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Geologic Report

on

HEATH COPPER PROPERTY

93 N / 6 E

Senate Mining and Exploration Ltd.

Received of
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No. 3200

Egil Livgard, P. Eng.

August 1971

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References:

Part Print of Geology Map by J. E. Armstrong 1941 G.S.C.
Geology Map by Amax Exploration 1969

Appendix: Cost of Mapping and Report Certificate 14

Maps:

#1 ^{*#2*} Location & Clam Maps

#3 Geology Map-Scale 1" = 400'

4A

INTRODUCTION

The writer has visited the property several times since August 1969 and spent about three weeks on the property in July 1969 during which time the geologic mapping proper was carried out.

Outcrops and geologic features were tied in to an established gridsystem and plotted on the accompanying map.

Photo-geological interpretation was carried out to aid in the mapping.

This report is based on the above work and on geologic maps as listed in the references.

SUMMARY

Part of the Heath and NS claims of Senate Mining and Exploration Ltd. at Nation Mountain, B. C. were mapped geologically during July 1971.

The property is located on the south-west corner of the Hogem Batholith near the PINCHI fault in dioritic and syenitic rocks of Jurassic or later age.

The mapping revealed a central zone of very highly altered diorite and syenite. Feldspathization has been very strong and oxidation is pervasive throughout the zone. The zone is bound by and intersected by strong fracturing or faulting. Copper mineralization consisting of malachite and chalcopyrite on fractures or disseminated through the altered and shattered diorite and syenite. Around the central area the alteration is still strong but generally tapers off further away. Copper mineralization is found in fractures and lenses or veins mainly paralleling the central zone.

The central grid area is considered to be a very good exploration target.

PROPERTY, LOCATION AND ACCESS

The property consists of 83 contiguous claims partly under option to and partly owned by the company.

The mapping was carried out on Heath MC# 1, 2, 4 - 11 and NS MC# 18, 19, 36, 37, 44 - 47 and to a small extent on Heath MC# 20, NS# 1, 20, 21, 38 and 39.

Eight claim posts being the #1 posts of 15 of the above claims were located in the field and tied in to the grid system. The claims appear to be well and correctly staked and no open fractions were located.

The property is located on the south slopes of Nation Mountain near TCHENTLO LAKE, 65 air miles northwest of Fort St. James, B. C. in the Omenica Mining Division. The property can be reached by fixed wing aircraft or helicopter from Fort St. James 65 miles away or from GERMANSEN LANDING, 40 miles away which is connected to Fort St. James by road.

The nearest road is 40 miles away and the nearest railway, when the P. G. E. extension is completed to TAKLA LK this year, will be 20 miles away.

REGIONAL GEOLOGY

The property covers largely what has been mapped as granodiorite, quartz diorite, diorite, minor gabbro and pyroxenite of Jurassic and (or) later age. The rocks are part of an intrusive complex known as the HOGEM BATHOLITH. It stretches some 90 miles to the north-west and it is from 5 to 20 miles wide. The property lies at its south-western corner.

West of the property are found Jurassic and TRIASSIC sediments and volcanic rocks.

The PINCHI FAULT, one of the major fault zones in B.C. lies along the western boundary of the property.

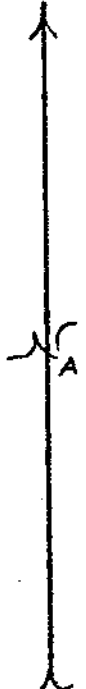
Associated with the intrusive are a large number of occurrences of copper, molybdenum and lead-zinc as well as mercury. The occurrences are located largely on or near the contact of the intrusive and the mercury occurrences mainly along the PINCHI FAULT.

In excess of 30 copper occurrences, 6 molybdenum occurrences, 10 lead-zinc occurrences and 30 mercury occurrences are at present known in and near the intrusive. It appears this batholith has given rise to an unusually large number of mineral occurrences.

