

BRITISH COLUMBIA DEPARTMENT OF MINES

Hon. W. A. MCKENZIE, Minister.

ROBT. DUNN, Deputy Minister.

J. D. GALLOWAY, Provincial Mineralogist.

J. DICKSON, Chief Inspector of Mines.

BULLETIN No. 1, 1931

PLACER-MINING IN BRITISH COLUMBIA

COMPILED BY

JOHN D. GALLOWAY, Provincial Mineralogist.



PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:

Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1931.

*To the Hon. W. A. McKenzie,
Minister of Mines, Victoria, B.C.*

SIR,—I beg to submit herewith a special bulletin on Placer-mining in British Columbia. This bulletin is in part a reprint of Bulletin No. 2, 1930, but contains additional information on placer-mining, particularly relating to activities during the field season of 1931. Of decided interest is the special report by Dr. R. W. Brock on the placer possibilities of the Pacific Great Eastern Railway lands.

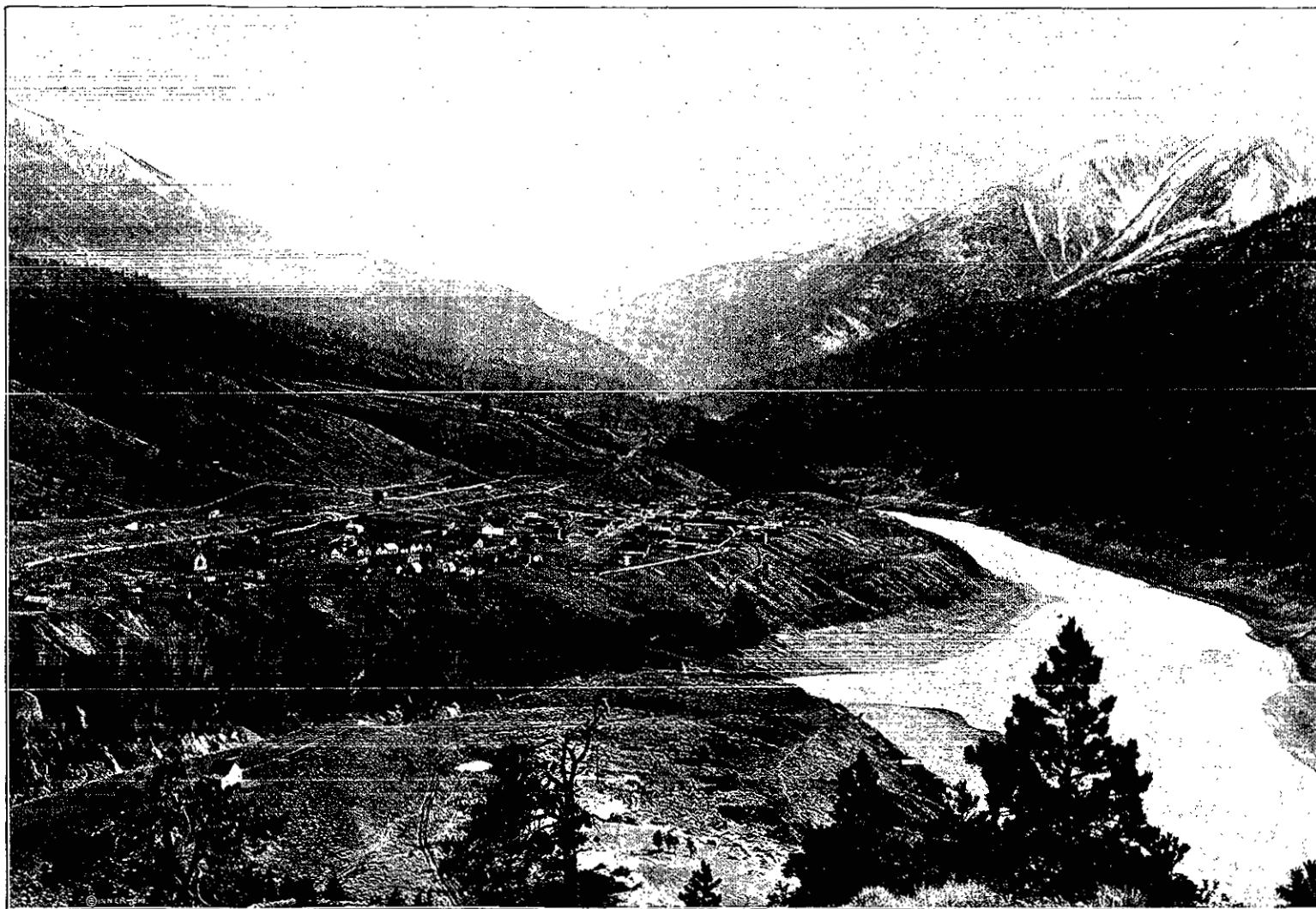
I have the honour to be,

Sir,

Your obedient servant,

JOHN D. GALLOWAY,
Provincial Mineralogist.

*Bureau of Mines,
Victoria, B.C., September 3rd, 1931.*



Lytton—Looking down Fraser River at Mouth of Thompson River. Scene of the Gold Discoveries of 1857.

PLACER-MINING IN BRITISH COLUMBIA.

GENERAL SUMMARY.

BY JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST.

INTRODUCTION.

During 1931 much interest has been shown in placer-mining. Prospecting has been particularly active as many men, finding employment difficult to obtain, have scoured the hills with gold-pan and shovel in search of the yellow metal, which is now more firmly entrenched as the symbol of real value than ever before. Development of placer properties has been vigorously prosecuted and productive hydraulics are enjoying a successful year.

