REPORT ON

LIARD COPPER MINES

SCHAFT CREEK PROPERTY

R. H. Seraphim, P.Eng.

August 1967

7 Dec/67 T. Osborne

1. Bulldozed but did not get much good outcrops.
2. 11,000 d.d. (by Asarco) (total 14,000?) (1-2-3) → Silver Std.
3. A porphyry prospect
4. Bick Syndicate – Scud Syndicate → L. Copp

66⅔ – S.S
Bal { – McI
– Kerr-Add

5. Judged results from dod. and decided to drop option because of this and possible future course for copper prices and costs in B.C.

TEL. - OFFICE 685-2914
RES. 224-7309

R. H. SERAPHIM
PH.D., P.ENG.
GEOLOGICAL ENGINEERING

427
~~309~~-470 GRANVILLE
VANCOUVER 2, B.C.

August 15, 1967

Silver Standard Mines,
808 - 602 West Hastings Street,
Vancouver 2, B. C.

Dear Sirs:

Enclosed is my report summarizing and interpreting the available information on Liard Copper Mines' Schaft Creek property. This property has the 'earmarks' of the multi-million ton porphyry copper-molybdenum deposits, and has much favorable ground waiting to be explored.

I enjoyed the opportunity to study the deposit. It is one on which I can recommend further work, more or less as outlined, without qualification.

Yours sincerely,

R. H. Seraphim

Dr. R. H. Seraphim

RHS/LA
Encls.

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RES. 224-7309

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REPORT ON

LIARD COPPER MINES

SCHAFT CREEK PROPERTY

By

R. H. Seraphim, P.Eng.

August 1967

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MAPS INCLUDED:

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REPORT ON

LIARD COPPER MINES

SCHAFT CREEK PROPERTY

SUMMARY AND CONCLUSIONS:

The Schaft Creek copper-molybdenum property, owned by Liard Copper Mines Ltd., is located in semi-dry belt country with locally moderate relief 37 miles south of Telegraph Creek, B. C. The closest feasible road route to tidewater involves building 50 miles of road to join the Cassiar-Stewart highway at More Creek, 115 miles from tidewater port at Stewart, B. C.

The property is underlain principally by altered Triassic andesites and feldspar porphyry on the east flank of a large granitoid intrusive. Copper-molybdenum mineralization is associated with irregular feldspathized zones, locally albite syenite porphyry, which are poorly exposed but appear to trend northerly. A northerly trending group of fault zones probably controls both the feldspathization and the mineralization. The favorable rock types and mineralization are known to continue beyond the north boundary of the property.

Exploration to date includes induced potential survey and diamond drilling. The induced potential survey

gave an unusually large and irregular anomaly, 10,000 ft. plus long and 4,000 ft. plus wide, with many local highs. Copper mineralization, in the 0.5% Cu range, is found in areas reading as low as 6 mv/v. The higher peaks in the general anomaly reach 18 mv/v. At least half the potential ground (above 6 mv/v) in the general I.P. anomaly is outside the drilled grid and remains untested.

The 29 holes drilled total 14,003 ft. A grid block of 6 million square feet is tested by 14 of these drill holes which contain practically all the best mineralized intercepts. The 16 intercepts total 1,774 ft. of core length, with weighted average 0.645% Cu, 0.037% MOS_2 and approximately 0.013 oz Au, 0.185 oz Ag per ton. The remaining core in the 14 holes, 4,930 ft. averages 0.203% Cu. The drilling is too widely spaced to connect intercepts from hole to hole with any reliability, thus tonnage is not calculated. Many of the intercepts are bordered by areas which are obscured by overburden, and untested except with I. P. survey.

Exploration to fill in the drilled grid, and to follow up outside of it, add up to a major and to a most attractive exploration venture.

RECOMMENDATIONS:

The first new work to be done at Schaft Creek is a magnetic survey. The information provided on the dimen-

sions and trends of the various rock types will undoubtedly be valuable in directing subsequent exploration. (A magnetic anomaly led to discovery of the largest mineralized zone at Galore Creek). Lines at 250 ft. intervals should be interpolated between the existing lines, and the grid should extend north to the claim boundary at 4,000 north, and south to say 2,000 south.

Bulldozer trenching is feasible in several of the areas of major interest. A D-8 equipped with rippers should be used, as some of the overburden, particularly that just above bedrock, approaches hardpan. The known mineralization should be trenched, across the trends suggested by magnetics and induced potential, at the 250 ft. grid line intervals, and also halfway between where warranted by sufficient mineralization. The swampy ground, and in places deep overburden (depth to bedrock is noted in the table of the drill holes) will preclude trenching in some of the desired locations. The D-6 cat now on the property will be useful to rescue the larger unit from the bog-holes. It is not large enough to perform the trenching recommended.

The D-8 or equivalent will be transported to the property most easily by walking it in from Telegraph Creek during March or April, as was the D-6. However, trenching is not practical until snow goes in May. Costs will thus

involve an initial move in, about six weeks standby time, then four or five months trenching, and likely further standby time prior to move-out, or a further season's work.

Percussion drilling, and perhaps some diamond drilling, should overlap the bulldozing and likely continue beyond it. The percussion equipment should be capable of completing angle holes up to 250 ft. or so depth, and should be adapted to transport to the property by aircraft. The D-6 cat now at Schaft will prove useful to prepare drilling sites and to move the drill rig.

The percussion work need not follow a complete grid, as there is no point in redrilling the diamond drilled intervals, or drilling areas shown to be sub-grade by the trenching program or by natural outcrop. Since the mineralized zones appear to be steeply dipping, the holes should be drilled at an angle as flat as feasible. The amount of percussion drilling which will be required to evaluate all the areas of interest is not yet known. A partial season's work, say 70 operating days at double shift, should provide about 35,000 feet of hole, which is commensurate with the area to be tested initially.

COSTS:

Line cutting and magnetic survey	$ 3,000
D-8 bulldozing - 1200 hrs. @ $30.00	36,000
Move in, move out, and standby	14,000
Percussion drilling - 35,000 ft. @ $3.00	105,000
Move in and out	5,000
D-6 bulldozer use - moving drill and site preparation, etc. 600 hrs. @ $25.00	15,000
Assaying, handling samples, etc.	15,000
Transportation and expediting	20,000
Field supervision, engineering and overhead	10,000
Camp cookhouse, and maintenance	7,000
	$230,000
Contingencies	20,000
	$250,000

INTRODUCTION:

This report is partly a compilation of work on the property by engineers for Silver Standard and Asarco. Their objective data is accepted without question.

Field work on ground north of and adjoining Liard's ground from June 12 to 20, 1967, provided the author with on-site knowledge of Liard's property. Traverses across Liard ground, inspections of Liard's core, and discussions with engineers working at Liard were frequent during this period. A second visit to Liard's property on July 16 furthered knowledge of it. Experience with similar properties elsewhere in B. C. also leads to an appreciation of the data presented by the previous workers at Liard. Some of the data are repeated directly from previous reports, but rather than indicate the quotations, this work is herewith acknowledged with appreciation.


