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R E P O R T

of

PLACER MINING POSSIBILITIES

on

LEECH RIVER

by

K. NORDLUND

C
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P
Y

B. F. Lundy, Esq.,
Vancouver, Block
Vancouver, B. C.

Dear Sir:

According to your instructions of May 17 I proceeded to your Leech River camp to make an investigation of placer mining possibilities on the properties there.

The scope of said investigation did not include the possibilities of a drilling campaign and was more directed towards checking up the reputed values from former tests and present development work. The determination of values across the channels, and also the channel's dimensions, are by necessity only approximate in places. In other places the ready accessibility of the points of interest made it possible to draw more accurate conclusions and the results of the investigation are more detailed in such places.

Respectfully submitting the results of my investigation, and thanking you for your kindly co-operation during this period,

I am,

Faithfully yours,

"K. Nordlund"

LEECH RIVER CAMP

June 5 1937

LOCATION

The properties, where the investigation was conducted, are located on the Leech River, a tributary of Sooke, on Vancouver Island, and covers territory about two miles up from the junction of Leech and Sooke Rivers.

The mine camp is about 2 miles from Leech Town, a flagstation of the C.N.R. and about 25 miles along the road from Victoria.

AREA

The Leech River placer area covers the entire length of the main river and also its forks and tributaries. The present report is a special study of the area from the first falls to the mouth of the Leech River.

The placer area in ~~shit~~ this section spreads in places to cover the entire width of the Leech River Valley but mostly it is numerous old channels seldom more than one hundred feet at the bottom, which present the possibilities for placer mining.

The thickness of pay gravels in the younger channels seldom exceeds 25 or 30 feet, although in some places they are covered with a later deposit of glacial drift several feet in thickness. In places on top of this glacial drift, and directly below the grass roots, is rich concentration presumably derived from the washed out drift.

HISTORY

Placer gold was first discovered near Leech Town in July, 1864 by Lieut. P. J. Leech. There is no record of actual recoveries for the early years and estimates vary greatly. From reliable sources the writer gathered the information that more than 3,000 men were at one time occupied in placer mining along the Leech River. The government built a ditch which supplied water for the miners along the river indicating the productiveness of operations. The early miners, however, were greatly hindered by the lack of proper equipment and the very limited area of claim allowed for a single individual. The writer is informed that the claims were only 25 feet square, therefore totally eliminating any possibility of operations on a big scale. Their efforts therefore were centered on the rich bed-rock pay in the present river bed and their equipment and methods employed were mostly handrockers and ground sluicing.

Numerous attempts have been made during the later years to resume operations on Leech River but inadequate capital invested in such attempts, and possibly, the lack of professional knowledge, have been the contributing causes of failure in each instance. However quite a number of individual miners are still wresting their means of living from the gravels of Leech River. The writer was shown a nugget 1 oz. 17 dwt. which came recently from Leech River together with several smaller ones.

CLIMATE

The climate is ideal for placer mining. The season is a long one, from 9 to 10 months, and is only interrupted a couple of months during the summer, when low water does not permit operation on a bigger scale.

WATER SUPPLY AND ITS DUTY

The necessity of stacking tailings with the monitor lowers the duty of water delivered by the flume. However the upper 25 or 30 feet of gravels are comparatively free of boulders and easy to handle. From practice elsewhere, it is the writer's opinion that a high duty of 4 cubic yards per miners inch will be obtained when handling upper gravels. Bedrock gravels evidently need to be handled with a hydraulic elevator. This, and a considerable amount of coarse rocks and boulders further lessens the duty of water. In handling the lower gravels the duty of 0.75 cubic yards per miners inch is safe basis for calculation.

The writer recommends that a supply of 1,000 miners inches be brought to the workings. This will give a monthly output of a minimum of 75,000 cubic yards of dirt in the upper gravels and about 18,000 yards in the lower gravels.

As it is necessary for successful stacking to have a head of 150 feet or more, the hydraulic water should be brought to the works at a considerable higher elevation than that of the government ditch. This will necessitate a longer flume, at greater expense. A preliminary survey made by the

writer shows that the necessary head can be obtained by building a flume 6,500 feet long. This flume could be erected in two months and would take about 100,000 board feet of lumber and about 30 kegs of nails. The total cost of flume should not exceed 9,000 dollars.

TRANSPORTATION AND ROADS

A railway station, Leech Town, is located about 2 miles from the Mine camp. From there an unimproved country road leads to the workings. A very serviceable road also connects the operations with Victoria, some 25 miles distant. Therefore, the haulage of machinery and supplies does not present any difficulties.

