REPORT

ON

GEOLOGY AND MINERALIZATION

IN THE

VAVENBY DISTRICT

KAMLOOPS MINING DIVISION

BRITISH COLUMBIA

FOR

BARRIER REEF RESOURCES LTD. (NPL),

904 - 675 WEST HASTINGS STREET,

VANCOUVER, B. C.

PREPARED BY

KERR, DAWSON & ASSOCIATES LTD.
1 - 219 Victoria Street

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Kamloops, B.C.
J. M. Dawson, P. Eng.,
August, 1977.

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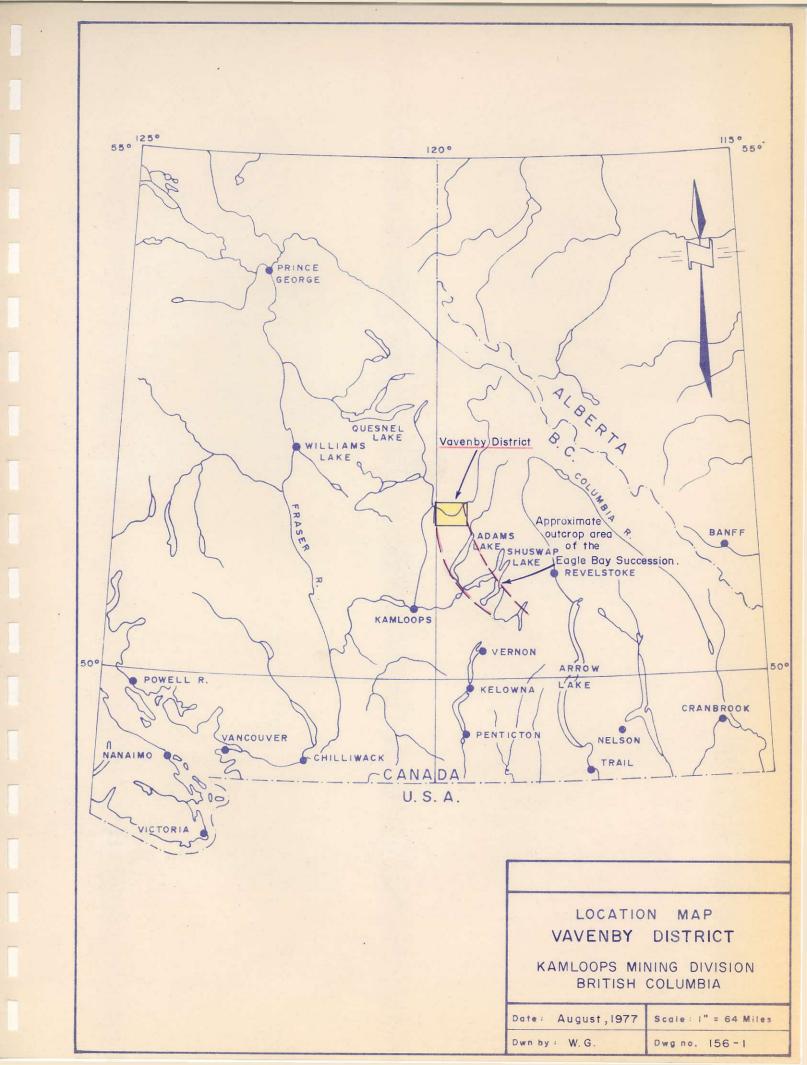
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### INTRODUCTION

Recently, volcanogenic sulphide deposits have become the object of intensive exploration effort by numerous companies in the Canadian Cordillera. This has come about because of (a). re-interpretation of Cordilleran geology in terms of the new volcanogenic model (b). the relatively poor economic outlook for "British Columbia-type" porphyry copper deposits and (c). recent discovery of "cordilleran-type" massive sulphide deposits. e.g.Goldstream River and Kutcho Creek.

One of the areas where exploration activity for such deposits has been most intense is the Shuswap Lake
- Adams Plateau - North Thompson region. Considerable staking has taken place here and several major companies have carried out airborne geophysical surveys.

This report outlines the potential of the Vavenby District for hosting volcanogenic mineral deposits.

This district is located at the north end of the Shuswap

Lake - Adams Plateau - North Thompson Region. The report is based on regional mapping of the subject district, numerous public and private reports on the area and the writer's personal experience conducting regional and detailed exploration programmes in the region.

### LOCATION AND ACCESS

For purposes of this report, the Vavenby
District is defined as that area bounded on the east
by the Shuswap Terrane, on the north by the Raft
Batholith, on the west by the Clearwater River and
on the south by the Baldy Batholith.

