Report on
NAHWITTI COPPER
Nahwitti Lake, B.C.

Feb.16/67 J.J.McDougall

REPORT

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B.C.

N.T.S. 92-L-12

Vancouver, B. C.
February 16, 1967

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INTRODUCTION

This short report follows the completion of work on a northern Vancouver Island copper prospect optioned early in 1966. The writer supervised the project, spending several days on the property and as well made a number of trips to it between February and May. The work was described in monthly reports during this period.

NAME

Mahwitti Copper.

OWNER

F.T. Russell, Apt. 303, 545 St. George's Avenue,
North Vancouver, B.C.

PROPERTY

Nine located claims, - Jean 1 - 8 plus the Lake Mineral Claim. Two years assessment credit was put against these by Falconbridge early in 1966.

LOCATION AND ACCESS

The property is located on the northwest shore of Mahwitti Lake, a 2½ X ½ mile body of water (elev. 660 feet) located about 30 miles northwest of Port Hardy, northern Vancouver Island (Map 92/6/1). Access is by way of the Port Hardy - Holberg road as far as the northwest end of Mahwitti Lake, then by one-half mile of forestry access road easterly to the crossing of the Mahwitti River from where a one-half mile trail leads southerly to the property (elev. Lake level to 1,000 feet).

Port Hardy is serviced by road, sea, and air; the latter, under Pacific Western Airlines, is by far the more convenient agency.

As with most of Vancouver Island, the area is very heavily forested and has overburden ranging from 2-20 feet on the hillsides to as much as a couple hundred feet in the valleys. Rainfall is heavy but snowfall, as far as the working area of the property is concerned, can range from zero to a couple of feet, the latter seldom lasting, however, for more than a week or two.

During 1966, the crews lived in Port Hardy and with a U-drive drove the twenty miles daily to the property.

HISTORY & DEVELOPMENT

The property was first brought to us by F.T.(Pat) Russell, one of our former prospectors, now working in North Vancouver. Years previous Meade Hepler (also one of our prospectors) and associates had apparently discovered mineralization north of the east-west trending lake while working on their silver-lead-zinc prospect (which we also spent sometime on - see reports by A.Smith) southeast of the Lake. A few pits and cuts were put in by Heplers' associates but nothing more was done until the property was staked by Russell. Some of the deposits uncovered ore described as the "North Shore" Group in the 1936 M.M. Report. A sketch map made following a rapid examination by Silver Standard late in 1965 showed values across 32 feet of up to 1.5% copper on the west end of the prospect and 18 feet of lower grade disseminated copper about 1,000 feet east of this. Russell presented this to us early in 1966 and because of the possibilities of continuation under overburden and the strong replacement nature of the mineralization plus the ease of access, especially during the off-season, it was decided to take a short term option. This was done and work was commenced early in

February and continued until May. Russell was hired and spent as much time as he had available on the property. His plans to prospect the claim area later in the year did not materialize as he had to work elsewhere.

Others working on the prospect included Steve Presunka (geophysics and geochemistry) with help from McBurnie and Alex Angus, an Indian fisherman from Hardy, plus John Schuesler (packsack drilling) and Wende Hepler (rock trenching). Little Joe of Port Hardy helped on occasion.

The main mineralized zone suggested by exposures on the Lake Claim to February of 1966 was about 700 feet long. Within this length, cuts three to five feet deep were made in five places; the longest of these was about fifty feet. In addition, a few sizeable pits were present along the same zone. Additions by Hepler and Russell, including one large pit and four smaller ones, added 200 feet to the known length of the zone and helped prove the existence of a second paralleling one north of the original. Cobra work extended the most easterly cut by ten to fifteen feet and provided a fresh sampling face.

Five packsack drill holes totalling 193 feet (plus abandoned footage) were completed, (logs enclosed). These were designed more to measure grade and width of known but poorly exposed mineralization rather than to search for new orebodies.

A chain and transit controlled main base line 1,600 feet long was set-up and lines turned off it for 300 to 400 feet on each side. A topographic map of this area was then evolved (MC/66/2) and geology sketched on it. Geophysical and geochemical observations were made every twenty-five feet along the sidelines from centres every fifty feet along the base line. This included 60% fluxgate magnetometer (Map MC/66/4) as well as self-potential (MC/66/3) work. Soil sampling prior to the geophysics involved hot extractions for copper and occasionally molybdenum (MC/66/5).

Anomalies, either coinciding or of merit otherwise, were tested by pitting or trenching where feasible and the contact area quite closely prospected.

ORE

Chalcopyrite with minor magnetite plus low but unusual values in manganese.

GENERAL GEOLOGY

The Mahavitti Lake area has not been geologically mapped thus correlations are not attempted at this time. (Best reference B.C. M.M. Report 1936, pp-47 which includes summaries of basic work by H.C. Gunning). Copies are enclosed with this report. In general the geology around Mahavitti consists of one (or several) lense-like blowouts of Triassic limestone (either Bonanza or Quatsino as described in numerous publications elsewhere) enclosed by basic volcanics described in part by Gunning as Hornblende latites. The whole assemblage is partially truncated a short distance to the north by the Mahavitti granodiorite stock and at intervals locally sills and dykes of similar material are found. In the claim area, a southerly dipping lense of limestone at least several hundred feet thick crops out along and parallels the northern lakeshore inland a distance of 400 - 500 feet at which point it is in contact with basaltic volcanics possibly gradational to hornblende latite. There is a possibility that this later material has a sill or dyke-like form as a second narrow band of limestones is suggested by sink holes to occur a couple hundred feet north of the main contact. Overburden prevents any clear cut deciphering of this at present. Garnet and epidote skarn has formed at the contacts of the lime and the volcanics and it is in this location that the ore minerals of interest occur.

Structurally the limestone lense strikes somewhat anomalously nearly east-west. Minor brecciation and shearing are occasionally noted associated with pods of mineralization but it is not known with certainty how close the mineralization follows the limestone contact as some of these structures appear to have a cross-cutting arrangement; until proven otherwise, however, the contact is assumed to be the major control.

