


810444

NICKEL PLATE REPORT

INDEX

	<u>Page</u>
INTRODUCTION	1 - 2
<b>I SOUTH RIM</b>	
SOUTH RIM SUMMARY	2 - 3
G.M. EXPLORATIONS PROGRAM 1967 - 1970	3
<b>A. <u>KINGSTON</u></b> <u>Accompanying Map No.</u>	
1. Sampling	3
2. Diamond drilling    1300-5-73	3 - 4
3. Geophysics            1300-5-74	4
4. Geology                1300-5-73	4
<b>B. <u>ROLLO AND WARHORSE</u></b>	
1. Sampling	4 - 5
2. Geophysics            1300-5-74	5 - 8
3. Diamond drilling    1300-5-75, -76, -78	8 - 9
4. Geology                1300-5-73, -75, -76, -77	9 - 12
<b>C. <u>PRINCETON GEOLOGY</u></b> 1300-5-73	12 - 13
<b>D. CONCLUSIONS</b>	13 - 15
<b>E. RECOMMENDATIONS</b>	15
<b>II <u>CENTRAL AREA</u></b>	
SUMMARY	16 - 17
<b>A. <u>I.X.L. AREA</u></b>	
1. Underground Sampling    1300-13-12	17 - 18
<b>B. <u>BULLDOG AREA</u></b>	
1. Bulldog Sampling	18
2. Bulldog Diamond Drilling	
1300-1-28	18 - 19



INDEX (Cont'd)

	<u>Accompanying Map No.</u>	<u>Page</u>
<b>C. <u>SUNNYSIDE AREA</u></b>		
1. Sunnyside Bulldozer Trenching		20
2. Sunnyside Underground Sampling (plan attached)		20
<b>D. <u>CLIMAX AREA</u></b>		
<b>E. <u>BULLDOG GRID</u></b>		
1. Bulldog Grid Soil Sampling 1300-4-42		21 - 22
2. E.M. Horizontal Loop Survey 1300-4-40, -43		23 - 24
3. Vertical Component Magnetic Survey 1300-4-41, -43		24 - 25
4. Conclusions 1300-4-43, -42		25
 <b>III <u>NICKEL PLATE AREA</u></b>		
<b>NICKEL PLATE SUMMARY</b>		
A. GOLDFIELD - ELECTROPLATE GRID SURVEYS 1300-1-28		26
B. WINDFALL CANYON AREA 1300-1-32, -33		27
<b>C. NICKEL PLATE GRID SURVEYS</b>		
1. Geochemistry 1300-1-29		28
2. Geophysics and Geology 1300-1-31		28 - 29
3. Conclusions of the Nickel Plate Grid Surveys 1300-1-31		29
4. Copperfield Adit sampling 1300-1-31		29 - 30




INDEX (Cont'd)

	<u>Accompanying Map No.</u>	<u>Page</u>
D. NICKEL PLATE MINE AREA		
1. Underground Sampling	1300-18-12	30 - 31
	Sketch Plan No. 2 and 3	
2. 1501 Portal Sampling	Sketch Plan No. 4	31
3. Underground Geology - 15 level	1300-18-8, -9	31 - 35
4. Underground diamond drilling	1300-18-8, -10, -11	35 - 36
E. CONCLUSIONS OF WORK DONE ON THE CENTRAL AND NICKEL PLATE AREAS		36 - 39
F. RECOMMENDATIONS - Central and Nickel Plate Areas		39 - 40

APPENDIX

4½ Level Sample Plan	41
9 Level Sample Plan	42
8 Level Sample Plan	43
1501 Portal Area Sampling	44
1967 Diamond Drilling Summary	45
1970 Diamond Drilling Summary	46
Legend to Geology Maps	47 - 48



INTRODUCTION

This report is presented as an outline of the exploration work done by G.M. Explorations on the Hedley properties formerly owned and operated by Kelowna Explorations Ltd.

During the course of work conducted, the following areas were delineated as targets in order that their potential for producing an ore body could be assessed.

- (a) The South Rim area, after cursory geological investigation and sampling indicated that widespread copper mineralization and favourable geological structures existed.
- (b) The central sector of the property was found to have weak copper mineralization. It was felt that these occurrences should be investigated further.
- (c) The down dip continuation of the main Nickel Plate ore system appeared to be feasible from sampling done on the 15 level and geological investigations in the Windfall Canyon area.

The discovery of the economical copper and/or gold deposits of two types were anticipated during the option period:

1. Moderate sized, medium to high grade gold-copper shoots, associated with the usual structural controls within skarn zones.
2. High tonnage, low grade copper deposit that could be the product of multiple structures.

In any case, the size and grade of an ore body or bodies discovered would have to be of economical proportions as



to warrant the feasibility of driving a low level adit for production operations.


SOUTH RIM - SUMMARY

The area south and west of the main gold productive areas, called the South Rim area, had been selected for initial exploration due to the occurrences of chalcopryrite mineralization in the Kingston, Warhorse and Rollo workings.

An examination of accessible old workings, preliminary sampling of workings, relogging of available diamond drill core and studying the geological records compiled by previous operators was compiled prior to commencement of work.

The results of this work are summarized as follows:

- (a) The frequent reference to chalcopryrite in the logs of a great number of diamond drill holes from Sunnyside #1 through the Bulldog and along the South Rim area to the Kingston workings, a dip slope distance of over 4000 feet and in several horizons, of a 400 foot thickness of sediments.
- (b) Two separate areas of copper mineralization on the Warhorse Claim are exposed by old surface and underground workings. The intervening 400 feet are relatively unexplored.
- (c) A diamond drilling program comprising eight holes and a total footage of 3513 feet, was carried out by Dundee Mines Ltd. on the Warhorse Claim in 1964. Numerous references to copper mineralization occur in the logs to depths of 200 feet below outcrop, but relogging and



and sampling of the cores to determine copper content has not been completed. Several interesting gold intersections, grading as high as 0.84 oz/ton over a 10 foot core length, were encountered during this program.

- (d) On the Kingston Claim, mineralized skarn zones were explored between elevations 3150 feet and 3400 feet by six short adits and 15 diamond drill holes. The best copper exposures are in the lowest adit and in a shallow winze below this level.
- (e) Copper-gold showings that have received limited exploratory work prior to commencement of work in 1967, occur on the Roll Metropolitan and Princeton Claims.

