphy (Fyles and Eastwood, 1962) was determined by sufficient observations of graded bedding between the Alkolkolex River and the Incommapleaux River. Only the lowermost member the Index Formation is of interest in this study because it hosts the Ruby Silver and Goldy mineralization and comprises all the units mapped on the 1:10,000 detailed property map.

Battle Range Intrusions (Cretaceous)

Battle Range Batholith intrudes the Hamill and Lardeau groups about three miles north of the Ruby Silver showing. The intrusion is composite; the southern portion consists of a biotite-hornblende quartz monzonite containing sodic andesine but the main body of the batholith is a muscovite-biotite granodiorite with calcic oligoclase. A pyritiferous alaskite is present in the central portion of the batholith.

DETAILED GEOLOGY

General Statement:

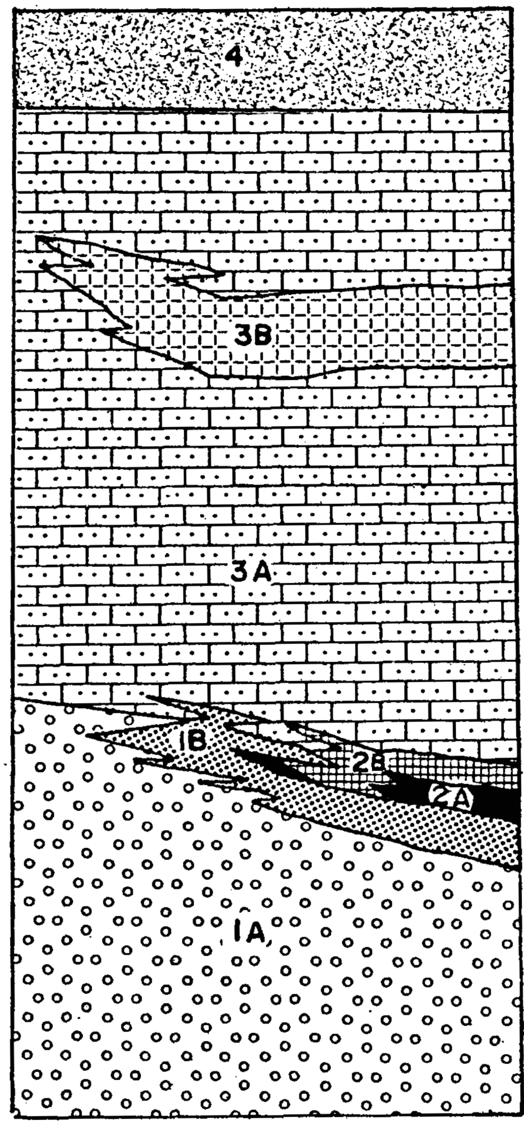
Overall structure on detailed map consists of a series of nearly upright folds within the lower Paleozoic Lardeau group (Fig. 1A). Observations of graded bedding (Fyles and Eastwood, 1962) have served to indicate the stratigraphic order, as no fossils have been found in this group to date. All members except the uppermost unit, unit 4 (Fig. 5) exhibit lateral facies changes between the lithologies contained within them. Lithologies present in stratigraphic succession from lowest to highest are; (1) Unit 1A, a quartz grit and green gritty phyllitic, (2) Unit 1B, gray-green and light green phyllitic siltstone, (3) Unit 2A, lead-zinc mineralization with associated silicification, (4) Unit 2B, manganosiderite with massive magnetite-hematite and lead-zinc, (5) Unit 3A, gray sugary limestone, (6) Unit 3B, gray graphitic limestone with thinnly interbedded dark graphitic phyllites, (7) Unit 4, dark green phyllite and greenstone (Fig. 5).

Stratigraphy:

Stratigraphy of the Index Formation sedimentary and volcanic rocks is well exposed on the Ruby Silver and Goldy claims in the amphitheater-like basins and on the narrow ridges. Dips are moderate to steep to the northeast, with some dip slopes being formed on the north facing slopes as a result of bedding and foliation orientation.

Unit 1, the lowermost member of the Index Formation, is a mixture of quartz grit and green, chloritic, gritty phyllite; it has a thickness of approximately 800 feet. An upper sub-unit (Unit 1B) of gray-green and light green phyllite is lenticular in morphology and is not continuously present. This unit has a maximum thickness of 120 feet. In some places the contact between gritty phyllite and upper gray-green and light green phyllite is distinct, in other places it is gradational. Lenticular manganiferous siderite (Unit 2B), metachert,and associated lead-zinc mineralization (Unit 2A) occur at the contact between Unit 1B and Unit 3A, a gray sugary limestone (Fig. 5). This gray sugary limestone forms the lower part of Unit 3, the major carbonate unit. This lower division appears bleached near the lower contact and locally has a white sugary appearance. In other places,particularly on the ridge between the Ruby Silver and Goldy claims, rusty lenticular lenses that contain up to two percent disseminated crystals of magnetite are found within the sugary limestone. The intermediate division, Unit 3B, is a gray graphitic limestone with thinnly, interbedded dark graphitic phyllites. Unit 3B has a maximum thickness of approximately 300 feet (Fig. 5).

The uppermost unit is a dark green phyllite and greenstone with rare pillows (Fyles and Eastwood,1962). This submarine volcanic unit is approximately 150 feet thick and conformably overlies the carbonate.



4 green phyllite and greenstone with rare pillows

3B gray graphitic limestone with thinnly interbedded black graphitic phyllites

3A gray sugary limestone

2B siderite with massive magnetite-hematite and Pb-Zn

2A Pb-Zn mineralization with associated silicification

1B gray green and light green phyllitic siltstone

1A quartz grit and gritty chloritic phyllite

Stratigraphic column of lithologies on Ruby Silver and Goldy claim groups

fig. 5

0 50 100 150 200 250

vertical scale in meters

Environment of Deposition of Stratigraphic Units:

Lower Index Formation clastics (Unit 1A) formed under conditions of high cratonic relief and were likely basinal slope deposits. The chlorite rich gray-green and light green phyllitic siltstone likely reflects a deeper basin environment. Overlapping lateral facies changes resulted from multiple transgressions and regressions, although structural complexity complicates this interpretation. Massive chlorite at the base of the silicified ore zone (Unit 2A) reflects hydrothermal activity in the basin. Lead-zinc mineralization associated with silicification is precipitated from metalliferous brines originating from fissures at some depth in the basin. The manganiferous siderite horizon is generally stratigraphically coincident with the lead-zinc mineralization but was precipitated more distally from the source of metalliferous brines. Speculatively, rates of influx of hydrothermal brines may have varied because of sea level changes and subsequent changes in hydrostatic head in the fissure system (Degens and Ross, 1970). Mineralizing episodes appear to have been fairly closely followed by either uplift or regression of the sea. Gray micritic limestone (Unit 3A) was apparently deposited above the carbonate compensation depth, in an off-shelf environment, as a pelagic ooze. Rusty lenticular lenses that contain up to two percent disseminated magnetite are present at several horizons within the gray limestone. These rusty horizons possibly represent several pauses in carbonate deposition with concomittant formation of insoluable residue by carbonate dissolution along these uncomformities. Transgressions of the sea resulted in more stagnant, deeper water conditions and depostion of graphitic carbonate with thinnly interbedded black graphitic phyllites (Unit 3B). Sea level regression followed, and deposition of pelagic oozes became dominant again.

Unit 4, volcanic greenstone and dark green phyllite formed in a submarine environment as flow rocks because rare pillows are found.

Structure:

Regionally, the stratified rocks of this area lie on the western limb of the Purcell Anticlinorium (Reesor, 1973). Three phases of folding and an associated faulting episode give rise to the map patterns observed (Fig. 1).

The first phase of folding resulted in the recumbant southeast plunging Alkokolex Anticline (Fyles, 1962) which closes to the northeast. Sparse evidence of this event is preserved but where it exists it is marked by rootless, isodinal folds with well developed axial plane foliation. Well developed cleavage, likely due to shear folding of the first event fans around phase two fold axes to some degree (Fig. 7).

Second phase folds are macroscopic and ubiquitous, and are largely responsible for the map distribution of rock units in figure 1. These folds are commonly assymetric with the majority being isoclinal. The F2 fold axes are defined on the stereonet plot by poles to F1 and F2 axial plane cleavage (Fig. 7) and minor fold axes (Fig. 9). Some incompetent units are repeated within themselves by isoclinal folding as is well displayed on the precipitous cliff north of Goat Creek (Fig. 1). Complexities of these structures are often so great that the original stratigraphy is no longer deciferable. Competent units tend to be broken into lenses surrounded by well cleaved incompetent, micaceous units. Observed thicknesses give little indication of original stratigraphic thickness because of the high degree of flowage. Some homoclines have been formed by attenuation during the later progression of the second folding event.

Only the lower overturned limb of the Alkokolex Anticline is observed in the study area, thus the stratigraphic sequence is overturned. The first two phases of folding were nearly coaxial with a trend of 148 degrees azimuth and plunge of 10 degrees. The two phases of folding are interpreted as a simple progression of a single stress configuration. Later stages have deformed phase two axial planes and fold axes slightly about a roughly easterly trending fold axis with a plunge of 60 degrees.

The observed faulting episode was post phase two folding and likely resulted from the natural progression of the stress condition that gave rise to F1 and F2 folds because the fault planes are nearly parallel fo F2 axial planes. All observed fold vergences were consistant with the geologic and structural interpretation shown in Figure 1A.