It is situated in south - central British
Columbia about 70 miles north of Kamloops and is
traversed by the Yellowhead Highway. Numerous
logging roads provide access to most outlying parts
of the district.

## GEOLOGICAL SETTING

The Vavenby District is underlain by a sequence of Lower Paleozoic volcanic and sedimentary rocks which are intruded by two granitic batholiths of Late Cretaceous age. Major structures trend eastwest; both batholiths are elongate in this direction and a doubly - plunging complimentary anticline - syncline also has this alignment. Major felding seems to be relatively simple; however, faulting is believed to contribute substantially to dislocation and apparent thickening of some horizons.

The volcano-sedimentary succession in the subject area is believed by the writer to be lower Paleozoic. The lowest part of the succession is very similar to parts of the Kaza or Snowshoe unit as mapped by Campbell west and north of the Clearwater River.

Parts of the so called "Eagle Bay succession" are lithologically similar to Lardeau-Badshot-Hamil rocks north of Revelstoke and in particular near the Goldstream River massive sulphide deposit.

The lowest unit of the succession exposed in the Vavenby District is termed quartz-feldspar-biotite gneiss. It outcrops along the north edge of the Baldy Batholith and near the axis of the major anticline which is exposed in Raft Canyon near the town of Clearwater. This unit consists primarily of quartz-feldspar-biotite gneiss or diorite gneiss but also contains quartzites, quartz-mica schists and minor amphibolite. The metamorphic grade is higher than the rest of the succession and it is possible that this unit is the "basement" upon which the acid and intermediate volcanic rocks of the "Eagle Bay succession" were erupted.

Above the quartz-feldspar-biotite gneiss is a thick (+700-1,000 meters?) and widespread sequence of light coloured schists, phyllites and "quartzites" which are considered by the writer to be the products of predominently felsic volcanism. The most common rock types seen are lustrous, silvery to cream coloured phyllites, buff coloured quartz-sericite schists and sericitic quartzites, greenish gray quartz-chloritesericite schists and distinctive "quartz-eye schists" or more massive "quartz-eye porphyies" which are considered by some geologists to be ignimbrites.

At the very top of the "felsic succession" (where exposed) is a thin (2-8 m.) layer of greenish, siliceous, fine grained material which sometimes resembles a chert and elsewhere looks like a type of skarn. It sometimes contains small amounts of pyrite, pyrrhotite, magnetite and chalcopyrite. At Mount McClennen, horizons of massive sulphides are found at the top of the "felsic succession" and the greenish, cherty tuff is considered to be laterally correlative with these. It therefore seems that the green, cherty unit is the so-called exhalite in the currently accepted model of volcanogenic mineralization.

is a sequence of graphitic schists and black slates, which though not universally present, is usually found when the appropriate part of the section is exposed near a mineral showing. The graphitic unit varies considerably in thickness from a few meters to more than a hundred meters. Its largest outcrop area is located near the northeast corner of the Noranda Harper Creek property (see figure #156-2).

Above the black, graphitic horizon is a thick sequence of greenish, chloritic, andesitic flows, coarse fragmentals and tuffs. Appreciable calcarious detrital sediments are present in this unit and widespread calcite veining is common in the massive andesite flows and tuffs. The andesite unit varies greatly in thickness over short distances and is primarily preserved in the deepest part of the doubly plunging syncline around Vavenby. Its maximum thickness is at least 300 - 400 meters.

In the southeastern part of the map area (see figure #156-2) lenses of andesitic and felsitic material appear to intertongue. This zone is interpreted to be an area of overlap of the products from two separate volcanic centers.

Above the andesite unit is a distinctive, massive, gray-weathering limestone which is known in the Adams Plateau-Barriere Lakes region as the Tshinikin Formation. It is at least 100 meters thick in places but has been largely eroded away in the

subject district. Again it has been preserved in the lowest part of the doubly-plunging syncline near the village of Vavenby. A thinner (10-30 meters) gray-weathering limestone horizon has been noted in the southeast corner of the area. Here the Tshinikin Formation and underlying andesite appears to interfinger with buff coloured schists and phyllites of the "felsic succession".

Overlying the limestone is a sequence of micaceous quartzites, graywackes and phyllites. This sequence is at least 70 - 100 meters thick but its upper contact is never seen since it is the uppermost part of the volcano-sedimentary sequence exposed in the Vavenby district. This unit was only noted on Mount McClennen and above the Tshinikin Limestone about four miles south of Vavenby.