G.M. EXPLORATIONS PROGRAM 1967-1970

A. KINGSTON

1. SAMPLING


During the 1967 exploration program 33 samples were taken from surface exposures and from underground workings. The No. 1 adit showed the best copper mineralization and a 50 foot length was sampled, averaging 0.07 oz. Au, 0.78 oz. Ag and 1.57% Cu/ton over a 32 foot width.

2. DIAMOND DRILLING Map No. 1300-5-73

On the strength of the sampling results and the favourable geology, three diamond drill holes were drilled on the Kingston in 1967. The best intersection was cut in DDH K67-1, underneath No. 1 adit, assayed 2% Cu/ton over 15.7 feet.

The drill logs of all the Kingston diamond drilling were

.....4



studied and a few plans and sections were drawn up. The results of this study indicated the existence of two mineralized fractures that converged near the portal of No. 1 adit. From these projections an "ore shoot" appeared to have developed on the intersection of the fractures, raking at N 80° W at -50°.

Although the shoot appeared small, DDH K70-1 was drilled in 1970 to intersect the structure 50 feet in elevation down the rake from K67-1. The structure was intersected at the anticipated depth, however, the mineralization had pinched to a mere 3 feet of massive pyrrhotite that assayed 2.36% Cu/ton.

3. GEOPHYSICS Map No. 1300-5-74

The Ronka E.M.-16 and vertical component magnetic survey did not indicate anything of significance. However, the horizontal loop electromagnetic survey indicated a shallow conductor, 700 feet in length, that appears to be the electromagnetic response of the most westerly striking mineralized fracture of the two structures mentioned in the previous section, "Diamond Drilling".


4. GEOLOGY Map No. 1300-5-73

A narrow zone of altered sediments and diorite sill structures lie along the southern contact of the Toronto Stock. This metamorphic zone, within the claim boundary, varies from 150 feet to 250 feet in width and dips to the south at approximately 70° and parallel to the southern contact of the stock.

B. ROLLO AND WARHORSE

1. SAMPLING

From the Warhorse surface exposures and workings, 67 samples.....5  
GIANT MASCOT MINES LIMITED



were taken and 44 were cut from the Rollo. Near the north boundary of the Rollo four trenches were sampled along an east-west strike length of 360 feet and width of 5.8 feet. The average of this zone was 1.24% Cu/ton, 2.15 oz. Ag/ton and 0.025 oz. Au.

A second zone, 400 feet to the south, about 150 feet southeast of the Rollo cabin, returned erratically distributed, but interesting gold and copper values. On the Warhorse two mineralized areas, separated by 400 feet of relatively unexplored ground gave interesting copper results. The northwesterly zone, covering an area 150 x 150 feet, averaged 0.04 oz. Au, 0.55 oz. Ag and 1.51% Cu/ton, while the southwesterly zone, up the formation dip, covering an area 200 x 600 feet, averaged 0.06 oz. Au, 0.61 oz. Ag and 0.80% Cu/ton.

2. GEOPHYSICS Map No. 1300-5-74

A. Vertical Component Magnetic Survey

A vertical component magnetic survey was conducted over the accessible areas of the Rollo and Warhorse claims. The results of this survey are as follows:


1. A strong northwest trend of magnetic highs and lows were found to be cutting across both claims. This trend generally coincides with a system of pyrrhotized northwesterly fractures.
2. A strong magnetic high was found to be centered over the Warhorse workings.

B. Ronka E.M.-16 Survey

This electromagnetic method was done on a reconnaissance basis and was found that the efficiency of the method was reduced because

.....6





of the steep and varied topography. However, an easterly trending conductor was found near the Warhorse workings.

C. Horizontal Loop Survey

On the recommendations arising from the 1968 reconnaissance geophysical survey, a horizontal loop electromagnetic survey was conducted over the more accessible portions of the South Rim.

The conductors found during this survey are plotted on the 100 scale composite plan. These conductors have been plotted with a conductor reference number, and using these numbers the results are discussed as follows:

1. Discussed under the heading "Kingston Geophysics".
2. On the northwest corner of the Warhorse mineral claim a weak conductor, trending N 60° W, was picked up. This conductor corresponds to a mineralized fracture in the immediate area and is parallel to this fracture. The conductor is centered a little to the south, which is because the fracture is southerly dipping.
3. A number of weak responses were obtained from a number & 4. of N.E. mineral fractures. It could be expected that these conductors would give a partial response because the survey was conducted at an angle of approximately 30° to these mineralized fractures.
5. A strong conductor was obtained just northeast of diamond drill hole W70-1. This response would be expected since a number of northeast and northwesterly fractures converge



in this area. Massive pyrrhotite with chalcopyrite and arsenopyrite are common in the workings.

6. On the Rollo only one weak conductor was found. This conductor is probably in the order of a few hundred feet in length and corresponds to a mineralized fracture which is about one foot in width.
7. On the Victoria Fraction one conductor a few hundred feet in length was located, which has generally the same strike as the Rollo conductor.

Six conductors were located as a result of this electromagnetic survey. All except the Victoria Fraction conductor are in response to mineralized fractures that have been located by geological mapping, trenching and old workings or diamond drilling.

Conductor number 7, the only "anomalous" conductor located, is on the Victoria Fraction and has almost identical properties to the one on the Rollo in that both have the same trend and both appear to have identical lengths. I feel that a reasonable interpretation of the Victoria Fraction conductor would be that it is in response to a fracture impregnated with arsenopyrite and pyrrhotite.

One line was done over the vicinity of the Rollo drilling and mineralized cuts. No electromagnetic response was recorded. This is rather strange because the orientation of the coils would be in almost the optimum position. However, an abnormal amount of calcite was observed during geological mapping and there could remain the possibility that this phenomenon could suppress induction.

Generally the horizontal loop method E.M. was moderately successful in being able to return a response over mineralization.

3. DIAMOND DRILLING Map No. 1300-5-78

DDH W70-1

Diamond drill hole W70-1 was collared just south of the Warhorse workings and drilled to a depth of 473 feet at  $-45^{\circ}$ . This hole did not reach the Toronto Stock and was terminated in a hard quartzite and chert formation. The hole was abandoned and the casing was left intact. The best intersection obtained was from 160 feet to 167 feet that assayed 0.38% Cu/ton.