The placer-output will undoubtedly show a substantial increase for the year, as preliminary figures indicate that larger amounts of gold are being recovered in the important areas of Cariboo and Atlin. In the aggregate a considerable amount of gold is being obtained this year by the numerous prospectors working with pan and rocker in many parts of the Province. Along the Fraser, Thompson, Similkameen, and other rivers, bars which have been unworked for years have again been attacked, and in the old placer camps many old diggings are being reworked.

Early in 1930, Bulletin No. 2, entitled "Placer-mining in British Columbia," was issued by the Department of Mines. This bulletin contained reports on special examinations of placer areas made in the field season of 1929, and in addition a general summary of placer-mining in the Province, including geological, historical, and statistical information regarding this branch of the mineral industry. Owing to the interest in placer-mining the demand for this bulletin has exhausted the issue. The present bulletin has therefore been prepared. It contains, in addition to much of the information in the previous issue, additional material in the form of reports by the Resident Engineers on the placer activities in their respective districts during the present field season of 1931. A valuable addition to the bulletin is the "Appraisal" of placer possibilities in the Pacific Great Eastern Railway lands by Dr. R. W. Brock, who headed the Commission on Mineral Resources for the investigation made on behalf of the Canadian Pacific Railway, Canadian National Railways, and the Government of British Columbia. A report by the Provincial Mineralogist on Rainbow creek—a newly discovered placer creek in Omineca Division—is also included.

Measured by production, placer-mining has declined considerably in recent years. It is expected, however, that 1929 will mark the low point in the present cycle and that the trend will be upward in the future. The following table shows the output from 1858 to 1930:—

YIELD OF PLACER GOLD TO DATE.