The second paralleling but unexposed band of limestone may be brought in by folding as weakly suggested in a couple of the cuts but again, this is anything but clear.

DESCRIPTION OF PROSPECT

The several mineral showings of interest occur along the main contact as described. The first and by far the more important of these is exposed in a cut south of the base line at 650 E from where it continues somewhat irregularly for about 200 feet easterly. Along this distance three more cuts expose mineralization in an area where the overburden is several feet thick. At the 1,000 E. mark on the base line a small amount of copper magnetite is exposed in a small cut while 50 feet south of the 1250E marker a few feet of fairly impressive material is exposed. This latter is not directly related to the main limestone contact which at this point is suddenly "wrapped around" (faulted?) to a point a couple hundred feet to the south. A small occurrence of limestone at this mineralized location may in fact be the only exposure of the "second band". At the main contact, low grade disseminated mineralization occurs throughout an area some 50 feet (or more) square.

Continuity between 800E and 1250E (600 feet) is very unlikely judging by outcrops and geophysical response, especially magnetics. A similar condition occurs east of 650E.

Pods of galena and sphalerite containing a small amount of silver occur occasionally in the limestone (marble) - particularly as replacements of local argillaceous material. These are very small and of no economic significance.

A small amount of manganese oxide is present throughout the copper-bearing zones. Its origin or derivation is uncertain.

ASSAYS AND RESERVES

Drill core assays as shown in the logs are probably more accurate than those obtainable by surface chip sampling. The highest grade expected over more than couple feet of length is about 1.5% copper. An educated guesstimate, arrived at by surface and core sampling, would put grade expected in the lower zone at about 1.1% copper. Here the greatest true widths with this grade would be about eight feet in the lower pit and about four 150 fett away, for an average 6 feet through a liberal 200 feet. This would give total of about 120 tons per vertical foot.

At the east end of the property, the best assays obtainable from more than a few feet of "disseminated material" showed less than 0.15% copper.

Float from an exposed "pod" of material in the limestone ran Tr Au., 13.5 oz. Ag., 2.27% Pb., 7.41% Zn.

GEOCHEMICAL RESULTS

The geochemical survey (map enclosed) shows quite clearly that the local area is anomalous but fails to indicate any strong continuation or correlative elsewhere. A second paralleling band is suggested.

GEOPHYSICAL RESULTS

(a) S.P.

This survey indicates a few pods of known S_2 but it did not pick out all of them. It indicated a discontinuous conductor

paralleling that shown by geochemistry. The limestone, which is unusually well exposed, reacted very strongly to SP and would have been a good drill target were it not exposed. Such readings could only be caused by finely divided argillaceous material or graphite present but such is not readily noticeable.

(b) Magnetics

Magnetometer work indicated a general high in the area of interest plus a few local offsets but failed to confirm the hoped for continuity of the cupriferous magnetite.

SUMMARY AND CONCLUSIONS

It had been hoped, judging from earlier reports and maps of the property, that a worthwhile 20 - 30 ft. wide medium grade copper body was present which would be traceable through 1,000 feet or more, and that deposits of low grade, disseminated material were present. However, our work has indicated neither to be the case, at least within the gridded area.

Remaining hopes for the property seem to be continued geophysical and geochemical prospecting along the contact to the west (this ground was otherwise tied up when we were there) plus deep trenching along the "parallel zone" on the rare chance that massive chalcopyrite rather than that associated with magnetite is present. Russell's proposed prospecting of reportedly "anomalous" areas to the southeast never did materialize but should be looked into. The silver content of the lead-zinc material is good but most of the host rock is under the lake or under the heavy overburden to the west.

Without some entirely new evidence or concepts, the property as known has no tonnage potential, thus is of no immediate interest to Falconbridge.

J.J. McDougall,
Geologist

Vancouver, B.C.
February 16, 1967

PROPERTY NAHWITTI COPPER

HOLE NUMBER

SHEET NUMBER

SECTION FROM TO

DIAMOND DRILL RECORD

LOCATION: LAT / DEP

ELEVATION OF COLLAR

DATUM

DIRECTION AT START: BEARING / DIP

STARTED

COMPLETED

ULTIMATE DEPTH

PROPOSED DEPTH

DEPTH FEET	FORMATION	FROM	TO	WIDTH OF SAMPLE

Nahwitti Copper

Packsack Diamond Drilling February, 1966

Driller Schussler - Prelim. logging J.J.M.

Abbreviations:

pyrr = pyrrhotite

mag = magnetite

cp = chaleopyrite

mn = manganese

ep = epidote

py = pyrite

Vi = amygdaloidal basalt - altered

Di - possible basic dyke rock - altered

Sk - skarn

lms = limestone or marble

CR = core recovery

bndg @ = banding attitude relative to cove axis

fg = fine grained

cg = coarse grained

N. M. P. - FORM A

PROPERTY NAHWITTI COPPER

HOLE NUMBER 1/66

SHEET NUMBER 1

DIAMOND DRILL RECORD

SECTION FROM TO

LOCATION: LAT approx. 1966 grid references: 03.0' S
DEP 700.0E

STARTED February 14, 1966

COMPLETED " "

ELEVATION OF COLLAR 770.0 feet

DATUM on mineralized outcrop neat cut

ULTIMATE DEPTH 25.0 ft.