DDH R70-1 Map No. 1300-5-75,-76

When the results which were obtained in W70-1 did not warrant any more drilling in this area, it was decided to test the "Tiger Zone" by drilling R70-1 1100 feet easterly of W70-1. Diamond drill hole R70-1 was drilled to 509 feet to intersect the mineral zone previously sampled and to obtain geological information. A number of mineralized sections were intersected, with the best mineralized fracture against a dike assaying 0.61% Cu, .025 Au and 1.2 oz. Ag across 12 feet, from 139' to 151'.

DDH R70-2

The results obtained from drilling R70-1 were encouraging and a second hole was drilled in the same direction at  $-65^{\circ}$ . Also a dike structure was intersected, and it was felt that more information should be obtained at depth with regards to the nature of the crotch of the dike and Toronto Stock.



The results of drilling R70-2 are as follows:


- (a) The mineralized fracture encountered in R70-1 had pinched while passing through a silland only a few inches of course grained arsenopyrite was recovered.
- (b) The best intersection obtained was .44% Cu across 42.5 feet, from 97.5 to 140 feet.
- (c) The dike intersected in DDH R70-1 was found to be dipping north at 65°.

DDH R70-3

DDH R70-3 was collared approximately 100 feet east of R70-1 and at the same bearing. The object of drilling this hole was to intersect at depth the mineralization in the two cuts above the collar and to intersect the dike. At 96 feet the bit and shell separated from the core barrel and could not be recovered. Most of the hole was in barren diorite and the altered sediments were also barren.

4. GEOLOGY Map No. 1300-5-73


The South Rim has been mapped in great detail in previous years by the geologists of Kelowna Explorations Ltd. Generally, the results of the work done by these men indicated that geologically favourable host rock types, diorite intrusives, and intense fracturing are all present. During the course of examination, particular attention was devoted to sedimentary rock types, minor flexures and the location and attitude of the "marble line", which is a transitional zone from highly altered garnet, epidote, calcite portion of the beds to fresh unaltered sediment. In other words, the "marble line" is



is the outer limit of metamorphism which is directly controlled by the size, shape and attitude of gabbro-diorite intrusives. The Sunnyside and Bulldog ore bodies were found close to the "marble line", which is almost parallel to the bedding of the limestones. The ore controls of these ore bodies is essentially gentle folding, altered limestone-limestone contact, sill and dike network and fracturing. At least three or more of these elements are present and intersecting one another at low angles in the vicinity of an ore body. This is a very important concept and it not only applies to the structural controls of the Nickel Plate and Sunnyside ore bodies, but to many others as well.

The South Rim area has been intruded by the Toronto Stock system of dikes and sills, that is almost at right angles to the bedding attitude of the limestone and quartzite formation. The "marble line", since it is controlled by the Toronto Stock and apophyses, is generally parallel to the diorite contacts. The Kelowna geologists felt that ore bodies, if they existed in the South Rim, would lie in close proximity to the "marble line" as in the case of the Nickel Plate and Sunnyside ore bodies. Hence, the "marble line" was carefully mapped. At the Kingston the "marble line" is steeply dipping to the south, becoming vertical across the upper part of the Warhorse Claim near holes S-6 and S-7, and overturning and dipping to the north as it advances easterly. In any case this study of the marble line indicates the general attitude of the Toronto Stock and it's apophyses.

During the option period, G.M. Explorations geologists endeavoured



to isolate, and study the attitudes and relationships of the various structural elements evident in the South Rim area.

The most significant structural elements isolated by geological mapping are as follows:

1. The southern and southeastern contact of the Toronto diorite stock that extends from the Kingston through the Warhorse and across the northern boundary of the Rollo.
2. The contact-metamorphic zone of dikes, sills, altered sediments and mineralized fractures extending along the south and southeastern contact of the Toronto Stock.
3. A large dike, which is an apophysis of the Toronto Stock, that cuts across the northern boundary of the Rollo mineral claim and trends generally southeasterly toward Tipple, the head of the inclined tramway. This dike, where it emerges from the Toronto Stock, appears to be almost vertical and dips increasingly flatter to the north, and at the same time flaring out into a system of thick sills.
4. In the Rollo-Warhorse area, two dikes, which may be connected, dipping northerly at steep angles have been found 300 - 600 feet south of the Toronto Stock contact. These dikes are of importance because the presence of these dikes widens the contact metamorphic zone.
5. Sills associated with the Toronto Stock and dikes. Generally, as one advances from the Kingston eastward, the sills become more abundant and thicker towards the eastern boundary at the Rollo mineral claim and then thin out again.

6. A system of mineralized fractures, of which the majority trend east to northeasterly, and generally dip northerly at high angles. The other trend is northwesterly and one zone is relatively strong in the Warhorse workings.

An area with all six structural elements present was isolated. This area is 600 to 300 feet wide and 1200 feet in length and includes the Warhorse workings and the workings on the northwest corner of the Rollo. This area is referred to as the "Tiger Zone", and is bounded by the Toronto Stock on the north and a dike structure of varying attitude and thickness on the south. The zone is strongly fractured with the most prominent fractures striking between north  $50^{\circ}$  to  $80^{\circ}$  east and the majority dipping steeply to the north.

The sediments are strongly altered within this corridor. Limestone members of the sedimentary horizon have been altered in various stages to mainly garnet skarn. Epidote and diopside skarn are present in somewhat lesser quantities. Some folding was noticed within the zone, with the fold axis being generally  $N 70^{\circ} W$ , parallel to the long axis of the Toronto Stock.

C. PRINCETON GEOLOGY Map No. 1300-5-73

The Horsefly Canyon section of the Princeton mineral claim was check mapped during the 1970 field season. The rock types and structures were found to be generally similar to the ones found on the Rollo and Warhorse. Contact metamorphism was found to be very intense near the northwest corner where the sediments have been strongly metamorphized to massive garnetite.

One ENE fault is of particular interest in that the adjacent sediments have been folded against it and a number of workings are located nearby. The mineralization in this area was found to be restricted to mineralized fractures that vary from inches to six feet.

