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GEOLOGICAL REPORT ON

THE NORA AND JOHN GROUPS OF MINERAL CLAIMS

FRISBY RIDGE AREA

REVELSTOKE MINING DIVISION

BRITISH COLUMBIA

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FRISBY RIDGE AREA

REVELSTOKE MINING DIVISION

BRITISH COLUMBIA

(Big Bend one degree quadrilateral,
11 miles northwest of Revelstoke;
SE 1/4 51 - 118; Sheet 82 M/-1 W)

by

L. W. Vigrass, P. Eng.

Regina, Saskatchewan

November 30th, 1968

Work conducted for

KING RESOURCES COMPANY

CALGARY, ALBERTA

Owners

During period: July - November, 1968

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INTRODUCTION

General Statement

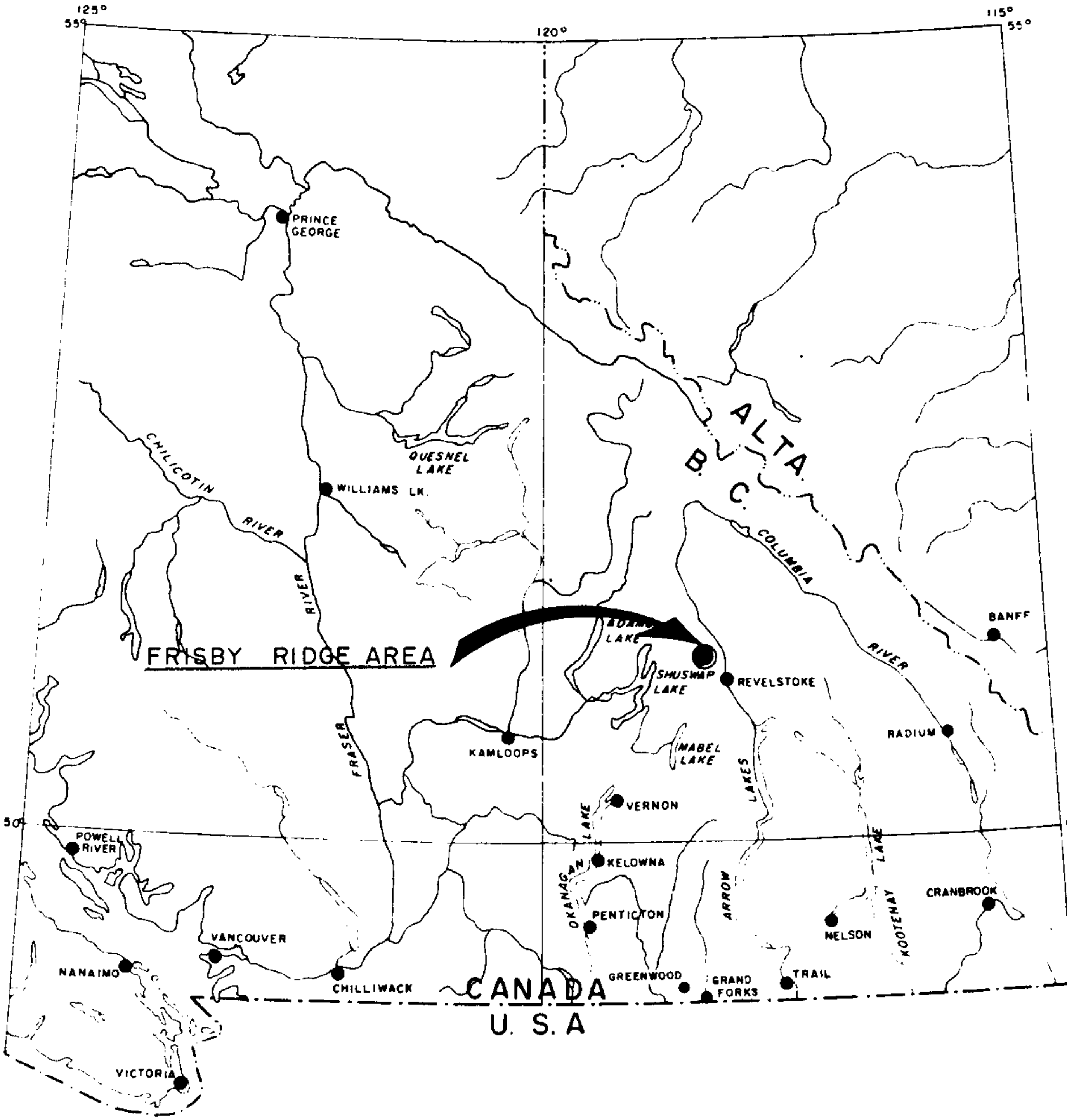
This report is concerned with the geology and mineral potential of the Nora and John groups of mineral claims located eleven miles northwest of Revelstoke in the Frisby Ridge area, Revelstoke Mining Division, B.C. (Figs. 1, 2)

The report is based on field work conducted by the writer and assistants during the period July 16th to September 18th, 1968. Compilation of field data and preparation of the report were completed during October and November, 1968.

The cost of the work is to be applied against assessment work due on certain of the claims in 1969 and subsequent years.

Location, Extent and Title

The Nora group of claims is made up of 182 mineral claims (Nora 1 - 182). The John group consists of 14 mineral claims (John 1 - 14). The Nora and John groups are situated in the Frisby Ridge area, some eleven miles north-northwest of Revelstoke and some five miles west of the Columbia River (Fig. 1). The claims area lies across the valley of upper Jordan River near the mouth of Copeland Creek (Fig.2). Nora 1 - 138 are situated for the most part on the top and west flank of Frisby Ridge, the broad north-trending ridge that forms the divide between the Jordan River system and Columbia River. The remaining Nora claims and the John group lie for the most part west of the



KING RESOURCES COMPANY		
FIGURE I LOCATION MAP FRISBY RIDGE AREA BRITISH COLUMBIA		
DRAWN BY E.R.B. ENTERPRISES	GEOLOGY BY	
DATE	SCALE	FIGURE No
	1" = 64 MILES	ONE

Jordan River and north of Copeland Creek (Fig.2).

The John group was staked in September, 1967, by Mr. J. P. Jones of Edgewater, B.C., agent for King Resources Company of Calgary, Alberta. The recording date was October 5th, 1967. The claims are presently owned by King Resources Company.

The Nora group of mineral claims was staked in April, 1968, by Messrs J. R. Eaton and G. W. Klein of Revelstoke, B.C., agents for King Resources Company of Calgary, Alberta. The claims are presently owned by King Resources (Maine) Ltd. Pertinent claim data are:

Claim Name	Staked by	Recording Date
Nora 1 - Nora 26 incl.	J. R. Eatom	29 April, 1968
Nora 27 - Nora 54 incl.	G. W. Klein	29 April, 1968
Nora 55 - Nora 82 incl.	J. R. Eaton	29 April, 1968
Nora 83 - Nora 110 incl.	G. W. Klein	29 April, 1968
Nora 111- Nora 138 incl.	J. R. Eaton	29 April, 1968
Nora 139- Nora 162 incl.	J. R. Eaton	8 May, 1968
Nora 163- Nora 181 incl.	G. W. Klein	8 May, 1968
Nora 182	J. R. Eaton	8 May, 1968

Access

From Highway No. 1 three miles west of Revelstoke, a good quality dirt road runs eight miles along the west side of Jordan River and then proceeds up Hiren Creek to the Copeland Mountain Mine. Where this access road follows Hiren Creek, it is within four miles of the claims area. A few years ago, there was a serviceable pack trail that took off from the mouth of Hiren Creek and followed the Jordan River and Copeland Creek to the Copeland Mountain silver-lead-zinc deposit (King Fissure deposit) but this trail has fallen into disuse. At the present time, the only practical means of access to the area and means of travel within the area is by helicopter. During the 1968 field season, the writer and assistants stayed in a tent camp at the mouth of Hiren Creek and were flown daily by helicopter to the claims area. During flying weather this provided access to the open tops of the ridges and to sand bars or other open spots along the valley bottoms. All other travel within the area was on foot.

The valley of Jordan River between Hiren Creek and Copeland Creek is ill-drained and swampy. Side hills are in general extremely steep and there is little soil cover. As a result, the building and maintenance of access roads within the Jordan River drainage would be difficult and costly. If a mine were to be developed on or near the top of Frisby Ridge, an access route up the Columbia River valley would probably be easier and cheaper to build and maintain.

Topography and Vegetation

The Frisby Ridge area is in the Monashee Mountains, a region characterized by rugged glacier-hung peaks and deep steep-walled valleys. Maximum relief is between 2200 feet in the bottom of Jordan River valley and 7800 feet on the high peak north of Copeland Creek. Most of the surface is in slope with many long declivities exceeding 40 degrees. Within the claims area there are three major mountainous features:

(1) Frisby Ridge, a north-trending ridge lying east of the main branch and the east fork of Jordan River. The flattish

crestal portion of this ridge, standing at altitudes of about 6300 feet to 6900 feet, is generally one half to one mile wide. The west flank is much steeper on the average than the east slope.

(2) The high peak (7800 feet) and southeast-trending wooded nose that lies between Copeland Creek and the western fork of upper Jordan River. A small permanent icefield lies on the north side of the peak. Southwest and northeast slopes on the wooded nose are of about equal steepness (about 40 degree average).

(3) A southward-directed wooded nose between the west and east forks of the upper Jordan River.

The major streams are: (1) Jordan River, (2) a major south-flowing tributary to Jordan River that is here referred to as the east fork of upper Jordan River, and (3) Copeland Creek. Most of the valleys are V-shaped with virtually no valley floor. A relatively flat valley bottom about a quarter of a mile across is developed along Jordan River between the mouth of Copeland Creek and the south edge of the map-area of Figure 3.

The peak north of Copeland Creek has been deglaciated fairly recently, soil cover is thin, and rock exposure widespread (Fig.3). On Frisby Ridge and the lower topographic noses there is little evidence of recent glaciation, soil cover is thick and extensive, and rock outcrops are not plentiful. Below an elevation of about 6000 feet the valleys are heavily timbered and thickly matted with underbrush. Alder, wolf willow and devil's club are particularly troublesome in areas of periodic avalanche or snow slide.

Climate

The Frisby Ridge area is in a region of high precipitation, probably averaging in excess of 50 inches per year. Snowfall is locally variable but extremely heavy, several tens of feet of snowfall per year being reported. Because of the high snowfall, the ridges and higher ground are clear of snow only late in the summer. In 1968, Frisby Ridge above an altitude of 6000 feet was not substantially clear of snow until July 25th, and a few inches of snow-fall on September 18th gave all indications of remaining through the winter above an altitude of 5000 feet. The short summer season is pleasant but spells of rainy weather with low cloud levels make use of the helicopter support uncertain.