DIRECTION AT START: BEARING --
DIP -90°

PROPOSED DEPTH

DEPTH FEET	FORMATION	FROM	TO	WIDTH OF SAMPLE	Au	Ag	Cu %	CR %
0-2.0	30% mag, 3-4% cp in ep sk							
2.0-5.5	black spots (Mn ?) in ep sk	0-5.0		5.0 ft.	Tr	0.1	1.38	35%
5.5-8.0	gray fg. mottled Cu6 silicified Vi sk	5.0-8.0		3.0'	Tr	Tr	0.15	70%
	- vfg pinpoints of white mineral	8.0-20.0		12.0	Tr	Tr	0.04	70%
	scattered throughout							
		20.0-25.0						90%
8-17.5	Rock resembling "epidote porphyry" sk;							
	scattered amygdule - like							
	spots composed of garnet, quartz & S2							
	- orc ep bndy @ 66°							
	17.4 - coarse black "pickles" in ep porph							
	- bndg @ 52°							
17.5-25.0	Silceous gray to green							
	ep sk; occasionally porpyritic							
	-- may be altered volcanic or basic sill or dyke?							
	(end)							
	Hole drilled on hi grade section of cut							

N.M.P.-FORM A

PROPERTY NAKWITTI COPPER

HOLE NUMBER 2

SHEET NUMBER 1

DIAMOND DRILL RECORD

SECTION FROM TO

LOCATION: LAT 02.0' N.
DEP 698.0,E

ELEVATION OF COLLAR 771.0

DATUM

DIRECTION AT START: BEARING 510°W
DIP -50°

STARTED February 15, 1967

COMPLETED " " "

ULTIMATE DEPTH 41.0 feet

PROPOSED DEPTH

DEPTH FEET	FORMATION	FROM	TO	WIDTH OF SAMPLE	Au	Ag	Cu	CR %
0-18.0	Ep porph as in hole #1							
18-22.0	Grey - dense fg. silic Vi epid sk							
	Vsl S2	15.0		8.0	Tr	Tr	0.14	75
	22.0 - suggestion of low angle ctct	23.0-27.0		4.0	Tr	0.1	0.56	90
22.0-25.5	Dark spotted v. epid sk' sl diss S2	27.0-30.0		3.0	Tr	Tr	0.05	85
	23.0 juting @ 38°							
	24.0 dark bndg @ 65°							
25.5-26.5	C.P. rich. mag. ep. SK							
26.5-29.0	Vfg diss. C.P. in sl epidotized, partly chloritic, dense Vi on basic sill							
29.0-41.0	Vfg sil V odc as prev. but occ sl epidote patches resembling amygdules (basalt??)							
	(end)							
	Hole drilled under hi-grade section of cut							

N.M.P.-FORM A

PROPERTY NAHWITTI COPPER

HOLE NUMBER 3

SHEET NUMBER 1

DIAMOND DRILL RECORD

SECTION FROM TO

LOCATION: LAT 33.0S
DEP 1250.0 E

ELEVATION OF COLLAR 748.0 ft.

DATUM on lower mineralized cut

DIRECTION AT START: BEARING N 10° E
DIP -47°

STARTED February 25, 1966

COMPLETED

ULTIMATE DEPTH 25.0 ft.

PROPOSED DEPTH --

DEPTH FEET	FORMATION	FROM	TO	WIDTH OF SAMPLE	Au	Ag	Cu %	CR %
0-8.0	Oxidized (RW) mag epid							
	sk, pl CP as disseminations							
	and as fracture coatings; amygdaloidal	0-5.0		5.0	Tr	0.4	1.59	98
	appearance	5-10.0		5.0	Tr	Tr	0.10	75
		10.0-15.0		5.0	Tr	Tr	0.18	80
8-19.0	as 0-8 but decreasing ep, cp.	15.0-25.0		10.0	Tr	Tr	0.08	90
	8.0 - ctct @ 50° amygnole							
	+ fg dense valc (Vi)?							
19-25.0	previous type gradational (?) to							
	Vfg, grey siliceous Vi on sill;							
	occ C03 - S03 stngs							
	- Occ weakly min							
	24.0 - bndg @ 47°							
	(end)							
	Hold drilled from 5 feet within visibly well							
	mineralized low cut to cut across best section of							
	mineral deposit							

N.M.P.-FORM A

PROPERTY MANITTI COPPER

HOLE NUMBER 4

SHEET NUMBER 1

DIAMOND DRILL RECORD

SECTION FROM ..... TO .....

LOCATION: LAT 60.0 S
DEP 1250.0 E

ELEVATION OF COLLAR 975' ±

DATUM .....

DIRECTION AT START: BEARING N 10° E
DIP -45°

STARTED February 26, 1966

COMPLETED " "

ULTIMATE DEPTH 63.0 ft.

PROPOSED DEPTH .....

DEPTH FEET	FORMATION	FROM	TO	WIDTH OF SAMPLE	Au	Ag	Cu	CR %
0.8.0	garnet - ep sk; partly silicified							
	sl mag. very sl. ep.	0-8.0		8.0	Tr	0.1	0.41	50
		8-18.0		10.0	Tr	Tr	0.14	65
8-17.0	light colored Vi ep. garnet	18-25.0		7.0	Tr	Tr	0.08	70
	skarn, amygdaloidal	25-38.0		13.0	Tr	Tr	0.03	40
	texture suggestive of Vi	38-50.0		12.0	Tr	Tr	0.04	75
	14.0 bndg. @ 52°							
17-25.0	dark, fg. brecciated silic garn-ep							
	skarn as 8-17							
	24.0 garnet bndg. @ 55°							
25-37.5	dense, hard black to grey spotted							
	cherty rock; occ. black oxide stngs (Mn?)							
	30.0 - sl. bndg. and fracturing @ 45°							
37.5-46.0	sl silic, sl brecciated							
	milky gray marble; weak							
	diss py							
46.0-48.0	chloritic skarn							
	46.0 - 2-3" 40% py, bndg @ 40°							
48.0-63.0	dense, fg, black Vi on sili ox as prev. occ sl sk; occ gob pyrr, sl cpy (end)							

N. M. P. - FORM A

Hole drilled to pass under high grade zone, never cut

PROPERTY NASWITTI COPPER

HOLE NUMBER S

SHEET NUMBER 1

SECTION FROM TO

DIAMOND DRILL RECORD

LOCATION: LAT 59.0' S
DEP 1250.0 E

ELEVATION OF COLLAR 975 ±

DATUM

DIRECTION AT START: BEARING S10° W
DIP -47°

STARTED February 27, 1966

COMPLETED " "

ULTIMATE DEPTH 25 feet

PROPOSED DEPTH

DEPTH FEET	FORMATION	FROM	TO	WIDTH OF SAMPLE	Au	Ag	Cu	CR%
0-13	Ep garnet sk							
	- occ sl. mag							
	- no visible CPy							
	- black spotted (Mn02?)						0-10	20%
							10-20	60%
13-25	gray, sl sil marble						20-35	90%
	(net min)							
	(end)							

N.M.P.-FORM A

PROPERTY NAHWITTI COPPER

HOLE NUMBER 6

SHEET NUMBER 1

DIAMOND DRILL RECORD

SECTION FROM ... TO ...