D. CONCLUSIONS

The conclusions arising out of the South Rim work are as follows:

- (a) The contact metamorphic zone of altered sediments and diorite which are potential host rocks for a mineral deposit or deposits was found to be restricted to a narrow band along the Toronto Stock and its apophyses. This band varies from 100 to 250 feet wide at the Kingston to 500 to 700 feet wide at the Warhorse Rollo area. Alteration intensity was found to become increasingly stronger towards the Toronto Stock contact. Diamond drilling cores from the Rollo drill holes near the stock contact were so intensely altered that it was nearly impossible to identify the original rock.
- (b) Mineralization was found to be closely controlled and often restricted to fracture filling and fractures along sills and dikes. Better mineralization could be expected at the crotches of dikes and sills similar to the Flange Dike - Hot Sill Structure.



It was also found that mineralization rarely extended far beyond a few feet in the skarnized sediments from a mineralized fracture.

A detailed examination of the geology in and around the Warhorse workings revealed that the wider widths of pyrrhotite and chalcopyrite mineralization were found on the intersections of northwesterly and east-northeasterly fractures. The rock type through which a mineral fracture passes closely controls the width of mineralization. A good example is evident on the Warhorse where a fracture passing through partially altered limestone has a width of three feet and where it cuts across a diorite sill, pinches to an inch of limonitic gouge.

(c) No separate sedimentary horizon was isolated as being a potential ore producing horizon. A brief summary of the rock types and percentage of each type is as follows:

(i)	Diorite	37 - 52%
(ii)	Quartzite and cherts	26 - 29%
(iii)	Skarns	16 - 20%
(iv)	Limestone	2.5- 17%

Of all the rock types the skarns are the most favourable host rock. Diopside skarn is best host rock type of the skarn group and garnet skarn being the poorest. An estimate of the amounts of skarn types is: garnet skarn 75%, diopside skarn 20% and epidote skarn 5%.

The occurrence of these skarn minerals vary greatly from area to area and is often controlled by contacts and fractures. Hence, since these skarn minerals vary so



greatly from location to location, a separate skarn horizon is impossible to isolate. In the Nickel Plate the ore horizons were separated by virtue of the sills that made up the footwalls and hanging walls.

The quartzites and cherts were found to be poorly mineralized except where strongly shattered, particularly at the contacts with intrusives.

Diorite for the most part is barren.

In comparison to the bedding of sediments in the Nickel Plate ore bodies, the sediments in the South Rim are generally much more thickly bedded. This is of great importance because the thinly bedded sequence, due to the multiplicity of competencies, fractures in a more widespread pattern under stress.

- (d) The combination of structures were found to be at too high of an angle to one another in order that a structural control be created similar in magnitude to that of the Nickel Plate system. As mentioned in the section under "South Rim Geology", the structural elements are in most cases at right angles to one another.

E. RECOMMENDATIONS

In view of the conclusions arising out of the work done in the South Rim, no single target was found that would have the potential of being developed into a commercial ore body.

One single recommendation is evident and that is that no further work be done in the South Rim area.



CENTRAL AREA


SUMMARY

The central portion of the widespread alteration zone on Nickel Plate Mountain has been unproductive to date and has received only a minor proportion of the overall exploration and development effort. This is probably due to adherence to accepted geological concepts of ore deposition and the cost of carrying out effective underground exploration in this relatively inaccessible area. However, the downward and lateral extensions of the structures controlling the Sunnysides, Bulldog and South Rim mineralized zones should occur in this area, and the Climax, Exchange and Cleft faults may contribute to the formation of hitherto unknown ore bearing structures.

Exploration drives from the Nickel Plate workings have been extended into this area at elevations of 4160 feet and 4500 feet.

The IXL tunnel at elevation 5215 was driven into the central area and encountered the Climax Fault and interbedded limestones, cherts, garnetized beds and diorite porphyry sills. A preliminary examination of this heading revealed areas of fine grained disseminated pyrrhotite and chalcopyrite mineralization and narrow mineralized skarn horizons. One skarn section assayed 0.20 oz. Au, 5.65 oz. Ag. and 2.00% Cu/ton over a 0.5 foot width. Two samples taken across the Climax Fault averaged 0.10 oz. Au, 0.07 oz. Ag. and 0.22% Cu/ton.

Four of the diamond drill holes in the Bulldog area were assayed for copper and gold. They partially explored an area 150 feet x 130 feet, with an average thickness of 60 feet, part of a



gold ore bearing horizon, and graded 0.07 oz. Au and 0.84% Cu/ton. The adjoining gold ore shoot averages 0.37 oz. Au/ton for an estimated 5635 tons.

The Bulldog #1 stope, which is 300 feet down-dip from the ore zone mentioned above and from which 4328 tons, averaging 0.43 oz. Au/ton was mined, was examined and chalcopryrite mineralization is intimately associated with other sulphides.

A. I.X.L. AREA


1. UNDERGROUND SAMPLING      1300-13-12

In 1967, 53 samples were cut from the IXL area. The IXL tunnel was chip sampled for 150 feet back from the northeast face, in silicified limestone and skarn. A 30 foot section from 60 - 90 feet averaged 0.015 oz. Au, 0.57 oz. Ag and 0.30% Cu, and expanding this section from 60 - 150 feet, the 90 foot length averaged 0.01 oz. Au, 0.44 oz. Ag and 0.19% Cu.

During the 1968 program additional mapping and sampling was conducted in this area. On the 800 level 229 samples were cut and sent in for assay.

A mineralized section 70 feet from the face of the I.X.L. Tunnel averaged .21% Cu over 65 feet. Samples were cut and averaged from both walls of the drift. This was the only section of interest in this particular drift.

A seven foot sample cut in the westerly stub near the IXL portal assayed 0.58% Cu.



Two samples cut near the East end of the 820 crosscut assayed 0.42 and 0.68% Cu. All other samples in this area assayed from 0.16% Cu to nil, with the bulk of the group assaying .03% Cu.

The southerly trending stub drift on the end of the 821 crosscut returned low copper assays. Values were expected to run higher this close to the Bulldog ore body.

All samples collected in the drift north of the main 800 drift returned low copper values.

On the results of this sampling all underground work was terminated.

B. BULLDOG AREA

1. BULLDOG SAMPLING

During the 1967 field season 24 underground and 119 surface samples were cut from the Bulldog workings and surface exposures. The surface sampling failed to indicate a target worthy of further work.

A total of 52 channel samples were cut at 10 foot intervals around the former working faces of the Bulldog No. 1 stope, on the 800 level. For a 5.5 foot mining width the average of the assays was 0.167 oz. Au, 1.08 oz. Ag and 0.41% Cu.