POLES TO CLEAVAGE

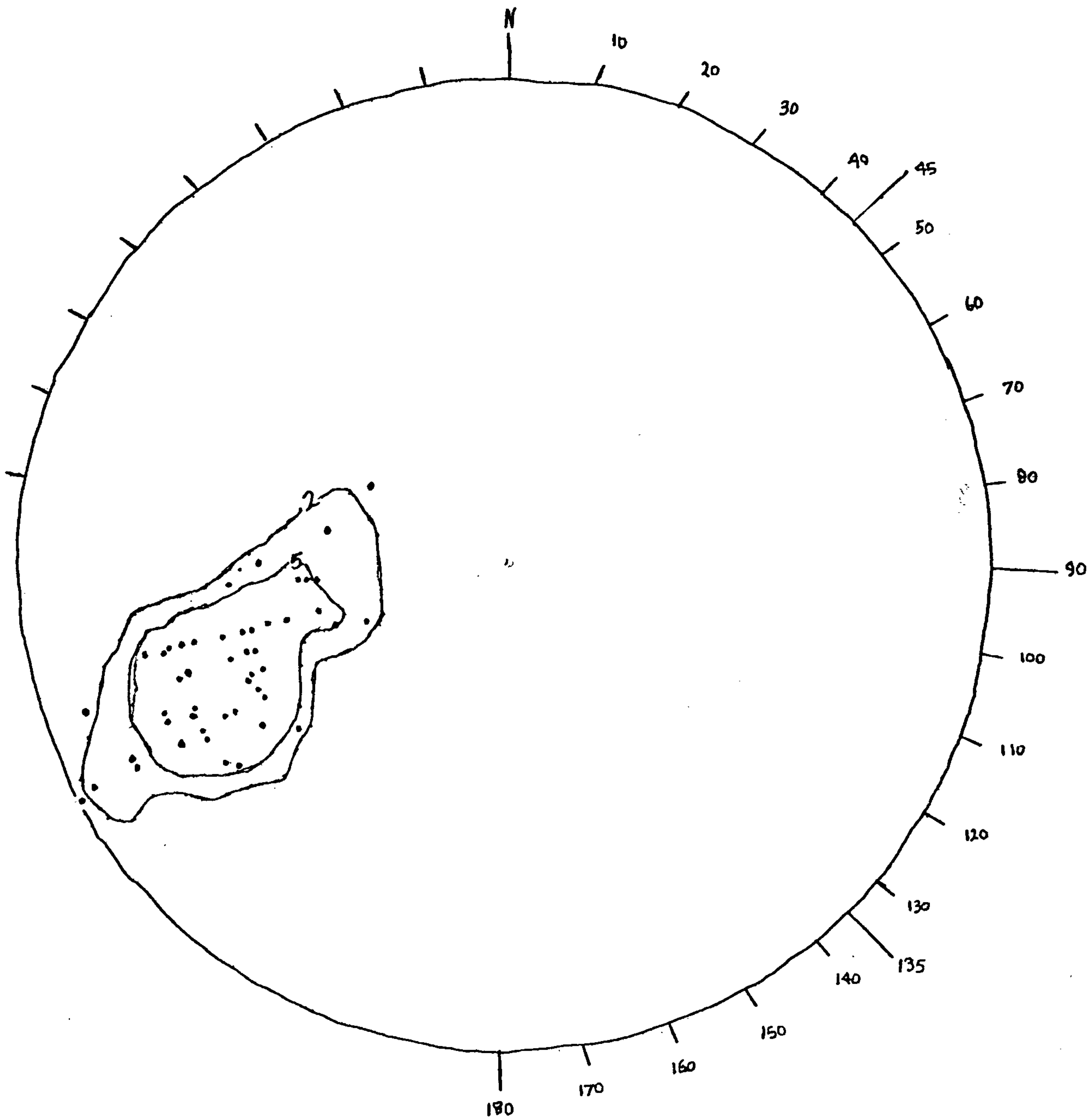


fig. 7

POLES TO BEDDING

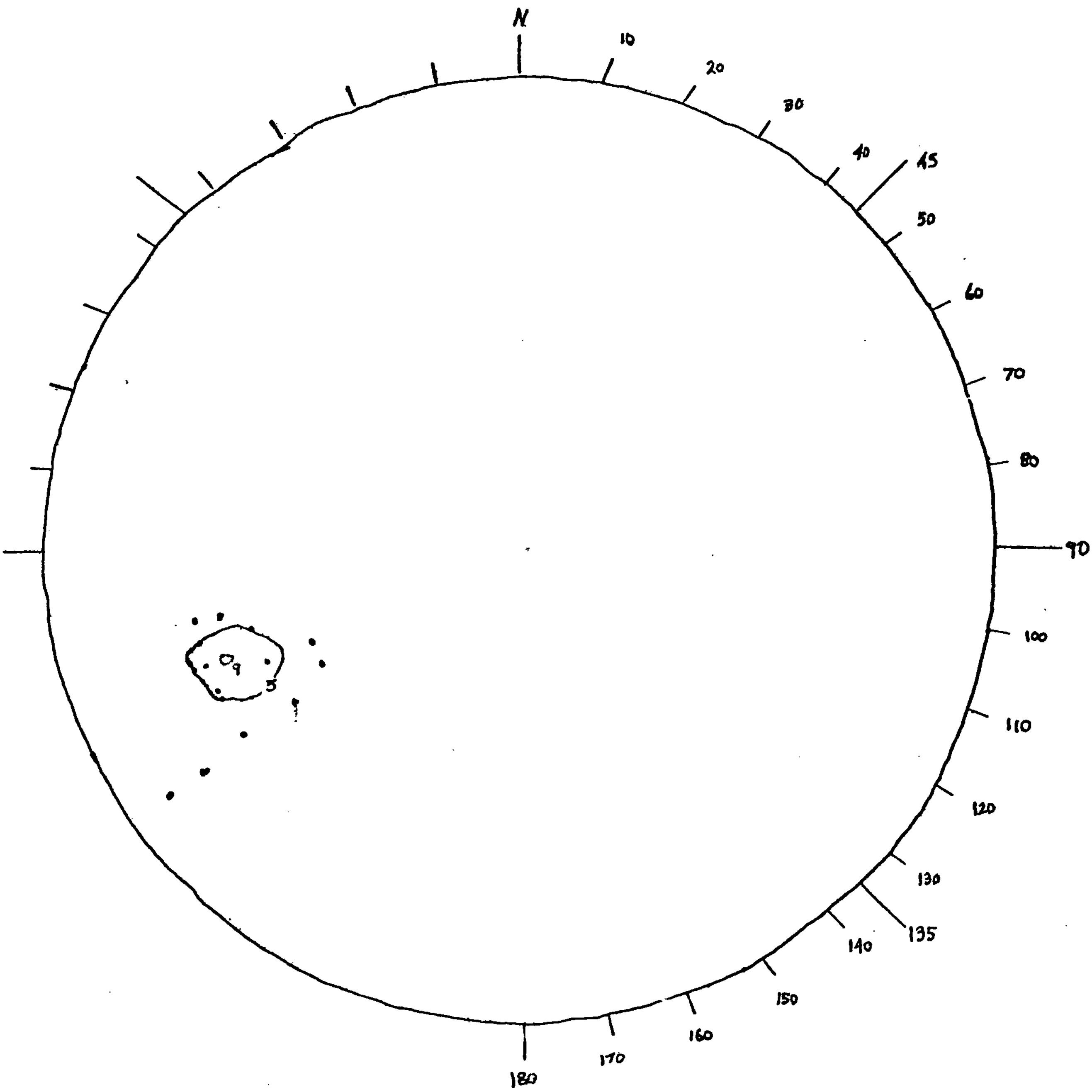


fig. 8

MINOR FOLD AXES ORIENTATIONS

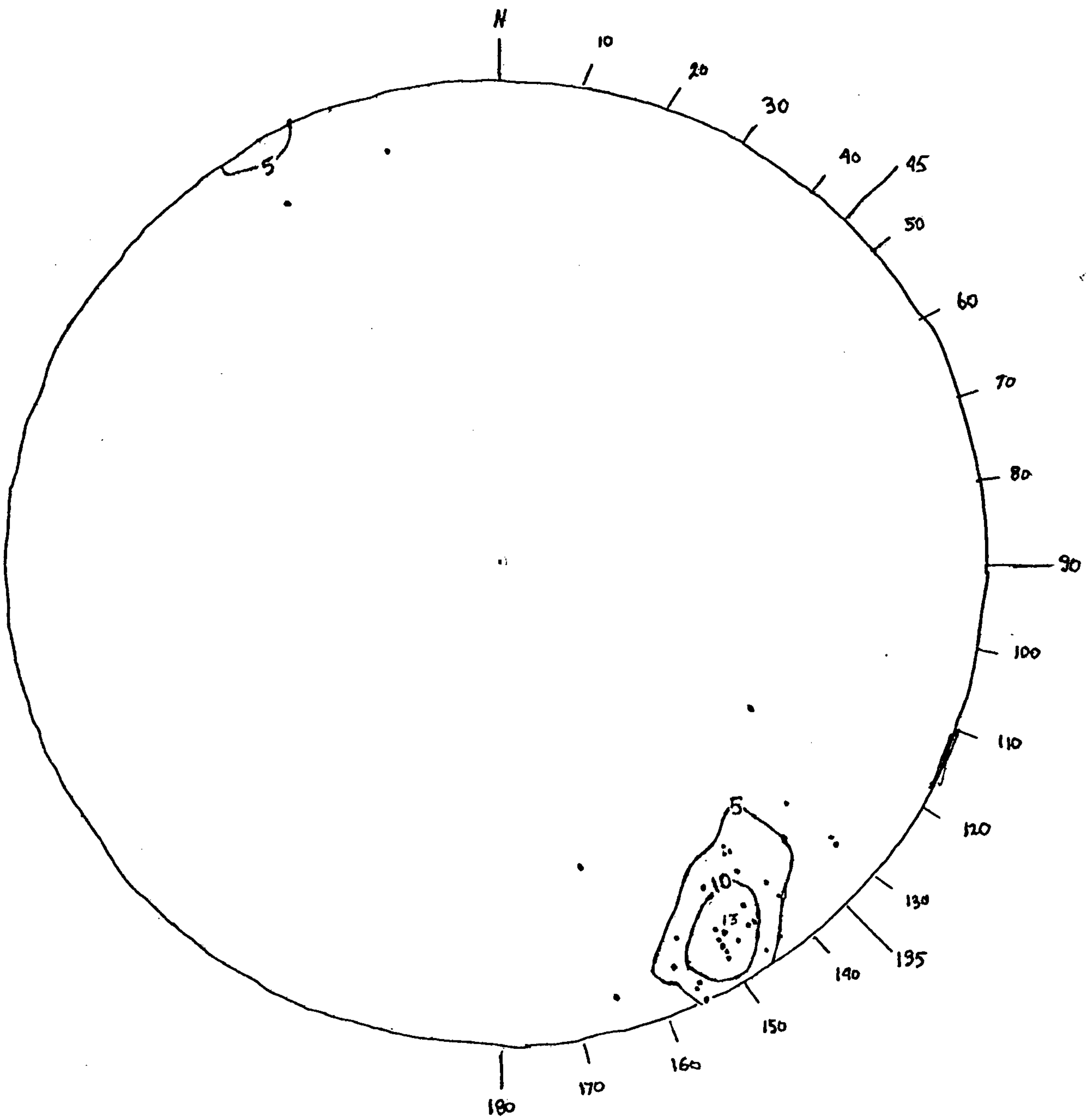


fig. 9

Composite data

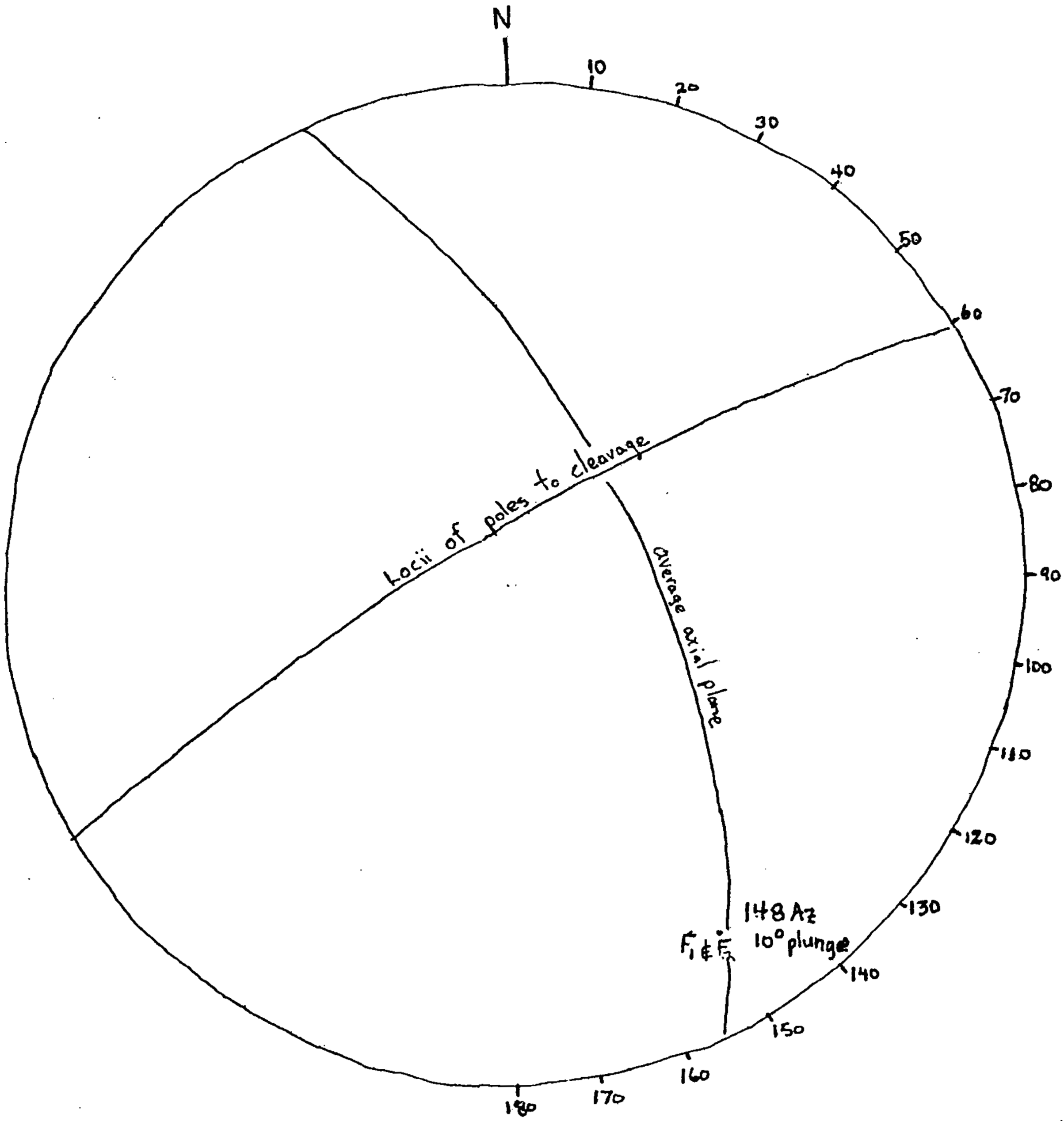


fig. 10

SULPHIDE MINERALIZATION

Ruby Silver Showing: .

Two major mineralized areas within hinge zones in anticlinal folds comprise this showing. The lower showing is situated at an elevation of 4600 feet to 4700 feet and consists of galena-sphalerite mineralization which occurs as patches and disseminations over a width occurs of 15 feet to 25 feet within the hinge zone of a parasitic anticlinal fold. The upper showing is located at an elevation of 4800 feet to 4950 feet and has the same basic minerology as the lower showing. The upper showing is located within the hinge zone of the major antiform (Fig. 2). This upper showing ranges from 10 feet to 40 feet in true width. Ore grades of both showings are approximately 10 percent lead, 1 percent zinc, and .5 ounces per ton silver. Complete assays are compiled in Appendix III. Higher grade mineralization is concentrated in the upper hinge zones indicating that some remobilization has taken place. Morphology of the controlling structure might not be due totally to later deformation, but may be due in part, to lateral facies changes.

The geologic situation and minerology indicate the most likely mechanism of depositionof the Ruby Silver sulphide showing. The evidence strongly suggests a distal volcanogenic source. The following characteristics compatible with this conclusion were observed:

1) Lead-zinc mineralization is stratiform; at the contact between the gray-green phyllite and gray sugary limestone (Fig. 5).

2) The contact in 1, above, is marked by the occurrence of metachert associated with manganiferous siderite; this unit might be exhalative in origin.

3) Massive chlorite occurs along fractures and at the base of the deposit; might be hydrothrmal in origin.

4) Pods of massive hematite-magnetite are associated with the mineralized horizon; such mineralization is commonly associated with volcanogenic deposits.