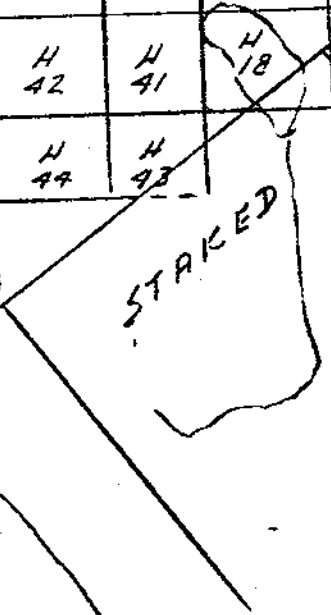
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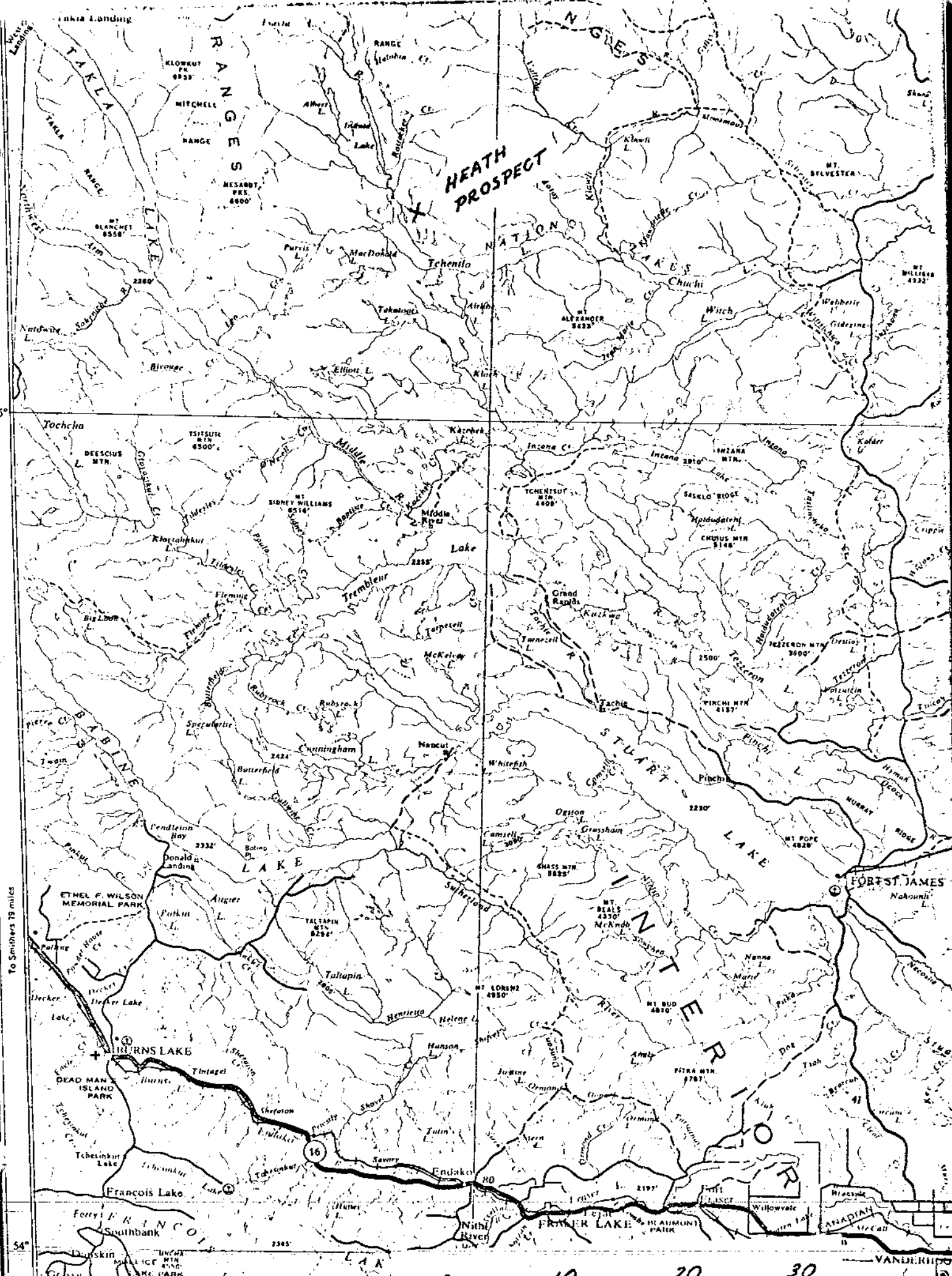
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H 32	H 31	H 27	H 28			N.S. 40	N.S. 41	N.S. 22	N.S. 23	N.S. 24	N.S. 26	N.S. 28		
H 34	H 33	H 25	H 26	H 19	H 20	N.S. 38	N.S. 39	N.S. 20	N.S. 21	N.S. 25	N.S. 27	N.S. 29		
H 36	H 35	H 23	H 24	N.S. 46	N.S. 47	N.S. 36	N.S. 37	N.S. 18	N.S. 19	N.S. 34	N.S. 32	N.S. 30		
H 38	H 37	H 21	H 22	N.S. 44	N.S. 45	H 5	H 6	H 9	H 10	N.S. 35	STAKED			
H 46	H 45	H 40	H 39	N.S. 42	N.S. 43	H 1	H 2	H 7	H 8	N.S. 2				
H 48	H 47	H 42	H 41	H 18	H 17	H 3	H 4	H 11	N.S. 1	N.S. 3				
H 50	H 49	H 44	H 43			H 14	H 15	H 16						
H 52	H 51					H 13	H 12							



