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HEDLEY CAMP

February, 1967

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HEDLEY CAMP

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SUMMARY AND CONCLUSIONS:

The Hedley camp produced roughly four million tons of 0.43 oz. gold between 1904 and 1954. The two main producers, Kelowna Mines Hedley and the Mascot, are essentially mined out, but should be re-examined if 0.2 oz. gold becomes attractive in this camp. The staffs at these properties were among the more competent, and exercised good geological knowledge in locating the ore in and near their operations. Competing now, with the wealth of knowledge and facilities they had there, is not attractive.

A few speculative chances remain within one or two claim lengths of the former operations, but there is no evidence of any major tonnage of grade which would be economic today in these. In fact, if there were any obvious good chances, the former operators would have acquired them when conditions were considerably more favorable. The South Rim and similar areas are best left for a better gold mining 'climate'.

QUIEN SABE!

The camp has not yet had a good search through its overburdened areas with geochemistry and geophysics. I do not believe the terms of an agreement currently suggested by Kelowna Mines Hedley are suitable for this type of program. Moreover, the open ground in the area was currently staked by Giant Explorations.

Continuing information on the area should be filed with the intent of following up when the ground can be acquired under favorable terms.

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INTRODUCTION:

The records of the Kelowna Mines operation supplied by Wm. C. Douglass to Silver Standard Mines Ltd. are summarized. Files accumulated by the writer, including a report made with the late Dr. D.F. Kidd a few months before the mine closure in 1955 were found very useful. Several hours discussion of these data with John Lamb, a former geological engineer employed at Hedley, was most informative.

This report is intended to outline exploration possibilities rather than deal with past performance, hence the fringes of the old mine are studied more than the old mine itself. Readers desiring more detail on the old mine are referred to the Bibleography below. Item 3 is of particular interest to geologists as it might be considered the late Paul Billingsley's 'bible'.

BIBLEOGRAPHY:

1. 1910 - "Geology and Ore Deposits of the Hedley Mining District" - Charles Camsell - G.S.C. Mem. No. 2.

2. 1930 - "Geology and Ore Deposits of Nickel Plate Mountain, Hedley, B.C." - H.S. Bostock - G.S.C. Summary Report 1929 Pt A pp. 198 - 253.

3. 1941 - "The Ore Deposits of Nickel Plate Mountain, Hedley, B.C. - Paul Billingsley and C.B. Hume - CIM Trans 1941 pp. 524 - 590.

4. 1945 - "Contact Metamorphism at Nickel Plate Mountain, Hedley, B.C." - Victor Dolmage and C.E.G. Brown - CIM Trans. 1945 pp. 27 - 67.

5. 1955 - "Examination of the properties of Kelowna Mines Hedley Ltd." - D.F. Kidd - private report.

6. 1964 - "Geology of the South Rim Area" - J. Lamb.

7. 1965 - "Dundee Mines Ltd. - Status of Exploration" - J. Lamb.

HISTORY:

The Nickel Plate was the oldest mine in the camp. It developed the gently plunging Nickel Plate "ore beds" and the Morning, Bulldog, Sunnyside 1, 2, 3, 3 1/2, 4, and 4 1/2 orebodies.

The original Hedley Gold Mining Company mined from parts of these prior to 1930, and then closed down. Billingsley studied the geology in great detail following the closure. His thoroughness and accurate observation of complex relationships led to discovery of important extensions and new orebodies. Kelowna Mines Hedley was formed in 1932 to take advantage of his recommendations. The gold price rise in 1933 gave the renewed enterprise an added 'lease on life' which continued until exhaustion of known reserves in 1955.

The Mascot produced from 1936 to 1949 from an eight acre pie-shaped fractional claim which covered a portion of the Nickel Plate "ore beds".

The Canty, to the northeast of the Nickel Plate, was developed in the boom of the 1930's by the same principals who controlled the Mascot.

The Good Hope and the French Mines are on Winters Ridge, one and one-half miles east of the main camp. The Good Hope produced from 1945 to 1948 from surface pits; the ore was milled by Hedley Mascot, the controlling company. The French was mined from 1950 to 1955 by Kelowna Mines Hedley; and from 1956 to 1961 under the name French Mines Ltd., with Cariboo Gold Quartz affiliation.