LOCATION: LAT 150.0 S
DEP 1260.0 E

ELEVATION OF COLLAR 1000.0 ft.

DATUM

DIRECTION AT START: BEARING
DIP -90°

STARTED February 28, 1966

COMPLETED "

ULTIMATE DEPTH 14.0 ft.

PROPOSED DEPTH

DEPTH FEET	FORMATION	FROM	TO	WIDTH OF SAMPLE	Au	Ag	Cu%	CR %
0-14	Very sl. mag in epid Vi	0-6		6.0	Tr	Tr	0.12	30%
	garnet skarn; many black							
	(MnO2?) spots							
	Recovery poor (30%) due to fractured nature							
	of ground							
	(end)							
	Drilled to sample low grade, diss CP, MnO2 in this							
	area							
	Composite DDH #1; 0-8, 15-23)							
	DDH #2: 23-27)							
	DDH #3: 0-5)							
	= 14.32% soluble iron							

N.M.P.-FORM A

it is mostly from 6 to 8 inches wide but swells at the western end to 2.5 feet. A selected sample assayed: Gold, 0.03 oz. per ton; silver, 0.4 oz. per ton; antimony, 10.9 per cent. This *No. 4* vein is 300 feet, roughly estimated, to the north of the *No. 1* vein. The *Westman* vein, exposed on the *Gray Rock No. 6* claim, which adjoins the *Gray Rock No. 1* to the north, is the lowest and farthest north of the series. It is exposed by outcrops and three open-cuts for a length of 400 feet or more along the 6,040-foot contour of the precipitous ground overlooking Truax Creek from the south. The showings consist of iron-stained quartz and oxidized siliceous gangue containing light sulphide mineralization without any appreciable amount of stibnite. A sample across 1 foot in the western cut assayed: Gold, 0.04 oz. per ton; silver, 4 oz. per ton; and a sample across 10 inches in a cut 150 feet to the east assayed: Gold, 0.02 oz. per ton; silver, 0.4 oz. per ton. In the third cut, 60 feet farther east, there are quartz stringers along well-marked fracturing in sheared, silicified, iron-stained rock. Two hundred feet farther east the vein, traced by outcrops throughout the interval, consists of a zone of quartz bands and stringers 8 feet wide.

Summarizing conditions, the veins occupy well-defined fissures and are remarkably persistent in lateral extent, appreciable continuity in depth being already indicated by the unequal erosion. The antimony content is of interest if, at a more advanced stage of development, it can be shown that a clean stibnite concentrate can be made. Grey-copper mineralization is sufficiently continuous in places to warrant the assumption that good average silver values exist in some vein areas. Gold values, not important in present exposures, may become of accessory value. No evidence is yet available of a possible change in the character of the mineralization at depth, the same minerals being exposed in deeply-eroded sections as at the higher elevations. The presence of arsenopyrite, as detected in the thin sections, is of considerable interest, this mineral usually being auriferous in the Bridge River District. The general tendency, in connection with deposits containing stibnite and arsenopyrite, is for decreasing amounts of the former mineral as depth is attained, with an increase in the proportion of the latter.

SILVER-LEAD-ZINC DEPOSITS.

Nahwitti Lake Area.

H.P.H., North Shore, South Shore.

The nucleus of the *H.P.H.* property consists of six claims known as the *H.P.H. Nos. 1, 2, 3, 6, 8,* and *Idas*, held by location and owned by S. S. Pugh and M. Hepler, the original discoverers, both of Port Hardy. In June, 1936, these claims were under option to W. G. Dickinson, who, with associates of Victoria, had acquired, by staking, eighteen additional contiguous claims. The *South Shore* group consists of ten claims held by location, three of which, owned by M. Hepler and F. Hicklenton, were included in the option, the other seven claims having been staked by the Victoria interests, who had also staked five claims known as the *North Shore* group. The *H.P.H.* camp and main workings, 14.25 miles westerly from Port Hardy, are situated about 6,000 feet easterly from the east end of Nahwitti Lake (*see* B.C. Lands Department Map No. 2c, entitled "Northerly Portion of Vancouver Island"). The *North Shore* and *South Shore* groups are located along the northern and southern sides respectively of Nahwitti Lake adjacent to its western end. All three prospects are in the Quatsino Mining Division.

The principal showings on the *H.P.H.* property are on the steep north slope of the ridge which forms the southern side of the Upper Nahwitti River Valley. This small stream flows westerly into Nahwitti Lake through swampy flats the elevation of which, at a point opposite the camp and main workings, is about 600 feet. Elevations in the prospected area to the south of the valley are up to 1,050 feet, this elevation representing the highest point on the summit of the ridge, which continues for some miles to the east and west. Showings on the *North Shore* and *South Shore* groups, at elevations up to 1,040 feet, are on the steep slopes to Nahwitti Lake, which is at about 575 feet elevation. The whole area is well timbered with hemlock, cedar, and balsam, trees being up to 6 feet in diameter, hemlock predominating. The area comprising the *H.P.H.* property contains small creeks flowing steeply to the main stream, such as Idas (Canyon) Creek, which affords possibilities for the development of a small water-power. There are also small creeks flowing into the lake on the *South Shore* ground. The *North Shore* prospect is just east of Nahwitti River where it flows out of the lake.