A possible mode of deposition proposed for this occurrence involves the collection of hot metalliferous brine in an anoerobic basin. This type of deposition is taking place in the Chain Deep from distal metalliferous fluids originating in the Atlantis II Deep, Red Sea area.

When these brines circulate and mix with oxygenated seawater colliodal precipates of iron oxides and sulphides result. It has been noted (Bishoff, 1969) that such iron rich brines will precipitate ferric hydroxide on contact with a source of oxygen. The mechanism of sulphide deposition,proposed by Degens and Ross (1970),states that bacterial sulphate reduction takes place at the anaerobic/aerobic interface. Sulphate reducing bacteria, Desulphovibrium, has been identified in the Red Sea brine. Sato (1972) states that these hydrothermal brines and metalliferous gels may travel down a very low gradient.slope by turbidity current phenomenon and prepitate sulphides many tens of miles from the source.

Manganese rich iron-carbonate is a direct precipitate as a result of decreased solubility with decreased temperature. Basinal depths were probably of the order of 2000 feet or more to ensure an anozic environment.

Chalcopyrite blebs in sphalerite indicate that diagenetic temperatures reached at least 352°C. It is believed that temperatures, in this range, could be reached, locally, if sediments covered an active hydrothermal system. It should be noted that this temperature is ideal and may be inaccurate due to the effect of trace amount of impurities on this geothemometry.

Other Mineral Occurrences:

Scout Showing:

The Scout showing (Fig. 1) originally was located by George Goldsmith in the early 1900's. At an elevation of 5800 feet to 6000 feet, a highly silicified zone, 15 feet to 25 feet wide and 300 feet long, conforms with bedding and roughly strikes 330 degrees and dip 45 degrees east. Silicification is intimately associated with the Scout Fault (Fig. 1), where it cuts carbonate rocks. The Scout Fault is post phase two folding and has brought the gritty green phyllite in contact with itself resulting in an antiform. The fault splits the antiform and is coincident with axial planes of local phase two isoclinal folds.