Production from the total camp is as follows:-

	Tons	Oz.	Grade
Nickel Plate Mine -			
1904 - 1909 (Marcus Daly) plus 1909 - 1930 (Hedley Gold)	1,226,000	643,220	0.525
1934 - 1955 (Kelowna Mines Hedley)	1,975,597	777,490	0.394
Hedley Mascot -			
1936 - 1949	686,625	254,051	0.37
Forward -	3,888,222	1,674,761	

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Camp Production - cont'd:-

French Mine -	Tons	Oz.	Grade
1950 - 1955 (Kelowna)	32,463	25,960	0.80
1950 - 1955 (French Mines)	53,085	26,277	0.49
Good Hope -			
1945 - 1948	4,563	2,830	0.62
Canty -	3,220	815	0.25
TOTAL: (including fig's on p. 3)	3,981,553	1,730,643	0.436 Av.

UNDERGROUND DEVELOPMENT:

The Nickel Plate was developed from a main adit at 5600 feet elevation, near the now abandoned upper camp. Lower levels of the Nickel Plate 'ore beds' were served by the Dixon Incline, which extended at 30 deg. from the 5600 level to a lower main haulage at 4850 elevation (1500 level). Below 4850 feet, the Morning orebodies were served by an inclined shaft at 50 deg. extending to 4150 elevation. The lowest sections of ore on the Morning claim were reached by a winze from 4150 to 3700 foot elevation. Below 4850 several connections were made between the Nickel Plate and Mascot workings.

The Sunnyside orebodies were mined from a main haulage level at 5455 elevation (450 level) which surfaced south of the Nickel Plate orebodies.

The Mascot was developed by a series of levels from 4300 to 5200 elevation. The main level was at 4800 elevation.

The French Mine, a long manto-like ore zone, was developed from levels at 3920, 3955 elevation, and 3785 (Cariboo) elevation.

GEOLOGY - REGIONAL:

The Hedley camp lies in the Nicola formation, which is here altered limey sediments intruded by numerous dykes, sills, and

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stocks. Metamorphism is presumably induced by these intrusives, and is widespread and intense. A major fault, the Bradshaw, strikes through the west side of the productive area, and has several associated faults; minor faults are also prevalent.

GEOLOGY - LOCAL:

(a) Rock types -

The productive Nickel Plate sediments are limey argillites, limestone, and some thin quartzite and chert beds dipping about 20 deg. westerly. The base of the sediments is the massive Sunnyside Limestone.

A complex of dioritic gabbroic sills and dikes intrudes the sediments. Some of the intrusives are reported to be stocks (e.g. Toronto Stock), but these might also be unusually thick sills or laccoliths. The most important dikes trend north-westerly, and have steep dips. These dikes form an important ore control. The sills, or rather sheets since in places they angle across the beds, are similar in composition to the dikes, and branch from them. They are equally as important as the dikes in ore control. One sill in particular, which was known as the Midway sill in the Kelowna workings, and as the Hot sill in the Mascot, had much ore near it; a prime locus of ore-deposition being near intersection with the Flange and Central dikes. In places all four quadrants formed by the intersection of dike and sill made orebodies which are pipe-like in shape. A sill known as the Flipper sill branches from the Sunnyside 4 1/2 dikes near the middle of the Sunnyside 4 1/2 orebodies. One dike, in the Sunnyside 3, called the Subway dike, was more similar in attitude to the 'sills' than to the steeply-dipping dikes.

Post ore dikes include Black dikes and Brown dikes, both lamprophyre.

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Geology - Local - cont'd:-

Rock Types - cont'd:-

Granodiorite, presumably a batholithic mass, outcrops at the base of Nickel Plate Mountain. Its elevation increases going easterly, and it underlies the French Mine at a few hundred feet depth.

(b) Rock Alteration -

Alteration is intense over much of Nickel Plate Mountain and parts of Winters Ridge to the east, near the French and Good Hope.