Access is from Port Hardy on the east coast of Vancouver Island, first for 1 mile along the road towards Coal Harbour, on Quatsino Sound, then westerly by trail 9 miles in length to

the eastern end of Kains Lake. A rowboat is then used for 2.5 miles to reach the western end of this lake. From this point the trail continues westerly for a length of 5 miles to the *H.P.H.* camp, the total distance from Port Hardy being about 17.5 miles. The trail, starting just above sea-level at the road west of Port Hardy, climbs to an elevation of 1,000 feet at Kains Lake, and the remaining section, after reaching a maximum elevation of 1,100 feet west of this lake, descends to the *H.P.H.* camp at 620 feet elevation. The trail sections traverse a densely wooded or timbered district in which swampy areas abound. The going is rough and pack-horses could not be used without extensive trail improvements, including construction of long stretches of corduroy. When development was in progress in the autumn of 1930 and following winter months, supplies and equipment were largely brought in by plane to Kains Lake, from which point men packed them to the property. Nahwitti Lake, which is much nearer, also affords good landing facilities for a plane.

A much shorter trail-location, possibly about 8 miles in length, could be located south-easterly and southerly from the *H.P.H.* camp over a low pass at 850 feet elevation to a point on the West Arm of Quatsino Sound some 6 or 7 miles west of Coal Harbour. Nahwitti Lake is about 4,000 feet wide and 2.2 miles in length and the *H.P.H.* property is connected with it by trail, the *North Shore* and *South Shore* prospects being reached by rowboat.

The general geology surrounding the *H.P.H.* deposits is described by H. C. Gunning in Geological Survey of Canada Summary Report, Part A, 1931, page 37-A. Extending this to include neighbouring prospects, silver-lead-zinc replacements have been found at intervals over a total length of 4.6 miles in an east-west direction (including the *Dorlon* group, described separately). The showings occur in bands of grey to black fine-grained limestone, frequently silicified. Limestone areas in the *H.P.H.* section have been prospected over a length of 4,500 feet and a width up to 1,700 feet. The principal limestone-band, to which the foregoing report applies, has been estimated to be at least 500 feet thick. It strikes a little north of west and dips to the south at from 35 degrees or less to 65 degrees. The base of this limestone is not exposed, but according to Gunning it probably contacts with the underlying volcanic flows and fragmentals in the drift-covered flats immediately north of the ridge. Near and south of the top of the ridge the limestone is interbedded with and overlain by siliceous grey tuffs, felsite, hornblende andesite, and hornblende andesite porphyry. Farther south, or at points from one-half to three-quarters of a mile south of the flats, the aforementioned rocks are intruded by a large body of granodiorite or diorite. A specimen representing a local phase of this intrusive is a fine-grained, light-coloured phanerocrystalline rock, determined microscopically as hornblende granodiorite, the approximate mineral composition being: Orthoclase, 20 per cent.; combined albite and oligoclase, 20 per cent.; quartz, 50 per cent.; with some accessory iron ore, chlorite, and epidote present. There are a few sills, dykes, and irregular bodies of aplite, felsite, and altered rhyolite or trachyte in the limestone, also occasional dykes of augite andesite and augite andesite porphyry. The above conditions apply to the *H.P.H.* section. On the ground comprising the *North Shore* and *South Shore* groups the limestone-bands, interbedded with acid and basic volcanics, shales, and tuffs, are comparatively narrow and outcrop over a smaller areal extent. Basic volcanics, which interrupt the continuity of the *North Shore* limestone, include hornblende latite and similar rocks are exposed along the southern side of the lake between the *South Shore* limestone and the water. To the south, and on the steep slope about 400 feet above the lake, this limestone is overlain by shales, tuffs, and felsites. Included in the series an extrusive type noted has been completely altered to yellowish-brown carbonate. Cutting shale near one showing there is a small dyke of grey fine-grained rock containing numerous specks of pyrite. Granodiorite, probably connected with the large intrusive body observed to the south of the *H.P.H.* group, outcrops at numerous points roughly parallel to the north and south sides of Nahwitti Lake at from 2,000 to 3,500 feet away, these main branches connecting at points half a mile or less west of the western end of the lake. At the western end of the *South Shore* property the limestone is directly underlain by granodiorite. In the vicinity of the showings on the same group the limestone is cut by a dyke, 50 feet wide or more, of hornblende diorite, a fine- to medium-grained greenish rock, a specimen of which was composed of andesine 50 per cent. and hornblende 40 per cent., with accessory iron ore, rutile, apatite, and quartz.

The prevailing type of mineralization, occurring as irregular replacements lacking definite structural boundaries, consists of galena and sphalerite in a gangue of black, fine-grained,

silicified limestone, or of dark-grey limestone. In some phases a crustified or cellular quartz gangue has been developed and in others the limestone is leached. The sulphides are generally exposed at or near the surface, oxidation, where present, being local or shallow. Some oxidized cappings containing sulphide remnants have only been partially exposed by stripping. The presence of small amounts of pyrite, pyrrhotite, and chalcopyrite has been reported in some specimens of silver-lead-zinc ore from the *H.P.H.* The mineralisation varies from material, generally siliceous, through which the lead and zinc sulphides occur as disseminations or streaks, to nearly clean galena or galena and sphalerite masses. The silver values fluctuate considerably. Twelve samples from the *H.P.H.* group show a silver ratio of from ½ to 3¾ oz. to the unit of lead, the average being 1.4 oz. Sphalerite predominates at the *North Shore* and *South Shore* prospects and silver values are low. Gold values in all samples varied from a trace to 0.04 oz. to the ton, the average content being negligible. Several undeveloped exposures of magnetite have been reported to occur on the *H.P.H.* group, but these were not visited. Gunning refers to a showing at the south-west corner of the original group, about 1 mile from the cabins, as an extensive development of garnet and epidote, with some magnetite, minor pyrrhotite, pyrite, and occasional arsenopyrite, lying against granodiorite, no work having been done at that point.