SCHAFT CREEK
GALORE
GRANISLE
ENDAKO
BETHLEHEM
BRITISH COLUMBIA
PACIFIC OCEAN
DIXON ENTRANCE
QUEEN CHARLOTTE ISLANDS
QUEEN CHARLOTTE SOUND
VANCOUVER ISLAND
ALBERTA
MONTANA
WASHINGTON
58°
57°
56°
55°
54°
53°
52°
51°
50°
49°

LOCATION AND ACCESS:

Liard Copper Mine's Schaft Creek property is in the Liard Mining District, 37 miles south-southeast of Telegraph Creek, B. C. The showings are on the west slope of a northerly trending ridge between Schaft Creek and Mess Creek. The accompanying topographic map, Telegraph Creek Sheet 104G, shows the location with reference to the Cassiar-Stewart Highway, and to the Stikine Copper property managed by Kennecott.

Access to the property for a major operation would require 45 to 50 miles of new road to join the Cassiar-Stewart Highway which is now under construction. The 45-mile route would utilize a pass at 4,300 elevation; the 50-mile route one at 3,500 elevation. An additional 115 miles, along the Cassiar-Stewart Highway, gives a total of 160 to 165 miles to tidewater port at Stewart. Granduc will be installing loading facilities at Stewart.

Stikine Copper Mines is on Galore Creek, only 25 miles southwesterly from Schaft Creek. However, glacier-filled valleys block the closest routes. Road connection from Schaft Creek to meet Stikine Copper's natural route to tidewater, via Stikine River, would be almost 90 miles (to the mouth of the Scud via Schaft and Mess Creeks and Stikine River). A further 85 miles of new

road would be necessary from the mouth of the Scud to tidewater port area in Alaska at the mouth of the Stikine. The Cassiar-Stewart route appears by far the least expensive in both capital and maintenance costs.

Transportation now is via Otter aircraft from Stewart, 105 air miles, or Terrace, 225 air miles. The 4,000 ft. gravel airstrip at the property should accommodate larger aircraft if large tonnage air freighting is desired. The D-6 'cat' at the property was walked in by Silver Standard during early spring from Telegraph Creek, but regular cat-train freighting would involve much road-building.

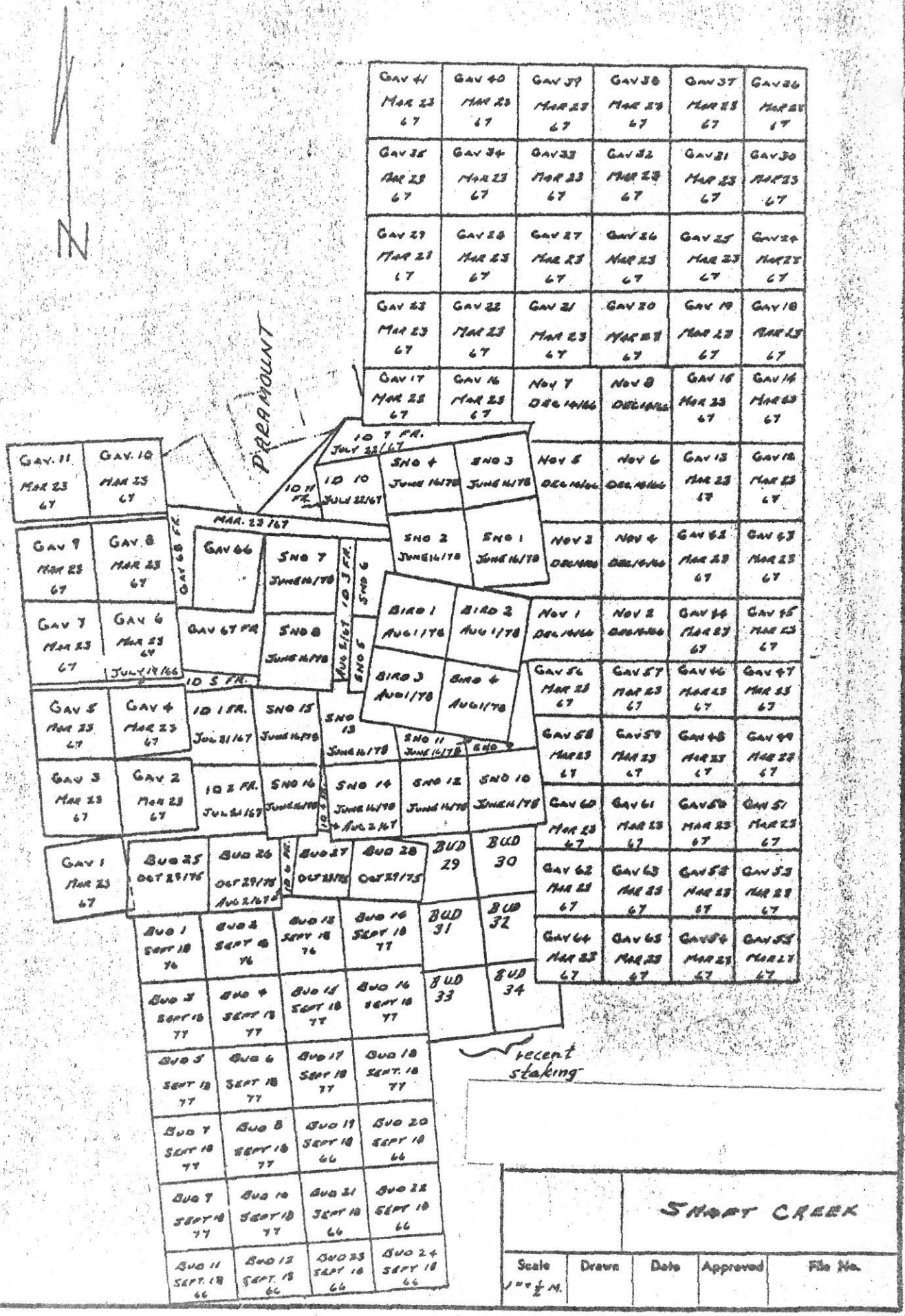
TOPOGRAPHY AND CLIMATE:

The property is on the west edge of the 'dry-belt' and experiences much less precipitation than the high ranges to the west. No records of winter precipitation are available, but snow is reported to reach less than 5 ft. depth in an average winter. Summers are pleasantly dry, and winters cold with abundant clear weather.

Elevations on the property range from 2,800 ft. near Schaft Creek to 3,800 on the divide into Mess Creek. Timber, predominantly spruce, was abundant but much of it was burned in a fire in 1957. The western portions of the known mineralized area include much swampy ground.