1858	\$705,000	1877	\$1,608,182	1896	\$544,026	1915	\$770,000
1859	1,615,070	1878	1,275,204	1897	513,520	1916	580,500
1860	2,228,543	1879	1,290,058	1898	643,346	1917	498,000
1861	2,666,118	1880	1,013,827	1899	1,344,900	1918	320,000
1862	2,656,903	1881	1,046,737	1900	1,278,724	1919	286,500
1863	3,913,563	1882	954,085	1901	970,100	1920	221,600
1864	3,735,850	1883	794,252	1902	1,073,140	1921	233,200
1865	3,491,205	1884	736,165	1903	1,060,420	1922	364,800
1866	2,662,106	1885	713,788	1904	1,115,300	1923	420,000
1867	2,480,868	1886	903,651	1905	969,300	1924	420,750
1868	3,372,972	1887	693,709	1906	948,400	1925	280,092
1869	1,774,978	1888	616,751	1907	828,000	1926	355,503
1870	1,336,956	1889	588,923	1908	647,000	1927	156,247
1871	1,799,440	1890	490,425	1909	477,000	1928	143,208
1872	1,610,972	1891	429,811	1910	540,000	1929	113,711
1873	1,305,749	1892	399,526	1911	426,000	1930	152,235
1874	1,844,618	1893	356,131	1912	555,500		
1875	2,474,004	1894	405,516	1913	510,000		
1876	1,786,648	1895	481,653	1914	565,000		
						Total.....	\$78,588,949

It will be noted that the most important period was from 1858 to 1877, with the maximum production in 1863, with an output valued at nearly four million dollars. From 1875 to 1893 a steady decline ensued and then the industry revived until 1904, when an output of \$1,115,300 was recorded. Since that time the output dwindled steadily until 1929 with a production of \$118,711. An increased production in 1930, it is expected, will be followed with a larger output in 1931, thus reversing the downward trend.

Although production has become negligible, it should not be concluded that there is not interest in the industry. Actually in the last five years much placer-mining has been carried on, but unfortunately without as yet very tangible production results. Much of this work has consisted of testing placer-ground, and in many instances the testing is not conclusive or completed. In a number of placer-fields of the Province plants for hydraulicking are being constructed, and some of these may be expected to be productive in the future. Much desultory small-scale work has been carried on, partly to recover gold and partly to prove up deposits of placer-gravels.

As the known placer-fields of the Province contain many areas which have not been tested, the question naturally arises whether there is not still a good possibility of reviving placer-mining to something like its former position in the mineral industry of British Columbia. With this objective in view, the Honourable the Minister of Mines decided to have some special investigations of placer areas made during the field season of 1929. Accordingly, Herbert Carmichael, a former Assistant Mineralogist, and now a practising consulting mining engineer, was secured to make a report on certain placer areas in the Queen Charlotte and Atlin Mining Divisions. Also C. W. Moore, an experienced placer operator, was engaged to make a careful study of the placer-fields of Cariboo, Quesnel, and Omineca Mining Divisions. He was unable to fully cover this large field in the time available, but did examine many sections of these Divisions. Bulletin No. 2, 1930, contained these reports and parts of them are reprinted in this bulletin.

Most of the maps and photos included in this bulletin do not necessarily represent present placer operations, but have been used to illustrate the various phases of the industry since its commencement.

It is not intended that this bulletin on placer-mining will be reprinted in the Annual Report for 1931; it should therefore be preserved by those who desire a permanent file of the publications of the British Columbia Department of Mines.

GENERAL HISTORICAL REVIEW.

Although small amounts of gold were reported to have been obtained from veins on Queen Charlotte Islands, the first real metal-mining in the Province was the recovery of gold from placer-gravels.

At the time of the discovery of gold in quartz veins on Queen Charlotte Islands James Douglas was Governor of Vancouver's Island and Lieutenant-Governor of Queen Charlotte Islands. Accordingly, as Lieutenant-Governor, he issued a proclamation on March 26th, 1853, which was the first mining regulation in the Pacific North-west. This set forth the terms and licence under which the digging or mining of gold could be carried on in the Queen Charlotte Islands.

At this time the mainland of the Province was an almost unknown area, commonly known as New Caledonia, and mainly administered by the Hudson's Bay Company. The discovery of gold was reported on the Columbia river, near the confluence of the Pend d'Oreille, in 1855, but this was of little importance. With the discovery of gold on the Thompson river in 1857 and the rapid influx of thousands, Governor Douglas assumed authority to govern the area and issued the following proclamation to regulate the mining of gold:—

" PROCLAMATION.