2. BULLDOG DIAMOND DRILLING Map No. 1300-1-28

During the 1967 field season 14 diamond drill holes were drilled from the Bulldog No. 3 adit.

.....19

A complete summary of the underground diamond drilling program, with important mineralized sections, is presented in the attached Diamond Drilling Summary. While this program was not nearly as extensive as the earlier diamond drilling by Kelowna Explorations, it would appear that the copper content of the mineralized zone below the Bulldog #3 level is not as great as indicated in Kelowna Exploration holes B-70, B-71, B-81 and B-77. The average assays for these holes were 0.07 oz. Au, 0.84% Cu.

Hole B67-2 was drilled beside Kelowna Exploration hole B-70.

Comparative results were as follows:

HOLE NO.	F O O T A G E			A S S A Y S		
	FROM	TO	LENGTH	Au.oz	Ag.oz	Cu%
B-70	37.5	137.0	99.5	0.10		1.34
B-67-2	58.5	82.5	24.0	0.27	0.31	0.09
	93.0	110.5	17.5	0.20	1.03	0.33

Hole B67-13 was drilled beside Kelowna Exploration hole B-81.

Comparative results were as follows:

HOLE NO.	F O O T A G E			A S S A Y S		
	FROM	TO	LENGTH	Au.oz	Ag.oz	Cu%
B-81	24.0	94.0	70.0	0.03		0.31
B67-13	34.6	72.5	37.9	0.04	0.30	0.04
	79.0	97.7	18.7	0.02	0.26	0.06

The diamond drilling program was designed to check the grade of mineralization in the known favourable Bulldog ore horizon and the overlying skarn horizon, in which persistent mention of copper mineralization is found in former diamond drill logs. No important gold or copper mineralization was encountered.



C. SUNNYSIDE AREA

1. SUNNYSIDE BULLDOZER TRENCHING

One bulldozer trench was cut 150 feet south-southeast of Sunnyside 2 to check the bedrock as a broad magnetic anomaly was indicated in the 1968 survey over the Coldstream Grid. Dark grey unmineralized and unaltered limestone was exposed in this trench.

The conclusions of this trenching is that the magnetic high outlined as a result of the geophysical work was caused by a halo of pyrrhotite around the Sunnyside No. 2 ore body.

2. SUNNYSIDE UNDERGROUND SAMPLING

On the 4½ level, north of the 4½ stope, twenty vertical chip samples were cut and assayed. Pyrrhotite and pyrite are strong in these old crosscuts, accompanied by sparse, very weak, chalcopyrite.

Sketch Plan Number 1 shows the sample locations and assay returns

D. CLIMAX AREA

No work was done on the Climax area until 1970 and surface soil sampling, magnetic and electromagnetic surveys were done on this area. The details of this work done will be covered in the next section of this report dealing with the "Bulldog Grid Survey".

E. BULLDOG GRID

The Bulldog Grid was cut over the more accessible section of the central section and covers portions of the Copper Cleft, Climax, I.X.L., Mound and Bulldog mineral claims. Geological surface mapping was done by several geologists in previous years

and the resulting maps are on file.

1. BULLDOG GRID SOIL SAMPLING Map No. 1300-4-42

During the 1970 Geochem Survey over the Bulldog Grid, 308 soil samples were collected at 100 foot intervals from just under the top of the "B" soil horizon, at a depth of approximately one foot. All samples were analyzed by the A.A. method for copper and silver.

After plotting the values attained from analysis of the soil samples at 100 foot stations, six distinct anomalous areas were found to exist. On the 100 scale Geochem map each anomalous area is marked with a reference on inside of an ellipse. Generally the anomalies are in two separate areas separated by a strip 700 - 900 feet wide in which the values do not generally exceed 200 ppm.

Anomalies (1) and (2) are in the Climax area and are on either side of the Climax fault. The second group, No's (3) to (6) are found in the Bulldog-Sunnyside band.

The extent, direction and values of the soil samples can be derived from the included Geochem map and there is no reason to discuss these features further under this section.

Generally, as one advances from west to east, the trends of the anomalies change from N85W at anomaly No. 1 to N60°E at anomalies No. 3 and 6. This phenomenon is quite plausible as in the South Rim a number of mineralized fractures have a similar strike and as one advances northerly, the mineral fractures, such as the south fault and the central fault, assume northwesterly strikes.

Anomaly No. 2 is on the direct projection of a N60E structure





that extends across the Warhorse and to the north wall of Horsefly Canyon. This fracture zone is mineralized rather erratically along its strike. On the other hand, extending the trend of this anomaly east-northeasterly, this projection will fall close to Sunnyside 3.

Anomaly No. 1 has a slightly different trend than 2 in that it is trending N85<sup>o</sup> W and is situated directly over the mineralized section near the face of the Climax drift. An explanation for the mineralization found here is that at this point a structural intersection is evident. The mineralized fracture contributing to anomaly No. 1 is intersecting the Exchange dike at 40<sup>o</sup>. Also a similar explanation is applicable to anomaly No. 2 where the IXL dike intersects the mineralized fracture contributing to No. 2 anomaly.

Anomaly No. 3 gains strength towards the Horsefly workings and all that can be said about it is that there is no surface expression that could account for its source.

In the case of anomaly No. 4, a reasonable assumption would be that it is due to the extension of the Horsefly fissure.

Anomaly No. 5 is located near the south limb of the Bulldog fold. It is rather difficult to say if this anomaly is due to the Bulldog ore body near the crest of the fold or a separate unknown mineralized section. Soil sampling on tighter intervals on intermediate lines and a survey check would probably clarify the situation.

Anomaly No. 6 is the geochemical response to the Sunnyside No. 1 mineralization.



2. E.M. HORIZONTAL LOOP SURVEY Map No. 1300-4-43 & -40

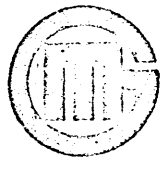
The SE 600 horizontal loop survey was conducted over most of the Bulldog Grid. The total amount of electromagnetic surveying in this area is 22,000 feet. The last two south-westerly lines were not completed due to instrument failure, which could not be repaired in time to complete the grid.