TCHENTLO
LAKE



HEATH & N.S.
CLAIMS
TCHENTLO LAKE
OMINECA M.D.
1" = 3000'
Jan/70 D.H.S.



HEATH PROSPECT

To Smithers 19 miles

54°

0 10 20 30

VANDERBILT

PROPERTY GEOLOGY - Rocktypes

The larger part of the property, that has been mapped covers diorite. The diorite is quite diverse in appearance and has been divided into eight varieties, based on grain size, amount of mafic mineral content and on amount of feldspathization. The diorite varied from a dark coarse grained to a light finegrained variety, and the feldspathization has in places, been so extreme that it constitutes more than 50% of the rock mass.

The central area of the claims, extending approximately from Line 400 south to 4000 north around but mainly east of the lease line has been extremely strongly altered. It is an area of generally low relief and outcrops are relatively scarce. About 2 dozen outcrops have been located and these consist mainly of strongly shattered and oxidized diorite in which the plagioclase has undergone a very strong alteration. The amount of feldspar, albite and or orthoclase is so large that there is some doubt whether this is an original rock constituent or all an alteration product. If all or part of the feldspar is an original rock constituent, then the rock is a monzonite rather than a diorite. In outcrops as opposed to hand specimens, the pink feldspar can be seen to be stronger near fractures although it is also well disseminated, suggesting it is an alteration product.

Within the central diorite several outcrops of a fine to medium grained syenite have been located. Most of these outcrops may be part of one irregular intrusive body into the diorite or there may be several pluggs. The syenite is highly shattered

and most "outcrops" consist of loose rubble. Much iron oxide is associated with the syenite.

To the east and north of the central area is found, abundant outcrops of diorite. The diorite here is relatively light coloured and medium grained. A considerable K-feldspar alteration has taken place. It is very strong near the central area (20 - 30% K-feldspar) and diminishing in intensity outward. The K-feldspar is in part different from that of the central area. It is to a large extent concentrated near fractures. The rocks have been partly densely fractured, but not shattered as in the central area. Epidote is widespread in irregular stringers.

To the southwest of the central area, the diorite is mainly coarse grained and relatively dark. The mafic minerals are largely hornblende and biotite which have been partly chloritized while the feldspar may have undergone some sericitization. The rock contains some 5% disseminated magnetite.

Further toward the west and north the rocks are generally medium grained dark diorite. Alteration seems to have taken place mainly along two or maybe three structural features. One east-west going trend around line 2800 north shows medium to strong propylitization and as this trend approaches and intersects a north westerly trend to the west, strong feldspathization has taken place.