Previous Investigations

The region embracing and adjacent to the Frisby Ridge area has been mapped and described by workers of the Geological Survey of Canada and the British Columbia Department of Mines and Petroleum Resources. The one-degree quadrilateral embracing the Frisby Ridge area has been mapped on a scale of one inch to four miles by J. O. Wheeler (Big Bend Map Area, B.C.; Geol. Surv. Canada Paper 64-32 and Map 12-1964). James T. Fyles of the British Columbia Department of Mines and Petroleum Resources conducted field investigations in the area during parts of the summers of 1964 through 1967 and visited the area again during the summer of 1968. A summary description of structure of the area and the region to the south was presented by Fyles in a paper delivered at the Vancouver meeting of the Canadian Institute of Mining and Metallurgy in the spring of 1968, and will be the subject of an extensive report by the British Columbia Department of Mines and Petroleum Resources. The Copeland Mountain silver-lead-zinc deposit (King Fissure deposit), just southwest of the claims area on the north flank of Mount Copeland, has been described by Christopher Riley in "The Jordan River Lead-Zinc Deposit, Revelstoke Mining Division, B.C." (Canadian Inst. Min. and Metall. Bull.: June, 1961; p. 437-441).

Present Work

The primary objective of the present work was to map and appraise the economic potential of a carbonate or lime horizon known to contain silver-lead-zinc mineralization in the Copeland Mountain area. In order to do this and to determine the general geological setting, mapping was extended well beyond the known extent of the carbonate horizon. Rock exposure is quite limited in parts of the claim area and the structure of the high-grade metamorphic Shuswap rocks is complex so that both extensive and intensive geological mapping is necessary to an understanding of the stratigraphic sequence and the structural problems.

The geological work was conducted by the present writer and assistants for M.C.R. Explorations Ltd. on behalf of King Resources Company. The writer and assistants stayed for most of the field season in a tent camp at the mouth of Hiren Creek and flew daily to the outcrop areas to be mapped or to start of the geological traverse to be run that day. Original mapping was on aerial photographs at an approximate scale of one inch to a quarter mile (20-chain scale). The lithological, structural and other data were then transferred to the one inch to 1000 foot topographical maps that form the base for the maps accompanying this report. Statistical plunges of cylindroidal folds that are common in the area (Fig. 3) were obtained by plotting foliation or bedding attitudes on a Schmidt stereonet. The vertical sections of Figure 4 were prepared by projecting lithologic contacts and bedding attitudes up or down the axial plunge into the planes of the cross sections. Several times as many foliation and bedding attitude readings were used in the stereonet plots and in preparation of the cross sections as there are on the geological map of Figure 3.

Field work and preliminary office work involved was completed in July, August and September, 1968. Final assembly of data and preparation of this report was carried out in October and November, 1968.

GENERAL GEOLOGY

Regional Setting

The geological setting of the Nora and John groups of claims is shown in regional fashion on the Geol. Surv. of Canada Map 12-1964 prepared by Dr. J. O. Wheeler. The map shows that bedrock in the Monashee Mountains consists of the Shuswap Metamorphic Complex. The rocks display a high grade of regional matamorphism and developed under conditions that characterize the amphibolite facies. Rocks comprising the Complex in this region are probably mainly of Cambrian and Proterozoic (Precambrian) age. Regional structure of the Monashee Mountains in the vicinity is dominated by the Frenchman's Cap gneiss dome. The core of this dome, composed of granitic gneiss, is some 30 miles long and 15 miles wide, trends north-northwest, and lies mainly northwest of the Nora and

John claims area. The core is surrounded by successive envelopes of metamorphic rock: an inner envelope of schists and gneisses of sedimentary origin, a central zone of paragneiss (gneiss of sedimentary origin) with abundant pegmatite intrusions, and an outer zone of granitic gneiss and pegmatite. The Nora and John claims area lies across the contact between the granitic core gneiss and the inner envelope of paragneiss, schist and quartzite. In a gross sense, the dome is dominated by a system of northwest-trending folds of various plunge, but across the southern ends of the core of the dome, the structure is dominantly east-trending. The strong set of young folds is superimposed on older fold structures.

On a regional basis, lead-zinc sulphide deposits commonly occur in impure carbonate rocks of the inner zone surrounding the core of the gneiss dome.

Local Geology

Introductory Statement

In general, bedrock in the area is poorly exposed except on the recently glaciated ridge west of Jordan River and north of Copeland Creek. It is difficult to map with confidence the distribution of bedrock types, to interpret structure, and to establish the exact stratigraphic sequence. Interpretation of the stratigraphic succession and the expected distribution of lithologic types is much complicated by the presence of two, three, or possibly more major episodes of deformation. Fortunately, from areas of more extensive exposure on Mt. Copeland and the ridge extending eastward from Mt. Copeland, there is some confirmatory evidence for the stratigraphic sequence that is described in this report from within the Nora and John claims area.

The sequence of Shuswap metamorphic rocks fall into two natural divisions separated by a strike fault (Fig. 3). Primary sedimentary structures show unequivocally that the Core Gneiss (Unit 1) lies stratigraphically below the Pebbly Quartzite Unit (Unit 2). There is no definite evidence of an uncomformable relationship between these units. Units 1 and 2 are separated from the other division (Units 3 - 6, Fig. 3) by a strike fault, possibly essentially a bedding fault. Features diagnostic of tops of beds have not been observed in Units 3 - 6: the assumption that Unit 3 is the oldest and Unit 6 the youngest is based largely on conjectural correlation by J. T. Fyles of Units 3, 4 and 5 of this report respectively with the Lower Cambrian Hamill Group, the overlying Mohican and Badshot Formations and the still younger Lardeau Group.

The Shuswap metamorphic complex is cut by relatively undeformed minor dikes of dolerite and lamprophyre and minor intrusive bodies of trachyte and pegmatite.

Although surficial material is widespread in the claims area, thick alluvium occurs only along Jordan River near the mouth of Copeland Creek. An extensive deposit of rock slide material, probably of Recent age, occurs a mile and a half northeast of the mouth of Copeland Creek in the "Big Slide" area (Fig. 3).

The structural history of the Nora and John claims area is complex and not well understood as a result of poor exposure, difficulty of tracing mappable beds, and the extreme detail necessary for an adequate structural interpretation. The Shuswap Metamorphic Complex has undergone at least two and probably three or more deformational events. It is suggested that there was an early phase of similar folding (Phase 1) not related to uplift of the gneiss dome. Strike faulting (thrusting?) was associated with the folding of this event. Subsequent (Phase 2) folding was associated with uplift of the gneiss dome. A relative late deformational event (Phase 3) has resulted in a rather broad warping with relatively widely spaced folds. Relatively young steep transverse faults cut across the older structures of the Shuswap Metamorphic Complex.

Table of Formations

Mapped rock units in the Nora and John groups claims area are as follows (Fig. 3):

AGE	MAP SYMBOL AND UNIT	
Quaternary	Qal	Alluvium
	Qrs	Rock slide deposit
INTRUSIVE ROCKS		
?	7 b.	Dolerite and lamprophyre dikes
	7 a.	Pegmatite, trachyte dikes and sills
SHUSWAP METAMORPHIC ROCKS		
Proterozoic -	6.	Quartzite Unit
	5.	Grey Gneiss Unit
Cambrian ?	4.	Lime Unit
	3.	Biotite-sillimanite and Quartzite Unit
	....	Strike fault ....
	2.	Pebbly Quartzite Unit
	1.	Core Gneiss Unit

Lithology of Shuswap Metamorphic Complex

Core Gneiss (Unit 1) - The core gneiss is well exposed at the north end of the Nora and John groups claims area on Frisby Ridge and along the Jordan River. The rock is predominantly fine to medium grained (1 to 4 mm.) granitic gneiss composed of white to pinkish feldspar, quartz and biotite. There is dark green hornblende present locally, at least within a few hundred feet of the contact with the Pebbly Quartzite Unit. Generally the rock is gneissose with ill defined thin schistose layers of biotite at intervals of 1 to 5 mm. but where mica is very subordinate, the texture is granoblastic. The rock is mostly light grey weathering a medium grey. At some localities, there are intercalations at a scale of six inches to eight feet of the light grey rock with dark-weathering medium to dark grey gneissose or granoblastic rocks. At the top of the Core Gneiss Unit immediately below the Pebbly Quartzite Unit on Frisby Ridge and west of Jordan River, there are three or four feet of crenulated, somewhat chloritized quartz-mica or mica schist.

Pebbly Quartzite (Unit 2) - The Pebbly Quartzite Unit occurs immediately above the Core Gneiss across the northern part of the Nora and John claims area. The Unit rests with apparent conformity on the Core Gneiss and is separated from the Grey Gneiss (Unit 5) by a strike fault (Fig. 3). The Pebbly Quartzite Unit is about 800 feet thick on Frisby Ridge and approximately 2000 feet thick along Jordan River (Fig. 4).

The basal beds of the Unit and the contact with the underlying Core Gneiss is well exposed on the west side of the Jordan

River. Rounded pebbles as much as five cm (2 in.) across are common in the basal 30 feet of the Unit. There is a greenish grey, extremely coarse conglomeratic layer about five feet thick that is separated from the underlying Core Gneiss by a foot of quartzitic sandstone. Most of the pebbles are white quartz not derived from the underlying Core Gneiss but at one place in the basal foot of quartzite there is a flattened boulder three inches thick by eight inches long that may be gneissose rock derived from the underlying rock unit. Most of the pebbles are flattened parallel to the contact. The contact with the Core Gneiss is sharp, slightly irregular, and without signs of deep erosion or angularity.

Above the basal conglomeratic beds, the Pebbly Quartzite Unit characteristically consists of white, light grey, clear pale brown or pinkish brown quartzite that weathers white, light grey or tan. Relict medium (1/2 mm.) sandstone grains are common and locally, particularly in the lower part of the Unit, there are abundant floating pebbles of quartz up to 1 cm. across. The pebbles are commonly flattened parallel to the primary bedding. The quartzite is generally distinctly layered with relict beds two inches to six inches thick. On Frisby Ridge, curved crossbed laminae (festoon bedding?) are clearly visible on the weathered surface and these provide indisputable evidence that the Pebbly Quartzite Unit lies stratigraphically above the Core Gneiss Unit. The quartzite is commonly semischistose with fairly abundant (5%?) muscovite or muscovite and biotite, and locally grades to a quartz-biotite granofels or gneiss.

Along the east fork of the Jordan River, there are abundant quartz-rich micaceous semischists and quartz-mica schists. The semischist and some of the quartzite in this succession weather reddish brown.

At the top of the Pebbly Quartzite Unit north of Copeland Creek, there is 50 to 100 feet of grey mica schist, pinkish feldspar-quartz-mica granofels, and minor green aphanitic calc-silicate rock. A major strike fault that appears to follow this layer is characterized, at least locally, by disseminated pyrrhotite mineralization and by strong rusty brown to yellowish brown weathering through a thickness of about 40 feet.

<u>Biotite-Sillimanite and Quartzite (Unit 3)</u> - In the Nora and John claims area, this unit is presumed to be the lowest stratigraphic unit of the division south of or above the strike fault. The Unit, not well exposed, is characterized by much crenulated biotite-sillimanite schist with interlayered quartzite that grades to quartz-feldspar-mica granofels. On Frisby Ridge forming the upper part of Unit 3 is a mappable subunit (Unit 3A) that is composed almost entirely of biotite-sillimanite schist. The original thickness of the entire Unit 3 is probably 1000 to 2000 feet.