The strike of conductors No. 1 to 4 was delineated from the geology magnetic and geochem data. Conductors 1 to 3 inclusive are almost identical in strike and length. These conductors returned reasonably clear responses on two adjacent lines and would have a length of approximately 500 feet each.

In magnitude the responses from these conductors are less than 20% and extend in width not greater than 100 feet. The parallel nature, similar length and magnitude of these conductors along with the geology and geochemistry indicate that these conductors are due to the electromagnetic response from a parallel set of mineralized fractures probably mineralized with pyrrhotite, chalcopyrite and arsenopyrite.

These conductors have almost identical strike as the Exchange Fault. The Exchange Fault failed to give a clear electromagnetic response. Conductor No. 4 has the same attitude as 1 to 3, but produced only a very weak response.

In the southeastern section of the grid a number of conductors are evident in the Bulldog area. Because the instrument was not functioning, intermediate lines could not be surveyed in order to clearly project these conductors.



Rather than trying to project conductors from line to line I have dealt with these individually because of the complex nature of rocks in this area.

Conductor No. 5 is very weak, however, I thought it worth mentioning in that there may be a northeasterly trend through conductors 6, 5 and the end of line 6N where a response is indicated.

Conductor No's 6 and 7 fall on magnetic highs of over +1000 gammas and in all probability these two are related to a single structure, a fault. No. 7 is broad and stronger than No. 6, indicating that 7 is deeper than No. 6. The cause of conductor No. 8 is difficult to explain, except that it is probably at a depth of 100 feet.


Conductor No. 9 is centered on the Bulldog No. 1 fissure.

3. VERTICAL COMPONENT MAGNETIC SURVEY Map No. 1300-4-41,-43

On the northern half of the grid area no particular trend can be established, whereas on the southern section everything is trending northeasterly, parallel to the geological trend.

The magnetic responses are due to the various amounts of mainly pyrrhotite and minor magnetite.

The magnetic anomalies correspond closely to the electromagnetic conductors as in the case of conductor No's 1, 2, 4, 6 and 7, which could be of interest in this particular case. None of the sources of the above magnetic anomalies are particularly deep. A reasonable estimate would be in the order of 100 feet.



In the case of No. 4, the sources are somewhat deep and related to the Climax fault zone and northeasterly structure that intersect in this area.


4. CONCLUSIONS OF BULLDOG GRID SURVEYS Map No. 1300-4-42, -43

A great number of details of interest are evident from the Geochemical and Geophysical surveys. A good many of the interesting areas have been investigated by previous geological mapping, workings and diamond drilling.

Only the following could be considered new data:

1. The northeasterly Geochem trends and associated structures as indicated by soil anomalies 1 and 2.
2. Magnetic and electromagnetic anomalies coincident with Geochem anomaly No. 4 in the Bulldog area, which with a bit of detailed work and possibly drilling, would explain the size and source of these features.

The ultimate conclusion of this year's work on the Bulldog Grid is that no single large structure was delineated.



NICKEL PLATE SUMMARY

The Nickel Plate gold deposits occur in Triassic limestones and quartzites that have been intruded by a stock and associated complex of dikes and sills; fractured and folded. Total production, 1904 through to 1955, from all operations on Nickel Plate Mountain is reported to be 3,800,000 tons valued at \$48,000,000. Present ore reserves are estimated at 67,118 tons, grading 0.245 oz. Au/ton.

Mining was conducted starting from the east side of Nickel Plate Mountain down the northwesterly rake of the ore bodies to the 15th level where gold values suddenly dropped. From the 15th level, the ore at the contacts of the Flange Dike and Hot Sill were pursued with the sinking of the Morning shaft southwesterly from 15 level down to the 4150 level. This ore was mined to the Nick 'O' Time - Morning boundary. When no agreement could be reached with regards to the ore between the 4150 winze and the 3750 level, no further mining advances were made in this area.

Copper mineralization is reported, in diamond drill holes, and geological mapping, however no attempt had been made to assess the grade and extent of copper values.

A. GOLDFIELD - ELECTROPLATE GRID SURVEYS Map No. 1300-1-28

Vertical component magnetic, Ronka E.M.-16 and soil sampling surveys were conducted over this grid during the 1968 field season. The results of the soil analysis reveal that the amount of copper in the soils range between 5 to 50 ppm. Also, the mag and electromagnetic surveys did not turn up any results that would generate any further interest in this area.



B. WINDFALL CANYON AREA Map No. 1300-1-32, -33

Reconnaissance of this area has found that several parts of Windfall Canyon are mineralized. The Flange Dike on the south wall of the Canyon is erratically mineralized along its contacts, with pyrrhotite, chalcopyrite and minor arsenopyrite up to widths of 10 to 20 feet. During 1913-14, the "B" series of eight diamond drill holes were drilled in this area. Several intersections were reported to have copper mineralization. Two sections, numbers 1300-1-32 and 1300-1-33, have been drafted up in order to try to correlate the information found in the Nickel Plate and Mascot workings with that found in the "B" series drilling.

Section 1300-1-32 is in the plane of 1501 crosscut and extends through to 3750 level. This section indicates that the mineralized intersections of diamond drill holes 5 and 6B could be the downward projection of the Nickel Plate horizons.

Just west of the collars of 5 and 6B, interesting copper mineralization was noticed along the wall of the bluff.

Section No. 1300-1-33 was drawn up in order to determine whether any folding or any other structure exists in this area. Correlation was found to be difficult because of the wide spacing of drill holes and ambiguities in identification of rock types in the drill logs.

The 3750 level and 2750 raise were examined and in each case only minor amounts of chalcopyrite were found associated with pyrrhotite mineralization.



C. NICKEL PLATE GRID SURVEYS

The object of conducting these surveys over this area was to try to delineate a structure or structures such as faults and/or dikes that could be possible structural controls for the northerly extension of the Nickel Plate ore bodies. Copper mineralization was found in interesting amounts in the Copperfield adit and is evident in some of the mineralized shears a few hundred feet north.

1. GEOCHEMISTRY - SOIL SAMPLING Map No. 1300-1-29

A total of 127 soil samples were collected from this grid and analysed by the atomic absorption method for copper and silver. Since copper was in greater quantities in the soils than silver, only the copper values have been plotted and contoured.


One strong soil anomaly resulted from this work and is centered around the Flange Dike. The 2400 ppm peak is located over a section of mineralized sediments lying just to the north of the Flange Dike and a small stope that broke through to surface.