Correlation of specific horizons is difficult because of the discontinous and local extent of the original units. The environment of deposition is envisioned by the writer to have been a series of local basins separated by volcanic centers which were

intermittently contributing material to a partly subaerial and partly submarine environment.

Large-scale folding seems to be fairly simple, the gross sequence being compressed into an east-west trending, low amplitude, anticline - syncline pair.

This fold system appears to plunge easterly to the west of the village of Vavenby and westerly, east of this point. There is speculation that the sharp bend in the North Thompson River just east of Vavenby may be the locus of a major north-south trending fault which would coincide with the change in plunge of the major folds.

Small scale, near isoclinal folds have been noted within individual beds of the andesite unit in canyons along Chuck Creek.

Small displacement (10-20 meters) normal faults have been noted in several places. A large-scale fault appears to offset the northern contact of the Baldy Batholith by about 2 miles, near the Lucky Strike

showing. This may be related to the postulated, major north-south trending fault located just east of Vavenby.

Several prominent linears (specifically in the valley of McCorvie Lakes and at the headwaters of Harper Creek) suggest a set of strong NNE trending faults; however, exposures are limited near these areas and no conclusive evidence of major faulting can be seen.

#### **MINERALIZATION**

Most mineral occurrences in the Vavenby District (except the Rexspar property) and in the "Eagle Bay Succession" within the Shuswap - Adams Plateau - North Thompson region are thought to be related to late stage fumarolic or exhalative activity at a number of felsic volcanic centers or "pipes". Except for minor fissure vein occurrences, most showings are of either one of (a). disseminated or fracture controlled two types: pyrite - chalcopyrite mineralization which cross cuts bedding and (b). stratiform and conformable bands of pyrite and pyrrhotite with lesser amounts of sphalerite, galena and chalcopyrite. Type (a) is considered to be analogous to the "pipe-zone" mineralization in the classical volcanogenic model whereas Type (b) is the equivalent of the upper massive sulphide horizon.

Occurrences of Type (a) or pipe zone-type mineralization are known from Vavenby to Sicamous in the "Eagle Bay succession" (see figure #156-1) and were extensively explored during the late 1960's and early 1970's. Mineralization is cross-cutting but may in

places be partly stratabound - presumably where more porous horizons were available at the time the pipe zone or fumarolic system was active. Mineralization consists of disseminations or fracture coatings of pyrite - pyrrhotite - chalcopyrite. Grades are generally low (0.2% to 0.4% Cu); however, locally areas of 0.7% Cu and higher are obtained. Potential tonnages are generally large (more than 100 million tons). This type of mineralization is only found within the phyllite, quartz sericite chlorite schist or "felsic unit".

Type (b) occurrences are usually strataform and conformable, massive to semi-massive layers of pyrite and/or pyrrhotite. These massive sulphide horizons usually contain variable amounts of sphalerite with lesser galena and minor chalcopyrite. Most commonly this type of mineralization is found at the top of the "felsic unit" or higher in the "Eagle Bay Succession".

Within the Vavenby District, a number of occurrences of both types of volcanogenic mineralization are known and will be described briefly here.

- (1). Harper Creek Deposit: This is the largest and best explored of the disseminated or pipe zone type mineral occurrences. It consists of a huge surface zone (1,500 meters square) of low grade disseminated pyrite chalcopyrite mineralization within which several higher grade areas have been delineated. Drill indicated reserves are given as 98 million tons of 0.42% Cu with two or three times that amount of lower grade material. It is thought that the conformable or massive sulphide part of the Harper Creek Deposit was eroded away since the top of the "felsic unit" is not present here.
- (2). Pine Lake Property: This showing consists of a quasi-conformable zone of pyrite and chalcopyrite enclosed within the "felsic unit". A lense of disseminated sulphides at least several hundred meters long and as much as 20 meters thick has been tested by at least 10 drill holes. Grades vary from 2.62% Cu over 6 feet (2 meters) to 0.72% Cu over 65 feet (~20 meters). This occurrence is deemed to be a part of a pipe zone mineralizing system which encountered a more porous horizon and preferentially travelled along it.