One of the most extensive sections of Unit 3 in the Nora and John claims area is exposed about 1000 feet northeast of the rock slide deposit known as "Big Slide" on the west flank of Frisby Ridge (Fig. 3). The sequence, which does not appear to be repeated by isoclinal folding or by faulting, is approximately 1500 feet thick and consists of the following:

Top of Section. Directly overlain by calc-silicate rocks assigned to the Lime Unit.

		Feet
7.	At the top, consists of white, semischistose micaceous quartzite that contains laminae at 1/2 inch intervals of muscovite and pale green chlorite or mica. Grades downward to quartz-muscovite schist	100
6.	Coarse grained (5 mm.) quartz-feldspar-mica-(sillimanite?) schist with coarse quartz or quartz and feldspar lenses or "eyes" . . .	150
5.	Covered	200
4.	Pale grey quartz-feldspar-biotite granofels that grades locally to gneiss and to coarse quartz-feldspar-biotite-(sillimanite?) schist with large eyes of quartz and feldspar. Characteristically weathers orange-grey or pale pinkish grey	400
3.	Very coarse (10 mm.) biotite-feldspar-quartz-(sillimanite?) schist with coarse quartz and feldspar eyes. Cut by strong vertical joint set filled with rusty quartz	150
2.	80% subschistose quartzite in layers 20 feet thick with 20% interlayers of very coarse mica schist about 5 feet thick	200

		Feet
1.	Intercalated layers 25 to 50 feet thick of medium grey semischistose quartzite and very coarse (10 mm.) biotite-feldspar-quartz-(sillimanite?) schist with lenses or eyes of quartz and feldspar that locally coalesce into laminae to give the rock a banded, gneissose structure. Foliation surfaces are coarsely crenulated	300
Base of Section.	Approximate thickness of Unit 3	1500

Approximately 3,500 feet south of the "Big Slide", quartz-mica schist assigned to Unit 3 is rather fine grained and grades to rather massive, medium grey hornfelsic argillite.

On the ridge north of Copeland Creek Unit 3 consists of quartzitic and hornfelsic dark grey argillite, semischistose quartzite, coarse feldspar-quartz-mica-(sillimanite) schist with coarse eyes of quartz and feldspar in part, and fine to medium grey mica schist.

In the northern area of exposure of Unit 3 on Frisby Ridge, the lower part of the exposed unit consists dominantly of semi-schistose quartzite that grades to quartz-feldspar-mica gneiss or granofels. Most of these rocks are very slightly foliated, muscovitic, very pale grey on fresh surface, and pale grey or very light orange-grey, pinkish grey, or brownish grey on weathered surface. Above these fairly massive rocks is Map Subunit 3A (Fig. 3, 4) composed almost exclusively of much crenulated coarse to very coarse feldspar-quartz-biotite-(sillimanite) schist. Eyes of quartz and feldspar are characteristic of this schist. The schist is generally medium to dark grey and weathers orange grey with a spotted weather surface and much rusty iron oxide.

Lime Unit (Unit 4) - In the Nora and John groups claims area, the Lime Unit is characterized by one or more white crystalline limestone layers and by fine grained granoblastic or aphanitic green calc-silicate rocks. The unit appears to have gradational contacts both with the underlying Biotite-Sillimanite and Quartzite Unit and the overlying Grey Gneiss Unit.

On the west flank of Frisby Ridge about 1700 feet east of the rock slide deposit (Fig. 3), the following sequence of the Lime Unit is exposed:

		Feet
	Top of Lime Unit. Overlain by Grey Gneiss Unit.	
10.	Coarse Biotite schist, fine subschistose quartzite, and minor calc-silicate rocks. Gradational into overlying rocks typical of the Grey Gneiss Unit	20
9.	67% very fine grained quartz-biotite semi-schist with very poor foliation that weathers rusty grey with 33% intercalated light green aphanitic slightly calcareous calc-silicate rocks	15
8.	White internally-contorted limestone that weathers very light grey. The limestone is very fine grained with sparse scattered very coarse crystals (3 cm.). Locally thins to 2 to 4 feet	15

		Feet
7.	Medium to dark grey an d light green aphanitic slightly calcareous calc-silicate rock	50
6.	Layer of white coarse grained limestone that is only locally present. Where the limestone is present, the basal two to three feet of the overlying calc-silicate rock contains disseminated pyrrhotite and weathers rusty-brown	10
5.	Medium grey to light greenish grey, very fine grained, slightly calcareous quartz-mica granofels with some calc-silicate minerals	30
4.	ORE LAYER. At the base of this granofels and immediately above the underlying limestone is a thin layer of massive pyrite, sphalerite, an d galena with a few specks of chalcopyrite and bornite. This layer, possibly a replacement deposit, has a remarkably constant thickness of 0.5 to 0.6 feet for a length of 2000 feet. Where Assay Samples #44,249 - 44,250 and #44,401 were taken (Fig.3), there are only scattered nests or spots of mineralization about 6 inches thick and 2 feet long at this horizon. Only pyrrhotite mineralization was observed farther north near the crest of the ridge	Minimal but Variable
3.	Medium grey to light greenish grey, very fine grained, laminated, slightly silicified, biotitic limestone that weathers medium light grey to yellowish grey. The upper part of this limestone locally contains contorted layers of	

		Feet
	yellowish fibrous tremolite (?). The thickness is generally about 10 feet but may locally be as much as 40 feet	10
2.	Rusty brown very fine grained quartzite grading down into calcareous quartzite or very white, pure quartzite. Spotty malachite staining resulting from traces of disseminated chalcopyrite occur in the upper part of the rusty quartzite through a thickness of 2.5 feet	20
1.	Dark brown, pale greenish grey and pale tan, very fine grained, slightly calcareous, grano-blastic calc-silicate rock that has a rather sugary texture. Generally finely laminated to thin bedded and weathers light rusty brown .	30

Base of Unit 4. Lies directly on semischistose quartzite of underlying Unit 3.

Approximate total thickness of Unit 4 — 200

Farther north on the top of Frisby Ridge, about a mile north of the "Big Slide", exposure of the Lime Unit is not nearly as continuous. In this part of the area, metamorphic strata assigned to Unit 4 are only about 100 feet thick and only one layer of limestone has been identified. The limestone layer, 20 to 30 feet thick, is very conspicuous and consists of snow white to very light tan coarse crystalline (2 mm. to 4 mm.) calcite marble that generally weathers a light grey. Silicate minerals are not abundant in the limestone although there are occasional thin discontinuous layers of quartzite, traces of muscovite and phlogopite flakes, and locally there are thin interlayers that contain prismatic crystals as much as an inch long of white to pale brown tremolite. A distinct cleavage lies parallel to the thin (3") to thick (2') primary bedding. Included in the Lime Unit are: (1) Below the limestone layer, 50 to 75 feet of grey quartzitic semischist with interlayers of light grey and greyish green calcareous granoblastic calc-silicate rock; and (2) Above the limestone layer, about 25 feet that consists mainly of grey schist but includes at the top about five feet of schistose to granoblastic medium grained (1 mm.) calc-silicate rock that is very calcareous where fresh but locally is leached to a pale tan porous granular mass.

On the ridge north of Copeland Creek, the Lime Unit resembles the northern outcrop belt on Frisby Ridge. One layer of coarse grained limestone, about 20 feet thick, is present and it is overlain by 20 feet of schist and calcareous quartzite. The quartzite is overlain in turn by 6 feet of slightly calcareous, medium green, hornblende-quartz-biotite schist.

Grey Gneiss (Unit 5) - The Grey Gneiss Unit is a rather heterogeneous unit of metasedimentary strata dominated by feldspar-quartz-biotite semischistose rocks that locally have gneissose structure. These gneissose rocks are characteristically fine grained (1/2 to 1 mm.) and are light grey to greenish grey in colour. The schists and gneisses characteristically contain abundant quartz rods and frets. In the Grey Gneiss Unit, there are occasional layers of white, very pale brown or pinkish brown quartzite. The quartzite layers are difficult to follow for any great distance along their traces. Interlayers of greenish grey fine grained calc-silicate rock are fairly abundant, particularly immediately below or above the quartzite interlayers. Many of the rocks contain needles or prisms of dark green hornblende. Generally the weathered surface of the strata assigned to the Unit has a grey or greenish-grey aspect. At the south edge of the map-area on Frisby Ridge where the Grey Gneiss is overlain with apparent conformity by Quartzite Unit 6, the Grey Gneiss Unit appears to be on the order of 1000 feet thick. Farther north on Frisby Ridge and south of Copeland Creek, where the Quartzite Unit 6 may be absent due to a sedimentary facies change, the Grey Gneiss Unit appears to be considerably thicker (Fig. 4).

On Frisby Ridge near the southern margin of the map-area, the Grey Gneiss Unit appears to be more hornblende-rich than elsewhere in the area. Interlayers of calc-silicate rock with occasional thin layers of limestone are common. Semischistose quartzite interlayers are most abundant near the base of the unit. The contact between the Grey Gneiss Unit and the overlying Quartzite Unit appears to be abrupt but unfaulted locally (Fig. 3, 4).

At the northern outcrop band on Frisby Ridge, quartzites appear to be most abundant in the Grey Gneiss Unit near the strike fault and thus probably in the upper part of Unit 5 (Fig. 3, 4).

On the ridge north of Copeland Creek, muscovitic schistose quartzite is abundant in the lower part of the Grey Gneiss Unit.

Northwest of the Lime Unit exposures on this ridge, some of the gneisses in Unit 5 are medium grained (2 mm. to 4 mm.).

Quartzite (Unit 6) - The Quartzite Unit 6 has been identified and mapped only in the southeastern part of the Nora and John claims area (Fig. 3). Mapping shows that in part the contact between the Quartzite Unit and the Grey Gneiss Unit is unfaulted but elsewhere the Quartzite Unit is in contact with Unit 5 and possibly also Unit 4 along a steep fault that trends north-northeast. Total thickness of the Quartzite Unit has not been determined but it is probably at least 1000 feet thick.

For the most part the unit is homogeneous and consists of very compact unbedded aphanitic quartzite. Most of the quartzite is white and weathers white but elsewhere it is pale brown to pinkish brown and weathers light brown. The quartzite is commonly fractured or brecciated. One or more sets of cleavage, one of which may be a bedding cleavage, occur locally.

At the south edge of the Nora and John claims area, the unbedded white and light brown quartzites are overlain by a sequence of grey-weathering semischistose quartzite, mica semischists, and greenish calc-silicate rocks. Distribution of these rocks is so limited in the map-area that they are included with the unbedded quartzite in Unit 6.

Minor Intrusive Rocks

Felsic Intrusives (Unit 7A) - Minor light coloured felsic intrusive rocks occur locally in the Nora and John claims area. The bodies of intrusive and possible intrusive origin are referred to as trachyte dikes, pegmatite dikes, and gneissose syenite bodies.

At least two steep irregular dikes or sills of trachyte (?) porphyry occur on the ridge north of Copeland Creek (Fig. 3). The bodies are about 10 feet wide and were followed along strike for only a short distance. Contact relations could not be observed. The rocks consist of unoriented coarse (5 mm. to 2 cm.) prisms of pink feldspar, blebs of quartz and needles of dark green hornblende (or pyroxene?) in a light grey to light greenish grey aphanitic ground mass.