Along the north-westerly trend a very strong feldspathization similar to that at the central zone has taken place although little shattering and oxidation of the rocks have taken place contrary to the case at the central area.

On line 4400 north at about 2700 west extreme propylitization has taken place, and one small outcrop contains about 60% epidote.

Toward the northeast corner of the grid system granite has been located. It is medium grained and has a high quartz content.

Several dykes have been noted on the property. On line 1600 north, near the base line, a diabase dyke outcrops and in the same area is found what is believed to be a quartz-feldspar porphyry dyke.

Several other dykes have been located on all parts of the property. They consist mainly of coarse grained pink feldspar.

PROPERTY GEOLOGY - Structure

The predominant structure on the property is a 2000 to 2400 foot wide northwest trend through the central part of the grid system. This zone encloses the topography of more gentle relief, and is bounded on the east by steep scree slopes leading up to 10 - 20 foot high aligned cliff-like outcrops. Along these outcrops fracturing has taken place parallel to the zone and dipping 45° - 50° to the east. On the west the zone is bound by the contact to coarse grained diorite. On this contact shearing (?) has taken place parallel to the zone. The shear is mineralized with magnetite and chalcopyrite. It dips 45° - 50° east.

These features together with the general topography and the very strong alteration inside the zone suggests that this is a zone of strong fracturing and probably faulting.

A parallel zone similar in alteration occurs on the west part of the claims and this also is probably a fault.

An east west trend about at lines 2800 to 3400 north may also be faulting. Along this line the central northwest trend appears to have been off set in a right handed movement of about 800 foot horizontal magnitude. The topography and the strong alteration along the trend is also suggestive of faulting or strong fracturing.

A west north-westerly trend crosses the central zone. This trend stands out clearly on aerial photo interpretation, but is noted on the ground only by one of several fracture directions.

Fracturing on the property is most pronounced in a northwesterly direction parallel to the central trend and also northeasterly at about 60° to the central trend. Less pronounced fracturing has been noted in a northerly and a west northwest direction. Most fractures dip to the north and east.

PROPERTY GEOLOGY - Mineralization

Mineralization on the property has been noted mainly in and around the central area. Within this area the rocks are strongly shattered and oxidized. Most outcrops show evidence of copper mineralization either as malachite staining or as disseminated or stringers of chalcopyrite. Mineralization is found both in the diorite and the syenite. As a very general rule the heavily oxidized outcrops show malachite while the less oxidized outcrops show finely disseminated chalcopyrite. Pyrite is found in fractures while little pyrite was noted with the finely disseminated copper.

None of the outcrops show definite economic grade copper but oxidation and removal of mineralization has taken place over a large area and fresh material below surface may contain copper in economic quantity. A lense or vein of copper in the central area assayed 5.81% over a width of 3 feet.

This central area, extending 3,200 feet to possibly 4000 feet in a north south direction and about 2000 to 2400 feet east west, is thought to be a very promising exploration target.

To the south west, the central zone is bounded by a shearzone (?) which consists of finegrained dark minerals probably mainly chlorite and it has been mineralized with magnetite, pyrite and chalcopyrite.

Assays of samples from across the zone has given two feet of 5.31%, seven feet of 3.25% Cu and seven feet of 8.32% Cu. The mineralization appears to taper off toward the north but is open toward the south.

As the zone is of high magnetic intensity the magnetic survey suggests it may extend 1200 feet and possibly more than 1600 feet to the south.

East of the central zone pyrite, chalcopyrite and malachite have been noted particularly in fractures near and parallel to the central zone and also in northeast and north striking fractures. This mineralization is found over the length of the grid system. It is generally associated with K-feldspathization.

Approximately at 2800 to 3200 north along the probable east west structure high geochemical values in soil survey suggests the possibility of further mineralization but overburden prevents verification of this. Toward the west minor malachite and chalcopyrite as well as galena occurs in north westerly striking fractures associated with the northwest trending structure.