Mineralization consists of galena, sphalerite, and pyrite located within the silicified carbonates of the hinge zone and occurs as patches and disseminations of sulphides. Ore shoots of massive galena up to five feet wide and 25 feet long with maximum depths of 15 feet were encountered while driving the 250 foot long Scout drift (Fig. 1). Most vein and crossfracture fillings are less than a foot wide,with maximum dimensions less than 25 feet. Assay of a sample from this showing ran 55.5 percent lead, 2 percent zinc, 58.4 ounces per ton of silver, and .1 ounce per ton of gold (Newton Emmons, 1914). A more recent aasay ran 19.6 percent lead, .3 percent zinc, 14.1 ounces per ton of silver, and .092 ounceper ton of gold.(Appendix III).

Mammoth Showing:

The Mammoth showings (Fig. 1) are located approximately one mile south of the Scout showing at elevations from 7400 feet to 8000 feet. Galena, tetrahedrite, and argentite mineralization occurs in flat lying cross fractures in the carbonate unit within 100 feet of the Scout Fault. These fractures are less than a foot in width,with maximum dimensions less than 50 feet. Several tons of ore that assayed approximately 400 ounces per ton of silver were shipped near the turn of the century.

Several other mineralized veins and cross fractures are also associated with the Scout Fault. Most of these showings exhibit similar minerology to those described above although only the Mammoth is known to contain argentite and tetrahedrite.

The Scout Fault apparently served as a conduit for diagenetic mineralizing fluids that deposited sulphides along this structural trap. These fluids likely are responsible for the massive silification of the fault zone and resulted in cementation and subsequent decrease in permeability halting further deposition of sulphides. Higher silver grades at the Scout and Mammoth compared to the Ruby Siver deposit is explained by their epigenetic relationship to the Scout Fault. Scout and Mammoth mineralization formed at a later time than the Ruby Silver showing but ultimate source of metal may have been similar as both types of occurrence coincide stratigraphically.

CONCLUSION AND RECOMMENDATIONS

Geology, genesis, and recommendations for further exploration have been arrived at on the basis of field observations, literature research, and other compiled data.

Conclusions:

The Ruby Silver deposit;

1) is a syngenetic distal volcanogenic type;

2) has been subjected to post depositional deformation which has been very intense and resulted in shearing and remobilization of sulphides to form a breccia protore in the core of the controlling antiform;

3) contain manganiferous siderite and massive magnetite-hamatite associated spatially with lead-zinc mineralization; this is common of many volcanogenic deposits in the world.

Silver rich veins;

1) are related to the Scout Fault;

2) might represent remobilization of metals from pre-existing stratiform sulphide bodies;

3) have small tonnage potential, but grades are significant.

Recommendations:

The full extent of the Ruby Silver lead-zinc showing (Fig. 1) along the plunge of the controlling antiform should be explored. Drill holes stepped out 300 feet on each successive drill set-up are required. Extent of drilling depends upon success of each previous hole.

Induced polarization surveys or drill holes should be used to test for sulphides down dip of the large siderite outcrop in Goat Creek (Fig. 1).

Further prospecting along strike of mineralization could very likely result in further discoveries.

BIBLIOGRAPHY

Bischoff, J.L., 1969.
Red Sea Geothermal Brine Deposits: Their Mineralogy, Chemistry, and Genesis; in Degens, E.T. and Ross, D.A. (eds.), "Hot Brines and Recent Heavy Metal Deposits in the Red Sea", New York, Springer-Verlag, pp. 368-401.

Degens, Egon T. and Ross, David A., 1970.
"The Red Sea Hot Brines," in Scientific American, April, 1970, pp. 32-42.

Emmons, Newton W., 1914.
The Mineral Resources of Lardeau and Trout Lakes Mining Divisions, B.C., Bur. Mines, Bull. No. 2, 1914.

Fyles, J.T., 1962.
Two Phases of Deformation in the Kootenay Arc; Western Miner Oil, Rev.,V.35, no. 7, pp.20-26.

Fyles, J.T., 1964.
Geology of the Duncan Lake Area, Lardeau District, British Columbia; British Columbia Dep. Mines Petrol. Resources, Bull. 49.

Fyles, J.T. and Eastwood, G.E.P., 1962.
Geology of the Ferguson Area, Lardeau District, British Columbia; British Columbia Dep. Mines Petrol. Resources, Bull. 45.

Reesor, J.E.,.1973.
Geology of the Lardeau Map-Area, East-Half, British Columbia; Geological Survey of Canada Memoir 369, pp.103-104.

Sato, Takeo, 1972.
The Kuroko and Associated Deposits of Japan; A Review of their Features and Metallogenesis; Economic Geology, V.69, pp.1215-1236.

Schouten, C., 1962.
Determination Tables for Ore Microscopy; Elsevier Publishing Company, New York.

APPENDIX I

Petrology and Mineral Identification (X-Ray Diff.)

JML RS1- Meta-Ultramafic

- bladed and radiating actinolite after pyroxene
- chlorite rims around actinolite
- this may be a metamorphosed lamprophyre dyke as it is found in only one location and is extremely limited in extent.

Modal Analysis

	Grain Size	Percentage
Actinolite	2mm	75
Chlorite	—	20
Tremolite	.3mm	3
Sericite	.3mm	2

JML RS2- Graphitic limestone

- dark coloured with slight foliation and micaceous scheen

Modal Analysis

	Grain Size	Percentage
$CaCO_3$	—	70
Quartz	.1mm	18
Sericite	.1mm	2

JML RS3- Coarse grained sandstone (grit)

- many sutured contacts
- some mottled grains

Modal Analysis

	Grain Size	Percentage
Quartz	.4 - 1.5mm	88
Chlorite	—	10
Feldspars	.2mm	2

JML RS5- Gray-green phyllite (siltstone)

- exhibits flow banding fabric
- stratification evident in thin section
- fine quartz grains

Modal Analysis

	Grain Size	Percentage
Quartz	.05mm	75
Chlorite	—	20
Sericite	.1mm	5

JML RS6- Meta-chert

- coarse grained quartz aggregates with a few sutured grains in a very fine grained quartz matrix.

Modal Analysis

	Grain Size	Percentage
Quartz	.4 & .03mm	90
Chlorite	—	10
Graphite	—	accessory

X-Ray diffraction:

Positive identifications were made on the following minerals:

Siderite: occurs commonly as a brownish weathered rock associated with Pb-Zn mineralization.

Magnesium Chlorite: found in fractures at the base of the main showing.

APPENDIX II

Mineralography

Samples:

16 polished sections

14 specimens

Fourteen specimens were selected from the property during the 1979 assessment for the purpose of a mineralographic investigation. The specimens were selected to sample all major features of the deposit and obtain specimens exhibiting good mineral associations.

A chain and compass map, showing the location from which the specimens were cut, is included with this report (Fig. 2).

Sample No.	Location	
B.S. 1	0+30	10R
" 2	0+60	10R
" 3	0+70	0
" 4	0+90	20L
" 5	0+30	0
" 6	1+00	20L
" 7	1+30	30R
" 8	2+20	20L
" 9	0+50	10R
" 10	0+70	30R
" 11	1+10	16R
" 12	4+50	10R
" 13	1+30	0
" 14	1+40	10R
" 15	1+30	10L

Table of Abundances

Sample No.	Sph.	Gn.	Hem.	Mag.	Cpy.	Py.	Qtz.	*Carb.	Chl.
1	-	26.5%	-	-	.5%	3%	20%	40%	
2	-	5%	-	-	-	20%	55%	20%	
3	7%	5%	-	-	-	8%	75%	4%	
4	-	15%	-	-	-	40%	35%	3%	
5A	-	12%	-	63%	-	-	5%	-	20%
5B	-	4%	-	.6%	.4%	5%	60%	15%	15%
6	20%	25%	-	-	-	5%	50%	-	
7	-	5%	-	-	-	10%	80%	5%	
8	-	-	30%	35%	-	-	45%	-	
9	-	15%	30%	5%	-	5%	45%	-	
10	-	18%	20%	-	-	2%	20%	45%	
11A	20%	20%	-	-	.5%	9.5%	45%	5%	
11B	25%	20%	-	-	.5%	4.5%	49%	1%	
13	30%	35%	-	-	-	10%	-	25%	
14	23%	47%	-	-	1%	4%	20%	5%	
15	10%	40%	-	-	-	10%	40%	5%	
Overall Avg.	8%	18%	5%	6%	.2%	8%	42%	12%	1%

* Carbonate includes calcite, siderite, and dolomite

Mineral Descriptions:

Sphalerite:

This mineral is best observed without crossed nichols and is easily identified by its gray-white reflectance. Identification can be substantiated by the presence of internal reflectance under crossed polars. This sphalerite is very black in colour and would commonly be referred to as "blackjack".

Sphalerite frequently occurs as massive blebs within a galena support matrix and in some isolated cases appears to replace pyrite. Small blebs of galena and chalcopyrite are often observed in the massive sphalerite. Sphalerite crystals are mainly anhedral and rarely occur as disseminated grains within the gangue. Some crystals are broken and comminated indicating post mineralization deformation and remobilization. This deformation is likely responsible for the crystal twinning observed.

Galena:

This is the most abundant economic mineral and forms much of the matrix around clasts of gangue, pyrite, and sphalerite; many of these clasts are matrix supported. Galena occurs sporadically in pyrite grains and is disseminated throughout the gangue.

Galena shows evidence of flow deformation such as alignment of euhedral quartz crystals along curved cleavage faces. This texture is often preferentially replaced around grain boundaries by textureless galena. Galena locally replaces sphalerite.