The original claims constituting the *H.P.H.* property were staked in 1930. Subsequently an option was acquired on the group by the American Smelting and Refining Company, with the result that a limited amount of exploratory work was done in the winter of 1930–31. The company ceased work in the spring of 1931 and relinquished its option. The property then lay idle until early in 1936, when an option was taken by the Victoria interest previously mentioned and small-scale development continued.

The claims constituting the *North Shore* and *South Shore* groups are recent stakings. Specific conditions on the three prospects are separately described as follows:—

H.P.H.—Locally the limestone is considerably jointed, most of the joints being at about right angles to the strike of the formation. In the vicinity of the principal workings there are numerous irregular and discontinuous fractures. Evidence of definite structural control is at present lacking, the mineralization occurring in irregular patches or lenticular zones. The largest showing is exposed or indicated by stripping and trenching for a length of 125 feet or more and a width of from a few inches to about 12 feet.

Exclusive of this comparatively large body, around which most of the development-work has been done, silver-lead-zinc mineralization has been exposed at fifteen separate points on five claims, the *H.P.H. Nos. 1, 2, 3,* and *6,* and *Pendic No. 18,* which form a block in the centre of the staked area. The principal showings, first referred to, are on the steep, "bluffy" ground forming the toe of the ridge just south of the flats at 600 feet elevation. Surface workings here consist of stripping and trenching. Those exposing mineralization are enclosed within an area 260 feet long measured easterly-westerly and about 42 feet wide between the 620- and 660-foot contours. The general trend of the mineralization is westerly, but this turns a little south of west towards the western end of the exposures. Chaining in feet from east to west conditions are as follows: From zero to 32, two parallel narrow zones of iron-stained capping containing sulphide-streaks and seams of decomposed oxidized material; from 32 to 70, limestone covered in part with moss and soil; from 70 to 92, strong lead-zinc mineralization from a few inches to 3 feet in width; 92 to 97, covered; 97 to 164, continuous irregularly-shaped meandering exposure of massive sulphides from 1 to 12 feet in width, plus adjoining small lenses to the north separated from the main body by unreplaced limestone; 164 to 188, iron-stained silicified limestone irregularly mineralized over a width up to 8 feet with scattered streaks and bunches of sulphides; from 188 to 208, covered; 208 to 214, trench exposing a width of 18 feet of oxidized capping and soil; 214 to 256, covered; and from 256 to 260, trench exposing width of 6 feet of oxidized capping and soil. Just west of here, at chainage 271 feet, a long trench is in soil, some mineralized float being found in it. Reverting to the area of the massive and continuous mineralization between chainage-points 97 and 164, the collar of the east shaft is at chainage 109 and 660 feet elevation. This shaft, 12.5 feet deep to the water-level, is first sunk 8 feet as a steep incline to the south and then vertical. A short crosscut said to be 8 feet long extends to the west from the shaft-bottom, but this was inaccessible. On the east side of the shaft massive sulphides are exposed over a thickness, measured down from the collar, of 6 feet, and a sample across this width assayed: Gold, 0.02 oz. per ton; silver, 35.2 oz.

per ton; lead, 41 per cent.; zinc, 25.7 per cent. Selected galena from the same place assayed: Gold, 0.01 oz. per ton; silver, 106.4 oz. per ton; lead, 78.5 per cent.; and selected sphalerite assayed: Gold, 0.01 oz. per ton; silver, 12.4 oz. per ton; zinc, 49.9 per cent. Massive sulphides, but containing less galena, are exposed down the west side of the shaft for 8 feet below the collar. It was not practicable to inspect the shaft below these workings due to the rotten condition of the ladder, and water. It is reported on good authority that mineralization persisted to some extent to the bottom of the shaft where the ore-width was reduced to 6 inches. The west shaft, at chainage 165 feet and about 648 feet elevation, is distant 56 feet on a bearing of north 62 degrees west from the collar of the east shaft. It was sunk vertically for the first 12 feet, but the lower part of this section has filled in so that for practical purposes the west shaft is now an incline sunk to south 32 degrees west for 28.5 feet on a 57-degree slope, attaining a depth of 24 feet below the collar. At this point it was driven into a cave in the limestone which extends south 60 degrees west for 30 feet to Station A, thence south 36 degrees west for 6 feet to Station B, and finally for 22 feet due west through a low gallery, difficult of access, to a pot-hole containing deep water at Station C. The cave descends gently to a level about 6 feet below the bottom of the shaft or 30 feet below the collar. From Station B a branch gallery 4 feet long leads south-westerly to another and larger water-filled hole. The cave has been formed along irregular fractures with variable strikes and dips. The shaft is first sunk in a zone, up to 8 feet wide on the surface, of light mineralization consisting of irregular streaks and disseminations of sulphides in iron-stained silicified limestone. Similar conditions are apparent for 12 feet down the shaft. From this point the sulphide mineralization continues chiefly along the western side of the shaft and north-western and western side of the cave, as stringers and scattered pockets, or patches lining the cave-walls. The most continuous mineralization of the last-mentioned type is exposed on the western wall of the cave opposite Stations A and B. This showing, 10 feet long and 10 feet high, is associated with a vertical fracture striking south 30 degrees west. Galena predominates here and a selected sample assayed: Gold, 0.02 oz. per ton; silver, 81.8 oz. per ton; lead, 55.5 per cent.; zinc, 15.7 per cent. Selected material from the farthest-west point reached in the cave assayed: Gold, 0.04 oz. per ton; silver, 17.4 oz. per ton; lead, 11.9 per cent.; zinc, 20.6 per cent. Similar mineralization, occurring as scattered streaks at numerous points along the northern wall of the cave between Stations B and C, is associated with a fracture striking due west with variable dips to the north. The restricted dimensions of the latter passage prevented thorough inspection of conditions, but it would appear that the cave generally follows along the southern margin of the mineralized zone traced on the surface, gaining depth on it going south-west.