" 28th December, 1857.

" Whereas by law all mines of gold and all gold in its natural state of deposit within the Districts of Fraser River and of Thompson's River, commonly known as the Quaatlam, Couteau, and Shawswap countries, whether in the lands of the Queen or any of Her Majesty's subjects belonging to the Crown:

"And whereas information has been received by the Governour that gold exists upon and in the soil of the said districts, and that certain persons have commenced or are about to commence searching and digging for the same, for their own use, without leave or other authority from Her Majesty:

"Now, I, James Douglas, the Governour aforesaid, on behalf of Her Majesty, do hereby publicly notify and declare that all persons who shall take from any lands within the said districts any gold metal or ore containing gold, or who shall dig for and disturb the soil in search of gold metal or ore, without having been duly authorized in that behalf by Her Majesty's Colonial Government, will be prosecuted both criminally and civilly as the law allows.

"And further notify and declare that such regulations as may be found expedient will be prepared and published, setting forth the terms on which licences will be issued for this purpose on the payment of a reasonable fee.

"Given under my hand and seal at Government House, Victoria, this 28th day of December, 1857, and 21st year of Her Majesty's reign.

"(Sgd.) JAMES DOUGLAS,
Governour.

"By His Excellency's Command.

"(Sgd.) RICHARD GOLLIDGE, Sec.

"God Save the Queen."

Shortly after this proclamation regulations were issued providing for a licence of 21 shillings a month and a commission appointed to deal with the size of claims, collect fees, etc.

On August 2nd, 1858, "British Columbia" was formally brought into existence by "An Act to provide for the Government of British Columbia," passed by the British Government. The mainland of the Province and Queen Charlotte Islands were included in the new colony of British Columbia, but Vancouver's Island remained a separate Crown Colony. James Douglas was Governor of both colonies.

In 1859 the "Gold Field Act" was passed; this was the first statutory recognition of mining in the Province, and in this Act the fee for a free miner's certificate was set at £1, substantially the same as the \$5 fee to-day. Under this Act Gold Commissioners were appointed who had extensive administrative and quasi-judicial powers.

Many accounts have been written of the discovery of placer gold in British Columbia and the famous Cariboo rush from 1858 onwards. The Provincial Archives have numerous documents relating to this early history of the Province and many books and brochures have been written based on the historical documents which have been carefully preserved.

For the purpose of this bulletin it is believed that the following comprehensive and informative summary by G. M. Dawson* is most suitable:—

"It is now difficult to ascertain under what precise circumstances the first discovery of gold placers on the mainland of British Columbia occurred. Little attention was at first given to accounts of the finding of small quantities of gold, and at a later date, when gold-mining sprung into importance, numerous stories respecting its discovery were invented or exhumed. One statement is to the effect that the Hudson's Bay agent at Kamloops had bought gold from the Indians as early as 1852, but, if correct, the amount purchased must have been very small. In 1855 a servant of the same company discovered gold near Fort Colville, a short distance south of the International boundary, and moderately rich diggings began to be worked in that vicinity. It seems certain that the epoch-making discovery of gold in British Columbia was the direct result of the Colville excitement. Indians from Thompson river, visiting a woman of their tribe who was married to a French-Canadian at Walla Walla, spread the report that gold, like that found at Colville, occurred also in their country, and in the summer or autumn of 1857 four or five Canadians and half-breeds crossed over to Thompson river, and succeeded in finding workable placers at Nicoamen, on that river, 9 miles above its mouth. On the return of these prospectors the news of the discovery of gold spread rapidly. It is also probable that their arrival on the Thompson caused the Indians to take an interest in gold-mining, for we read in a dispatch of Governor Sir James Douglas that from October 6th, 1857, to the end of that year 300 oz. of gold had passed through the hands of the Hudson's Bay Company, this amount being

* "Mineral Wealth of British Columbia." Geological Survey of Canada Annual Report, Volume III. (pt. II.), pt. R, pp. 18-21 (1888).

all, so far as known to Douglas, which had been obtained. Douglas speaks of the region, including the lower Thompson, from which the gold came, as the 'Couteau country.'