NAME: 12N, 5E Diorite?
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%): K-Feldspar 30% ?
Plagioclase
Epidote

ALTERATION: K-Feldspar alteration
Oxidation - copper stain - leached
ACCESSORY MINERALS: Disseminated chalcopyrite - malachite
REMARKS:

NAME: 12N, 2W Diorite
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%): K-Feldspar 20%
Plagioclase
Chlorite
ALTERATION: Feldspathization & Propylitization
Strong red fracture surfaces
ACCESSORY MINERALS: Epidote - mariposite
REMARKS:

NAME: 36N, 44W - Diorite
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%): Plagioclase 60%
Orthoclase 25%
Mafics 15%
ALTERATION: K-Feldspar alteration particularly along fractures
ACCESSORY MINERALS:
REMARKS:

NAME: Shear zone (Approximately 2S, 1W)
GRAIN TEXTURE & SIZE: Finegrained
CONSTITUENTS (%): Chlorite 80%
Chalcopyrite 10%
Pyrite 5%
Magnetite 5%
ALTERATION: Chloritization

ACCESSORY MINERALS:
REMARKS:

NAME: Shear zone (Approximately 2S, 1W)
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%): 40% Pyrite
15% Chalcopyrite
35% Chlorite
ALTERATION: Chloritization

ACCESSORY MINERALS:
REMARKS:

NAME: Shearzone (Approximately 2S, 1W)
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%): 60% Chalcopyrite
30% Pyrite
10% Chlorite
ALTERATION: Chloritization

ACCESSORY MINERALS:
REMARKS:

NAME: ON, 1W Shear 20W Mineralization
GRAIN TEXTURE & SIZE: Fine to Medium Grained
CONSTITUENTS (%): Magnetite 80%
Chlorite 10%
Chalcopyrite 10%
ALTERATION: Chloreitization
ACCESSORY MINERALS:
REMARKS: Shearing of Mineralization

NAME: 4S, 4E Diorite
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%): Feldspar - Plagioclase
Chlorite
Epidote
ALTERATION: Strong Propylization
Strong oxidation
ACCESSORY MINERALS: Disseminated chalcopyrite
REMARKS:

NAME: N162W Diorite
GRAIN TEXTURE & SIZE: Medium grained
CONSTITUENTS (%): 60% Plagioclase
40% Mafics
ALTERATION: Strong chloreitization particularly on fracture
surfaces - oxidation on fracture surfaces.
ACCESSORY MINERALS: Minor disseminate pyrite.
REMARKS:

NAME: 40N, 40W Altered Diorite
GRAIN TEXTURE & SIZE: Medium to coarse grained
CONSTITUENTS (%): 50% Pink K-feldspar
40% Plagioclase
10% Mafics - mainly chlorite biotite

ALTERATION: Alteration to K-feldspar
Chloritization biotization

ACCESSORY MINERALS:
REMARKS: Oxidized fracture surfaces

NAME: 16N, 2W Diorite
GRAIN TEXTURE & SIZE: Medium to coarse grained
CONSTITUENTS (%): 65% Plagioclase
35% Mafic - Hornblend chlorite

ALTERATION: Strong sericitization

ACCESSORY MINERALS: Specks of red hematite
REMARKS:

NAME: 28N 8E? , Approx. Diorite
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%):

ALTERATION: Strong chloritization

ACCESSORY MINERALS: Disseminated chalcopyrite and malachite
REMARKS: Three fracture directions

NAME: N16, 1W Altered Diorite
GRAIN TEXTURE & SIZE: Medium grained - equigranular
CONSTITUENTS (%): 55% Pink K-feldspar
25% Plagioclase (?)
20% Mafics mainly biotite - chlorite
ALTERATION: 55% K-feldspar alteration (?)
Propylitization
ACCESSORY MINERALS: Epidote
REMARKS:

NAME: 44N - 27W Strongly altered Diorite
GRAIN TEXTURE & SIZE: 60% Epidote
CONSTITUENTS (%): 30% Plagioclase
10% Biotite-chlorite
ALTERATION: Extreme Propylitization
ACCESSORY MINERALS:
REMARKS:

NAME: 16N, B.L. Vein zone
GRAIN TEXTURE & SIZE: Quartz drusy-feldspar brecciated
CONSTITUENTS (%): 95% (oxidized) quartz-feldspar
5% galena
ALTERATION: Oxidation
Brecciated feldspar
ACCESSORY MINERALS: Manganese stain
REMARKS: Vein zone of undetermined extent and grade.