CLAIMS:

The claims are as listed below. A legal survey of the northmost and more important claims was completed in 1966.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PARAMOUNT
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GAV 16 MAR 23 67
NOV 7 DEC 14/66
NOV 8 DEC 14/66
GAV 16 MAR 23 67
GAV 14 MAR 23 67
GAV. 11 MAR 23 67
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10 7 FR. JULY 22/67
10 11 FR.
ID 10 JULY 22/67
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NOV 5 DEC 14/66
NOV 6 DEC 14/66
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GAV 12 MAR 23 67
MAR. 23 /67
GAV 9 MAR 23 67
GAV 8 MAR 23 67
GAV 66
SNO 7 JUNE 14/78
SNO 2 JUNE 14/78
SNO 1 JUNE 14/78
NOV 3 DEC 14/66
NOV 4 DEC 14/66
GAV 62 MAR 23 67
GAV 63 MAR 23 67
GAV 67 FR
SNO 8 JUNE 14/78
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BIRD 2 AUG 1/78
BIRD 3 AUG 1/78
SNO 4 AUG 1/78
NOV 1 DEC 14/66
NOV 2 DEC 14/66
GAV 64 MAR 23 67
GAV 65 MAR 23 67
GAV 7 MAR 23 67
GAV 6 MAR 23 67
JULY 19/66
10 5 FR.
GAV 5 MAR 23 67
GAV 4 MAR 23 67
ID 1 FR. JUL 21/67
SNO 15 JUNE 14/78
SNO 13 JUNE 14/78
SNO 11 JUNE 14/78
GAV 56 MAR 23 67
GAV 57 MAR 23 67
GAV 46 MAR 23 67
GAV 47 MAR 23 67
GAV 58 MAR 23 67
GAV 59 MAR 23 67
GAV 48 MAR 23 67
GAV 49 MAR 23 67
GAV 3 MAR 23 67
GAV 2 MAR 23 67
ID 2 FR. JUL 21/67
SNO 16 JUNE 14/78
SNO 14 JUNE 14/78 to AUG 2/67
SNO 12 JUNE 14/78
SNO 10 JUNE 14/78
GAV 60 MAR 23 67
GAV 61 MAR 23 67
GAV 50 MAR 23 67
GAV 51 MAR 23 67
GAV 1 MAR 23 67
BUD 25 OCT 29/75
BUD 26 OCT 29/75 AUG 2/67
BUD 27 OCT 29/75
BUD 28 OCT 29/75
BUD 29
BUD 30
GAV 62 MAR 23 67
GAV 63 MAR 23 67
GAV 52 MAR 23 67
GAV 53 MAR 23 67
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BUD 10 SEPT 18 77
BUD 21 SEPT 18 66
BUD 22 SEPT 18 66
BUD 11 SEPT. 18 66
BUD 12 SEPT. 18 66
BUD 23 SEPT 18 66
BUD 24 SEPT 18 66
recent staking
SHORT CREEK
Scale 1 inch = 1/2 M.
Drawn
Date
Approved
File No.

LIARD COPPER MINES LTD. (N.P.L.)

Claims	No. of Claims	Work filed to
Bird 1 to 4	4	Aug. 1, 1978
Sno. 1 to 16	16	June 1, 1978
Bud 1 to 2	2	Sept. 18, 1976
3 to 10	8	Sept. 18, 1977
11 to 12	2	" 18, 1967
13	1	" 18, 1976
14 to 18	5	" 18, 1977
19 to 24	6	" 18, 1967
25 to 28	4	Oct. 29, 1975
Nov. 1 to 8	8	Dec. 14, 1968
Gav 1 to 11	11	Mar. 23, 1973
12 to 15	4	" 23, 1968
16 & 17	2	" 23, 1973
18 to 20	3	" 23, 1968
21 to 23	3	" 23, 1973
24 to 55	32	" 23, 1968
56	1	" 23, 1973
57	1	" 23, 1968
58	1	" 23, 1973
59	1	" 23, 1968
60	1	" 23, 1973
61	1	" 23, 1968
62	1	" 23, 1973
63 to 65	3	" 23, 1968
66, 67F, 68F	3	" 23, 1978
I D 1 Fr & 2 Fr	2	July 21, 1978
3 Fr to 11 Fr	9	Aug. 2, 1978
	135	

Six additional claims, south of most of the above, not yet shown on the records (see sketch facing page) are:

Bud 29 to 34	6

HISTORY:

The initial claims, the Bird Group, were staked in 1957 for the BIK Syndicate. Three thousand feet of hand trenches, near the locations of drill holes 1, 2, and 14, were dug. No further work was completed until 1964. The BIK Syndicate in that year staked additional claims, the SNO group, and dug a dozen or so shallow hand trenches, totalling 405 ft. of bedrock.

Work in 1965 included -

(1) geological mapping of an area 5,000 ft. N-S by 3000 ft. E-W, the eastern portion of the 200 scale geological map presented herein;

(2) an induced potential survey; and

(3) diamond drilling three holes totalling 2,063 feet.

Asarco optioned the property, and in 1966 expanded the I.P. survey over the extensive drift covered terrain ~~easterly~~ westerly towards Schaft Creek. The D-6 'cat' was walked in during the early spring, the airstrip extended to 4,000 ft., a permanent (and comfortable) camp erected, and 24 holes drilled totalling almost 11,000 ft. Paramount Mining located ground to the north, completed

surveys which showed the anomalous I.P. readings extended onto their ground, and also located copper showings north of the anomalous and overburdened area.

Asarco in 1967 drilled only two holes to test I.P. 'highs' well to the south of any previous drilling. Paramount drilled one hole on the I.P. high 1,200 feet north of the Liard border. Both properties are idle at time of writing.

OWNERSHIP:

Information concerning Liard's corporate status is detailed on the following page.

LIARD COPPER MINES LTD. (N.P.L.)