- (3). Mount NcClennen Showings: At Mount McClennen, conformable zones of massive to semi-massive sulphide mineralization are found at several localities over a strike length of at least 2,000 meters. These sulphide layers occur at the top of the "felsic unit" and within various types of sediments and tuffs which immediately overlie it. A distinctive, thin, greenish, siliceous layer is found at the top of the felsic unit here and is interpreted as being laterally equivalent to some of the massive sulphide horizons. The strataform sulphides consist of pyrite and pyrrhotite with lesser sphalerite and galena, and minor chalcopyrite. At one locality within the area of the central showings, a portion of the section at the top of the felsic unit is exposed. Here, cross-cutting chalcopyrite and pyrite mineralization is seen below the strataform mineralization which is primarily pyrite-sphalerite-galena. This zone is believed to be a portion of the extreme top of a pipe zone mineralization (predominently pyrite-chalcopyrite), and the strataform massive sulphide horizon (pyritesphalerite-galena).
- (4). <u>QCM-RCV Showing:</u> This is an area of low grade pipe zone mineralization occurring within quartz eye schists of the "felsic unit" at the eastern edge of the Harper

Creek Property. It would appear to be near the top of the felsic pile as the overlying graphitic horizon outcrops not more than 100 to 200 meters to the north. It is quite probable that additional disseminated mineralization occurs underneath the graphitic horizon and possibly massive sulphide horizons as well.

(5).Lucky Strike Showing: This showing consists of one or more layers of massive sulphides - (primarily pyrrhotite with lesser sphalerite and chalcopyrite) which occur between a footwall of greenish andesitic volcanics and a hanging wall of grey-crystalline limestone (Tshinikin?) The area is heavily overburden covered and the mineralization is poorly exposed; however, the massive sulphide horizon(s) is believed to be several meters thick and can be traced for more than 200 meters along strike. It is interpreted as being a distal massive sulphide occurrence emplaced in the transition zone between two volcanic centers. Andesitic material from one vent was already laid down while an adjacent system was still at the waning stages of the felsic cycle. Limestone was being deposited during and immediately after the deposition of sulphides as at one place the two are interbanded.

- (6). Nicanex Showing: This showing consists of a linear (40 M x 800 M), possibly semi-stratiform occurrence of disseminated, pipe zone mineralization. Pyrite and chalcopyrite are finely disseminated in quartz-chlorite-sericite schists of the "felsic unit". Grab samples by Chapman, Wood, and Griswald indicate "that the overall grade of the exposed section of the copper-bearing horizon may run between 0.3% and 0.4% Cu". (Janes, 1970). The Nicanex zone is now included within a block of claims owned by Barrier Reef Resources.
- (7). AFR Showing: This showing is a new discovery located about 600 meters southwest of the Nicanex zone in bedrock newly exposed in a roadbed. Very little outcrop is exposed in this area, but the occurrence is typical pipe zone mineralization in quartz-eye sericite schists of the felsic unit. It is estimated that the graphitic slate unit is not more than 100 meters above this horizon. Mineralization consists of disseminated chalcopyrite and pyrite at the edge of the road over a length of more than 30 meters. This showing is also located on ground owned by Barrier Reef Resources.

(8). Exhalite Showing: This showing is found in the eastern part of the Barrier Reef property where a semi-continuous section through the upper part of the felsitic unit and the overlying black shale and andesite units are exposed. At the top of the quartz-sericite schists and immediately below the graphitic horizon, a 3 to 5 meter bed of rusty-weathering, greenish, cherty tuff or exhalite is exposed. This bed contains minor disseminated pyrrhotite and magnetite as well as lesser amounts of chalcopyrite and sphalerite. It is interpreted as being remote from a fumarolic pipe or vent but laterally contiguous with a massive sulphide horizon.

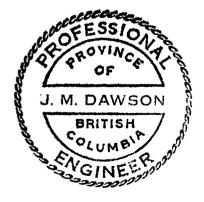
#### EXPLORATION POTENTIAL

The Vavenby District contains a number of known volcanogenic mineral showings of both the pipe zone and stratiform massive sulphide variety. The pipe zone mineralization always occurs within the phyllite - quartz sericite schist or felsic unit whereas the massive sulphides always occur above the felsitic unit but generally below the distinctive Tshinikin limestone.

In the writer's opinion, there are two good possibilities for finding economic zones of volcanogenic - related mineralization: (a). portions of pipe zone mineralized systems where more porous horizons may have hosted higher grade copper mineralization than the average 0.2% to 0.4% of many of the known mineralized pipe zones. (This situation has given rise to higher grade mineralization at the Pine Lake property and there are suggestions that a similar situation might be present at the Nicanex and AFR showings). (b). Massive sulphide pyrite - sphalerite - galena - chalcopyrite bearing horizons which are presently masked by overburden or covered by overlying units of the "Eagle Bay succession".