Pegmatite float is common in an inferred area of pegmatite dikes that cut the Grey Gneiss Unit in its northern outcrop belt on Frisby Ridge (Fig. 3). Only two pegmatite exposures were found, and distribution of the dikes is based largely on surficial depressions that show up as strong lineaments on the aerial photographs. The pegmatite consists of coarse (10 mm.) crystalline aggregate of white feldspar, quartz and muscovite. At one exposure, the pegmatite is intruded parallel to the foliation of the enclosing schist which strikes 70^{o} and dips 10^{o} S.E. At the second exposure at the northeastern edge of this inferred pegmatite swarm, an irregular intrusive body about 10 feet long by 6 feet wide that cuts schistose quartzite consists of very coarse grained white feldspar with less than 10 percent quartz blebs. An irregular remnant of quartz-feldspar-muscovite pegmatite also occurs parallel to the foliation of schistose rocks in the Grey Gneiss Unit on Frisby Ridge near the south edge of the map-area (Fig. 3).

No bodies of syenite gneiss were definitely identified in the Nora and John claims area. Some medium grained (2 mm.) gneissos rocks in the Grey Gneiss Unit along the crest of the high ridge north of Copeland Creek have a definite igneous aspect. Minerals identifiable in hand specimens in these rocks are feldspar, quartz (?), muscovite and biotite. The rock has fairly well defined but sparse gneissose banding. Somewhat similar medium grained gneiss occurs in float southeast along the same ridge about 300 feet north of the outcrop of the Lime Unit. Similar appearing rock is exposed in a small outcrop in an area of Grey Gneiss about 1000 feet north of the northernmost occurrence of Unit 4 on Frisby Ridge. Megascopically these rocks resemble the syenite gneiss that occurs on Copeland Mountain.

Intrusion of these rocks appears to postdate the major episodes of metamorphism and folding of the Shuswap Complex.

Mafic Intrusives (Unit 7B) - Steep intrusions of grey dolerite and biotite lamprophyre cut the Core Gneiss and Pebbly Quartzite Units along the Jordan River (Fig. 3). Several of the bodies cut across foliation in the Core Gneiss but others are more sill-like, lying parallel to the gneissosity. Width of individual bodies changes rapidly along strike, ranging from 2 or 4 feet to 10 feet within a strike distance of a few hundred feet. The dolerites are extremely fine (1/4 mm.) equigranular rocks whereas the lamprophyres are dark porphyries that contain medium to coarse (1 to 2 mm.) clotted phenocrysts of biotite in a very fine groundmass. Straight crosscutting dark lineaments visible on the aerial photographs in the outcrop area of the Core Gneiss indicate that there are many other mafic dikes in addition to those shown on Figure 3.

Several of the mafic dikes examined have a distinct foliation parallel to the gneissosity of Unit 1. This suggests that intrusion predated the last stages of regional matamorphism even though the dikes appear to be largely undeformed.

Surficial Deposits (Qal and Qrs)

Outcrop is not extensive in the Nora and John claims area but the mask of surficial material is generally too thin and of too widely diversive nature to be classified and mapped. An extensive area of thick Quaternary alluvial deposits occurs on Jordan River near the mouth of Copeland Creek and is mapped separately (Fig. 3). Similarly, a chaotic deposit of rock slide debris covering an area at least a quarter mile square on the west flank of Frisby Ridge is shown separately (Fig. 3). The hillock formed by this rock slide debris is known locally as the "Big Slide". The debris is derived from the adjoining Frisby Ridge but a well defined rock slide scar is not visible.

Structural Geology

Schistosity, Cleavage and Joints - The Shuswap rocks of the Nora and John claims area are in an advanced stage of regional metamorphism so that micas, other platy minerals, and elongate mineral grains tend to be oriented in parallel manner. This mineral orientation is distinct in the rocks referred to as schists, less so in the rocks containing lenses, blades or streaks of platy or lineate grains that are referred to as gneisses, indistinct in the fine grained rocks referred to as semischists, and virtually absent in the rocks of granoblastic texture referred to as granofels. In general, the schistosity in the rocks above the Core Gneiss Unit is parallel to layering and thus to primary bedding.

Fracture cleavage parallel to layering (bedding cleavage) is common in the quartzites, limestones, and some of the other rocks above the Core Gneiss Unit. Oblique fracture cleavage is developed locally. A striking example of the development of flow cleavage with a new direction of schistosity oblique to the older gneissose layering occurs in the Core Gneiss on the west side of the Jordan River 2000 to 2500 feet northwest of the contact with the Pebbly Quartzite Unit (Fig. 3). At this location, the older foliation in the gneiss strikes 150° to 155°, dips 80° S.W. to 83° N.E. The new foliation, which dominates the gneiss in places, strikes 120°, dips 67° S.W. The plunge of the lineation formed by the intersection of these foliations is 42° on a trend of 152°.

Joint sets are common in the quartzites and other less foliated rock types. No consistent pattern has been discerned in the orientation of these joint sets.

Folds - Deformation of the Shuswap Metamorphic Complex in the map-area has been intense. The rocks have been subjected to at least two and probably three or more deformational events. The entire history of these deformational events is not clear from evidence within the area, largely because of limited exposure. Some interpretations of the sequence of folding are of necessity based on observations made by other workers elsewhere, particularly on the observations of J. T. Fyles in the country to the west and southwest.

An early episode of folding in the region, Phase 1, resulted in isoclinal similar folds. The axial direction of these folds is revealed, particularly in the country to the southwest of the Nora and John claims area, by a lineation defined by parallel grains of hornblende and sillimanite, by trains of biotite, and by clusters of garnets and feldspar porphyroblasts. Where the direction of Phase 1 folds are distinctly different from the later folds, small Phase 1 folds with attenuated limbs can be seen in single outcrops or identified from a distance. These larger Phase 1 folds have been outlined during mapping by James T. Fyles.

Within the John and Nora claims area, mineral alignments believed indicative of the Phase 1 axial direction are shown by the lineation "l_1" on Figure 3. On Frisby Ridge, the "l_1" lineations are essentially parallel to the axes of later (Phase 2) folds. This is in agreement with the regional picture which suggests that the Phase 1 folds are part of a regional system that trends northeast and pre-dated the elevation of the Frenchman's Cap gneiss dome.

The major structure in the area of the Nora and John claims groups is an antiform that trends eastward along lower Copeland Creek and, farther east, swings northeastward, and then returns to an east-northeast trend on Frisby Ridge (Fig. 3). If the assumption is correct that there is a decrease in geologic age of the Shuswap rocks from Unit 3 through Unit 6, then the major structure is an overturned anticline. If the correct stratigraphic order is the reverse of that assumed, then the gently dipping south limb of the antiform is a "peel-back" from the gneiss dome, and it forms the overturned lower limb of a large-scale recumbent fold or nappe. Part of the crude S-shape of the major structure in the plan view results because the axial plane of the large structure dips southward at about 50 degrees (Fig. 4, Section A-B).

The major antiform is modified by smaller amplitude folds with rather rounded axial regions (Fig. 4). The plunge and trend of these approximately cylindroidal structures were determined by plotting poles to foliation and bedding on the Schmidt stereonet and are shown by the lineation "l_3" on Figure 3. Axes of minor folds visible in outcrop and crenulations on foliation planes (lineation "l_2" of Figure 3) are approximately parallel to the "l_3" direction: presumably the "l_3" lineation would be obtained by averaging representative "l_2" values over a restricted area.

Presumably the minor folds with rounded axial regions are the Phase 2 folds of Fyles. Trend and plunge of the Phase 2 folds vary with geographic position. Around the salient of Core Gneiss on the Jordan River, the Phase 2 folds plunge steeply and trend normal to the Core Gneiss-Pebbly Quartzite contact. Somewhat farther from the contact, the Phase 2 folds appear to trend parallel to the Core Gneiss margin: the trend of the folds on the high ridge north of Copeland Creek may be a reflection of a domal area of Core Gneiss exposed a few thousand feet farther west. On Frisby Ridge, the Phase 2 folds have approximate east-west trends and are horizontal or have small plunges to the east or to the west.

The form of the minor Phase 2 folds varies with their position on the major antiform. The steeply dipping "overturned" north limb of the antiform is modified by inequant overfolds with axial planes dipping about 30 degrees south (Fig. 4, Section E-F). Lime Unit remnants on the top of Frisby Ridge show that near the axis of the major antiform the shallow dipping upright south limb is modified by the same type of inequant overfolds (Fig. 4, Section A-B). The minor folds on both limbs "face" toward the axial portion of the major structure: that is, the short limbs of the minor antiform are toward the axis of the major antiform. The reverse situation prevails on the gentle south limb farther from the major axis where the short limbs of the asymmetric inequant minor antiforms are directed away from the axial portion of the major structure (Fig. 4, Section A-B). This characteristic is especially prominent where the south limb of the major antiform steepens up through the development of several moderate size recumbent folds one above the other (Fig. 4, Section C-D). By analogy, the same type of recumbent overfolds on the south limb of the major antiform are interpreted in the eroded portion of the structure along Section G-H (Fig. 4).

The major antiformal structure and the minor folds that modify it probably formed during the same deformational episode, presumably the Phase 2 of Fyles. Relationship of these folds to the Core Gneiss suggests that uplift of the gneiss dome occurred during the Phase 2 episode. The major antiform and the smaller Phase 2 folds are warped by a later (Phase 3 of Fyles) broad antiform that lies along the Jordan River. The salient of core gneiss on the Jordan River is presumably connected with the Phase 3 antiform.

Faults - The strike fault separating the Pebbly Quartzite (Unit 2) from the Grey Gneiss (Unit 5) is exposed, largely in cliff, on the north face of the 7800-foot peak north of Copeland Creek. The fault is in a zone of rusty brown and yellowish brown mica schist and calc-silicate rock that occurs above the quartzite of Unit 2. The rusty brown colour results from disseminated pyrrhotite and pyrite in the fault zone. Southeastward to Jordan River the fault trace shows up on aerial photographs as a series of lakes and topographic depressions. On Frisby Ridge the fault is not exposed but is traced from an aerial photograph lineament that separates outcrops of pebbly quartzite from outcrops of the Grey Gneiss Unit. The fault on Frisby Ridge appears to closely parallel layering in the Pebbly Quartzite Unit and to truncate layering in the Grey Gneiss Unit at a small angle. Fyles reports that on a regional basis the fault cuts across overlying formations. It appears to be a bedding fault that followed a schist zone at the top of the Pebbly Quartzite Unit. Relationships of folds to the fault suggest that the faulting accompanied Phase 2 folding. If the assumed succession of Shuswap units is correct, it is most likely a bedding thrust and it would suggest that Units 3 - 6 are thrust upward on to the younger Pebbly Quartzite Unit and Core Gneiss. If the assumed succession is incorrect - that is, if Unit 3 is younger than Unit 6 - then the strike fault could be a gravity slip along which the Shuswap rocks slid off a rising gneiss dome.