Soil values drop off quickly to around 70 ppm just to the north of the soil high.

2. GEOPHYSICS AND GEOLOGY Map No. 1300-1-31

The composite geology, magnetic and electromagnetic map of this grid sum the details of the surveys rather well.

Geological work was done on this grid area mainly to correlate the geophysics and soil sampling to the various



structures. No dikes, other than the Flange, were found within the Grid area.

Several magnetic changes are in existence in the area north of the baseline. These changes are all trending either east-west parallel to the Flange Dike and pyrrhotized fractures or northwesterly parallel to northwesterly faults.

An explanation of the electromagnetic conductors is as follows:

- (i) Conductors 1 and 2 - response from the Central Fault Zone
- (ii) Conductors 3 and 4 - contacts of the Flange Dike
- (iii) Conductors 5 and 7 - weakly pyrrhotized fractures
- (iv) Conductor 6 - appears to be isolated
- (v) Conductor 8 - strong northwesterly fault that produced a somewhat weak electromagnetic response, probably due to relatively unconductive fault gouge.


### 3. CONCLUSIONS OF THE NICKEL PLATE GRID SURVEYS

1. The Flange Dike system and Central Fault zone were found to be the only mineral structures of significance in this area.
2. Copper values in the soils were found to be restricted to an area 300 to 600 feet wide centered around the Flange Dike. In any case, it appears quite feasible to conclude that the Flange Dike system is the loci and structural control of copper mineralization in this area.

### 4. COPPERFIELD ADIT SAMPLING Map No. 1300-1-31

The Copperfield adit was driven in mineralized skarn, probably





the Purple horizon, along the southern contact of the Flange Dike. A section 30 feet from the face to the face was sampled. The average of these samples assayed 1.11% Cu/ton over a 30 foot width.

D. NICKEL PLATE MINE AREA

1. UNDERGROUND SAMPLING Map No. 1300-18-12 Sketch Plan 2 and 3


In 1967, after a cursory examination of the Nickel Plate workings, the 1500 crosscut was sampled from collar to face. The assay results of this sampling returned an average of 0.46% Cu across 200 feet. The 1502 drift was examined and one grab sample from a stub at 4060N, 5420W, assayed 0.65% Cu, 0.48 oz. Ag/ton.

Copper mineralization was noticed in the 1501 crosscut in the Orange, Red and Purple horizons. The Purple horizon on this level was not stoped and thus left intact.

During the 1970 exploration program the 1501 crosscut, 1503 crosscut, a section of the 1502 drift, Red stope, 15-3V stope and the Orange stope were sampled.

The best section sampled on 15 level was from the collar of the 1502 drift, near and including the Central Fault to the 1500 level - Mascot 4800 level manway. This section, near the Orange Footwall, assayed 0.626% Cu/ton for 170 feet.

The average of 45 samples taken from Red stope was 0.189% Cu/ton, 13 samples taken from the 15-3U stope was 0.13% Cu and 18 samples from the Orange stope was 1.30% Cu. The samples cut in the Orange stope were along the Orange Footwall and within 60 feet of the Central fault.



Sampling done in the 1502 drift, on the south fault and a fault 320 feet to the south returned only low assay values.

The section from the Flange Dike northerly along the 909 and 901 drifts was sampled on 9 level. A section of 110 feet averaged 0.585% Cu/ton. Sketch plan No. 2 has these values and averages plotted.

On 8 level the Orange or "83 stope" was sampled from the Flange Dike northerly along the western wall. The average of the assays over 80 feet was 0.50% Cu/ton. Sketch plan No. 3 shows where the samples were cut.

2. 1501 PORTAL SURFACE SAMPLING Sketch Plan No. 4

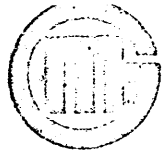
Copper mineralization was noticed a short distance above the 1501 portal while mapping was being done in this area. Sampling was done along two lines and a total of 28 samples were cut from the outcrops in this area.

The bottom line, 160 feet in length across the Central fault for a true width of 60 feet, averaged 0.53% Cu/ton.

The mineralized sediments in this area are confined to the hanging wall contact zone of a sill and the Central fault zone. An estimate of the thickness of the hanging wall contact zone of the sill would be in the order of 20 to 30 feet in the sampled area of the bottom sample line.

3. UNDERGROUND GEOLOGY - 15 LEVEL Map No. 1300-18-8, -9

The general structure in the 15 level mine area is a horizontal lying gentle anticline that has been cut at low angles to the fold axis by the steeply dipping Flange Dike and Central fault zones.



The sediments in this area are mainly quartzites with minor thinly bedded limestones, cherts and garnet diopside skarns, garnet skarn being the most common. Diorite sills flaring out from the Flange Dike have intruded the sediments and make up approximately 50% of the rock by volume.

Several minor folds exist, and are important in the localization of ore. The flexure in the 15-3U stope is a good example of this case. These flexures die out down plunge to the west as does the main Nickel Plate anticlinal-synclinal structure.

A unique breccia is prominent in this area between the Central fault and the Flange Dike. This breccia is made up of fragments and all rock types ranging in size from 1/8 inch to one foot and often longer. The fragments are angular and cemented with calcite, some quartz and in some cases chloropal.


This breccia is lying in the same attitude as the bedding and does not outcrop in Windfall Canyon.

I doubt very much if this breccia is a product of a single thrust fault or fault system at very low angles to the bedding, but has resulted from the intersection of three fault zones:

These faults are:

1. Bedding thrust fault as encountered in DDH U15-1.

A distinguishing feature of this fault is its intense chloropal alteration.

- 
2. "4300" fault which cuts the 1501 crosscut 100 feet west of U15-1. This fault is in the order of ten feet wide, and is strongly bleached. On the 4300 level this fault is closely associated with good grade gold ore.
  3. Central fault zone. This zone is strong on this level. DDH U15-2 penetrated the Central fault and it was found to be 64 feet wide, very strongly altered to calcite, chloropal, chlorite and strongly leached. Gold values were found to increase in near the fault. A few short sections had specks of native copper associated with intense chloropal alteration.

The breccia is confined to only specific horizons such as the Orange footwall, the Yellow, etc., and is post mineral. Weak values in gold and copper have been obtained, suggesting that in view of the loose packing, the sulphides have been leached out of the fragments.