Chalcopyrite:

Chalcopyrite occurs as a few irregularly shaped grains mainly in sphalerite but infrequently within gangue and galena. Grain boundaries are smooth between chalcopyrite and spalerite. Chalcopyrite grains range in size from .25 mm. to .4 mm.

Pyrite:

Relatively evenly distributed throughout the showing, pyrite occurs as eudral crystal from .06 mm. to 2.5 mm. in diameter. These pyrite crystals sometimes contain inclusions of gangue and galena and are often highly fregmented and altered to iron oxides on the rims.

Hematite:

Massive hematite occurs as intergrowths with magnetite and exhibits graphic, pseudo-spinifex texture. Some small fragments of galena are found in a matrix of hematite.

Some hematite crystals with square cross-sections were observed and thought to be pseudomorphs after pyrite.

Magnetite:

This mineral is observed to be both massive and disseminated and occurs as intimate intergrowths with hematite.

Vanderveer Diagram:

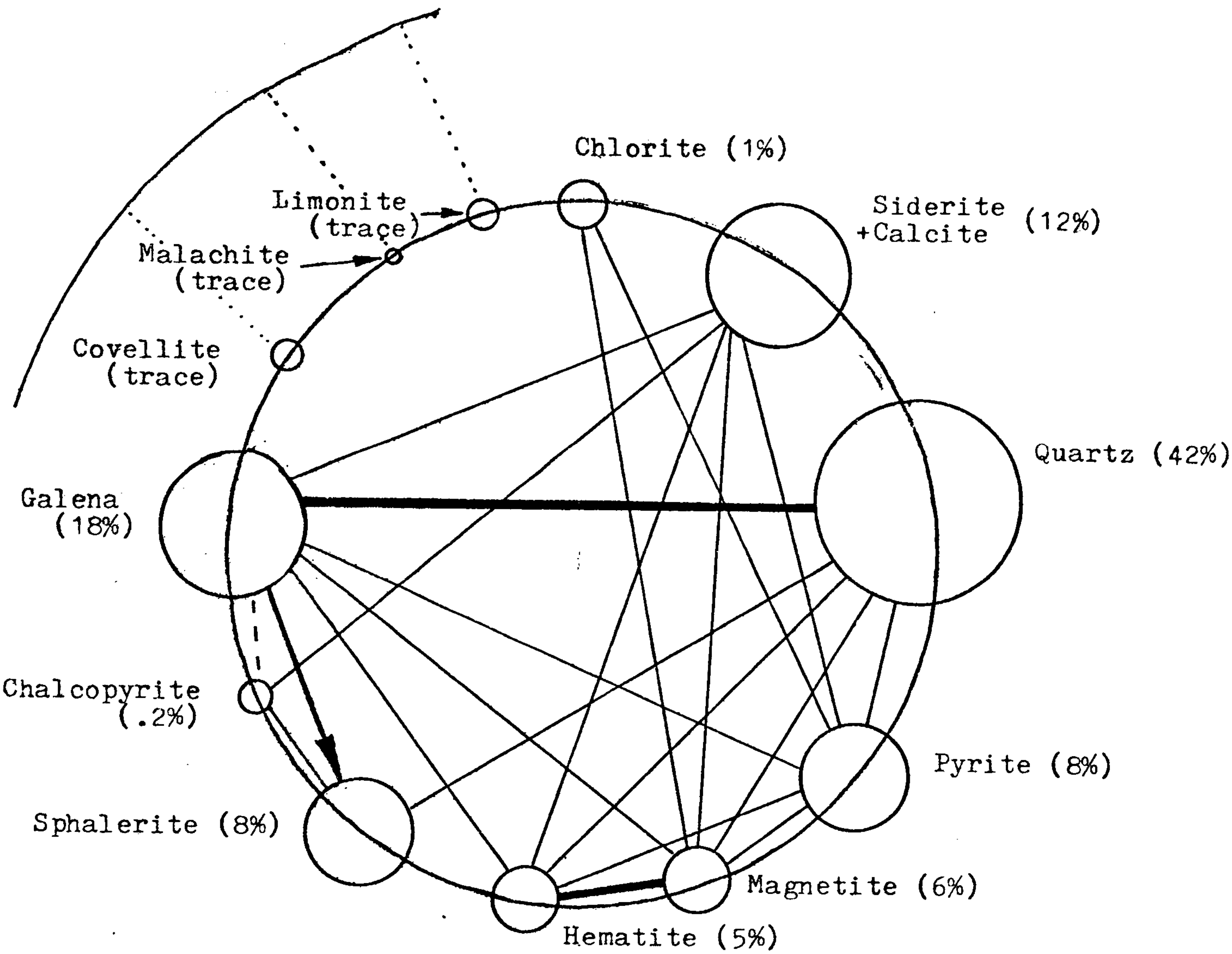


Fig. 11

Paragenetic Line Diagram:

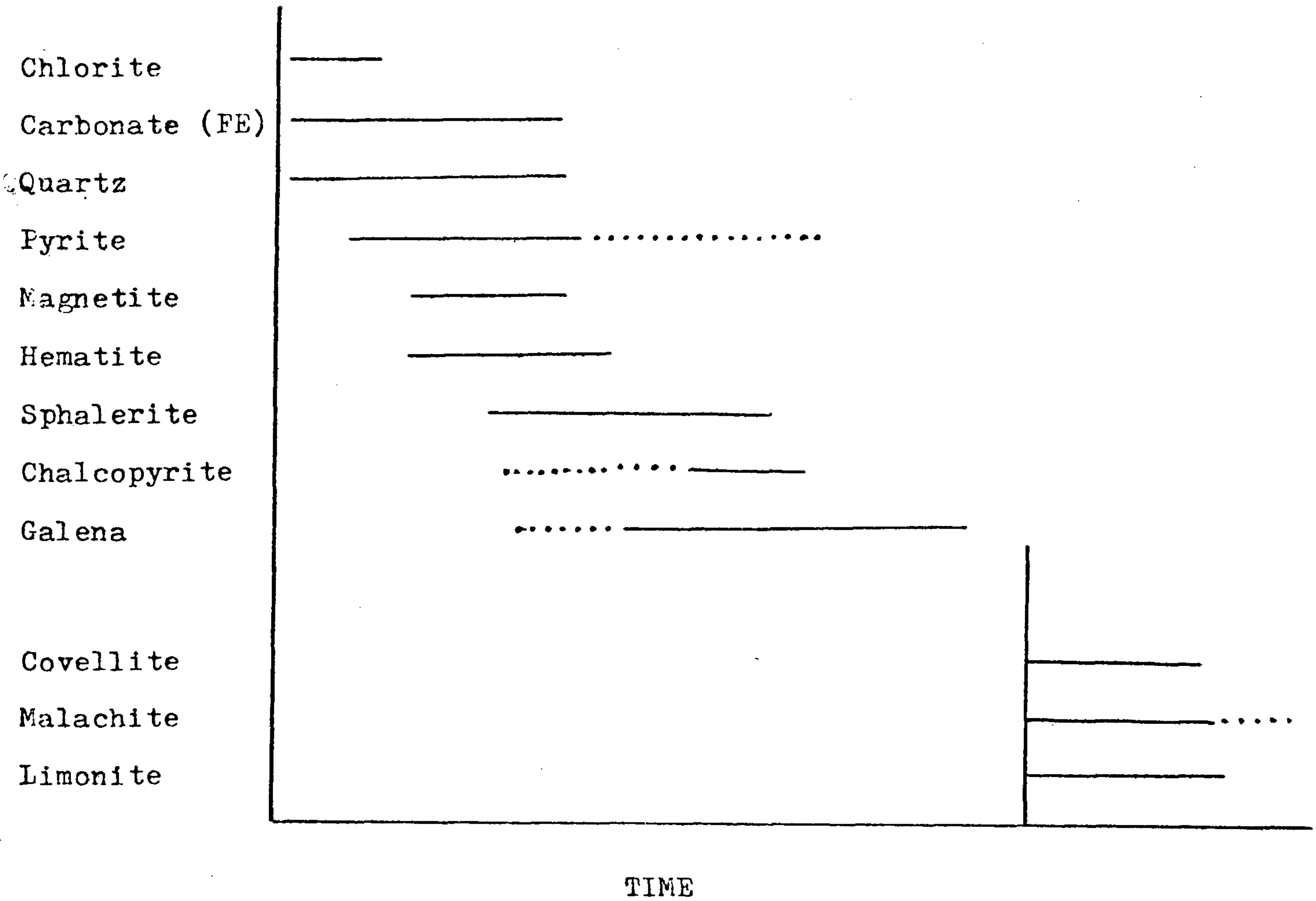


Fig. 12

General Descriptions:

From the relationships apparent on the detailed chain and compass map (Fig. 2), it appears that the deposition of chlorite was the first signature of hydrothermal activity. Deposition of the siliceous horizon followed and was likely contemperaneous, (at least in part), with manganosiderite deposition (Fig.12). As the brines became increasingly saturated with iron, magnetite-hematite lenses and concretions began to form at the sediment-seawater interface, proximal to hot fumerolic activity. Pyrite likely was forming by diagenesis in the unconsolidated iron rich sediments throughout the initial stages of hydrothermal activity. The bottom brines became increasingly saturated with metal, and sulphides began to precipitate from the brine column. Precipitation was perhaps aided by sulphate reducing bacteria (Degens and Ross, 1970). With this mode of deposition postulated, it is likely that sphalerite, galena, and chalcopyrite formed as colloidal precipitates and settled to the bottom. Intimate intergrowths of these sulphides suggest a contemperaneous deposition and later dissociation by diffusion. This explaination accounts for smooth intergrowths of chalcopyrite in sphalerite and galena in pyrite cubes.