Undetected strike faults may occur in the area on the much attenuated limbs of folds. West of Jordan River the carbonate member on the south limb of the major antiform has not been identified although this may be due to poor exposure.

High angle cross faults that trend north to northeast occur on Frisby Ridge. The most obvious, which trends 20 degrees across the crest and east slope of Frisby Ridge, has the eastern block down thrown about 1000 to 1500 feet so that Quartzite Unit 6 lies in local fault contact with Units 5, 4 and 3 (Figs. 3, 4). A much less obvious fault farther north on Frisby Ridge strikes 42°, dips about 65° S.E. The southeastern block is downthrown, probably about 600 feet, and right-lateral movement of a few hundred feet may also be involved.

Three other faults are based on strong lineaments on the aerial photographs but all have not been verified on the ground. On the east side of the high peak north of Copeland Creek and a mile and a half west of Jordan River, a fault is interpreted along a strong lineament that marks a discontinuous silicified zone containing disseminated pyrrhotite. On the ridge about 6000 feet farther southeast, no offset could be detected along a strong lineament that trends 80°. Both of these suspected high angle faults appear to be truncated by the strike fault separating Units 2 and 5. A third fault is interpreted from a strong lineament along the east fork of Jordan River at the north edge of the map-area (Fig. 3). Neither lineament nor displacement could be detected farther south so the fault is questionably shown to die out along the Core Gneiss - Pebbly Quartzite contact.

ECONOMIC GEOLOGY

General Statement

From a regional point of view, silver-lead-zinc sulphide deposits of potential economic worth occur in impure carbonate or lime layers within the schist-paragneiss envelope of the Frenchman's Cap gneiss dome. In particular, the sequence of limy rocks that contains significant silver-lead-zinc sulphides on the north flank of Mount Copeland occur in the Nora and John claims area, and showings of silver-bearing pyrrhotite, galena, and sphalerite occur in this sequence on the west flank of Frisby Ridge. The bedded lode deposit on the west flank of Frisby Ridge, where it has been examined in outcrop, appears to be much too narrow to have economic potential.

Farther south on the west flank of Frisby Ridge, however, the Lime Unit is involved in a favourable-appearing structure and could well contain economic silver-lead-zinc deposits.

Several zones of pyrrhotite-pyrite mineralization, localized in part along specific rock layers and in part along faults, are known west of Jordan River. Some of these zones, particularly the mineralized calc-silicate zone in the Grey Gneiss Unit that contains traces of zinc and lead, warrant additional prospecting for economic mineral deposits.

Molybdenite occurs on Mount Copeland about five miles west of the Nora and John claims area. The molybdenite appears to be genetically related to nepheline syenite gneiss, a rock type very questionably present in the Nora and John claims area.

Silver-Lead-Zinc Mineralization

General

Examination of the stratigraphic sequence and local structure at the Copeland Mountain silver-lead-zinc deposit (King Fissure Deposit of the B.C. Department of Mines and Petroleum Resources) is instructive. On the north flank of Mount Copeland the stratigraphic sequence is as follows:

Top of Section

E. Grey Gneiss Unit. Several thousand feet of metasedimentary strata that locally display gneissose structure.

D. Marble Unit. A few hundred feet of mica schist with three intercalated marble beds, each a few tens of feet thick. The lowest limestone layer has a striking white colour.

C. Ore Sequence. Somewhat less than 100 feet of fine mica schist with intercalated calc-silicate layers. One calc-silicate layer, about 40 to 45 feet above the uppermost underlying quartzite, is partly replaced (?) by fine grained pyrrhotite, pyrite, galena and dark sphalerite.

B. Quartzite Sequence. Several hundred feet composed of mica schist with quartzites and two thin limestones. At the top of this unit is a brown, rather limy, somewhat micaceous quartzite.

A. Biotite-Sillimanite Schist. Several hundred feet of sequence with coarsely crenulated biotite-sillimanite schist at the base and very rusty weathering biotite schist or biotite-sillimanite schist at the top.

Tentatively the Biotite-Sillimanite and Quartzite (Unit 3) of the Nora and John claims area is correlated with Units A and B on Mount Copeland and the Lime Unit (Unit 4) is correlated with Units C and D of the Mount Copeland area. The Lime Unit at its southern exposures on Frisby Ridge contains three limestone beds as does the Marble Unit on Copeland Mountain, but the ore layer on the west flank of Frisby Ridge occurs above, not below, the lowest limestone bed. The Lime Unit on the northern limb of the antiform in the Nora and John area is dissimilar from the Lime Unit on the southern limb and the Marble Unit on Mount Copeland because it contains one, not three, limestone layers.

The dominant structure at the Copeland Mountain silver-lead-zinc deposit is a doubly-plunging isoclinal synform with an axial plane that dips southwesterly at about 45 degrees. This is a Phase 2 fold with rounded axial region. The thickest sulphide and the best value of the deposit occur on the steep southwest limb and in the axial portion of the fold, suggesting structural control by the Phase 2 folding. The deposit appears to have been affected by at least one episode of folding and metamorphism, so that it is possible that the sulphide deposit was remobilized during the Phase 2 event to be redeposited in the axial portion and "upper limb" of a Phase 2 synform. It is here suggested that the Copelan d Mountain structure is a portion of a recumbent overfold similar to the eroded recumbent structure shown on Section G-H, Figure 4.

Big Slide Area

A showing of silver-lead-zinc occurs in the Lime Unit on the west flank of Frisby Ridge about 1500 feet east of the rock slide deposit known locally as the "Big Slide" (Fig. 3). The bedded sulphide deposit, probably a replaced layer of calc-silicate that has been affected by a metamorphic and deformational event, occurs at the top of the lowest limestone of the Lime Unit (see previous description of Unit 4). The layer consists almost entirely of massive fine grained pyrrhotite with minor pyrite, black sphalerite, and traces of galena, chalcopyrite and bornite, a mineral suite similar to the suite at the Copeland Mountain silver-lead-zinc deposit. Nowhere was the layer observed where its thickness exceeded 0.6 feet. The layer is remarkably continuous for 2000 feet along the trace of the Lime Unit and then gives way to nests or spots of mineralization (Sample Locality 44,401, Fig. 3). The best values were in the grab sample numbered 44,407 with assays as follows: silver 0.6 oz./ton; lead 0.26%; zinc 7.91%, and copper 0.02%. (See Assay Nos. 44,249-250; 44,401-405; 44,407; 44,409.) Altered wall rock that contains disseminated pyrrhotite and pyrite for two to three feet on either side of the sulphide layer also contains minor amounts of silver (0.4 oz./ton), zinc (0.52%) and copper (0.02%). (See Assay No. 44,408.)

A significant thickening of this bedded deposit along plunge to the east-southeast is unlikely in view of the consistent narrow width of the layer along an outcrop length of 2000 feet.

About 400 feet west of the main Big Slide silver-lead-zinc showing and at an altitude of 5200 feet, a small outcrop of fault breccia occurs in an area almost entirely obscured by talus, soil and vegetation. This fault breccia is composed entirely of angular fragments of medium grey semischist similar to semi-schist exposed in a small outcrop at slightly lower elevation. Almost all fragments of the breccia are partially replaced by pyrite and pyrrhotite. Slickenside surfaces in the breccia strike 5°, dip 85° N.W., and indicate that the northwest side has moved down. The breccia, which appears to have a local width of about 10 feet, contains 1.5 oz. of silver per ton with minor lead, zinc and copper (Assay No. 44,406).

<u>Other Areas</u>

The Lime Unit on the west flank of Frisby Ridge near the south edge of the map area is apparently involved in a large recumbent overfold (Fig. 3; Fig. 4, Section C-D). By analogy to the structure at the Copeland Mountain deposit, significant silver-lead-zinc mineralization may occur on the upper limb and in the axial portion of this fold.

Light to moderate sulphide mineralization has been observed in the Lime Unit at a few other localities in the Nora and John claims area. Disseminated pyrrhotite is abundant where the southern outcrop belt of the Lime Unit is exposed at the crest of Frisby Ridge and occurs sparingly in the isolated remnants of Lime Unit on Frisby Ridge half a mile farther north. These particular areas appear to be barren of base metal sulphides but additional silver-lead-zinc deposits may be present, obscured or largely obscured by overburden, elsewhere along the outcrop of the Lime Unit.

On the ridge a mile north of Copeland Creek and a mile west of Jordan River, a layer within the Grey Gneiss (Unit 5) contains disseminated pyrrhotite with local minor values of zinc and lead (Locality 44,410). The layer consists of rusty schistose quartzite with interlaminated calc-silicate rock and is mineralized over a width of at least ten feet. Selected surface samples collected by prospectors L. Zettergreen and L. Atwood from along this zone contained 0.57% zinc and 0.32% lead (Assay No. 44,410). Further investigation of this zone is warranted.

Other Sulphide Mineralization

On the north side of the 7800-foot peak north of Copeland Creek, about 40 feet of calc-silicate rock and mica schist along the prominent strike-slip fault between Units 2 and 5 contain abundant pyrrhotite and pyrite. No significant values in precious or base metals were detected in two samples sent in for assay. Along a nearby lineament, possibly a high angle cross-fault truncated by the strike fault, there is patchy silification and disseminated iron sulphides. No metallic sulphides of economic worth were detected at this place but this zone, and similar cross-faults, might contain economic deposits where it crosses suitable host rocks.

On the ridge a mile north of Copeland Creek and a mile west of Jordan River, about 30 feet of quartzitic grey semischist in Unit 3 contains disseminated iron sulphides and weathers a conspicuous rusty brown. The layer contains pyrrhotite and pyrite possibly along 2500 feet of trace but no minerals of economic worth were found in the few places visited.

RECOMMENDATIONS

1. During the 1969 field season, the distribution and structure of the Lime Unit on the west flank of Frisby Ridge near the south edge of the map-area should be verified by detailed surface mapping.
2. Four areas warrant additional surface prospecting:
   - (a) The area of the large recumbent synform in the Lime Unit on the west flank of Frisby Ridge near the south edge of the map-area.
   - (b) The northern outcrop band of the Lime Unit on Frisby Ridge. Particular attention should be directed to the unit east of the crest of the ridge and south of the outcrop of the limestone layer.
   - (c) The quartzite and calc-silicate layer in the Grey Gneiss that contains some zinc and lead and that crops out a mile north of Copeland Creek.
   - (d) Cross faults west of the Jordan River, particularly those truncated by the strike fault separating Units 2 and 5.

Laurence W. Vigrass

Laurence W. Vigrass, P. Eng.

APPENDIX I

ASSAY CERTIFICATES

44,249 - 44,250

44,401 - 44,410 inclusive

CREST LABORATORIES LTD.

7911 Argyll Road • EDMONTON, ALBERTA • Phone 469-2391

CERTIFICATE OF ASSAY

TO King Resources Company,
1300 Elveden House,
Calgary, Alberta. Attn: Mr. B. T. Gallant - PERSONAL & CONFIDENTIAL.

Lab. No. 725
August 25, 1968.

I hereby certify that the following are the results of assays made by us upon the herein described samples.