LABOUR

The year round working season affords an opportunity to secure a highly trained crew of hydraulic operators, from the men who now depend on the few short months each summer in Alaska and the Cariboo for their living.

Ordinary labour is to be had easily from the local district.

THE GOLDBEARING GRAVELS

The character of the gold-bearing gravels is that of an ordinary river wash overlain in places with glacifluvial deposits of varying thickness. The gravels vary in size from fine to coarse. The boulders occupy the bottom layer, about

3 to 5 feet, and drilling and blasting are necessary with 0.1 shot per cubic yard of gravel moved. The top layers are practically free from boulders too large for the sluice.

Overburden in places is heavy necessitating logging operations prior to mining. The ready market of logs for local sawmills, however, brings the cost of clearing the land to a minimum. In map-area, Plate 1, the length of the channel was previously cleared of trees by old-timers; the area in question being used as a campsite and therefore, except for a few big trees, only a small amount of work is needed to clear the surface. No records are at hand from any former testing of the values per yard. At present the testing is directed to map-area Plate 1 in order to secure a sufficient yardage of pay-gravels to justify the initial cost of putting the ground into production. There is much evidence of former work along the rim of the old channel (B), and the writer is informed by prospectors who have been sniping along the river, of values running in many dollars per yard. Although it is possible and likely that high values exist in places, the writer has disregarded all such information and the present calculation is done only on the results obtained from personally directed tests.

These tests consist of a tunnel driven from pit (2) to cross-cut the channel (B) and numerous quantity tests along the channel at hundred-foot intervals. The test-drift is 7 feet by 8 feet and timbered. The gravel is wheeled out

and washed in a longtom equipped with expanded metal riffles and an undercurrent. The undercurrent produces concentrate at the rate of about 10 lbs. per yard. The value of such concentrate is a very important factor in modern hydraulic operations and will be further discussed under the heading of "Gold Saving Plant". In the following estimate of cost and profit, it is, however, for the present omitted, as no result from an assay of these concentrates is at hand.

On top of this pay-gravel in the tunnel there is a layer of stratified fine gravels. Tests made from these sands and gravels resulted in 25¢ per yard. Overlaying these deposits is a concentration from Colwood sands and gravels averaging 40¢ per yard or an average 32¢ per yard from the grassroots to the floor of the tunnel. The values below the floor of the tunnel for the most part, consist of bedrock pay.

The tests made by the writer consisted of putting gravel from ½ cubic yard up through a smaller longtom and panning out the gold so concentrated.

THE SOURCE OF GOLD AND THE ROLE OF GLACIAL EROSION IN THE FORMING OF THE LEECH RIVER PLACERS

The Leech river placers are mainly the results of three different causes:

1. Local gold from the numerous small quartz stringers which do not carry values as commercial gold ore, nevertheless, by the action of erosion furnished a big part of the gold in Leech river placers.

2. Re-concentration from the pre-Glacial channels in the vicinity of Jordan Meadows.

3. From the glacial debris released on the retreat of the ice.

The role of the glaciers was very small in forming the Leech River valley. Only in the eastern part of the valley have the glaciers scoured the soft sedimentary rocks and removed all signs of pre-Glacial weathering. In other parts the valley is clearly the result of normal downcutting, i.e., the work of water erosion. Still, in forming the Leech river placers the glaciers played an important part, as the type of moraine (Colwood Sands) is undoubtedly gold-bearing. The post-Glacial streams cutting down through this moraine also concentrated the auriferrous part of it.

Most of the glacial drift was deposited by the sub-glacial streams running in tunnels in the ice or below the ice. This explains the peculiar esker-like form of some of the deposits and also the statification in the moraine. Undoubtedly some of the higher terrace-like gravel accumulations were deposited by marginal streams. Along the lower Leech river the well-formed gravel terraces extend 1.5 miles from the mouth. The difference in altitudes between the lower and upper end of these terraces corresponds to that of a mature river with a slow gradient. Therefore, when the post-Glacial streams with the heavy load of auriferrous gravel from the upper part of the valley entered this section, they dropped their load in the comparatively standing

water body of lower Leech. As the valley cutting by running water was progressing, and the material of the successively lower parts were dragged to their places over the upper terraces, most of the gold was meanwhile left behind and thus enriched the surface of the over-ridden upper parts. This phenomena of enrichment right under the grassroot was proven by tests made by the writer and the theory is also supported by the extensive shallow diggings of the old-timers. It is impossible to imagine, however, that such an action as described above took place only once. Any obstruction in the river, rock slikes, ice blockade, etc., may cause the forming of a local delta and still-water. During the period of such pseudo-delta formation, first the light gravels and afterwards silt and clay will be deposited in successive layers on top of the formerly enriched surface. Valley cutting goes on and the once rich gold-bearing surface may now be buried several feet. Newly enriched surfaces were formed and are again buried under the later formations.