In this respect it is significant that at both places where the top of the felsic sequence can be definitely established, either exhalite occurrences or massive sulphide lenses are present. At several places, the top of the felsic unit can be located within 50 - 100 meters because of the presence of the overlying black graphitic unit.

There is a good possibility of encountering massive sulphide horizons in the area between the village of Vavenby, the Noranda Harper Creek property and the Barrier Reef claim group since the top of the felsic unit would be preserved under the limestone, andesite, black slate units and because pipe zone - type mineralization occurs in two places at the borders of this overlying sequence.

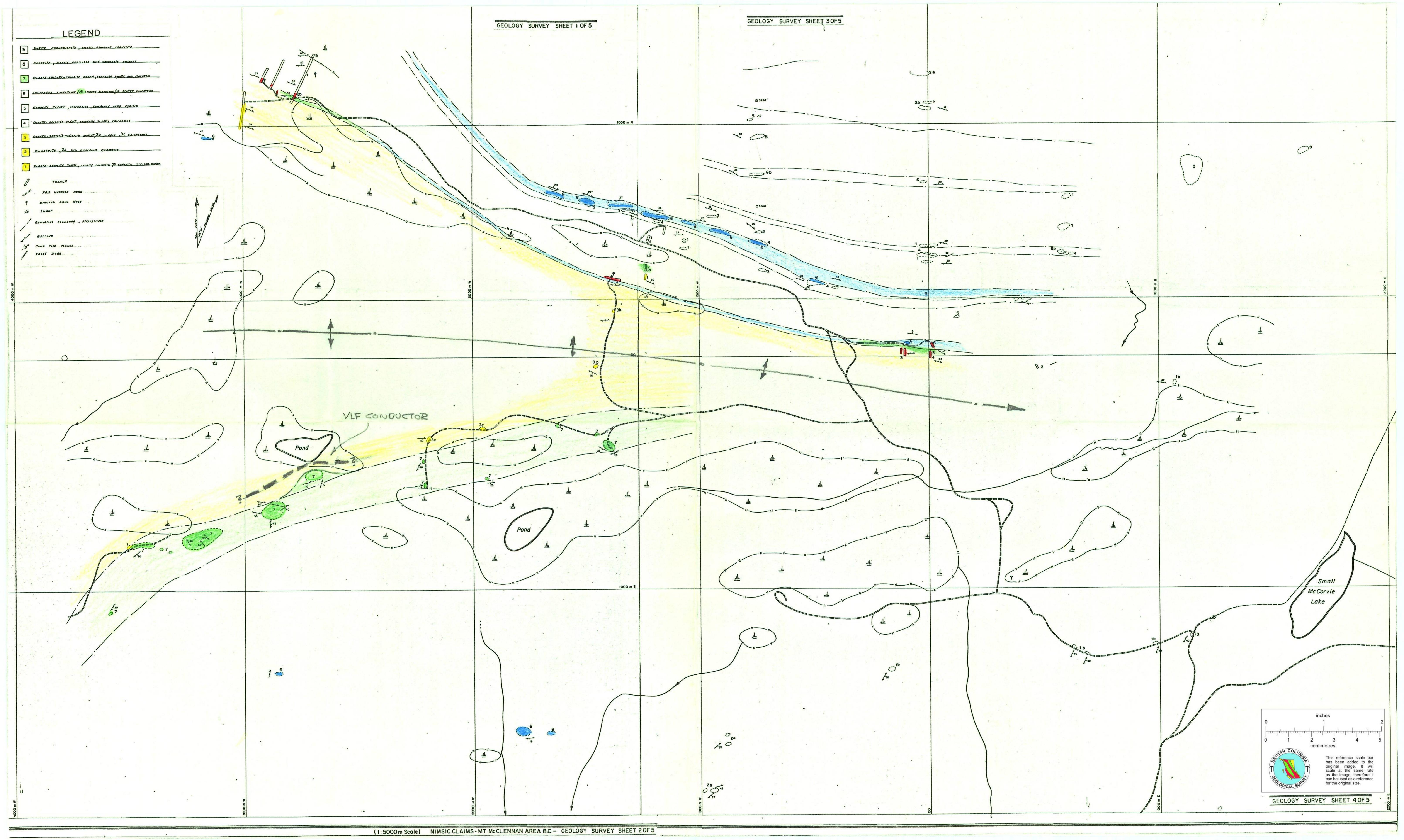



Respectfully Submitted:

KERR, DAWSON & ASSOCIATES LTD.,

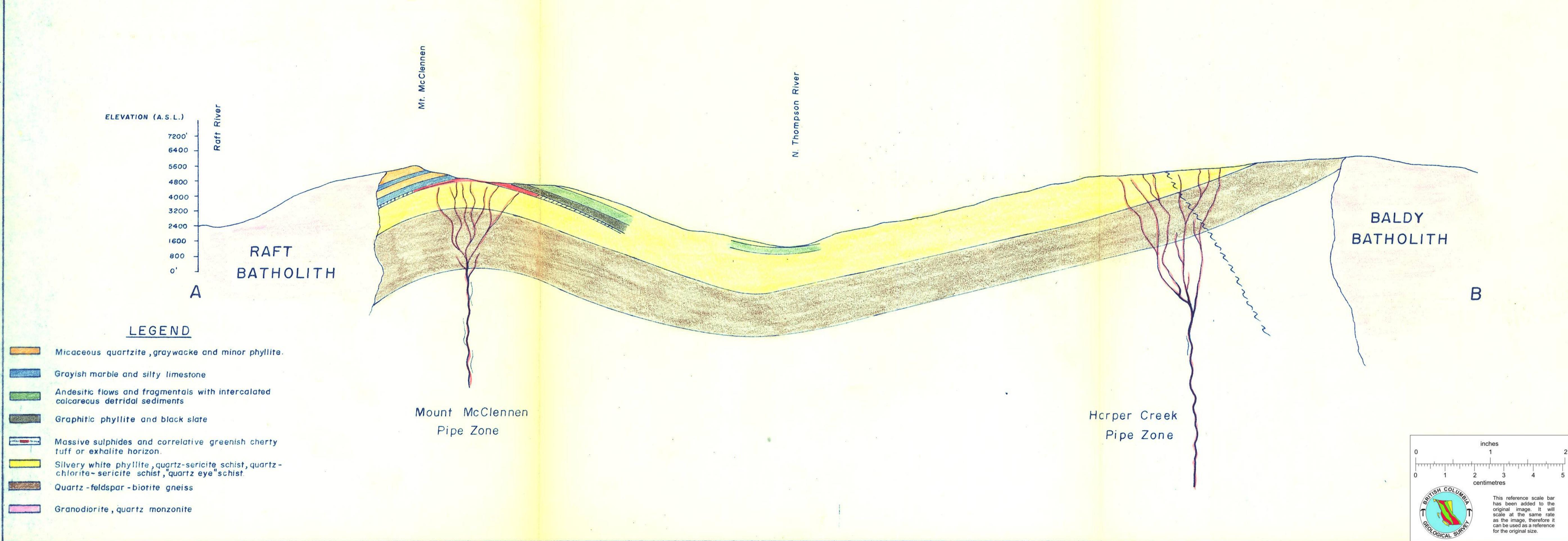
James M. Dawson, M. Sc., P. Eng., GEOLOGIST

August 15th., 1977, KAMLOOPS, B. C.









BARRIER REEF RESOURCES LTD.(N.P.L.)

REGIONAL GEOLOGY

VAVENBY DISTRICT

SECTION A-B

LOOKING EAST

TECH. WORK BY: KERR, DAWSON & ASSOC. LTD.

HORIZONTAL SCALE 1:50,000

APPROVED BY: J.M. DAWSON, P. ENG.

VERTICAL SCALE 1:48,000

DRAWN BY : W.G.

DATE: AUGUST, 1977.

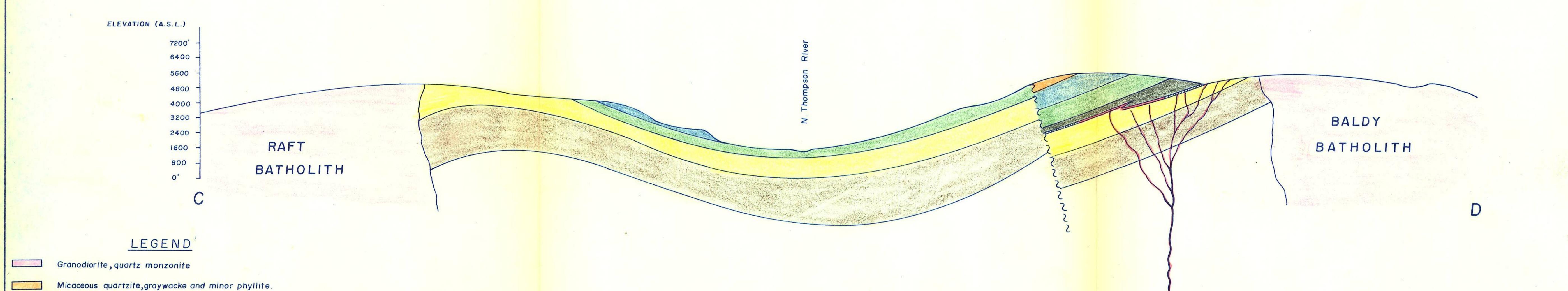
Figure 156-3





VAVENBY DISTRICT

SECTION C-D LOOKING EAST



Grayish marble and silty limestone.