MARKED	GOLD		SILVER	COPPER	LEAD	ZINC	MoS_2				TOTAL VALUE PER TON (2000 LBS.)
	Ounces per Ton	Value per Ton	Ounces per Ton	Percent	Percent	Percent	Percent	Percent	Percent	Percent	
44248	-----		-----	-----	-----	-----	-----				
44249	trace		trace	0.07	0.07	trace	trace				
44250	trace		0.1	0.06	0.24	1.36	trace				
44401	trace		0.3	0.12	0.51	3.64	trace				

NOTE:
Rejects retained one month.
Pulps retained three months unless otherwise arranged.

Gold calculated at $.................. per ounce

F. C. Burgess
Registered Assayer, Province of British Columbia

CREST LABORATORIES LTD.

7911 Argyll Road • EDMONTON, ALBERTA • Phone 469-2391

CERTIFICATE OF ASSAY

TO King Resources Company,
1300 Elveden House,
Calgary, Alberta. Attn: Mr. B. T. Gallant - PERSONAL & CONFIDENTIAL.

Lab. No. 718
August 25, 1968.

I hereby certify that the following are the results of assays made by us upon the herein described samples.

MARKED	GOLD		SILVER	COPPER	LEAD	ZINC	MoS_2				TOTAL VALUE PER TON (2000 LBS.)
	Ounces per Ton	Value per Ton	Ounces per Ton	Percent	Percent	Percent	Percent	Percent	Percent	Percent	
44402	trace		0.3	trace	0.83	5.74	trace				
44403	trace		trace	trace	0.05	0.07	trace				
44404	trace		0.1	0.06	0.16	5.05	trace				
44405	-----		trace	trace	0.11	0.07	-----				

NOTE:
Rejects retained one month.
Pulps retained three months
unless otherwise arranged.

Gold calculated at $.................. per ounce

L. E. Burgess
Registered Assayer, Province of British Columbia

TO:

Versatile Mining Service Ltd.,

P.O. Box 1420

Revelstoke, B.C.

ATTENTION: Mr. L.W. Vigvass

Certificate of Assay

COAST ELDRIDGE

PROFESSIONAL SERVICES DIVISION

WARNOCK HERSEY INTERNATIONAL LIMITED

125 EAST 4TH AVE. VANCOUVER 10, B.C., CANADA

CTA

PHON[redacted] (604) 876-4111
TEL[redacted]04-50353
CAB[redacted]ADDRESS: ELDRICO

FILE NO. A.3-V.1-68-1274

DATE August 30, 1968

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *samples*

MARKED	GOLD		SILVER	Lead (Pb)	Zinc (Zn)	Copper (Cu)			
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.
		$							
44406	Trace	-	1.5	0.24	0.30	0.02			
44407	Trace	-	0.6	0.26	7.91	0.02			
44408	Trace	-	0.4	Trace	0.52	0.02			
44409	Trace	-	0.2	Trace	1.55	0.02			
* 44,410	–		Trace	0.32	0.57	0.02			

* Assay results on Sample 44,410 added to this certificate by L.W. Vigrass.

Ref. No. ....
Project .... Equip. Repair ....
Equip. Rent .... Camp Sup. ....
Tel & Tel .... Tunnel Sup. ....
Freight .... Fuels & Lub. ....
Exp. Acct. ....
Other ....
Remarks:

Approved ....

/jp

Gold calculated at $ .... *per ounce*

Note. Rejects retained one week.
Pulps retained one month.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

Unless it is specifically stated otherwise, gold and silver values reported on these sheets have not been adjusted to compensate for losses and gains inherent in the fire assay process.

H. Shayles

Provincial Assayer

APPENDIX II

COST OF SURVEY

Final costs in connection with the survey described herein, which was done under the writer's direction, have not been assembled. However, the property-related cost data which are available from the accountants total $22,346.51 and are in excess of the $3,900.00 claimed in connection with the Bass Group in October, 1968, the $8,000.00 claimed in connection with the Charlie Group in March, 1969, and the $7,800.00 claimed with respect to the Donald Group, also in March, 1969. The total of these various claims is $19,700.00.

	Item	Amount
(1)	Technical work (consulting)	
	(a) Field geological mapping	$ 9,732.72
	(b) Compilation of field geologic data and report preparation	2,533.47
	(c) Assays and analyses	402.00
(2)	Technical services (contract)	
	(a) Geological assistants	4,760.37
	(b) Drafting and reproduction	559.17
(3)	Transportation - Helicopter	2,535.45
(4)	Supplies	83.33
(5)	Supervision	1,740.00
	TOTAL PROPERTY-RELATED COSTS	$22,346.51

APPENDIX III

DOMINION OF CANADA PROVINCE OF BRITISH COLUMBIA TO WIT:	IN THE MATTER OF COST OF GEOLOGICAL SURVEY ON THE KING RESOURCES COMPANY BASS, CHARLIE AND DONALD GROUPS OF MINERAL CLAIMS, FRISBY RIDGE AREA, REVELSTOKE MINING DIVISION, BRITISH COLUMBIA

I, MALCOLM CAMPBELL ROBINSON, Ph.D., P.Eng., of 1486 Everall Street in the City of White Rock in the Province of British Columbia, DO SOLEMNLY DECLARE that a geological survey of 118 located mineral claims and fractional mineral claims owned by King Resources Company of Calgary, Alberta, was conducted during the field season of 1968 and was reported on in March, 1969, after technical compilation, review and description of the field data obtained at a total property-related cost to King Resources Company in excess of $22,346.51.

AND I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the "Canada Evidence Act".

DECLARED before me at the City of White Rock in the Province of British Columbia

this 12th day of March, A. D. 1969.

A Commissioner for taking Affidavits for British Columbia

APPENDIX IV

CERTIFICATE

I, MALCOLM CAMPBELL ROBINSON, of 1486 Everall Street, White Rock, British Columbia, DO CERTIFY THAT:

(1) I am a graduate of the University of British Columbia (B.A.Sc.), Queen's University (M.Sc.), and Princeton University (M.A., Ph.D.), and I have been practising in the fields of exploration geology, engineering and management over the past sixteen years.

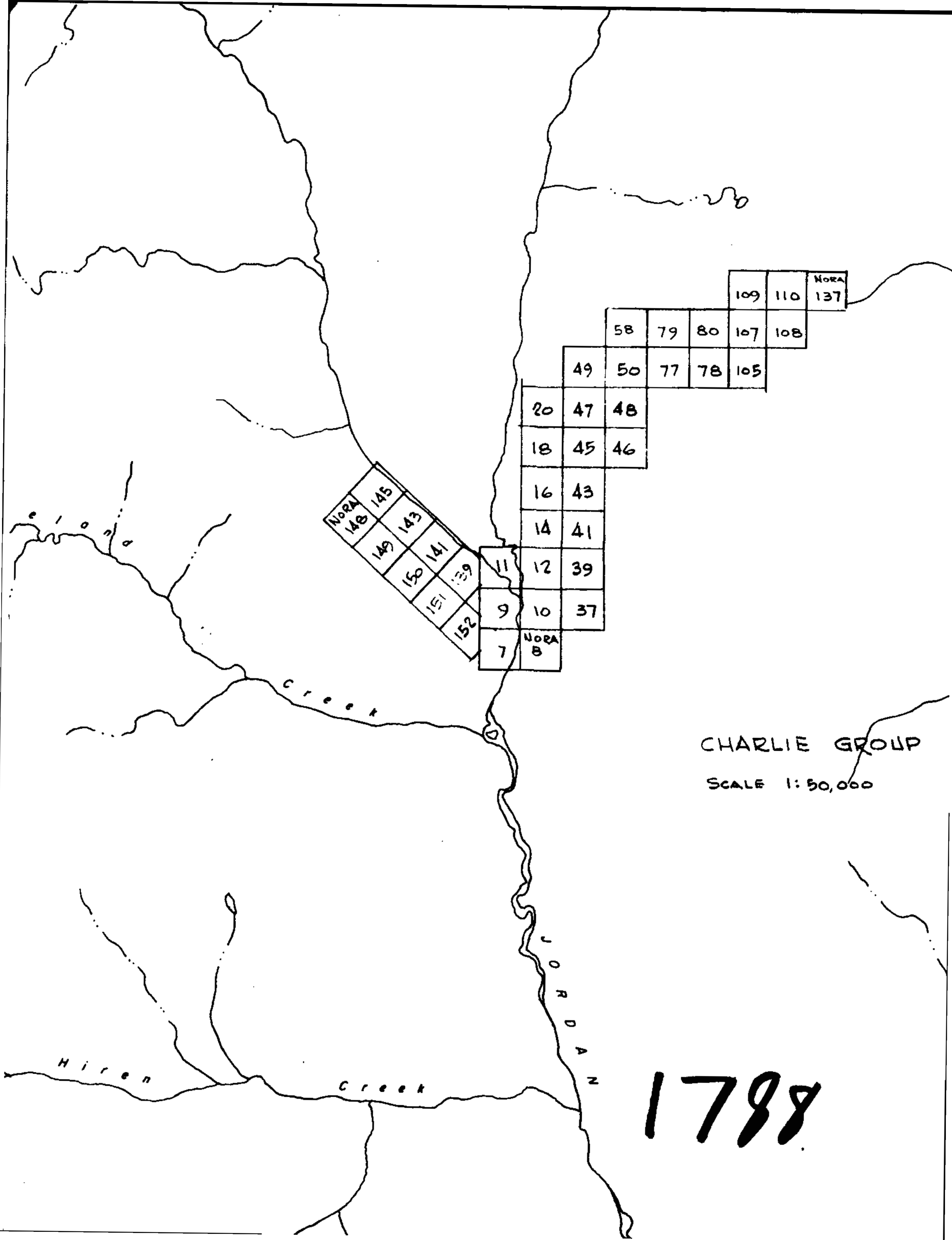
(2) I am a member of the Associations of Professional Engineers of British Columbia and of Alberta.