Photomicrographs: Plate I

Photo #1
Specimen B.S. 15

Galena-Sphalerite support matrix with clasts of gangue and pyrite cube.

Photo #2
Specimen B.S. 5A

Magnetite crystal surrounded by galena and gangue.

Plate II

Photo #3
Specimen B.S. 14

Emulsion texture of chalcopyrite in sphalerite with some galena intergrowths and pyrite cube.

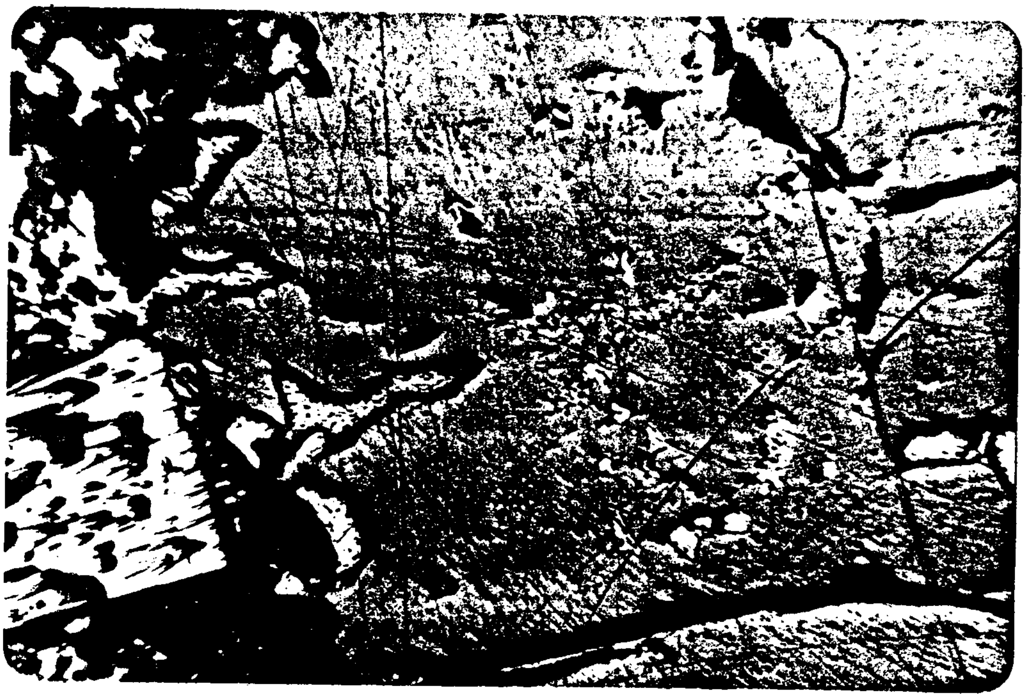
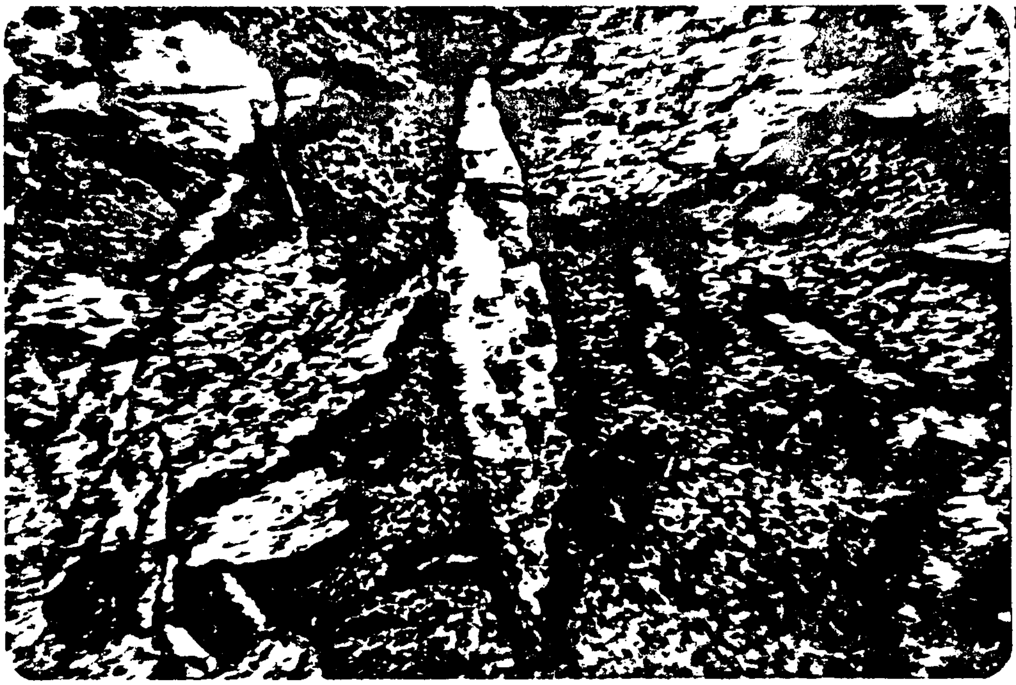


Photo #4
Specimen B.S. 15

Pyrite cube containing galena blebs surrounded by galena and gangue.

Plate III

Photo #5
Specimen B.S. 8



Magnetite-Hematite intergrowths

Photo #6
Specimen B.S. 2

Fractured pyrite with blebs of galena.

APPENDIX III

Assays

To: Hudson Bay Exploration &
Development Co. Ltd.,
440 - 1055 W. Hastings St.,
Vancouver, B. C. V6E 2E9

Assaying & Trace Analysis
852 E. Hastings St., Vancouver, B.C. V6A 1R6
Telephone: 253 - 3158

ASSAY CERTIFICATE

File No. 0347
Type of Samples Rocks
Disposition

No.	Sample	Pb %	Zn %	Ag oz/ton	Location of Channel Samples				No.
1	22337	51.20	2.15	2.55	0+30				1
2	22338	10.20	.02	.42	0+50				2
3	22339	12.50	1.63	.88	0+70				3
4	22340	22.90	.83	1.80	0+90				4
5	22341	28.40	1.74	1.68	1+10				5
6	22342	18.80	2.36	1.35	1+30				6
7	22343	8.45	4.50	.56	1+50				7
8	22344	.35	.10	.02	Grab sample of gouge LOWER ADIT				8
9	22345	26.40	2.45	1.33					9
10	22346	1.63	.02	.12	4+60				10
11	22347	6.14	.78	.32	Chip sample across 3.0 m 0+70				11
12	22348	7.55	.01	.39	Large pod of galena sample across 3.0 m 0+50				12
13	22349	8.05	.10	.44	1+50				13
14									14
15									15
16									16
17									17
18									18
19									19
20									20

refer to fig. 2 for widths

DATE SAMPLES RECEIVED Aug. 8, 1979
DATE REPORTS MAILED Aug. 13, 1979
ASSAYER [signature]

DEAN TOYE, B.Sc.
CHIEF CHEMIST
CERTIFIED B.C. ASSAYER

DEPARTMENT OF ENERGY, MINES AND PETROLEUM RESOURCES

VICTORIA

SAMPLE RECEIVED FROM JOHN M. LEASK

ADDRESS 354 Crestview Crescent, Castlegar, B. C. V1N 3B3

LABORATORY No.	SUBMITTER'S MARK	LABORATORY REPORT
3069 refer to Fig. 2	2631 E Big Showing 4+40	Spectrochemical Analysis: Lead; Zinc and 0.02% Copper were found. The other base metals found, and their percentages, were those occurring normally in rocks. Gold - Trace Silver - 2.5 oz. per ton Lead - 14.9% Zinc - 0.66%
3070 refer to Fig. 2	2632 E Big Showing 4+60	Spectrochemical Analysis: Lead; 0.07% Zinc and 0.02% Copper were found. The other base metals found, and their percentages, were those occurring normally in rocks. Gold - Trace Silver - 1.3 oz. per ton Lead - 8.58%
3071	2633 E M.G.M 3900'	Spectrochemical Analysis: Zinc; Lead and 0.01% Cadmium were found. The other base metals found, and their percentages, were those occurring normally in rocks. Gold - 0.01 oz. per ton Silver - 0.4 oz. per ton Zinc - 6.22% Lead - 1.28%

DATE September 27, 1979

W M Johnson

CHIEF ANALYST AND AS...

CHEMEX LABS LTD.

ANALYTICAL CHEMISTS GEOCHEMISTS REGISTERED ASSAYERS

CERTIFICATE NO. 34993

INVOICE NO. 29614

RECEIVED Feb. 13/79

ANALYSED Feb. 14/79

TO Silver Standard Mines Ltd.,
904 - 1199 W. Hastings St.,
Vancouver, B.C.
V6E 3T5
ATTN: P. McAndless - General Expl.