NAME: 40N, 48E Granite
GRAIN TEXTURE & SIZE: Medium grained - equigranular
CONSTITUENTS (%): 20% Quartz
50% Orthoclase
20% Plagioclase
10% Pyroxene and biotite
ALTERATION: Light sericitization
ACCESSORY MINERALS: Magnetite
REMARKS:

NAME: 4S, 4E Diorite
GRAIN TEXTURE & SIZE: Medium to coarse grained - equigranular
CONSTITUENTS (%): 65% Plagioclase
35% Mafics - Hornblend chlorite
ALTERATION: Strong sericitization
strong red surface oxidation
ACCESSORY MINERALS: Magnetite
REMARKS: 1/8 - 1/4" fracturing in one direction - shearing ?

NAME: 12N 9W Diorite
GRAIN TEXTURE & SIZE: Medium grained - equigranular
CONSTITUENTS (%): 60% Plagioclase
40% Mafics - Hornblend, chlorite, biotite.
ALTERATION: Some Seritization, biotization (?),
Propylitization
ACCESSORY MINERALS: Magnetite epidote
REMARKS: Mafic minerals partly aligned giving a schistose
appearance.

NAME: 44N, 42W Probable Feldspathized Diorite
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%): 55% pink Feldspar
15% Mafics - chlorite & biotite
30% Plagioclase
ALTERATION: Propylitization
K-Feldspathization
ACCESSORY MINERALS: Epidote
REMARKS:

NAME: 16N, 10E (?) approx. Diorite
GRAIN TEXTURE & SIZE: Medium grained - equigranular
CONSTITUENTS (%): 60% Plagioclase
30% Mafics - Chlorite
10% Orthoclase
ALTERATION: Partial Chloritization of Mafics - Some sericitiza-
tion - 10% K-feldspar primarily near fracture
ACCESSORY MINERALS: Chalcopyrite associated with K-feldspar
REMARKS:

NAME: N32, 25E Mineralized Fracture
GRAIN TEXTURE & SIZE:
CONSTITUENTS (%): 50% Pink K-feldspar
30% Epidote
10% Mafics - 10% Plagioclase
ALTERATION: Oxidation of sulphides - Chloritization of mafics,
Sericitization of Plagioclase
ACCESSORY MINERALS: Chalcopyrite, malachite, pyrite.
REMARKS: Typical for northwest striking fractures near
probable northwest faultzone.

NAME: L32N42E Granite
GRAIN TEXTURE & SIZE: equigranular - medium grained
CONSTITUENTS (%): Quartz - 30%
Plagioclase - 20%
Orthoclase - 38%
Mafics - 8%
ALTERATION: very slight - sericitization
ACCESSORY MINERALS: Magnetite 4%
REMARKS:

NAME: 16N, 6W Quartz-Feldspar porphyry dyke
GRAIN TEXTURE & SIZE: 1 min grains of quartz and feldspar homog groundmas
CONSTITUENTS (%): 3-4% Quartz
96 - 97% Feldspar
ALTERATION: Feldspar mass homogenized - grey yellow greasy looking
ACCESSORY MINERALS: occasional grains of black unidentified mineral
REMARKS: Strong earthy smell due to clay on fractures surface

NAME: N16, 50'W Diabase dyke
GRAIN TEXTURE & SIZE: equigranular finegrained diabase texture
CONSTITUENTS (%): 60% Plagioclase
40% Mafics
ALTERATION: Chloritization of Mafics
Some sericitization ? of the feldspar
ACCESSORY MINERALS:
REMARKS: Pitted surface

PHOTOGEOLOGIC INTERPRETATION

Structural trends as outlined on the photographs conform very well with the structure as indicated on the ground. The northwest trending zones stand out clearly.

A west northwest trending fracture zone about 3200 to 3600 feet wide is very evident on the photographs while the same fracturing is only weakly evident on the ground. The east-west striking faulting inferred from evidence on the ground is not clearly outlined in the photo interpretation but its presence is possible.