The gold derived from pre-Glacial channels play an important part in the Leech placers. It is well rounded, water-worn gold, nuggety in character and distinctly different from the gold eroded from the local glacial debris and only in few places afford a closer examination. The age of these channels is that of pre-Glacial. During Tertiary times the surface of the map-area of Leech River formed a peneplain

which was subsequently uplifted and a new erosion cycle started, which formed the valley of Leech River. During the following glacial periods the valley was filled with glacifluvial material, only the most eastern part of the valley, being scoured by the movements of the ice.

In late Glacial times the stream in the valley has mainly flowed marginally-submarginally, while most of the valley was still remaining under ice cover. These marginal or submarginal streams evidently occupied one side of the valley only at a place, and changed sides in traversing the ice. During this time the forming of the lateral terraces took place and consequently, also the lateral concentration. These marginal streams in cutting down through glacial debris also eroded the soft sedimentary rocks of the valley sides and released the gold in the quartz stringers. Therefore, where lateral concentration took place, the gold is not only derived from glacial debris but also by erosion from the local gold-bearing formation. The Vashon drift, which in places is directly overlain with the Colwood sands has so far proven barren. Its thickness in map-area Plate 1 is, however, very limited. It occurs more frequently in the higher elevations where the drift in the form of a bluish-grey boulder clay covers the hard rocks or the interglacial deposits. The coarse, more or less local boulders, which are evident in the present stream bed and also on the surface of some of the higher lateral terraces, are characteristic features of the Vashon drift.

PROJECT OF MINING METHODS AND GOLD SAVING PLANT

The upper gravels are composed of fine to mediu m coarse stratified gravels, overlain in places with glacial clay. The almost total absence of large boulders renders these gravels very easy for hydraulicing. The writer suggests that the first season be spent in piping out these gravels from the area now tested. This would call for about 250,000 cubic yards of gravel to be washed during the high water season in winter and spring 1937-38. The following season would be used in excavating the bottom layers and simultaneously stripping the area ahead. For stripping operations two giants, a No. 7 and No. 3, would be used in the pit under a head of 130 feet. A No. 4 giant under 150 ft. head is to be used for stacking tailings.

The gravels below the present drainage level are best mined by hydraulic elevators. The use of two large elevators in separate pits affords the operations to be continuous. When one elevator is in operation the rocks in other pits can be cleared away. The sketched plan of operations as suggested, is shown in Plate 2.

Concentration of placers gravels to a certain limit is very easy and necessitates only the most primitive equipment, i.e., ordinary sluice-boxes with Hungarian riffles. Often this simple equipment is quite sufficient, especially where gold is coarse and gravel is practically free from clay.

The samples from Leech River show however that the biggest part of the gold is very fine, often microscopical, and heavy clay is present, more so near the bedrock. Ample evidence from former comparative tests made by the writer between Hungarian and expanded metal riffles, shows the definite superiority of the expanded metal in handling clay material, and also gravels free of clay material. This is due to the fact that the sharp edges of the metal cuts clay and helps to dissolve it. Also the fact that the velocity of flow in the sluice is greater on the surface than on the bottom is important in making the choice between the type of riffles used. The concentration which takes place in the sluice is that of a free settling in different layers of current. Therefore by increasing the difference in velocity of the corresponding layers of water the free settling concentration is aided. This is accomplished by the use of several thicknesses of expanded metal. As the velocity of the water is very low against the bottom of the sluice, the heavy black-sands are settling down directly and form a cushion on which further deposits of concentrates settle. This eliminates the need of cocoa-matting in the sluice and greatly reduces the time of clean-ups.