SAMPLE NO.	% Pb	% Zn	oz/ton Ag	oz/ton Au
Beaton River (Incommapleaux R.) Scout showing (Fig. 1)	19.6	0.27	14.10	0.092

CTA

DEPARTMENT OF ENERGY, MINES AND PETROLEUM RESOURCES
VICTORIA

SAMPLE RECEIVED FROM MELVILLE BAYES

ADDRESS 354 Crestview Crescent, Castlegar, B. C. V1N 3B3

LABORATORY No.	SUBMITTER'S MARK	LABORATORY REPORT
2699	4921 E Ruby Silver Z.I.P. Basement	Spectrochemical Analysis: Zinc; Lead; Copper; 0.25% Cadmium and 0.05% Arsenic were found. The other base metals found, and their percentages, were those occurring normally in rocks. Gold - 0.05 oz. per ton Silver - Trace Zinc - 28.1% Lead - 0.29% Copper - 0.049% -lowermost showing the Scout Fault controls refer to Fig. 1 for location

DATE July 5, 1979

CHIEF ANALYST AND ASSAYER

I, hereby declare that I, John M. Leask,

1) am a graduate geological engineer, University of British Columbia, 1980

2) have been involved in various aspects of geological exploration for three years previous to the preparation of this report

3) have been a citizen of Canada and a British Columbia resident for the past 24 years

4) reside permanently at 507 14th Ave. South, Cranbrook B.C.

Respectfully Submitted

J. M. Leask

Mr. John M. Leask
507 14th Ave. S. Cranbrook, B.C.

To whom it may concern:

I, Colin I. Godwin, P. Eng. (B.C.) certify that I supervised John Micheal Leask in the preparation of the report, dated April 1980, entitled:

Geology of the Ruby Silver and
Goldy Pb-Zn-Ag Properties,
Lardeau District, Southeastern
British Columbia

I have followed the project for one year and, although, I did not personally visit the property, I certify that the area was mapped as described in the report.

Respectfully submitted,

Colin I. Godwin
P.Eng. (B.C.)

3010 Aries Place
Burnaby B.C., V3J7E8
29 April, 1980

Fieldwork:

50 days mapping

John Leask (geologist)	50 days at $120 per day	= $6000
Steve Evans	10 days at $ 50 per day	= $ 500
Gordon Leask(prospec.)	40 days at $ 60 per day	= $2400
Mel Bayes (prospector)	25 days at $ 60 per day	= $1500

Trailwork and Heliport:

~~Mel Bayes 20 days at $ 60 per day = $1200~~

Equipment:

~~Chain saw~~	~~20 days at $ 8 per day~~	~~= $ 160~~
Jet river-boat	60 days at $ 20 per day	= $1200
4X4 truck	2 months at $500/mo.	= $1000
Miscellaneous(files,gas,tent,axes,rope,ect.)		= $ 500

Food:

	2 months at $400/mo.	= $ 800

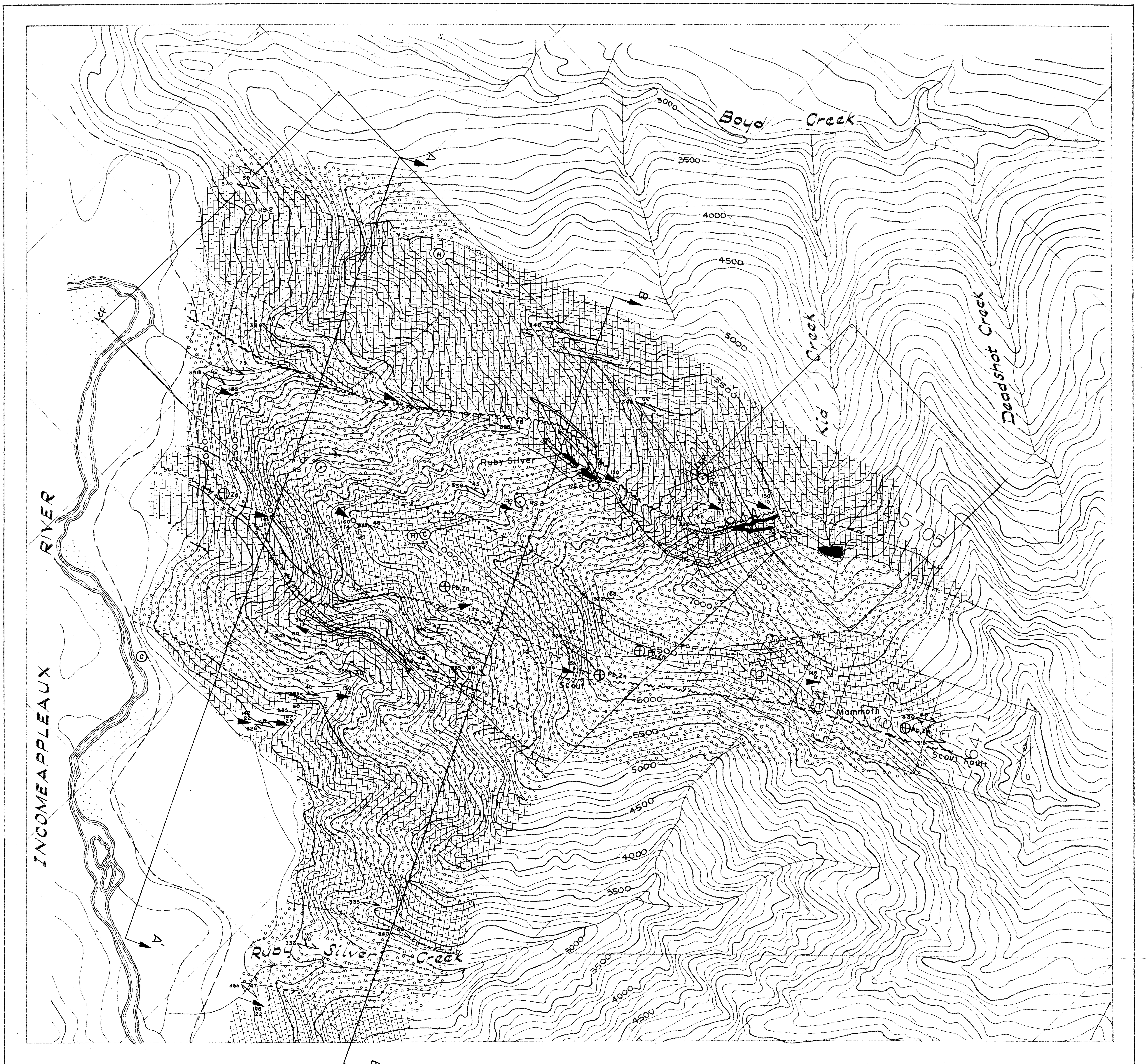
Office work:

Air photos	4 1:10,000		= $ 120
	16 1:40,000		= $ 35
Base map	1:10,000	B.C.I.T. contract	= $ 700
Draughting supplies			= $ 100
Draughting maps		250 hours at $10/hr.	= $2500
Draughting text		70 hours at $10/hr.	= $ 700

Mineralography:

8 thin sections at $10 each		= $ 80
16 polished sections at $10 each		= $ 160
Interpretation	40 hours at $10/hr.	= $ 400

18,695



GEOLOGY OF RUBY SILVER AND GOLDY CLAIM GROUPS

(FIG. 1)

LEGEND

INDEX FORMATION

Dark green phyllite and volcanic greenstone

Gray arenanaceous and dark phyllitic limestone

Manganiferous siderite horizon with magnetite-hematite, Pb-Zn, and associated silicification with Pb-Zn

Quartz grit and green gritty phyllite with minor light green and gray-green phyllite

Attitude of bedding

Attitude of cleavage

Minor fold axes

Fault (known, approximate, inferred)

Geologic contact (known, approximate, inferred)