The main structural feature observed while mapping the 1502 drift was a fold axis near the centre of the most southerly drift. North of the axis the general strike of the sediments is N05E to N30E, whereas on the southern limb the strike of the beds is generally N to N20W.

Skarn alteration has been intense in the 1502 drift and crosscuts. The skarns are generally coarse grained but are barren except for very restricted areas around fractures and faults.

Some dikes were cut by the 1502 drift, but it appears that the only influence the dikes have is to further the development



of skarn minerals. No sulphide mineralization of consequence was found to be associated with the dikes.

Two fault zones are of significance:

1. South fault, probably in the order of 10 to 20 feet wide and carries mainly pyrrhotite with minor chalcopyrite and arsenopyrite. Samples taken across this fault averaged 0.02% Cu across 20 feet.
2. A fault zone 320 feet south of the south fault, which is the same strike as the south fault was sampled across a 10 foot width. This fault assayed nil copper.

Ten samples were cut south of the previously mentioned fault. Although this sill footwall carried strong pyrrhotite, the copper values were found to be low. The best copper assay obtained from this section was .07% Cu for 7 feet.

4. UNDERGROUND DIAMOND DRILLING Map No. 1300-18-8, -10, -11


Diamond drilling commenced on 15 level after 3700 feet of four inch airline was installed from the compressor at No. 3 portal, through the upper stopes, down the Dickson Incline and out to a drill setup on the 1501 crosscut.

A total of five holes were drilled in order to test the down dip extension of the Nickel Plate ore bodies and the Central fault section in this area.

The best mineral intersection cut in this diamond drilling was in drill hole U15-1, from 0 to 210 feet, which averaged 0.327% Cu/ton.

The results of the diamond drilling are explained in

the following details:

- 
- (a) Copper values decreased westerly along the 1501 crosscut.
  - (b) No sulphide mineralization of interest was found below the Orange horizon in diamond drill hole U15-1.
  - (c) Copper values decreased northerly from the Flange Dike - Hot Sill network. The assays from diamond drill holes U15-3 and U15-2 demonstrate this northerly fading of values.

A complete summary of the underground diamond drilling, with important mineralized sections, is presented in the attached Drilling Summary.

E. CONCLUSIONS - CENTRAL AND NICKEL PLATE AREAS

CENTRAL AREA

- (a) Mineralized faults, striking east-northeasterly to west-northwesterly, have been located by soil sampling and horizontal loop electromagnetic surveys in the Climax-Copper Cleft area. Copper mineralization occurs at the intersection of these mineralized fractures with the Exchange and I.X.L. dikes. A portion of such a structural intersection was sampled near the face of the 8 level Climax drift and found to assay 0.21% Cu over 70 feet. Similarly, sampling done around the I.X.L. Dike intersection returned low copper assays.
- (b) A study of all the work done on the Copper Cleft, Climax, Exchange Fraction, I.X.L. and Mound mineral claims reveals:

.....37




- (i) Folding is gentle,
- (ii) Only two identifiable dikes exist that cut the sedimentary beds and fold axis at high angles.
- (c) The diamond drilling done on the Bulldog No. 3 level concluded that the mineral zone beneath this level is not as great as was indicated by Kelowna Exploration diamond drill holes.
- (d) Soil sampling and geophysics outlined an anomaly just south of the Bulldog No. 3 adit. The magnetic response indicates that the body producing the anomaly is in the order of 2 to 3 times that of the Bulldog ore body. In any case, this body would be too small to warrant any further work in this area.
- (e) No downward continuation of the Sunnysides and Bulldog ore bodies was found to be apparent.

Generally, in the Central Area, the mineral bodies are too scattered and too small to have the potential of being a large low-grade prospect.

NICKEL PLATE AREA

- (a) From the soil sampling done on the Nickel Plate Grid, copper values were found to be restricted to the Flange Dike structure.
- (b) Throughout the Central portion of the Nickel Plate workings, copper values were found to be mainly on the north contact of the Flange Dike and along the contacts between the altered sediments and diorite sills. The Orange footwall



is a good example of this phenomenon. Very little chalcopyrite was found in the section of the mine south of the Flange Dike, and from 8 level through to surface. The sampling done on 15 level shows a similar result in that area.

- (c) The downward extension of the Nickel Plate ore was found, by diamond drilling, to die out down rake from 15 level. This is due to mainly two reasons:
  - (i) The Flange Dike and Nickel Plate fold structure diverging.
  - (ii) The Nickel Plate fold flattening and becoming a less effective ore control.
- (d) Samples collected from selected underground areas where copper mineralization was strong shows that the grade of mineralization ranges from 0.189% to 0.626% Cu over appreciable widths.
- (e) The upper Purple horizon or a horizon above could be a prospective copper bearing horizon as indicated by the 1501 portal surface sampling and by the mineralization found in the Copperfield adit horizon.
- (f) Considering the general aspect of structure, the Nickel Plate, Sunnyside and Bulldog ore bodies vary from the established concept of contact metamorphic deposits in that these mineral deposits are not located close to the main intrusive stock but are situated some distance away from the stock along apophyses. Such is the case with the

case with the





Flange Dike and Sill system and Nickel Plate ore bodies where multiple structural elements intersect at low angles to one another. There always remains the possibility that a contact metamorphic ore body may exist within the contact zone surrounding the Toronto Stock. However, no new data or ideas can be derived from the work done during the 1967-70 option period that would lead to the exploration for contact metamorphic ore body along the confines of the Toronto Stock contact zone.

- (g) The 1967-70 Exploration Program was conducted on the Nickel Plate workings in order to assess the copper content left in the old workings and in the lateral and vertical extensions. The results of the work done indicates that dilution due to unmineralized diorite sills would be high and that the grade and amount of copper would be insufficient to justify the mining and milling of ore from the old workings and immediate areas.

F. RECOMMENDATIONS

No single mineral structure or zone of economical potential was found directly or indicated by sampling, soil sampling, geological investigations, geophysical surveying and diamond drilling on both the Central Area and Nickel Plate area.

.....40



In view of this fact it is recommended that G.M. Explorations Limited do no further work on the Nickel Plate mineral claims owned by Burden Investors Services Inc.

Respectfully submitted,

*Walter S. Clarke*

*for* A. Gerun, Geologist

AG/lg

January 20, 1971