Private Company - Incorporated January 21, 1966 #67852
Authorized Capital - 5,000,000 Ordinary Shares - 50¢ par value
Issued Capital - 1,500,002 Ordinary Shares

Above shares were issued as follows:

Vendors Shares	750,000
Shares for expenditures @ 25¢ per share	678,032
Shares for cash @ 25¢ per share	71,968
Shares to Subscribers to Memorandum	2
	1,500,002

Shareholders:

Silver Standard Mines	972,995
McIntyre Porcupine Mines	109,547
Dalhousie Oil	110,000
Kerr Addison Mines	167,924
Scurry-Rainbow Oils	10,790
W. St. C. Dunn	21,141
Nicholas Bird	19,819
Wilson Mining	56,073
R. D. Wesemann	19,819
H. B. Gilleland	7,927
A. C. Ritchie	3,966
R. W. Wilson	1
	1,500,002

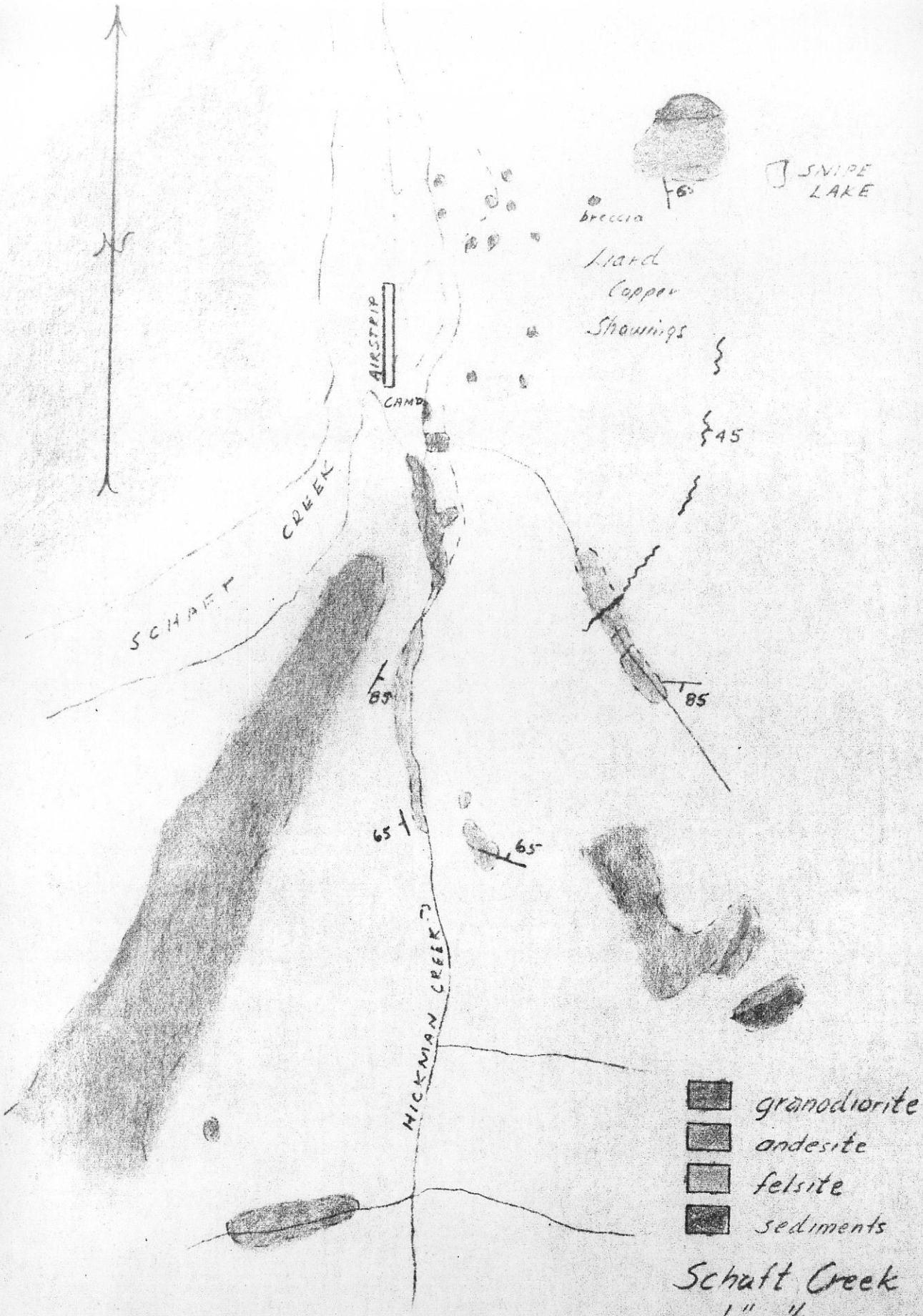
Directors:

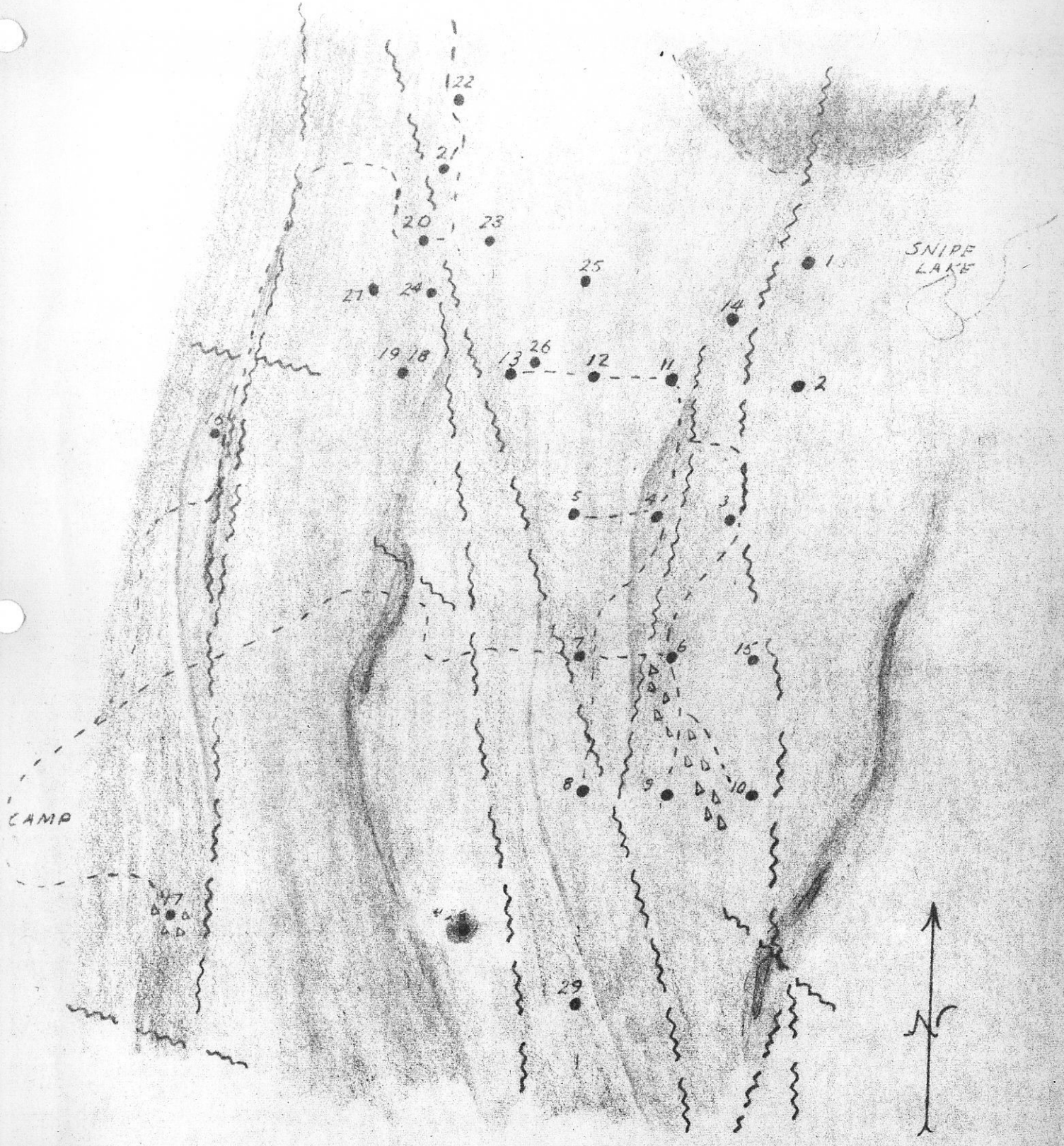
R. W. Wilson, P.Eng.	(Silver Standard Mines)
A. C. Ritchie, P.Eng.	do.
W. St. C. Dunn, P.Eng.	do.
D. M. Clark, Q.C.	do.
Dr. P. M. Kavanagh	(Kerr Addison Mines)
Wm. M. Sirola	do.
J. W. MacLeod	(McIntyre Porcupine)