North striking fracturing is also clearly outlined on the photos and confirmed on the ground.

The three linear trends outlined over the central grid area and confirmed on the ground are repeated 1 to 2 miles to the northwest part of the claimground. No work has been carried out on these claims. Government aerial magnetic maps show a magnetic low intensity area here similar to that at the central grid area.

This second fractured zone is therefore thought to be a good secondary exploration target.

CONCLUSIONS

The geological mapping in the central grid area has outlined geology and mineralization which indicates that the conditions are favourable for mineralization and located and delimited an area within which copper mineralization of economic grade and size may be present.

S. Cuzco

COST OF GEOLOGY

E. Livgard - June 29 to July 30, 1971
 30 days @ \$100.00/day

\$3,000.00 - $\frac{1}{4}$ allotted to Geology Mapping
 and Report \$750.00

Food and Camp Supplies \$300.00
 Helicopter to and from
 the Property \$500.00
 Travel \$200.00
\$1000.00

\$1,000 - $\frac{1}{6}$ allotted to Geology \$160.00
 ($\frac{5}{6}$ allotted to Magnetic Survey)
\$910.00

\$700.00 of which is claimed as assessment work



E. Livgard, P. Eng.

LIVGARD CONSULTANTS LTD.

**1331 MARINE BUILDING
VANCOUVER 1, B.C.**

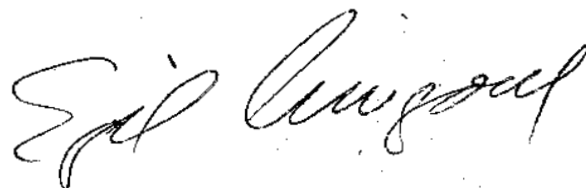
EGIL LIVGARD, B.Sc., P.Eng.

CERTIFICATE

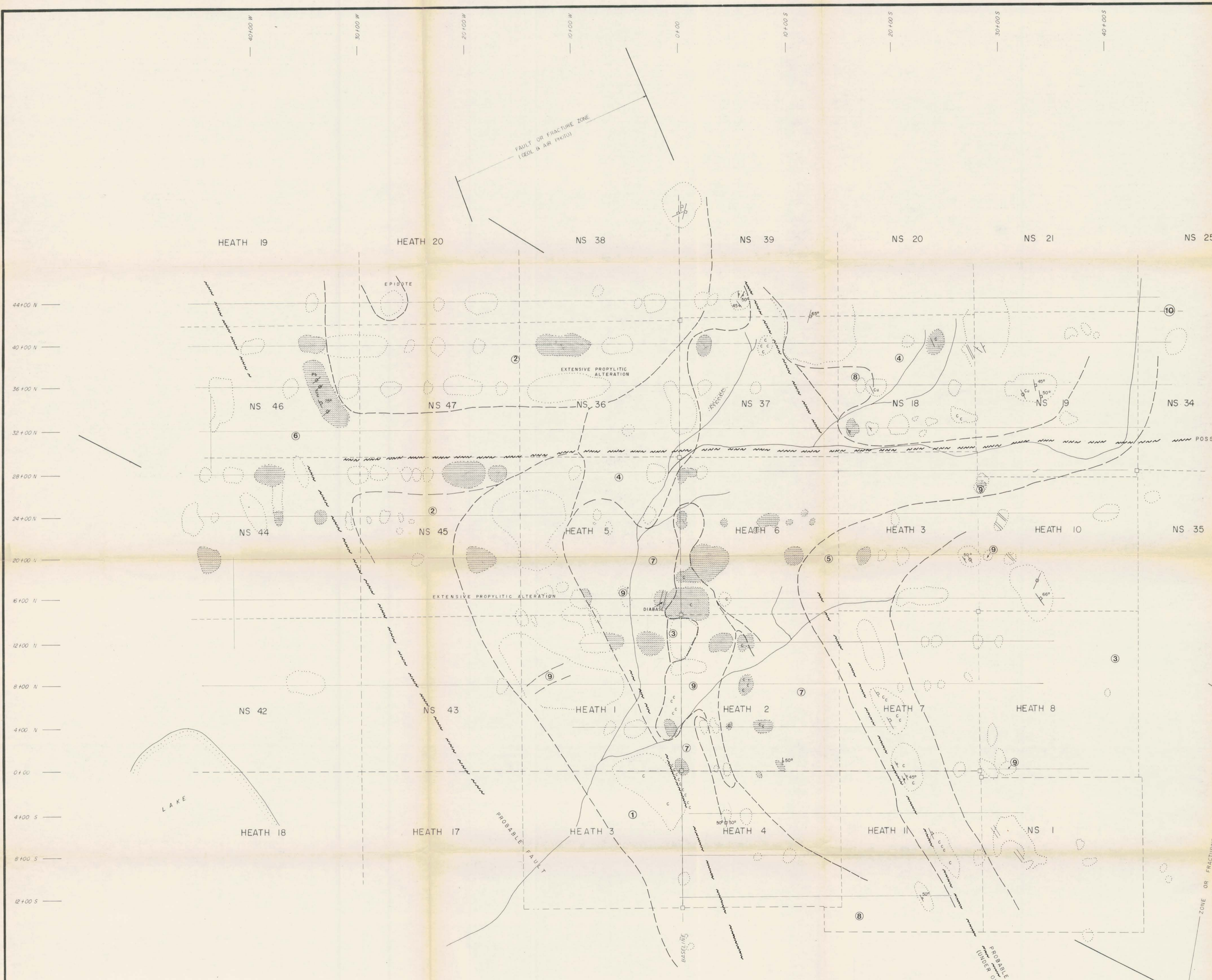
I, EGIL LIVGARD, with business and residential addresses in Vancouver, British Columbia, do hereby certify that:

1. I am a consulting geological engineer.
2. I am a graduate of the University of British Columbia, B. Sc., 1960, Geological Sciences.
3. I am a Member of the Association of Professional Engineers of the Province of British Columbia.
4. From 1960 to 1970 I was engaged in mining and exploration geology in Canada and Norway.
5. I am a director of and hold a large share position in the Company.

DATED at Vancouver, British Columbia, this 30th day of August,
1971.



Egil Livgard, B. Sc., P. Eng.
Vancouver, British Columbia.

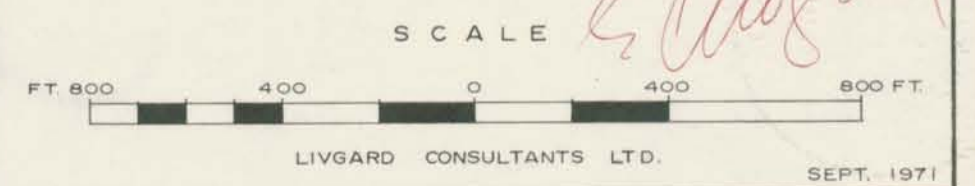


- LEGEND**
- ① Diorite - coarse grained dark-little K-feldspar
 - ② Diorite - medium grained - medium K-feldspar
 - ③ Diorite - medium grained - light K-feldspar
 - ④ Diorite - medium grained - light medium K-feldspar
 - ⑤ Diorite - medium to coarse grained - light strong K-feldspar
 - ⑥ Diorite - medium grained - dark strong K-feldspar
 - ⑦ Diorite - medium grained - exceptionally strong K-feldspar
 - ⑧ Diorite - medium grained dark - medium K-feldspar
 - ⑨ Syenite - fine coarse grained
 - ⑩ Granite - fine to medium grained
 - Area of oxidation
 - c Copper minerals
 - Dykes - primarily feldspathic
 - Faults
 - Claim posts located in relation to grid system

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3200 MAP #3

LIVGARD CONSULTANTS LTD.
SENATE MINING & EXPLORATIONS LTD.
HEATH COPPER PROPERTY

GEOLOGICAL MAP



3200 M-3

NOTE:
TO ACCOMPANY GEOLOGICAL REPORT ON THE HEATH COPPER
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