Skarn formed from the limestone and limey beds is of major importance because it is host to most of the ore. Green pyroxene skarn lies closer to the unaltered sediments, and is transitional to the reddish-brown garnet skarn near the center of the skarn bowl. The mineral deposits are found chiefly in the pyroxene skarn. The contact between skarn and unaltered sediments is in most places abrupt, though skarn interfingers with limestone beds where it has extended out into some of the limey beds which were most susceptible to skarn formation. The skarn-lime contact is called the Marble Line, and the Marble Line forms the floor and rims the bowl-shaped major skarn zone. The Marble Line is fairly flat in some of the explored central parts of the bowl where it parallels the gently dipping beds. However, it cuts across bedding and is steep on the north, east, and south rims. The Marble Line is a major ore control because all the Nickel Plate and Mascot ore was found within a few hundred feet of it, inside the skarn bowl.

Bleaching of the dikes and sills in the upper parts of Nickel Plate Mountain is the second type of rock alteration. The original diopside is altered to pale augite, and much silica was added. Note that this alteration could be allied to the formation of the skarn since both result essentially from an addition of much silica.

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(c) Structure -

The major fault in the camp is the Bradshaw Thrust fault, which strikes north-easterly, and dips north-westerly. It bounds the camp on the west. It passes through the valley occupied by the village of Hedley, and continues north-easterly up Twenty-mile (Hedley) Creek.

Several zones of thrust faulting are known in Nickel Plate Mountain. These zones strike more or less parellel to the Bradshaw, and dip toward it at a flatter angle than the Bradshaw itself. Billingsley considered them to be flatter strands of the Bradshaw. The crushed zone occupied by the Midway or Hot sill is one of these zones, it may correlate with the Rollo fault zone on the South Rim. The major brecciated zone locally called the District Footwall Fault is another thrust strand; its outcrop strikes north-south just east of the Nickel Plate and Sunnyside 4 1/2 and 3 orebodies.

North to north-westerly trending faults with steep dips are fairly common. One member of this group is known along the north-east boundary of the Climax claim. A second member caused minor displacement in the Morning orebodies.

An unexplained mass of brecciated skarn, much of it making ore, was found in the Morning and Mascot Fraction claims below the 4150 level. It does not extend either upward or horizontally.

Three distinct fold types, without direct relation, are known in the area. The major fold is the regional assymetric anticline, which has steep easterly dips on Sixteen-mile Creek, east of the camp, and low dips (20 deg.) westerly on Nickel Plate Mountain.

Two groups of secondary folds influence the westerly dipping beds on Nickel Plate Mountain. The first group trends north-westerly, parallel to the north-westerly trending faults, and are perhaps related to these faults. They are thus transverse to the westerly dipping beds, and form more or less symmetrical open wrinkles with

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amplitude of a few feet to a few hundred feet plunging northwesterly (down the 20° dip of the west limb of the major anticline). These folds are known in many places as 'noses' and are in many places an ore control, particularly in the Nickel Plate 'ore beds'.

The third fold type, which is also of local effect only, is the Morning type. These folds lie on the back of the major thrust zones such as the Midway and District Footwall zones, usually where these zones have an abnormally steep dip. The folds strike parallel to the thrusts, and are overturned to the east, thus they fit the category of drag-folds associated with the thrusts. They vary from open to almost isoclinal. The Morning and Sunnyside 3 orebodies occur on them.

MINERALIZATION:

The ore in Nickel Plate Mountain is gold, with the values tightly locked in massive to crystalline arsenopyrite. However, not all the arsenopyrite is auriferous. Also gold occurs in skarn without much arsenopyrite at both the French and Good Hope Mines. In general, sulphides in the orebodies are sparsely disseminated - constituting 5% or less of the total weight. Chalcopyrite and pyrrhotite are present in places, and the silicates scapolite and axinite may be prevolent in the better grade sections..

ORE CONTROLS - SUMMARY:

The recognized ore controls are:-

1. The Marble Line is invariably within a few hundred feet of, and below the ore zone.
2. Diorite to Gabbro prophyry dikes and sills such as the Midway and Flipper sills, and Flange dikes have ore on their contacts, and particularly at their intersections.
3. Major thrust faults appear to have been the channelways for introduction of the silica and gold-bearing 'fluids'.
4. Transcurrent folds provide fairly precise ore controls.

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Recognized Ore Controls - cont'd:-

5. Drag-folds associated with the thrust faults also make fairly precise ore controls.
6. Pyroxene skarn seems a better host than the garnet skarn.