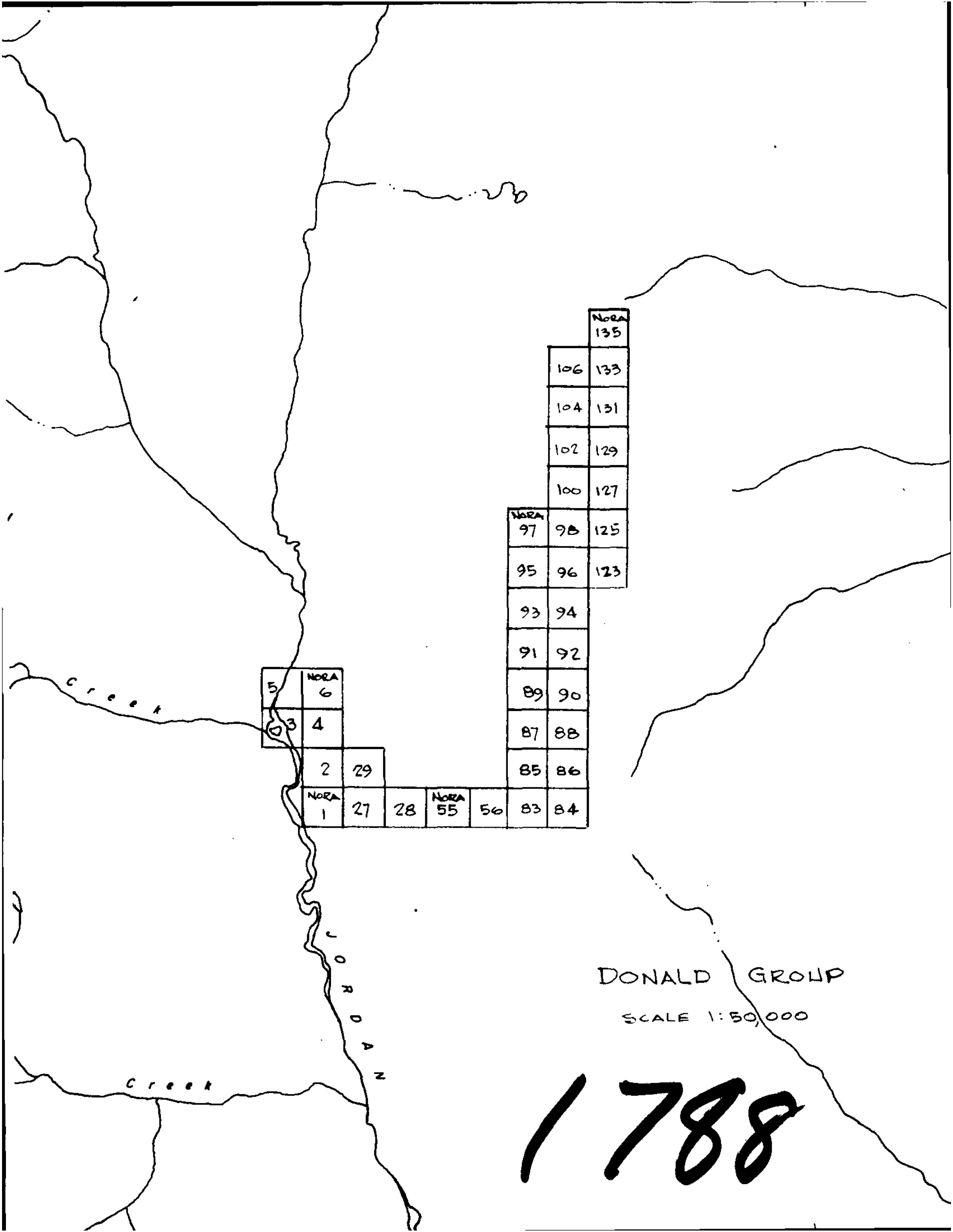
(3) The field program and report preparation referred to herein were designed and supervised by myself.

M. C. Robinson

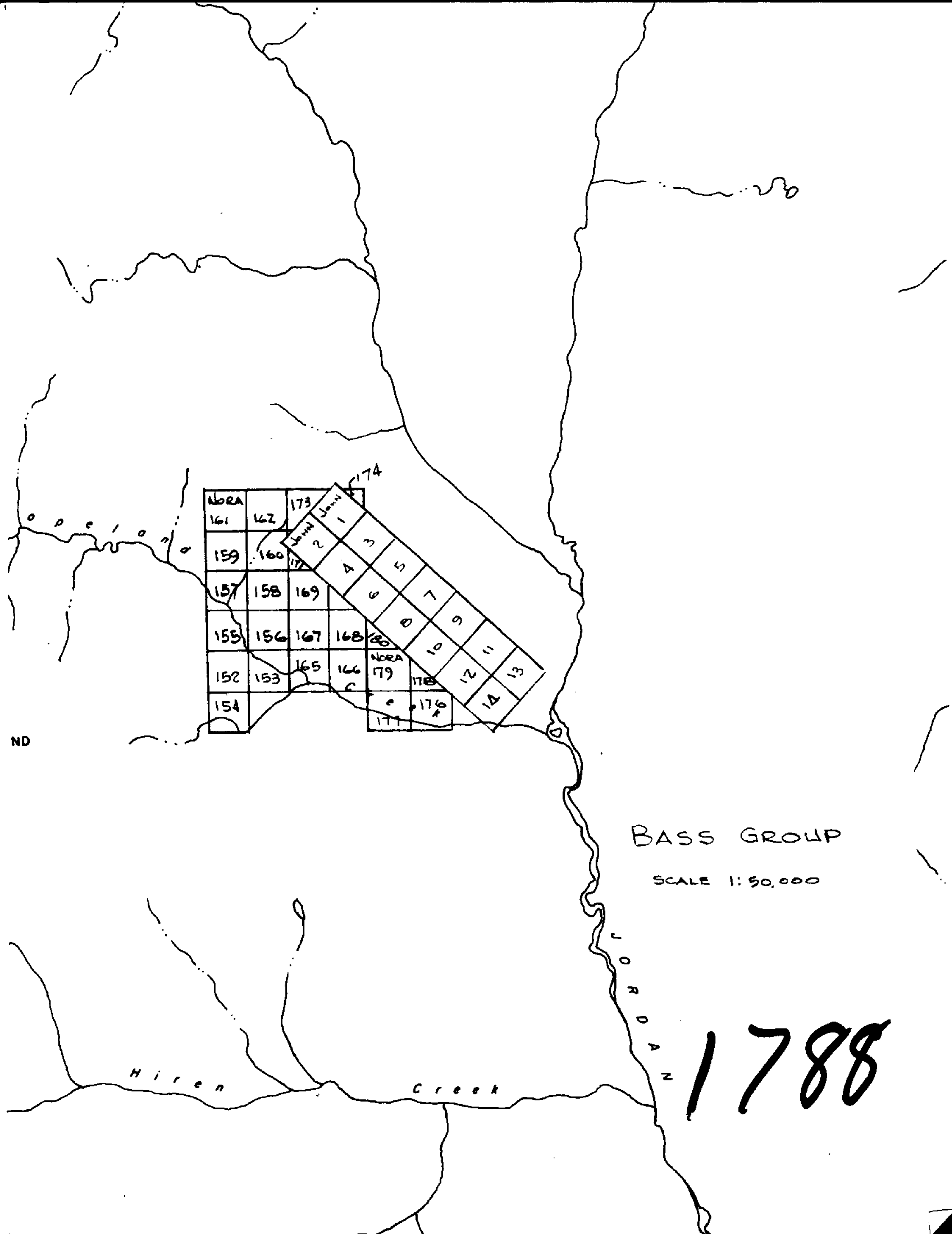
M. C. Robinson, P.Eng.

White Rock, B.C.
March 12, 1969.

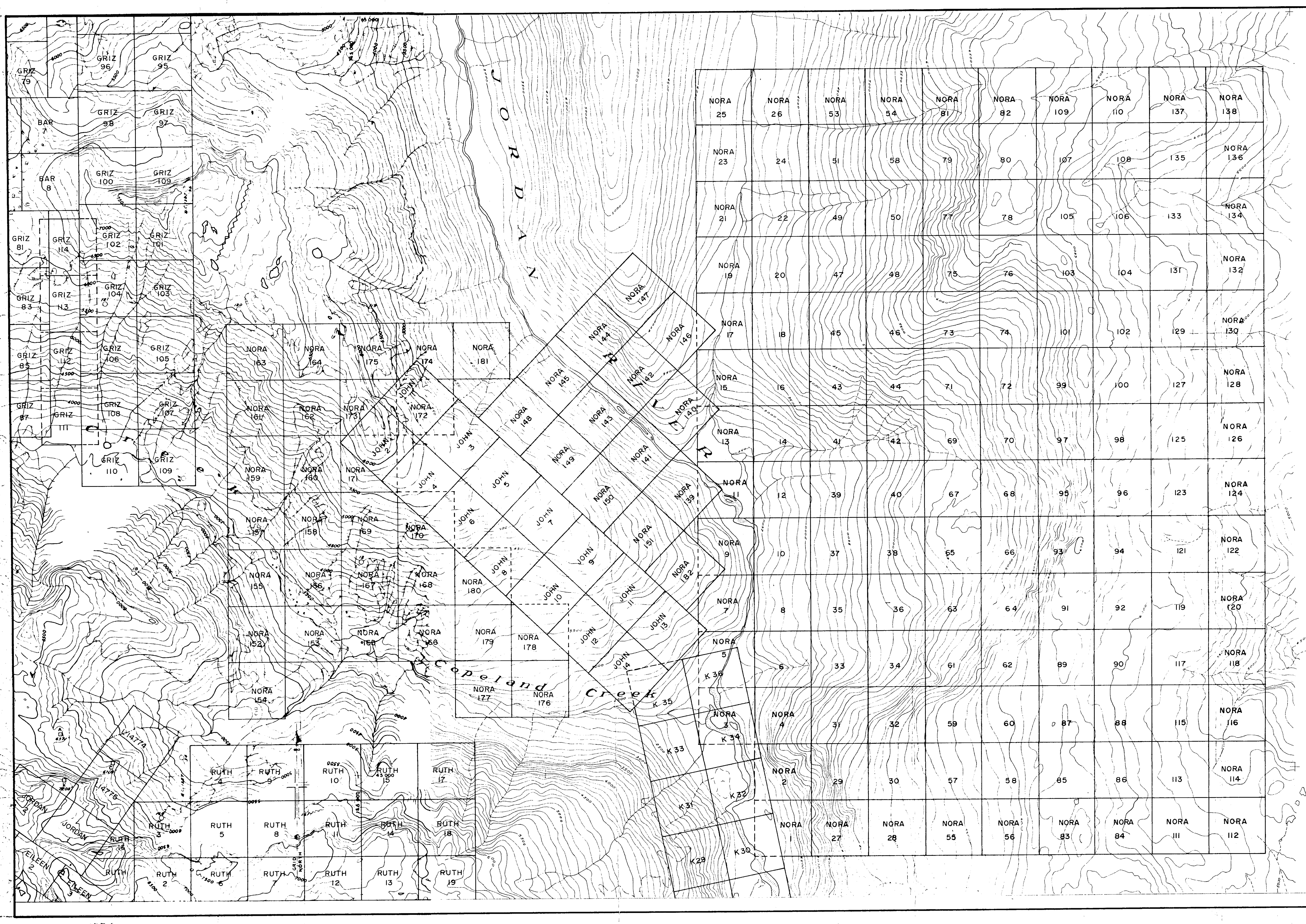

CHARLIE GROUP
SCALE 1:50,000
Creek
Hiren Creek
JORDAN
NORA 137
109
110
107
108
58
79
80
105
49
50
77
78
20
47
48
18
45
46
16
43
14
41
12
39
11
10
37
9
7
NORA 8
NORA 148
145
143
149
141
150
139
151
152
1798



NORA 135
106
133
104
131
102
129
100
127
NORA 97
98
125
95
96
123
93
94
91
92
5
NORA 6
89
90
3
4
87
88
2
29
85
86
NORA 1
27
28
NORA 55
56
83
84
Creek
JORDAN
Creek
DONALD GROUP
SCALE 1:50,000
1788



BASS GROUP
SCALE 1:50,000
1788
NORA
JOHN
JORDAN
Hiren Creek
opeland
ND



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TO ACCOMPANY A GEOLOGICAL REPORT BY DR. L. W. VIGRASS ON THE NORA AND JOHN GROUPS OF MINERAL CLAIMS, DATED NOVEMBER 30, 1968