Officers:

R. W. Wilson	President
R. H. Rayner	Secretary

None of the shareholding companies other than Silver Standard have to date shown an active interest in the company's affairs.


SNIPE LAKE
breccia
Liard Copper Showings
AIRSTRIP
CAMP
45
SCHAFT CREEK
85
85
65
65
HICKMAN CREEK
granodiorite
andesite
felsite
sediments
Schaft Creek
1" = ½ mi



LIARD COPPER
SCHAFT CREEK
1000 ft = 1 in
from
W. J. 1966

POWER:

A possible hydroelectric power site on Iskut River has been investigated by several companies as a possible power source for Granduc, Stikine Copper, and Schaft Creek, if and when warranted. The site is about 25 miles downriver from the point where the projected Schaft Creek road would join the Cassiar-Stewart Highway. A transmission line to Schaft Creek would thus be about 75 miles long, the last 50 miles being along the projected road to Schaft Creek. Closer sources could be available near Yehiniko Lake, or on the Stikine itself near Telegraph Creek.

REGIONAL GEOLOGY:

G.S.C. Map 9, 1957 shows that the property lies in Carboniferous to Permian andesites on the east contact of a large granodiorite mass, the Mt. Hickman Intrusive. Permian to Triassic sediments are shown to the north of the property, and these would overlie the andesites which host some of the copper mineralization. The mapping at 1/2 inch to the mile completed in 1965 confirms the G.S.C. work, except that the later workers placed the mineralized andesitic volcanics in the Triassic.

The intrusive contact with the andesitic volcanics is of principal interest as it is the locale of the copper mineralization. The contact is poorly exposed but trends

generally northerly. At one exposure in Hickman Creek 'a considerable mixing of types is a feature of the contact - - - - - inclusions (of andesite) are often rounded or lens shaped'.

Faults are common in the area. The faults tend to be broad zones, up to several hundred feet wide, with multiple gouge strands, and associated fractures and breccia. A major north-trending system of faults is shown on the accompanying 1000-scale sketch and the 200-scale geology map. The fault locations are deduced from drill hole intercepts, a study of aerial photographs, and a few exposures. The system is known to continue to the south, where it is represented by a large fault exposed in Wolverine Creek. Several members of the system are also exposed as major rusty zones where they cross the ridge to the north of the Paramount ground. The faults are particularly important to the area as they obviously provide control for both the feldspathic alteration and the mineralization.

The mineralized andesitic volcanics are complexly folded, but the pattern of folding has not been determined. The barren 'cap-rock' volcanics and sediments, exposed on the ridge north of Snipe Lake, are gently dipping and probably unconformable to the underlying mineralized andesites. These rocks are suspected to cover the north-easterly extensions of the copper mineralization.

LOCAL GEOLOGY:

A geological map, at 200 ft. to the inch, is in the front pocket. Rock types mapped include -

(1) Green andesitic flows, agglomerates, and tuffs which are extensively and intensively altered. Thin section work has shown that the feldspare are broken down to white micas and saussurite, and the amphiboles to chlorite. Siliceous and feldspathic alteration appear to reach an end stage in irregular masses of grey and cream to pinkish albite porphyry. Unfortunately, some of the earlier workers lumped the strongly altered andesites, and even the coarse-grained feldspathic rocks, with the green, weakly-altered, andesites. Mapping the degree of alteration is important as the mineralization is definitely associated with the feldspathized zones. Some outcrops are left blank on the accompanying 200-scale map because the degree of alteration was not recorded.

(2) The porphyritic augite basalts are intercalated with the andesites, but do not appear to have been receptive to the widespread alteration. They are strongly chloritized, but the feldspathic zones within them are narrow, and apparently localized near the stronger fault zones.

(3) Granitoid rocks are well exposed only on the west side of the mapped area. The main intrusive is reported to

grade from diorite through granodiorite and quartz monzonite to a true granite east of Hickman Creek. Some gneissic banding is found in the more basic sequences.

(4) The feldspathic-silicic alteration has been partially described with the andesites under (1). The alteration is gradational from grey bleaching to patchy fine grained, cloudy, and probably porphyroblastic, crystallinity to a medium grained plagioclase porphyry with a very 'dirty' matrix. Some of the zones of alteration can be observed ramifying with very irregular boundaries through the andesites. The larger zones commonly show the courser crystallinity, and these are locally strongly brecciated. The breccia interstices are in places filled with pyrite and chalcopyrite, and in other places are void.

(5) Late andesite dykes, fresh looking and barren of sulfides, cut the above rock types. They have in general northerly trends, but in many places are at a slight angle to, rather than parallel to, the main faults. They do, however, appear more abundant near the stronger and broader zones of faulting.

(6) The 'cap-rock' is a purple, fresh-looking andesitic agglomerate. It also lacks the shearing, fracturing, and alteration which is prevalent in the mineralized andesites.

Much remains to be learned of the structure in the area. Practically nothing is known of the fold pattern in

the mineralized andesites. The bands of porphyritic augite basalt, and the zones of feldspathic alteration trend northerly, but the divergence from true north appears as much as 20 degrees either east or west.

The fairly well exposed feldspathic alteration zone explored by drill holes 2 and 14, and which was trenched in the early work, is apparently very irregular - - - a broad system of faults, fractures, and brecciation with in general a north to north-easterly trend, but with offshoots into and gradational boundaries with the andesites. The fault system shown on the 200-scale map suggests that northwest trending zones may also exist, and a few east-west fault zones are present too. Probably more north trending members exist than are shown on the 200-scale map, and those shown are likely incorrectly positioned at least locally.