"Nearly ten years previously, in 1849, gold had been discovered in California, and that country was swarming with a cosmopolitan population of gold-seekers; thus when the discovery of gold in the north became known and authenticated, by the exhibition of the gold itself, an extraordinary migration followed. Between March and June, 1858, from 20,000 to 23,000 persons arrived by sea from San Francisco in Victoria, and converted that place (first founded by the Hudson's Bay Company in 1843) from a quiet village of two or three hundred inhabitants into a city of tents. At the same time, many miners (estimated by some at 8,000 in number) reached British Columbia by overland routes from the south. A large proportion of those who arrived at Victoria never got as far as the mouth of Fraser river, their objective point, and so great were the natural difficulties and the resulting disappointment experienced that all except about 3,000 of this promiscuous migration returned to California before the following January. The inland country was entirely without routes of communication, by nature a singularly difficult one, and unprovided with means for the support of a large population. Meanwhile, by the more fortunate and energetic development of its wealth had been fairly inaugurated. The auriferous river-bars in the vicinity of Hope and Yale on the lower Fraser, being the most accessible, were the first to be worked, and the return of gold began to assume important dimensions.

"Before the close of the working season in 1858, some of the adventurers who had come overland from the south had pushed onward in face of extraordinary difficulties—resulting not alone from the roughness of the country itself, but combined with the want of supplies and occasional overt hostility of the Indians—as far as Fountain, a short distance above Lillooet on the Fraser, and by the line of the Thompson to Tranquille river on Kamloops lake. In the following year a renewed advance brought a number of miners to Quesnel river, and in 1860 rich diggings were found at the forks of the river and over 600 whites were at work on its length, while Antler creek was discovered and some work done upon it by a few score men—thus fairly entered on the extremely rich central region of Cariboo.

"The theory formed by the miners who first worked the fine 'flour' gold of the Fraser below Yale was that this gold had its origin in richer deposits toward the sources of the great river, and though this theory was only partly correct as regards the origin of these particular deposits, it none the less served as the impelling force which led to the opening-up of Cariboo district.

"In 1861 Williams and Lightning creeks, Cariboo, the two most celebrated in the annals of British Columbia placer-mining, were discovered, and in this and the following year most of the other rich creeks in Cariboo became known. The first gleanings from the old Cariboo stream-courses were notable. It is estimated that gold to the value of \$2,000,000 had been got out by a population not exceeding 1,500 before the end of 1861. In consequence of those finds a second important migration of miners and others towards the Province commenced before the close of 1861, which continued in greater or less volume until about 1864. A series of letters from a correspondent of the *Times* contributed largely to this result, and extended the area of interest to very wide limits, bringing adventurers from England, Canada, Australia, and New Zealand. A party of men even set out for Cariboo from eastern Canada overland in 1862. Of this party several members lost their lives in the mountains, but some eventually reached their destination."

The history of the placers of the Cariboo and Quesnel Divisions from 1864 to the present time is well known; it constitutes practically the history of the country for some years. The sudden outburst of wealth in the short space of a few years did much to lay the foundation of the material prosperity of British Columbia, and the influx of thousands changed the country from a wilderness inhabited by Indians and trappers into an area in which many forms of industrial activity commenced.

It is interesting to note that in the early years of mining the authorities were very careful not to give away too much ground. Considering the vast area administered, it seems strange that such small areas were allowed to each individual, and it is quite evident that the new placer-fields were considered to be extremely rich. The first placer claims were only 12 feet square—144 square feet—hardly worth while starting on. The permitted size of claims was gradually increased until now they are 250 feet along the stream and 1,000 feet wide. By the "Placer Act," passed in 1891, provision was also made for taking up placer leases half a mile

in length and also 5-mile dredging leases along the beds of rivers. These present regulations contrast sharply with the early ideas that prevailed.