Trail

Minor mineral occurrence

Heliport

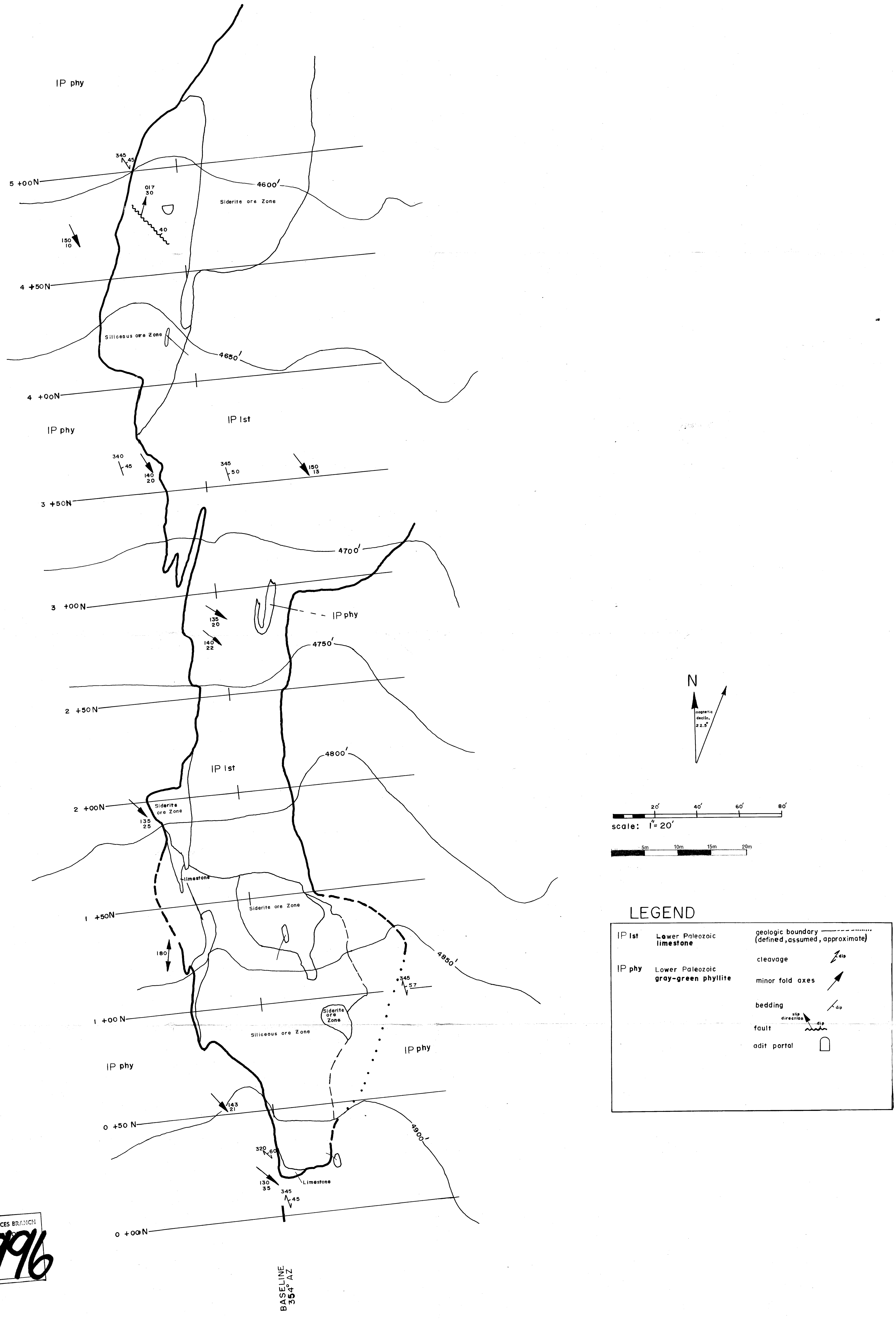
Camp

Adit and crosscut

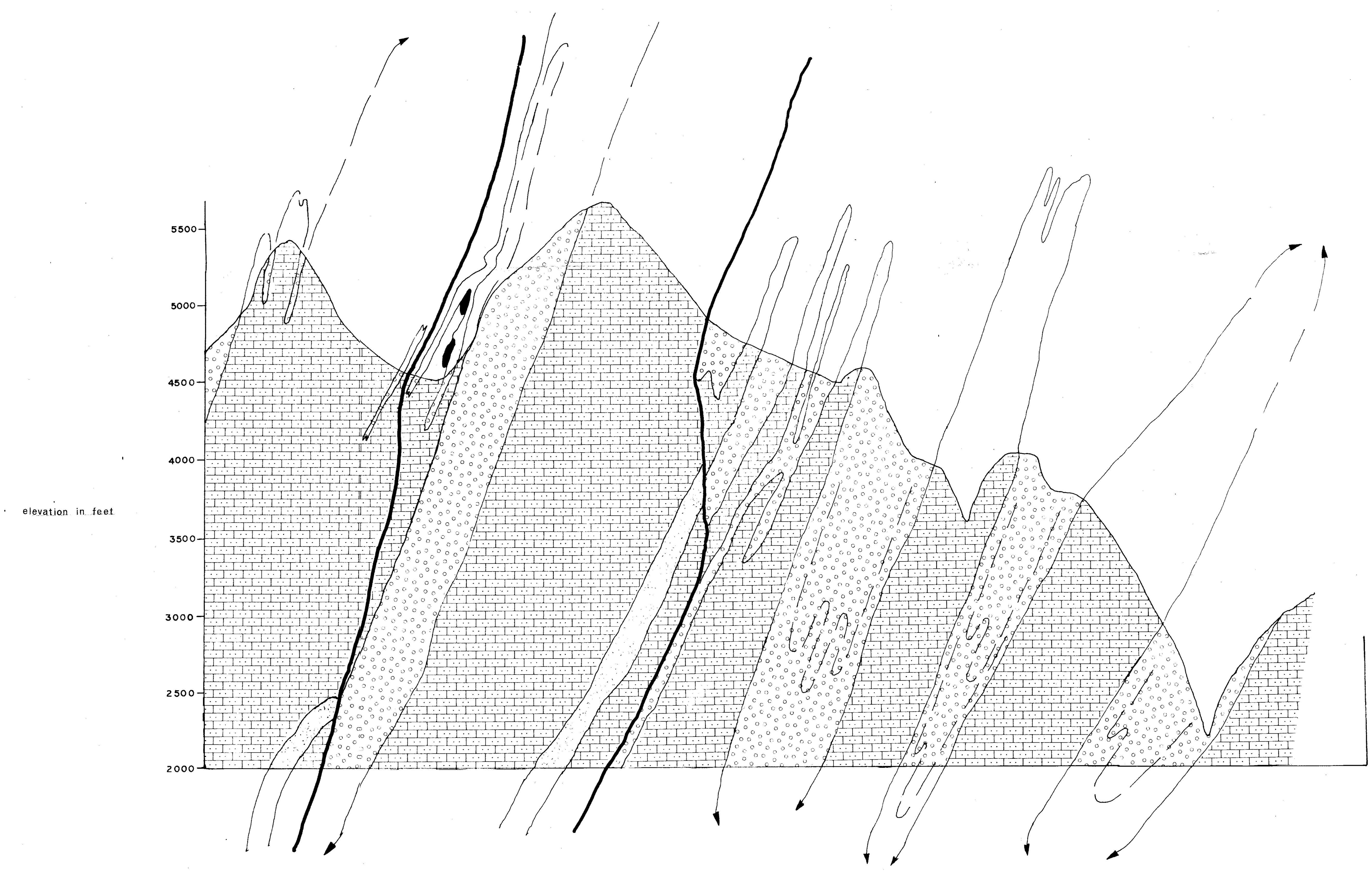
Cross section

Sample location

claim boundaries were located by altimeter and compass



(FIG. 2) RUBY SILVER PROSPECT, MAIN SHOWING



CROSS-SECTION B-B′ 1.67 X vertical exaggeration

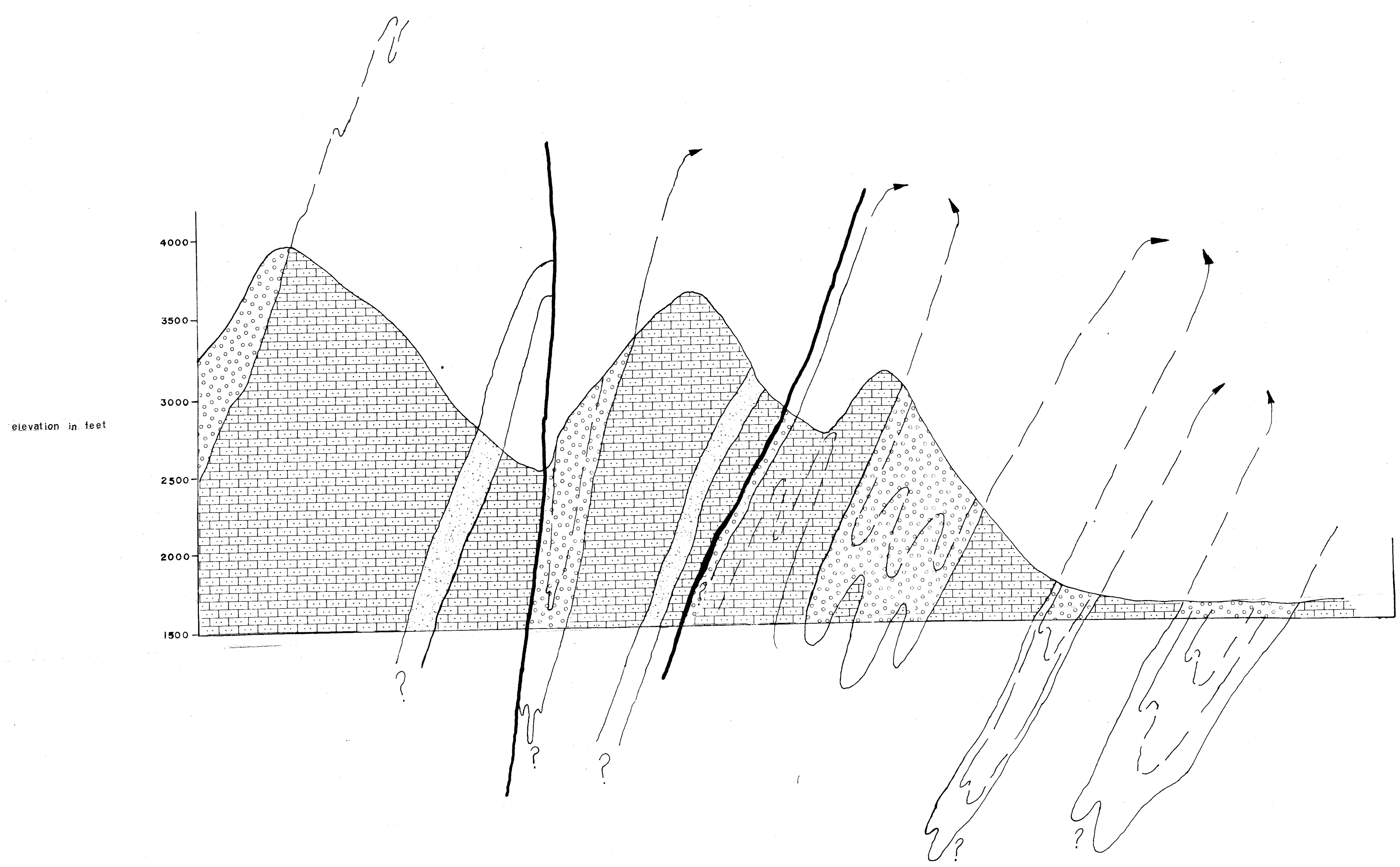


FIGURE 1A: CROSS-SECTION A-A′ 1.67 X vertical exaggeration