Sulfide mineralization is unusually widespread in the area. Chalcopyrite and pyrite are the most abundant sulfides, molybdenite and bornite are common, magnetite is reported but rare. The mineralization is best exposed on surface in the outcrops near drill holes 1, 2, and 14. Here, and in the drill core, it is very irregularly distributed but favors the zones of fracturing, faulting, and brecciation. It is also associated with the feldspathized zones, and the relation is likely mutual - i.e., both the mineralization and feldspathization are most abundant in the broken

zones. The better grade mineralization in drill holes 18, 19 and 20 coincides with intense shattering, in fact a breccia zone, but the relation is not consistent. The mineralization is low grade in breccia in neighboring holes 21, 23, and 24. The I.P. and fault trends suggest the mineralization could have swung westerly from drill holes 18 and 19. Irregular swings in trends of mineralization are to be expected, judging by the zone explored in the surface trenches and drill holes 2 and 14.

Exploration for mineralization along the postulated fault zones could be productive as drilling to date has not been laid out to test the probable relation. One might suspect, too, that the east-west trending fault zone shown near the westerly end of, and parallel to, the 'D' line (0 North) might account for 'D' being the best mineralized section. But neither the core from the drill holes, nor exposures near the saddle at Snipe Lake, give evidence that the fault zone is strong and persistent enough to cut through the more prevalent north-south system. The evidence available to date suggests that the predominant trend of mineralization is northerly, and that the explorer should look for irregular and sinuous zones from a few tens of feet up to several hundreds of feet in width, steeply dipping, swinging from perhaps N 20 degrees E to N 20 degrees W, and perhaps offset or jogging on minor E-W breaks.

GEOPHYSICAL SURVEYS:

Geophysical work has been limited to induced potential. Surveys completed in several periods are compiled onto one map (see front pocket). Note that distances on this map are slope chainages, and since the map will not fit the geological and assay maps when overlain, the drill holes have been plotted on it in their correct relation to the I.P. anomalies. The contouring of the I.P. anomalies is likely inaccurate in places because of the wide spacing, 1,000 ft. in places, between surveyed lines. Survey of Paramount ground was completed by the same company, Canadian Aero Mineral Surveys, Ltd.

The I.P. anomalies have been caused by both copper-bearing sulfides and by pyrite. The ratio of copper sulfides to pyrite varies from area to area, and localized I.P. highs may reflect relatively abundant pyrite rather than abundant copper sulfides. For example, the highs covering drill holes 21 and 22, and also 28 and 29, are attributed to the abundant pyrite found in the core.

Mineralization of 0.5% or better grade can be found well out of the 12 mv/v contour, as shown by the series of trenches extending northerly from D.D.H. 14, and the group of drill holes 12, 13, 25 and 26. I.P. readings acroes these mineralized zones range from 6 to 10.

The observations in the two preceding paragraphs are in general accordance with experience elsewhere - in general, a large area of high I.P. readings is almost as likely to contain good grade copper (or other) sulfides on the flanks as on the peaks of the anomalies.

Some further data derived from the geophysicist's reports are of interest. The I.P. data near holes 9, 10, and 15 suggested an easterly dipping zone. The geological map shows a fault zone, east of the holes, dips 60 to 75° easterly. This zone correlates with the "Wolverine" fault, which is mapped further south at 45° E dip, and which is reported to be a well mineralized fault zone. The holes contained low copper values, but they may be mostly in the footwall of, and drilled almost parallel to, the better mineralization. Further ground checking in this area might add to available information.

The I.P. highs are far from thoroughly tested. Asarco's first 12 holes (Nos. 3 to 15) are reported to be laid out primarily on a grid to provide a statistical test of the property, and most of these holes were completed before the I.P. survey covered the specific area. Further, most of the holes are drilled easterly, yet both I.P. results, and geological work, in many places indicates easterly dips. Further drill holes specifically recommended by the geophysicist are -

" (1) Located at DDH #23 collar and drilled west. This would ascertain whether or not the mineralization has an easterly dip, and if drilled far enough the thickness of the zone can be determined.

(2) At 1,700 West on line 'D' (0 North and beyond the toe of 19) to investigate under the western portion of the I.P. anomaly. This would clarify whether or not there are two zones to the main anomaly.

(3) Located in the vicinity of DDH 12, 13, 26 and 25 to investigate the lateral extent of the mineralization, and to clarify whether or not the zone is parallel to the surface.

(4) Located at 400 West on Line B (2,000 S.) This would investigate the anomaly located here by the I.P. survey. "

Recommendations 1, 2 and 3 may be carried out with less expense using bulldozer and percussion drill rather than diamond drill. Recommendation (4) has already been investigated to some extent by bulldozing. The geophysicist also recommended further investigation of the I.P. high between drill holes 2 and 3, as well as those at the eastern ends of lines A and B (3,000 and 2,000 S) and at 5,000 and 5,500 S.

The I.P. high stretching between holes 2 and 3 is certainly also a favorable zone geologically, and well worth

further exploration in conjunction with other areas on the property. The eastern ends of lines A and B appear underlain by the unfavorable porphyritic augite basalt, and magnetite content may be producing the I.P. anomalies. Holes 28 and 29 were drilled in the anomalies at 5,000 and 5,500 south after the geophysicist's recommendation. The holes found high pyrite, with sparse feldspathization, and only low grade copper sulfides.

A magnetic survey would add greatly to the determination of trends on this property, and probably determine the location of at least the bands of unfavorable porphyritic augite basalt, and perhaps also the syenitized zones. The difference in the amounts of magnetite in most of the rock types appears sufficient to make a magnetic survey very much worthwhile.

ORE RESERVES:

The property has not yet reached the stage where a calculation of ore reserves can be made with any reliability. Two calculations have been completed by others, primarily to obtain a measure of potential. Both calculations were based on assumptions which in time will certainly prove in some measure incorrect.

One of the calculations is based on Plate 2, a 400-scale map reproduced and in the back pocket. The accompanying text reads -

" Assuming that the 'Bird' type of mineralization can be correlated over 1,000 ft. horizontally and 500 ft. vertically, I have calculated that the best grade that might be anticipated from an open pit encompassing the areas outlined on Plate 2 would be 24 million tons @ 0.51% Cu, 0.029 MOS_2 with a 6.5/1 waste to ore ratio for a 0.4% Cu cut-off, or 65 million tons @ 0.43 Cu, 0.027 MOS_2 with a 3.6/1 waste to ore ratio on a 0.30% Cu cut-off. This was arrived at by estimating the grade and tonnage on a tons per vertical foot basis within the mineralized areas shown on Plate 2 and the cross sections. Grades were arrived at by taking the horizontal projections of drill intercepts and assuming that these inclined holes <u>represent a random horizontal sampling</u> of the mineralized area. The effect of dilution resulting from mining is not incorporated in these grade estimates. "

A check of the dimensions shown on Plate 2 shows that the likelihood of similar grade of mineralization existing between the holes drilled was not included in the calculations, despite the stated assumption that the holes drilled "represent a random horizontal sampling".