Graphitic phyllite and black slate.

Quartz -feldspar - biotite gneiss

Andesitic flows and fragmentals with intercalated calcareous detridal sediments.

Massive sulphides and correlative greenish cherty tuff or exhalite horizon.

Silvery white phyllite, quartz-sericite schist, quartz-chlorite-sericite schist, "quartz eye" schist.

This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

APPROVED BY: J.M. DAWSON, P. ENG.

DRAWN BY: W.G. DRAWN BY : W.G.

QCM-RCV

PIPE ZONE

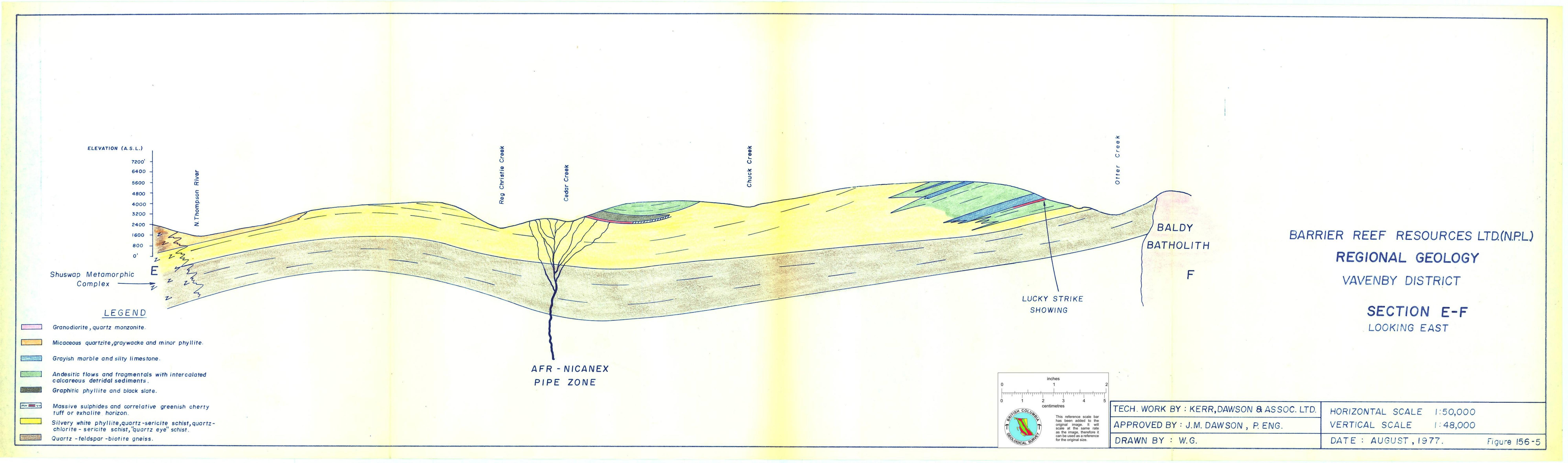
TECH. WORK BY : KERR, DAWSON & ASSOC. LTD.

HORIZONTAL SCALE 1:50,000

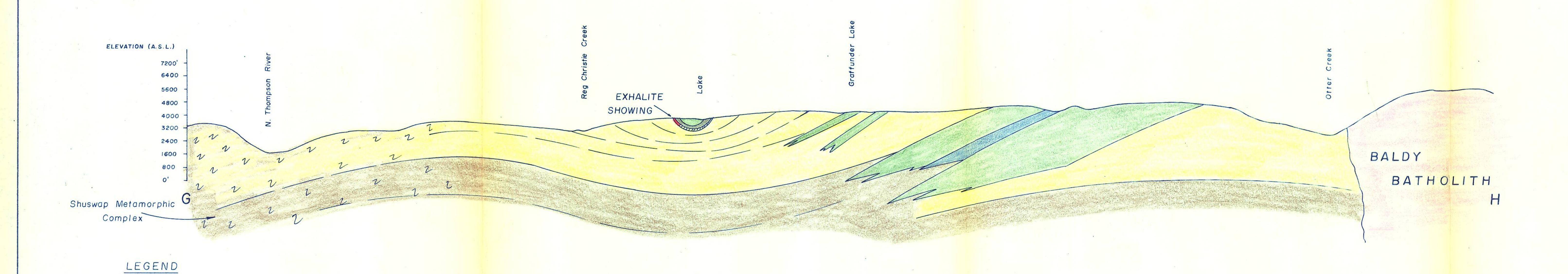
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DATE : AUGUST, 1977.