Consideration of these controls makes it evident that some inter-relation exists in places. They might seem both numerous and complex, but the Mascot and Kelowna staffs used them continually, and with continual success, during their mining from 1933 to 1955. They are obviously far more reliable (and far more productive) than the controls which are used to direct exploration at Sandon.

ORE FINDING CHANCES:

Exploration using the above listed controls kept the Kelowna Mines Hedley operation at a comfortable milling rate of 300 to 350 tons per day. However, in the last four years of operation the amount spent on exploration, and the tonnage of ore reserves, declined steadily. Close-in exploration chances were slowly exhausted, and little or no funds were allotted to speculative exploration. The speculative funds, roughly $600,000 were spent at Sandon.

Detailed study of all the records might disclose a few locations where extensions, or new close-in orebodies were missed. However, one must concede that the resident staff were very capable, and Billingsley gave them the initiative and direction necessary to achieve optimum results. Lamb's opinion, and my own, are that the old mined area is well explored, and almost completely exploited of the better grade ore.

The ore reserves at the beginning of 1955 were reported at 160,747 tons of 0.339 oz. Au. During 1955, prior to closure on September 23, tonnage mined was 90,572 at 0.42 oz. Arithmetically, this should leave 70,000 tons of 0.26 oz. reserves, but statistically,

an over-run of 23% is reported. Thus reserves could be in the order of 100,000 tons of 0.26 or better grade. Lamb admitted that the old records of drilling, which are all available, are worth a study, particularly with regard to the uppermost and lowermost beds (the Upper Purple and Lower Yellow) in the old Nickel Plate ore bed series, if 0.2 oz. gold ore becomes interesting in this camp.

The next proximate area which appears of interest is the area below the Sunnysides and Bulldog, above the dip of the Marble Line. Two long exploration headings, the 5450 and 4850 levels, tested this area. The 5450 level found the 'blind' Sunnyside 4 1/2 orebodies which yielded 180,000 tons of 0.918 oz. Au. Many drill holes tested the ground around these levels. If the tunnels were still accessible it might be worthwhile to adapt the induced potential method to underground survey here, but no other exploration work appears attractive at present.

CLIMAX AREA:

An area on the Climax claim, and on south part of the Copper Cleft claim, roughly 2500 feet southwest of the head of the Dixon Incline in the Nickel Plate Mine, contains some of the ore controls. The Marble Line is near a tunnel at 4150 feet elevation driven south from the Morning workings. This tunnel was driven between 1948 and 1951, and the last few hundred feet was reported driven with no geological control. A sill-like body, suspected to be the southerly extension of the Midway sill, was cut at places along the tunnel. A major steeply dipping northwesterly trending fault zone, the Climax fault, outcrops on surface 1450 feet above. Advice is that no drilling was completed off the last several hundred feet of this working. According to reports of the old Hedley Gold Mining Company surface trenches near the Climax fault contained 0.88 oz. Au across two feet, and 1.02 oz. across six feet, 40 feet northwesterly from the above trench. A shallow drill hole in this area yielded 0.75 oz. across two feet. The tunnel below

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seems a long way from this known mineralization, but it would seem that further testing by drilling from the tunnel was certainly warranted while it was accessible.

SOUTH RIM AREA:

The geology of the South Rim of the skarn bowl, which includes the Rollo, Warhorse, and Kingston claims, shows that this area is almost a dip slope. The outcrops of the sills cover large areas, and obscure other features of the geology. The Midway sill is traced towards this area, and is likely the sill exposed on the south corner of the IXL claim. It there merges with, or is interrupted by, a large mass of diorite porphyry.

South of this diorite prophyry, and close to or perhaps a few hundred feet stratigraphically above the projection of the Midway sill and the favorable Nickel Plate ore beds, conditions return to those favorable for ore deposition.

Dundee Mines Ltd. completed eight drill holes here in 1964. A limited amount of drilling by the Trethewey Syndicate, and by Kelowna Mines Hedley, had previously shown scattered sub-ore mineralization. J. Lamb gave some geological direction to the Dundee work, and his report of December 1964, summarizing the results is available. Prints of his maps, and a longitudinal section showing the drilling accompany this report.