It was mentioned above, the biggest part of placer gold in the Leech river area is very fine. The surface examination also very often shows a heavy surface contamination and the particles are of rusty appearance. More thorough examination also will reveal that the recesses in the minute

particles of gold are filled with the substances of natural slimes, etc., which reduces the absolute weight of such particles beyond the scope of recovery in ordinary sluices, even with the best kind of riffles. Such particles will slowly move down stream along the riffles as their buoyancy is too great to afford them to settle down in the medium encountered i.e., the water heavily laden with black-sand. Therefore, in the operations through British Columbia and also in ohter places, such gold in old days and as a matter of fact even now, is lost. This loss in many cases presents the difference between a successful operation and that of a failure. During the last few years the writer has made a special study of the condition of gold lost in tailings and of the ways to remedy this loss. The flow sheet suggested in Plate 3, offers the best known method of saving the fine gold not interfering with the quantity of gravel mined.

As shown in the sketch, the slow-moving medium heavy layer of silt with the fine gold, is drawn out from the sluice through a perforated plate to wide under-currents. The construction of the under-currents and the following settling tank renders it possible to bring the gravity concentration to any desired point. In former days the costly process of treating black-sand concentrates and slimes from the recovery plant, made it unpracticable to attempt any high recovery. In recent years very important developments in this field have taken place and now the saving of fine gold

is an accomplished feat. The recoveries nearing 99% and even over that, is a reality. The machine suggested in the flow sheet or others of the same type give a very excellent result.

As it is planned to use two shifts in piping and one shift for drilling and blasting, the necessity of a double sluice is eliminated. The clean-up time which, with the modern methods does not exceed 6 man-hours, is easily performed during the third shift. The clean-up machine needs 1; H.P. and should be run with a motor from an electric light circuit. This 1½ H.P. is sufficient also for the small trommel screen needed for screening the plus 1/8 inch material from the macine feed. The amalgamation takes place directly in the machine and the amalgam will be retorted immediately after clean-up. Total lapse of time spent in the clean-up from the start until the retorted gold is ready for the market, takes less than 3 hours and is accomplished by two men. The specification of the process is however, beyond the scope of this report.

ESTIMATE OF COSTS AND PROFITS

In the following, the writer is suggesting a preliminary estimate of the costs of bringing the area in Plate 1 into production, and the approximate profit of such an operation.

This estimate is only referring to the first season's operations, i.e., handling the upper gravels down to the natural drainage level. The amount of gravels moved per 24-hour day, and 25-day month, is estimated at 75,000 cubic yards per month. The value is taken only at 25¢ per yard even if a much higher average is shown by the tests made. The total amount of the upper gravels in the area is calculated to be roughly 250,000 cubic yards.

Initial Expense

Water system	$10,000
Hydraulic and Recovery Plant	3,500
Buildings and camp equipment	1,500
Tools, light plant, etc.,	3,000
Clearing the land, roads, etc.,	1,000
Total	$19,000

Cost and profit during the first part of operations- four months-

Costs

Labour and Wages	9,000
Explosives	2,000
Overhead, etc.,	2,000

Cost per cubic yard

Operation	$ .036
Overhead	.008
Explosives	.008
	$ .052

PROFIT

250,000 cubic yards of gravel washed.

250,000 x 0.25	$ 62,500
costs 250,000 x .052	13,000
Net profit	$ 49,500

The average gold value in the gravels immediately above the bedrock is higher. Former tests made by sinking a shaft down to bedrock revealed values up to $3. per cubic yard. This, and also the values in black-sand, which are easily recovered by the suggested recovery machine, were not taken into consideration when the above estimate was made.

CONCLUSION

It is the writer's intention in the foregoing detailed paper, to bring forth the findings of the investigation of the Placer Mining possibilities on Leech River. The area is however so large and the time allowed for such an investigation so short that by necessity the efforts were concentrated to an area where former development work was in progress.

Less detailed investigation was also carried both up and down stream of said area in search of possible placer-fields. There is no doubt whatever in the mind of the writer that quite a large yardage of placer gravel is along the Leech

River. Of a special prominence, the writer counts the area near the mouth of West Fork and also the formerly tested deposits of the Williams Creek flat. The Williams Creek flat contains a minimum of 2 million yards of gravel and tests made by N. C. Nesbitt, E. E. in the summer of 1932 resulted in an average of over 14¢ per cubic yard. The gold was valued at 17 dollars per oz. and only coarse gold was recovered by the sluice with pole riffles used. During the summer 1934, the owner of this lease (No. 64) Mr. Spur, to whom the writer is indebted for the foregoing and following information, made further tests on this lease with the recovering corresponding to that of the above. In places, where it was possible to reach the bedrock exceptionally rich pay was uncovered.