A copy of a plan showing a second summary of calculations is also included in the back pocket. The engineers assumed that the ratio of 'ore' to waste remains the-

same in the unexplored intervals between the holes as it is in the holes. The cut-off is presumably 0.35% Cu, but this is not defined. The results, ranging from 176 million tons to 258 million tons, depending on perimeters chosen, of 0.39% Cu, 0.022% MOS_2 with an 'ore' to waste ratio of 1 to 1, gives perhaps a more realistic idea of the potential within the perimeter chosen. However, the calculations include many lengthy sections averaging less than 0.35% Cu, and appear to anticipate copper extraction by low cost methods which might be available sometime in the future.

Neither of the above calculations include the very real possibility of important extensions far outside the partially drilled area. The hole recently completed by Paramount shows that copper-molybdenum mineralization, in the same general rock types and in the same general I.P. anomaly as Liard, continues for at least 2,400 ft. north of Liard's hole 22. The geological and geophysical data discussed previously does not suggest that the average grade of the mineralization which likely exists between the widely spaced holes will improve beyond that showing in those drilled to date. It does suggest that similar mineralization will likely be found between and beyond the holes now drilled.

GRADE:

The Assay map accompanying this report shows the intercepts of better grade copper calculated to horizontal widths. Assay logs are available, but not included with this report. The core lengths of intercepts grading better than 0.4% copper are averaged on the following page. The averages are weighted. Single assays, i.e. isolated 10 ft. sections, of better than 0.4% are not listed, but very few of them are found. The sections listed also contained very few individual assays of less than 0.4% Cu. This tendency for the shoots to occur with definite limits and fairly uniform grade suggests the shoots have a precise structural and/or lithological control.

Hole	Dip	Vert.ft. Depth to Bedrock	% Core Recovery		Min. Intercept	Core Length	% Cu	% MoS_2	Composite Intercept	Oz Au	Oz Ag
1	Vert.	0	95		505 - 550	45	0.59	0.06			
2	60 W	8	95		180 - 460	280	0.60	0.04			
					690 - 726	36	0.55	0.04			
3	56 E	75	95		132 - 280	148	0.50	0.08	One high	MoS_2 assay	is cut
					460 - 490	30	0.42				
					690 - 714	24	0.54	0.015			
4	55 E	21	91.7		310 - 350	40	0.49	0.04			
5	55 E	24	90		100 - 120	20	0.645	0.013	60 - 230	0.005	0.05
					160 - 180	20	0.80	0.01			
6	60 E	10	98		20 - 40	20	0.47	0.025			
					70 - 90	20	0.43	0.025			
7	60 E	26	97		230 - 250	20	0.47	0.02			
8	60 E	10	97		Nil						
9	60 E	11	98		Nil						
10	60 E	9	98		Nil				13 - 100	0.005	0.06
11	55 E	20	98		350 - 370	20	0.66	0.014	360 - 462	0.01	0.09
12	55 E	19	97		19 - 160	141	0.63	0.022	19 - 150	0.02	0.13
13	55 E	28	99		36 - 70	34	0.58	0.03			
					110 - 130	20	0.50	0.10			
				or	36 - 130	94	0.45	0.04	36 - 180	0.01	0.13
14	55 E	53	99		190 - 270	80	0.52	0.041			
					370 - 400	30	0.47	0.02	370 - 470	0.005	0.10
15	55 E	10	92		70 - 90	20	0.45	0.04			
16	55 E	8	98		500 - 536	36	0.88	0.01			
17	55 W	11	96		Nil						
18	55 E	8	98		120 - 140	20	0.84	0.01			
					170 - 380	210	0.77	0.04	160 - 290	0.01	0.23
				or	120 - 380	260	0.71	0.03			
19	55 W	8	95		40 - 90	50	1.55	0.025	30 - 120	0.02	0.29
20	55 E	8	96		230 - 500	270	0.84	0.04			
21	55 E	30	-		Nil						
22	55 E	13	-		Nil						
23	55 E	10	-		450 - 500	50	0.49	0.026			
24	55 E	8	-		200 - 230	30	0.46	0.06			
25	55 E	16	-		270 - 330	60	0.66	0.04			
26	55 E	16	-		20 - 100	80	0.45	0.015			
					130 - 200	70	0.61	0.01			
				or	20 - 200	180	0.49	0.016			
27	55 W	25	-		Nil						
28	60 E	69	98		Nil						
29	45 E	21	98		Nil						

The following of the above tabled holes form a distinct spatial group which contains practically all the best intercepts. This block of holes is averaged.

Hole	Intercept	% Cu	Mult.	% MoS_2	Mult.	Total Core length (minus ovbdn.)
1	45	0.59	26.6	0.06	2.70	623
2	280	0.60	168.0	0.04	11.20	718
	36	0.55	19.7	0.04	1.44	
3	148	0.50	74.0	0.08	11.84	622
11	20	0.66	13.2	0.014	0.28	428
12	141	0.63	88.8	0.022	3.10	304
13	94	0.45	42.2	0.04	3.76	359
14	80	0.52	41.6	0.04	3.28	440
	30	0.47	14.1	0.02	0.60	
18	260	0.71	184.0	0.03	7.80	489
19	50	1.55	77.5	0.02	1.00	490
20	270	0.84	227.0	0.04	10.80	490
23	50	0.49	24.5	0.026	1.30	488
24	30	0.46	13.8	0.06	1.80	490
25	60	0.66	39.6	0.04	2.40	381
26	180	0.49	89.3	0.016	2.88	382
Totals	1,774		1,143.9		66.18	6,704
Average			0.645 Cu		0.037 MoS_2	

Subtracting the better grade intercepts listed above from the total core length, 6,704 ft. minus 1,774 ft., gives a 'waste' total of 4,930 ft. The calculated average Cu content of this 'waste' is 0.203%. The ratio of the better grade to the waste is 4,930 to 1,774 or 2.77 to 1.

The gold and silver assays which might be considered pertinent to the above 16 intercepts provide a weighted average of 0.013 oz Au and 0.185 oz Ag per ton.

Molybdenite is noted on many slickensided fractures in the core. This type of occurrence usually produces an up-grading during bulk-sampling.

The above averages should not be considered to represent an average for the grid block, 6 million sq. ft. in area, into which these holes are drilled. Information concerning the extent and configuration of the mineralization intercepted is much too scant, and the holes are too few to constitute a statistical sampling.

EXPLORATION AREAS:

The information available at Schaft Creek gives two geological guides to mineralization, fault structures and feldspathization, and one geophysical guide, I.P., with a second, magnetics, to be added. Areas of coincidence of favorable indications by these guides are of course the prime targets for exploration. A study of the maps suggests several prime areas. Before discussion of these some further detail on one of the guides, the feldspathization or 'porphyry', may be pertinent.