From a point 60 feet north 7 degrees east from the collar of the east shaft and 50 feet below it, at 610 feet elevation, the *Lee* adit has been driven 111 feet along a bearing of south 17 degrees west, so that it passes under the ground between the two shafts. Chaining in feet from the portal, solid rock was reached at 26; from 26 to 45 the adit cuts altered grey to green siliceous rock containing garnet, epidote, scattered specks of pyrrhotite, pyrite, and rarely chalcopyrite; at 45 feet this rock contacts irregularly with grey limestone dipping from 30 to 45 degrees to the south; from 45 feet to the face the adit is all in limestone. At 98 feet in from the portal a branch working 10 feet long has been driven north 60 degrees west at a point where some galena and sphalerite mineralization, associated with local silicification, is exposed in the back of the main adit. This stringer, up to 14 inches wide, pitches westerly at about 30 degrees into the floor of the branch working. Fifteen other scattered silver-lead-zinc showings were examined, but it is not practicable to describe them all separately in this report. Only a small amount of work, consisting of stripping and shallow cuts, had been done on them, so that little evidence is afforded of the continuity, form, or extent of the mineralization. The sulphides, irregularly distributed through the limestone, generally where it is silicified, occur in some cases as remnants in oxidized cappings. All the showings trend westerly or south-westerly, dips where indicated being generally to the south or south-east into the hill. In two cases, however, dips to the north were noted. No definite structure was observed, discoveries having been made at various horizons in the limestone. These can be roughly segregated into two broad zones, most of the prospecting having been done on the northern one, which includes the previously described *Lee* adit area. This zone, traversing the *H.P.H. Nos. 2, 1, and 3* claims from east to west along the steep, northerly slope to the flats, lies north of and roughly parallel to a dyke or sill of augite andesite, up to 20 feet wide or more, which passes 438 feet south of the *Lee* adit-portal. In this belt there are four showings, numbered for convenience

1 to 4, on the *H.P.H. No. 2* claim at points 480, 650, 800, and 850 feet east of the adit. Selected samples from Nos. 1, 2, and 3 locations assayed respectively: (1.) Gold, trace; silver, 1.8 oz. per ton; lead, 2.6 per cent.; zinc, 8.3 per cent. (2.) Gold, 0.01 oz. per ton; silver, 14.6 oz. per ton; lead, 20.8 per cent.; zinc, 15.4 per cent. (3.) Gold, trace; silver, 11.8 oz. per ton; lead, 29.1 per cent; zinc, 9.2 per cent. The other showings, number 5 to 11, are at the following points described with reference to the *Lee* adit-portal: No. 5, elevation 710 feet, south 72 degrees west, 231 feet; No. 6, elevation 780 feet, south 53 degrees west, 250 feet; No. 7, elevation 765 to 785 feet, south 66 degrees 30 minutes west, 324 feet; No. 8, elevation 860 feet, south 77 degrees west, 427 feet; No. 9 elevation 890 feet, south 73 degrees west, 1,400 feet; No. 10, elevation 750 feet, south 72 degrees west, 2,060 feet; No. 11, elevation 750 feet, south 73 degrees west, 2,160 feet. Of these the No. 5 showing, where stripping was proceeding, consisted of iron-stained capping irregularly mineralized with sphalerite, occasional galena, and decomposed streaks, being exposed for a width of 3.5 feet along its westerly strike and for 10 feet on its dip of from 40 to 45 degrees to the north. Apparently part of a more extensive capping, the mineralization seemed to follow the foot-wall of a dyke of altered rhyolite or trachyte, a dense greyish silicified rock containing much pyrite. A selected sample here assayed: Gold, trace; silver, 1 oz. per ton; lead, *nil;* zinc, 19 per cent. Selected samples from Nos. 6 and 7 locations assayed respectively; Gold, 0.01 oz. per ton; silver, 82.8 oz. per ton; lead, 22.2 per cent.; zinc, 7.6 per cent.; and: Gold, 0.01 oz. per ton; silver, 3.8 oz. per ton; lead, 1.1 per cent.; zinc, 14.5 per cent.

The southern zone, in which mineralization is naturally exposed or has been found at widely separated points on the *H.P.H. No. 6* and *Pendic No. 18* claims, lies on the undulating ground draining to Idas (Canyon) Creek south-west of the *Lee* adit and south of the main ridge. These showings, numbered 12 to 15, are described with reference to the *Lee* adit-portal as follows: No. 12, elevation 725 feet, south 54 degrees west, 1,500 feet; No. 13, elevation 770 feet, south 56 degrees west, 2,130 feet; No. 14, elevation, 1,000 feet, south 67 degrees 30 minutes west, 3,150 feet; No. 15, elevation 725 feet, south 72 degrees 30 minutes west, 3,000 feet. Of these the showing at No. 13 location is an exposure 4 by 5 feet, covered around the edges, being part of a strong oxidized capping containing streaks and bunches of sphalerite, with some molybdic oxide as a yellow incrustation. A selected sample assayed: Gold, 0.04 oz. per ton; silver, 12.2 oz. per ton; zinc, 7.2 per cent. A selected sample from No. 14 location assayed: Gold, trace; silver, 29.8 oz. per ton; lead, 7.9 per cent.; zinc, 20.3 per cent. No. 15 showing, apparently part of an extensive capping, consists of several widely-separated patches of oxidized, silicified limestone containing streaks of sulphides and seams of decomposed material. A selected sample assayed: Gold, 0.01 oz. per ton; silver, 17.4 oz. per ton; lead, 26.4 per cent.; zinc, 7.9 per cent.

Summarizing conditions on the *H.P.H.* property, the various partial and incomplete exposures include promising objectives for development.