Figure 156-4





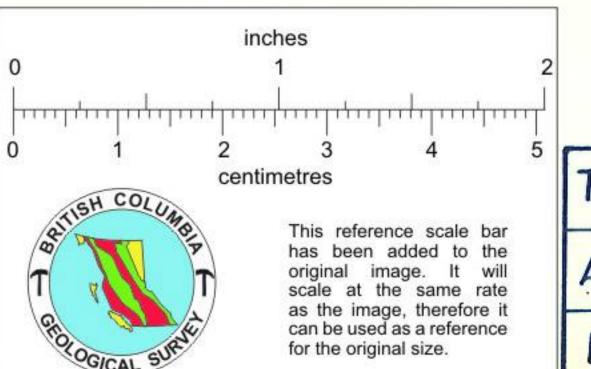


BARRIER REEF RESOURCES LTD.(N.P.L.)

REGIONAL GEOLOGY

VAVENBY DISTRICT

SECTION G -H LOOKING EAST



TECH. WORK BY: KERR, DAWSON & ASSOC. LTD. HORIZONTAL SCALE 1:50,000
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DRAWN BY: W.G. DATE: AUGUST, 1977.

Figure 156-6

Silvery white phyllite, quartz - sericite schist, quartz - chlorite - sericite schist, "quartz eye" schist.

Granodiorite, quartz monzonite.

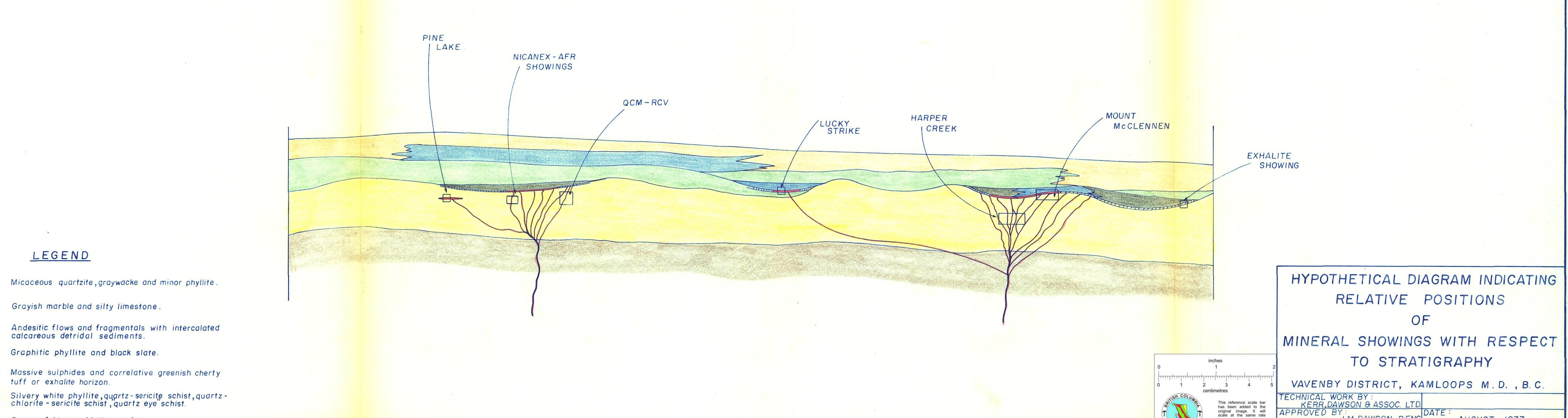
Grayish marble and silty limestone.

Andesitic flows and fragmentals with intercalated calcareous detridal sediments.

Quartz - feldspar - biotite gneiss.

Graphitic phyllite and black slate.

Massive sulphides and correlative greenish cherty tuff or exhalite horizon.



RELATIVE POSITIONS

TO STRATIGRAPHY

J.M. DAWSON, P.ENG. DATE:

DATE:

AUGUST, 1977.

DRAWING NO. 156-7

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LEGEND

Grayish marble and silty limestone.

Graphitic phyllite and black slate.

Quartz-feldspar-biotite gneiss.