The same cautiousness is seen in the first regulations for lode-minerals, by which mineral claims only 100 feet square were granted, which compares with the present size of 1,500 feet square.

The easily worked bonanza deposits of the Cariboo quickly yielded their golden treasure and from 1863 a progressive decline in the yearly output ensued. As the rich diggings were worked out, many extensive hydraulic plants were put in to handle low-grade ground in large quantities; also numerous expensive enterprises were commenced to carry on deep drifting in ground that, owing to adverse physical conditions, was left by the old-timers. It is unfortunate that most of these projects were financially unsuccessful, and it is evident that lack of adequate knowledge of the placer deposits and the problems to be contended with were the primary causes of failure.

Since the Cariboo rush successive new placer-fields have been discovered in the Province, and each one has been marked by a greater or lesser "stampede" to the new diggings. While other important fields have been discovered, the Cariboo has been without doubt the richest and most productive placer-field discovered in the Province up to the present time.

In 1863 rich placer deposits were found on Wild Horse creek, in East Kootenay, which caused some excitement at the time and were worked somewhat extensively in the following year.

In 1864 placer gold was found on the Leech river and in 1865 discoveries were made on the Big Bend (of the Columbia) north of Revelstoke. This latter resulted in quite an excitement in 1866, which, however, subsided very quickly.

Some placer-mining had been done on the Peace river as early as 1861, but it was not until 1869 that the Omineca placer-field, with discoveries on Manson and other creeks, was found. Placering in this field reached its height in 1871, but it was never a particularly rich area and it was practically abandoned when the more important Cassiar district, on the headwaters of the Dease river, was discovered in 1872.

The Cassiar fields have been quite productive and rank next in importance to the Cariboo district. From the Dease Lake area prospectors extended their discoveries and eventually the placers of Atlin Division were found in 1898, and this area is still being actively developed.

In the southern portion of the Province the Similkameen Division has been the scene of much placer-mining. Some mining was done on the bars of the Similkameen river, near the mouth of the Tulameen, as early as 1860, but it was not until 1885, when coarse gold was found in Granite creek, a tributary of the Tulameen, that real interest was aroused in this district. In 1886 a production of \$193,000 in gold and platinum was credited to this area and since then the yearly output has gradually waned.

In recent years several companies have been started to explore the possibilities of the placer-gravels of this area, but as yet no great success has been obtained.

In connection with the early history of placer-mining in the Province, the following extracts from an article by H. T. Nation on the "Dewdney Trail," published in the proceedings of the British Columbia Historical Association, are interesting. This trail was primarily constructed to provide a route in British Columbia for the safe passage of gold to Victoria, without going through United States territory.

"Another event in the progress of the Province now took place, for in 1855 two ex-servants of the company discovered placer gold on the Columbia river at the confluence of the Pend d'Oreille river.

"As is usual, and as was certain in those days of placer discoveries, men came in from the south and spread along the Columbia, Kootenay, Similkameen, and upper Fraser rivers, following up the deposits of gold-bearing gravels in the rivers.

"In 1857 they found gold at the junction of the Fraser and Thompson rivers, where Lytton now stands. This last discovery was noted officially by Governor James Douglas, and he reported it privately to England. The news got out, however, and more discoveries being made in the lower reaches of the river, the Cariboo rush began in 1858.

"From the Kootenay flats the Dewdney trail entered the mountains by Goat river, found by Carnes of Big Bend fame, and down a branch of the Moyie, striking that river at the present settlement of Yahk.

"Here the famous trail from Walla Walla, which had been serving the East Kootenay goldfields from the southern country, was met. This was followed through St. Joseph's Prairie, now Cranbrook, to the right bank of the Kootenay river, where it terminated at Galbraith's Ferry. The miners on Wild Horse creek built a road for themselves from the river for 5 miles. . . .