Evidence of definite structural control of mineralization is lacking at the present stage of exploration. In regard to the major objective, or the largest body exposed in and adjacent to the two shafts, there is evidence that, though irregular in outline, cross-section, and intensity of mineralization, it has an approximately tabular or pipe-shaped form pitching somewhat flatly to the west or south-west. This is indicated by the mineralization along the western or north-western wall of the cave, which was penetrated farther than had been done before. The adit and adjacent workings have disproved continuity in other respects. In this connection an interesting discussion regarding the origin and form of the *H.P.H.* deposits is contained in Gunning's report previously mentioned. Taking into consideration the present lack of transportation facilities and the economics of silver-lead-zinc production, conditions call for larger tonnage of better-grade and more regular ore than if the property was more cheaply accessible.

North Shore.—A limited amount of prospecting on this group of claims has disclosed irregularly-silicified limestone containing scattered streaks and patches of sphalerite mineralization, with minor amounts of galena, at several widely-separated points along the steep, densely-wooded slope to Nahwitti Lake at 575 feet elevation.

Two indefinite showings, at elevations of 625 and 775 feet, were examined in cuts near the western boundary of the claims east of Nahwitti River and just east of an area of hornblende latite. A selected sample from the upper point assayed: Gold, trace; silver, 6 oz. per ton; lead, 1.3 per cent.; zinc, 13.6 per cent. Another cut in this vicinity, at 725 feet elevation, exposes contact-metamorphic mineralization, consisting of magnetite and cupriferous pyrite,

trending south-westerly along the limestone-volcanic contact. Little work has been done on this showing, from which a selected sample assayed: Gold, 0.02 oz. per ton; silver, 1.2 oz. per ton; copper, 3.3 per cent. Another cut at 587 feet elevation, or just above the lake-level, and about 4,000 feet easterly from the previously-mentioned locations, exposes a stringer of sphalerite-galena mineralization, up to 14 inches wide, in silicified limestone just west of another area of hornblende latite. Here, as at the other points specified, conditions are indefinite.

South Shore.—Superficial prospecting on these claims has disclosed some indefinite mineralization, consisting chiefly of disseminations and streaks of sphalerite, with occasional galena, in a narrow belt of limestone bounded to the north along the lake by hornblende latite and to the south by shales, tuffs, and felsite. The showings examined are across the lake from and approximately opposite and south of the last-mentioned showing on the *North Shore* group. Located on the wooded, steep, north slope to the lake, between the lower limestone-volcanic contact at 800 feet elevation and the upper contact at 970 feet elevation, there are four small exposures of erratic low-grade mineralization at elevations of 810, 910, 935, and 955 feet respectively. They appear to be part of an extensive zone of altered limestone, silicified and iron-stained in part, irregularly mineralized with fine streaks and disseminations of the sulphides. Selected samples assayed: Gold, 0.02 oz. per ton; silver, 0.8 oz. per ton; lead, 13.3 per cent.; zinc, 9.8 per cent.; and: Gold, trace; silver, 0.6 oz. per ton; lead, 0.5 per cent.; zinc, 6 per cent. Silver-lead-zinc mineralization is reported to have been found at other widely-separated points, but these were not examined.

Dorlon. This group, in the Nanaimo Mining Division, consists of four claims held by location and owned by S. S. Pugh, of Port Hardy, and associates. It is situated to the south of the Upper Nahwitti River Valley about 7,100 feet easterly from the *H.P.H.* camp. Slopes adjoining the workings, at elevations varying from 910 to 1,020 feet, are northerly towards the valley at 675 feet elevation, the character of the timbered ground being irregular with occasional benches. The property is reached by a short branch from the main trail leading to the *H.P.H.* group about 16.16 miles from Port Hardy. General transportation conditions have been described in the foregoing *H.P.H.* report.

Limestone extends up the slope from the valley to an elevation of 1,020 feet over a distance of 2,000 feet or more measured from north to south. Towards the south-western corner of the claims there is a large area of dense siliceous volcanic rock. In the vicinity of the main showings, toward the centre of the square block of claims, the limestone is cut by a dyke of silicified and altered aplite, or felsite, 5 feet wide, which strikes north 20 degrees west and has a vertical dip. The mineralization consists chiefly of black sphalerite occurring in massive stringers or as scattered streaks replacing the locally dark to black, generally silicified limestone. Rare specks of galena are associated with the zinc sulphides at one point. Two samples of sphalerite mineralization contained from 0.54 to 0.94 oz. gold per ton and from 0.8 to 2.0 oz. silver per ton. The gold values are apparently associated with pyrite occurring in "hair-line" seams in the sphalerite.

The *Dorlon* claims, known formerly as the *Yucan* group, were staked in 1930, since when work has been confined to shallow cuts and stripping at a few points.

The most definite showing seen, 6 feet long and up to 28 inches wide, is situated on a local bench at 910 feet elevation and adjoins the previously-mentioned dyke to the east.

Structural conditions could not be ascertained due to the limited amount of work done. A channel sample across 28 inches of sphalerite-streaks with intervening oxidized seams assayed: Gold, 0.54 oz. per ton; silver, 0.8 oz. per ton; zinc, 33.6 per cent.; and a selected fresh sample of sphalerite, containing pyrite in cleavage planes, assayed: Gold, 0.94 oz. per ton; silver, 2.0 oz. per ton; zinc, 35.6 per cent. At points from 8 to 12 feet west of the dyke, dark limestone, containing scattered sphalerite streaks, is only slightly exposed. The above showings are near the south-west corner of the *Dorlon No. 1*, which is the north-eastern of the four claims in the block. To the south-west about 300 yards, roughly estimated, and on the *Dorlon No. 4* claim, at 1,020 feet elevation, a small patch had been lightly stripped showing silicified iron-stained limestone containing scattered streaks of the black sphalerite accompanied by occasional specks of galena. The gold values associated with the mineralization at the point sampled warrant systematic prospecting, the showings adjoining the dyke presenting an interesting objective for exploration. Gold values may be present at other points where similar sphalerite mineralization is in evidence but where little or no work has been done.