Where the old river bed crosses to the right side of Leech, above Williams Creek, a couple of prospectors are shovelling in a fairly rich surface pay. No attempt is made by these men to reach the bedrock. Pan tests made by the writer, show the values to be not less than $3 per yard. This same channel extends up stream about 2,000 feet and has a very large yardage. Many other similar gravel deposits occur almost continuously from the mouth of Leech River up stream. The comparative shallowness of such deposits, seldom over 30 feet, offers a good opportunity for testing by shaft sinking. However, the now tested ground offers a

splendid opportunity to start the operation. The failure of former operations, in the opinion of the writer, was due to two separate causes. First, the former operations were not carried in a big enough scale to eliminate the hand-handling of the medium size boulders. This limited the yardage moved much below the profit assuring margin and of course raised the cost per yard enormously. The second, also very important factor, was the total loss of fine gold in former operations. The comparisons of hydraulic properties elsewhere in B. C., and the merits of Leech river placer, are very much in favour of the latter on account of the easy accessibility and the much longer hydraulic season. The values per yard also compare favourably with that of the biggest hydraulic in B.C., the Bullion mine, where the average value is much less than the average of the surface gravels on Leech river.

In conclusion the writer offers his sincere opinion, based on many years experience in many placer fields, that the Leech river properties offer a very excellent opportunity of profitable mining if conducted in a business-like manner, under experienced management.

Respectfully submitted,

"K. NORDLUND."

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Leech River Camp
June 5 1937

EXPLANATION TO PLATE 1

There is evidence that the upper channel (A) crosses the Leech river at a point approximately 600 feet from pit 2 (Mackay Pit). After crossing the river it lies buried about 40 feet above present river level. The continuation of this channel down stream is not quite clear at present. The other channel marked (B) also crosses the Leech river about 350 feet west of pit 2. Most of old and present work has been done along the right rim of this channel. It is the writer's opinion that this channel recrosses the Leech somewhere near the mouth of Martin Gulch and enters the right bank of the river behind Starling's cabin. The spill from this channel is worked now by Starling in pit No. 6, where he reports recoveries up to $3. per yd. The pit No. 7 and other pits further down stream also present the spill from the channel (B). South of Starling's cabin is quite a wide terrace-like accumulation of stratified gravels. No information is at hand at present to determine if they are of commercial value. However it is the writer's opinion that the rapid downcutting of Leech river valley was followed with constant charges in the location of the stream centers and therefore any or all of the abandoned creek beds could carry gold values.

At point (C) rimrock is exposed almost in a vertical position, indicating probably the furthest point north where the higher channel was situated.

At point (D) approximately 80 feet above 0-point the writer took a pan of gravel resulting in heavy black sand and a few fine colors. The origin of these sands is explained elsewhere in present report.

West of Starling's cabin a lower and also higher bench continues up river. At a point about 1200 feet up-stream, not shown in Plate 1, the Finlayson creek cut these benches. It is reported that coarse gold was recovered from the Finlayson creek.

Fixed point -0-P is located in the mouth of Martin Gulch and letters K.N. engraved in solid bedrock.

EXPLANATION TO PLATE 2

Piping into the head of the sluice is the method suggested in hydraulicing the upper gravels. In handling the gravels nearer the drainage level it evidently will be necessary to use the method of piping over the side. This method however is not discussed in the present paper.

The sluice boxes (S) are placed in the lower end of the proposed pit. Heavy timber wings (W) are erected and the piping is commenced first with the monitor (C) by piping a cut through the proposed pit. After that the second monitor is put into operation in under-cutting the sides and driving the material into the field of the monitor (C).

In the sketch, (A) is the main pipeline, (B) branch-lines, (C) monitors, (S) sluice, (E) recovery plant- (H) Pelton wheel driven compressor. The stacker giant stacks the coarse rocks into a pile (F) while the finer material is

carried away with the water of the Leech river. During the high water season the pile F is also carried away. The monitors (C) and (C1) works under 100-foot head. The stacked (C2) ander a 150-foot head.

EXPLANATION TO PLATE 3

The auriferrous gravel, well-broken up with the powerful jetts from the monitors, is entering the sluice where most of the coarse gold is recovered in the first 15 feet. The length of the sluice is 72 feet. Towards the end of the sluice there is placed a steel plate with 1/8" perforations. The 1/8" is led through this plate to a double set of wide under-currents, where fine gold is recovered. The concentrates from the under-current are fed into a centrifucal gold-saving machine. Slimes from the under-current are fed into a setting tank and the sediments from the latter into the recovery machine. The concentrates from the sluice are cleaned once a week. The concentrates from the under-currents, daily.