Favorable Features of this area include:-

1. The Marble Line which trends NNW across the Warhorse claim, and swings to WNW across the Kingston. It is steep, and perhaps even south rather than north dipping in places.
2. The wedge of skarned sediments, which outcrops between the diorite porphyry mass and the Marble Line, contains scattered mineralization; those showings on the Kingston and Metropolitan reported to contain 3000 tons plus at 0.35 oz. per ton.

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Favorable Features of South Rim Area - cont'd:-

3. A fault zone, from its attitude one of the thrust type, has been mapped on the Rollo claim.
4. The Nickel Plate 'ore-beds' should pass through the area at a few hundred feet depth.
5. Northwest trending folds are mapped near the Metropolitan, Beaver, and Kingston common boundary - near the Kingston showing.
6. Arsenopyrite mineralization was found in several Dundee drill holes, though mostly in the porphyry itself.

Unfavorable Features include:-

1. The narrow extent of the skarn panel between the diorite mass and the Marble Line - only 100 feet or so. This width is not constant, however, and might push out further from the intrusive in the favorable beds.
2. The mineralization is scattered, with no indication of any of the long pipes found in the old mine.

Lamb recommended continuation of exploration by driving a tunnel at the 3700 elevation along the skarn panel, and a rough access road was completed to the site before Dundee's option was dropped.

COPPER SHOWINGS ON THE BULLDOG CLAIM:

The Bulldog showing contained unusually high copper, with one drill hole in particular reported to contain 88.5 ft. of 1.4% Cu as well as 0.2 oz. Au. This area was discussed with Lamb, and the impression gained is that the better copper mineralization is not sufficiently widespread to be of exploration interest now. The copper content of the mined ore in the Nickel Plate was far from sufficient to be of economic interest by itself (one lb. per ton?).

WINTERS RIDGE:

Winters Ridge continues one and a half miles east of the Nickel Plate Mine. The French Mine is at 3900 feet on the Ridge, and the Good Hope at about 5900. The ore in both these mines was good grade gold with some copper in skarn zones. Open folds appeared to exercise some ore control. A major thrust is postulated within about 200 feet of the French and the main granodiorite is mapped 500 feet below the French. Several other showings, the Canty, Horsefly, Hedley Gordon, and Victoria, are known. Overburden is widespread.

Kelowna Mines Hedley did no regional mapping or other basic exploration over this ridge. The geology is unusually attractive, and the area certainly warrants a 'saturation prospecting' program, with regional mapping, geochemistry, and magnetics. Giant Explorations program, if any, should be kept under surveillance.

MINING COSTS:

An appreciation of the mining costs is of value, in order to determine what might be ore-grade material in the camp. Total costs, from 1945 to 1954 ranged from $11.60 to $12.95. The last full year was principally a salvage operation, thus is not applicable. The highest costs in the last several years was $12.829 in 1951, and the details of this year follow. Production for the year was 115,488 tons of 0.400 oz. Au.

Mining	$ 5.665
Electric tram	.270
Gravity tram	.265
Milling	2.451
Loading & trucking	.043
Auto equip. operation	.050
Gen. Repairs & Maintenance	.151
General expense	.679
Sanitation & retirement	.441
Insurance & Legal	.567
Property Taxes	.077
Total Plant Costs:	10.659
Marketing Expense	1.245
B.C. Mining Tax	.007
Depreciation	.076
Depletion	.046
Total before Taxes:	12.033
Misc.	.747
Income Tax	.049
TOTAL COSTS:	$ 12,829

MILLING:

The cost which appears abnormal in the tabulation on page 14 is the milling cost. The mill had a capacity of 350 tons per day. The skarn ore was very tough and expensive to crush and grind. The crushing went through three stages: jaw crushing, cone crushing, and passage through a battery of 40 stamps. Two-stage grinding was followed by flotation and cyanidation of the tailings. A re-grind circuit for the flotation concentrate made an 1800-mesh product which was cyanided . Overall recovery was 85%. The mill circuit was revised in 1952 to the above because of the difficulties in obtaining a continuation of the contract involving smelting of the arsenical concentrate.

Respectfully submitted,

Dr. R.H. Seraphim, P. Eng.

February, 1967