Lawrence W. Vigrass

REVISIONS	
DATE	BY

KING RESOURCES COMPANY

FIG. 2
LOCATION PLAN
NORA AND JOHN GROUPS
FRISBY RIDGE AREA
REVELSTOKE MINING DIVISION
BRITISH COLUMBIA ①

GEOLOGY BY	TECHNICAL WORK BY	DRAWING NUMBER
M.C.R. EXPLORATIONS	VERSATILE MINING SERVICES	
SCALE	DRAWN BY	DATE
1000 ft. to 1 in.	E.R.B. ENTERPRISES	DECEMBER, 1968

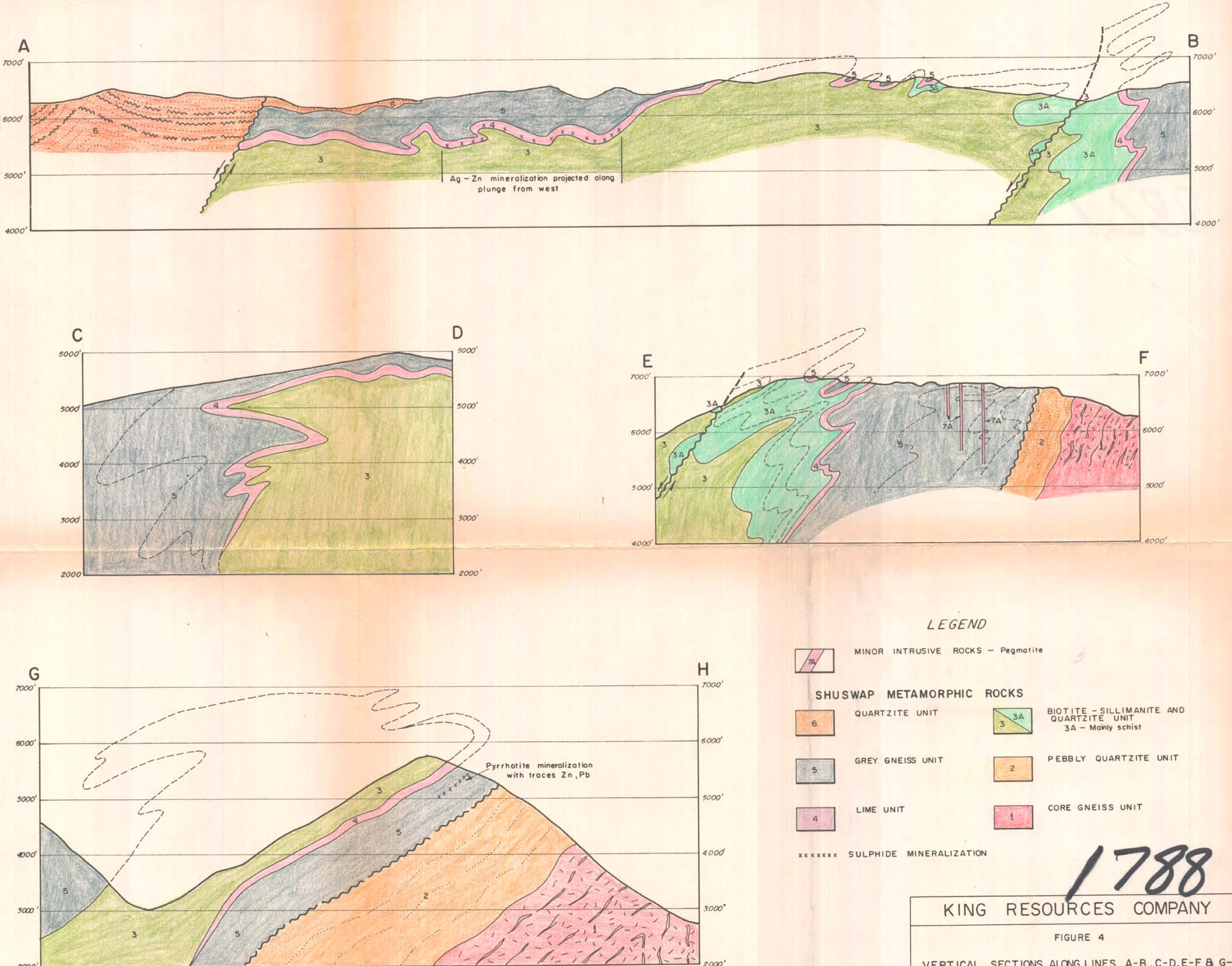

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FIGURE 4

VERTICAL SECTIONS ALONG LINES A-B, C-D, E-F & G-H

NORA AND JOHN GROUPS CLAIM AREA

FRISBY RIDGE AREA

REVELSTOKE MINING DIVISION, B.C.

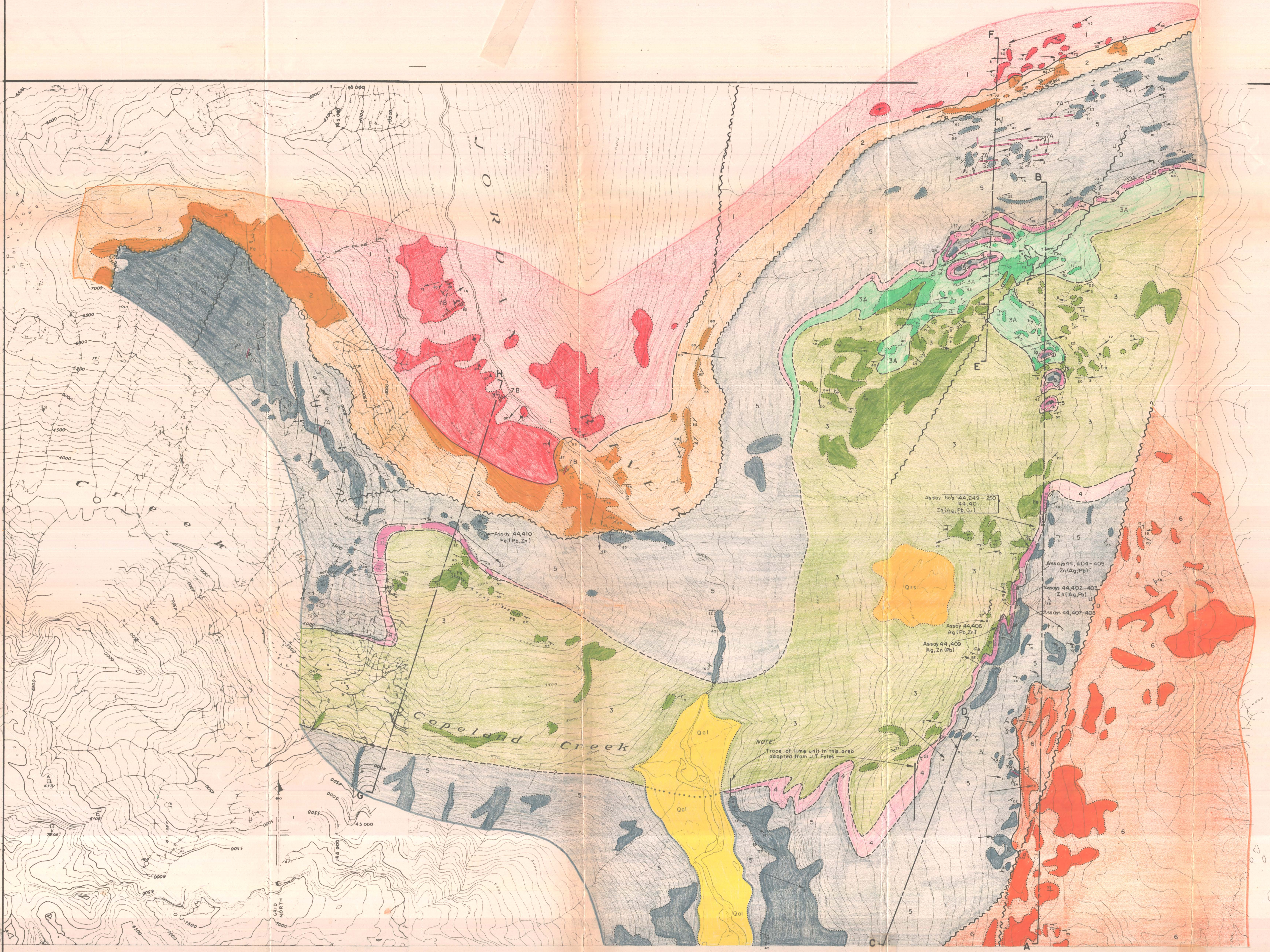
(2)

Drawn by:	Geology by:	Scale:	Date:
Technical Drafting Services	Dr. L.W. Vigrass	1 inch = 1000 feet	November 30, 1968

NOTE: To accompany geologic report on the Nora and John Groups of mineral claims, Frisby Ridge Area, Revelstoke Mining Division, B.C.

Prepared by: Dr. L.W. Vigrass, November 30, 1968

Laurence W. Vigrass



LEGEND

SURFICIAL DEPOSITS
Qal — Alluvium
Qrs — Rock slide deposits

INTRUSIVE ROCKS

MINOR DIKES
7A — Pegmatite, trachyte
7B — Dolerite, lamprophyre

SHUSWAP METAMORPHIC ROCKS

6 QUARTZITE UNIT

5 GREY GNEISS UNIT

4 LIME UNIT

3 BIOTITE - SILLIMANITE AND QUARTZITE UNIT
3A - Mainly biotite - sillimanite schist

STRIKE FAULT

2 PEBBLY QUARTZITE UNIT

1 CORE GNEISS UNIT

xxxxxxxxxxxxxx Fe, Ag, Pb, Zn (Cu) SULPHIDE MINERALIZATION
Fe - Pyrite and pyrrhotite
Ag, Pb, Zn (Cu) — Silver, lead, zinc, trace: copper

Outcrop areas (not all shown) and boundary of surficial deposits

Geological contact: defined, approximate

Geological contact very approximate, below surficial deposits

Fault: approximate, uncertain (U - up; D - down)

Fault: possible (from aerial photos)

Attitude: bedding, foliation

Attitude: joints, dikes

Trend and plunge of lineation: mineral alignments $-(l_1)$

Minor fold axes, foliation crenulations $-(l_2)$

Statistical plunge of cylindroidal folds (bedding and foliation) $-(l_3)$

Axial traces: antiform, synform

Lines of sections A — B

NOTE: To accompany geologic report on the Nora and John Groups of mineral claims, Frisby Ridge Area, Revelstoke Mining Division, B.C.

Prepared by: Dr. L.W. Vigrass, November 30, 1968

Laurence W. Vigrass

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FIGURE 3

GEOLOGICAL PLAN
NORA AND JOHN GROUPS CLAIM AREA
FRISBY RIDGE AREA
REVELSTOKE MINING DIVISION, B.C.

(3)

Drawn by:	Geology by:	Scale:	Date:
Technical Drafting Services	Dr. L.W. Vigrass	1 inch = 1000 feet	November 30, 1968