Similar 'porphyry' copper-molybdenum deposits elsewhere in B.C. commonly have a general spatial relation between the better grade mineralization and the 'porphyry'. The better grade mineralization may be (1) in shattered zones in or near the core of the exposed 'porphyry' (2) within

the porphyry but near its perimeter or (3) in altered rocks outside of but near the 'porphyry' contacts. Data on Schaft lead to a suspicion that (2) may be the location of major mineralization, but further work could easily refute this suspicion and disclose an alternative. Brecciated or highly fractured altered andesitic volcanics also provide some copper and molybdenum, but apparently lower in grade.

The group of drill holes bounded by 19, 12 and 22 show an irregular zone of 'porphyry' with considerable brecciation and the chalcopyrite favors the breccia. The andesitic rocks in the toes of holes 19 and 27 bound the 'porphyry' to the southwest but it is otherwise open for several thousand feet north and south and several hundred feet to the east. The drill hole on Paramount ground and the I.P. anomaly continuing north from drill hole 22 to and beyond the Paramount boundary, suggest excellent potential for copper mineralization to Liard's north boundary, about 1,500 ft. north of hole 22, and on the flanks of the porphyritic rocks shown in holes 21 and 22. The lack of copper sulfides in hole 22, particularly on the contact of the andesitic and porphyritic rocks shown near the collar, is disappointing, but both the fault zone trend and the I.P. results indicate a more westerly trend to the copper mineralization here is possible. Extensions south of drill holes 18 and 19 are limited only by the boundaries suggested by I.P. readings - which as previously discussed may be as low as 6 or 7 mv/v.

The mineralized zone shown by drill holes 3, 2, and 14 appears, at least in part, lower in grade, but much further work is necessary to determine its dimensions and grade.

ECONOMIC CONSIDERATIONS:

The property has not yet reached the stage at which anything approaching a thorough study of costs or feasibility is warranted. Nevertheless, an appreciation of the production costs which might be achieved under the size and type of operation envisioned is necessary to determine the grade of mineralization which should be sought.

Three open pits in the 5,000 to 15,000-ton range are currently in operation in B.C. - Bethlehem, Endako, and Granisle. All have topographic and climatologic conditions similar to those at Schaft Creek. All are and were closer to existing roads and railroads, but none have a shorter route to a tidewater port. Initial exploration costs, and capital costs, will undoubtedly be higher at Schaft, but operating costs should eventually be comparable. Costs achieved at these operations are used in the following tabulation, and increments applied where considered necessary to adjust to a projected Schaft Creek operation. The grade and stripping ratio assumptions which are used should not be considered a prediction of grade or tonnage which might be found eventually at Schaft, but are in line with results obtained from drilling to date. Tacoma smelter schedules are used.

ESTIMATED OPERATING COST OF PRODUCING COPPER AT SCHAFT CREEK

Assumptions:	Cu	MOS_2	Au	Ag
Heads:	0.645	0.037	0.013	0.19
Recovery:	85%	65%	70%	70%
or	11 lbs.	0.48 lbs.	0.009 oz.	0.133 oz.

Byproduct Prices:

- 80¢/lb. MOS_2 - (pay 100% @ $1.35 less 0.55¢ marketing, transportation, etc.)
- $30.50/oz Au - (pay 90% @ $35.00 less $1.00 refining, etc.)
- $ 1.70/oz Ag - (pay 90% @ $ 2.00 less 0.10 refining, etc.)

Waste to Ore ratio	-	3:1
Milling rate	-	20,000 tpd.
Concentrate	-	28% Cu with Au and Ag credits

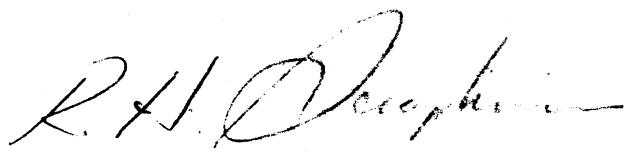
Costs -	Per ton Ore	Per ton Con.	Per lb. Cu.
Mining and waste disposal	$1.00		0.091
Milling	0.85		0.077
Service and admin.	.50		0.046
Con. trucking		9.60	0.017
Loading, barging to Tacoma, stevedoring		3.90	0.007
Smelting, Refining, Marketing			0.070
			0.308

Credits -

0.48 lb. MOS_2 @ 80¢ net	38.8	
0.009 oz. Au @ $30.50 net	27.5	
0.133 oz. Ag @ $ 1.70 net	23.5	
Per ton ore	89.8	
Per lb. Cu		0.082
Net Cost per lb. Cu		0.226

The above calculations do not make allowance for Canadian-American fund conversion as this factor is likely within the limits of error in some of the above assumptions. Writeoff of capital costs are also excluded, as prediction of capital costs involves too many unknowns at present.

Exploration costs experienced by previous workers at Schaft Creek are of interest because of their bearing on choice of exploration methods. Although drilling was relatively easy, and required little or no cementing in spite of locally shattered ground, the direct cost of drilling, $15.00 per foot, is so high that one could drill perhaps 5 ft. of percussion hole for the same price as 1 ft. of diamond drill hole. Camp and airstrip costs, totalling approximately $20,000.00, are non-recurring costs. The camp and strip are adequate for the recommended exploration.



LIARD COPPER MINES LTD., SCHAFT CREEK

EXPLORATION COSTS

Diamond Drilling (10,939 ft.) (BQ Wireline)				$ Cost per Ft.
Direct:				
Contractor's footage charges	105,575		9.65	
Moving, Overburden, Cost Plus	33,575		3.07	
Roads, drillsites, tractor work	25,037		2.29	
Total Direct Costs		164,187		15.01
Indirect:				
Camp Maintenance, Cookhouse	6,107		0.56	
General Transportation & Expediting	22,761		2.08	
Camp construction, airstrip, Transportation	8,230		0.75	
Camp construction, airstrip Other	11,534		1.06	
Assaying, sampling, core handling	8,402		0.77	
Communications	782		0.07	
Field supervision	4,417		0.40	
Total Indirect Costs		62,233		5.69
Total Diamond Drilling			226,420	20.70
Geological Mapping:				
Transportation	318			
Other	2,506			
Total			2,824	
Trenching and Stripping:				
Transportation	2,050			
Other	6,379			
Total			8,429	
I.P. Surveys and Line Cutting:				
Transportation	1,483			
Other	7,577			
Total			9,060	
Claim Surveys, Staking, Filing Work:				
Transportation	2,094			
Other	9,494			
Total			11,588	
General Supervision, Reports, Travel			5,326	
Legal, Contracts			1,496	
Miscellaneous and Unallocated			1,102	
TOTAL EXPENDITURES			$266,245	