"As stated before, gold was discovered on the Columbia at the mouth of the Pend d'Oreille river. It was in 1863-64 found on the Kootenay, and a flourishing settlement arose on the Wild Horse Creek diggings, called Kootenay. Hence the establishment of Galbraith's Ferry at the end of the trail.

"Coincidental with the determination of the International boundary by the British and United States parties came the development of the gold-placer mines all along the boundary from Kootenay to the Tulameen river. Rock Creek was the centre of this activity, and the Gold Commissioner of that day lived there, Wm. G. Cox, and administered the mining and customs laws. His reports to Governor Douglas are preserved in the British Columbia Archives.

"New trails were opened up in every direction by reason of rushes to new fields, but the main lines of travel were still in use towards Fort Thompson (Kamloops), and up the Columbia to Canoe river and the pass over the Rockies.

"Owing to the isolation of Rock Creek area, the traffic was over the border, this being quicker and cheaper than by way of the Hope-Skagit trail, or the Lytton trail, which latter was previously used. . . .

"Commissioner Cox's reports were full of interesting matter, and some notes therefrom will be sufficient to indicate the values of gold recovered in that area. He says, on July 17th, 1861, that there were on the creek ninety-three men, four ditches, and two sluices; averaging a yield per day per man of \$16; wages to hired men, \$16 per day. Rufus Henry wrote that his best week, July 10th to 16th, 1861, gave him profit, four hands working, of \$349.

"Cox relates how the 'Southern Boundary Act' stopped active building operations at Rock Creek, as it forced the collection of customs upon the traders from the south.

"Gold was discovered then, 1861, on a creek called Riviere de L'Anse du Sable, which is now Mission creek, at Kelowna, and Mr. Cox regretted this, as it made more trails to guard.

"In 1861 Rock Creek began to lose its miners, as the Nez Percé Indian Reserve was opened to prospectors, and they rushed over there. Some, however, came back, and between June and November, 1861, \$83,000 was taken out of Rock creek. The discoverer of the creek was one Baume."

GENERAL GEOLOGY OF BRITISH COLUMBIA PLACER-FIELDS.

While it may seem to be rather out of the question to generalize regarding the geological features of placer-fields which are many hundreds of miles apart, still there are certain conditions which pertain to all the placer areas of the Province; and a realization of these may be decidedly useful.

In the following geologic discussion, only a brief summary is given and in general reasons are not given for the conclusions reached or ideas advanced. In the aggregate there is an extensive literature on British Columbia placer deposits, which contains much of the evidence on which this summary is based.

It is noticeable that the important placer-fields of the Province lie along a broad zone stretching north-westerly from the International boundary-line up to Atlin and extending into Yukon Territory. This fact gave rise to an early theory of an immense "flow" of gold-bearing gravels or "wash" traversing the Province along this line; the theory, of course, was quite untenable and erroneous.

This grouping of the main placer areas along one zone was noticed by Dawson, who said:—

"While it may now be safely affirmed that gold is very generally distributed over the entire area of the Province of British Columbia, so much so that there is scarcely a stream of any importance in which at least 'colours' of gold may not be found, the enumeration of the principal discoveries of important mining districts show very clearly that most of these are situated along the system of mountains and high plateaus which comprises the Purcell, Selkirk, Columbia, and Cariboo ranges and their north-western continuations, lying to the south-west of the Rocky Mountain range properly so called, and parallel in direction with it. Of all the gold-producing districts that of Cariboo has proved the richest and the most continuously productive."

Physiographically the placer-fields are situated in the Central Belt of the Cordilleras of Canada. This Central Belt is comprised of the Columbia, Interior, Cassiar, and Yukon systems, which systems in turn include the Selkirk, Monashee, and Cariboo mountains and the Fraser, Nechako, and Yukon plateaus.

Generally speaking, the placer-fields of British Columbia occur in plateau areas where alpine mountains are absent. As a rule the topographic relief is not great, although in places the deep valleys of the Fraser plateau give an appearance of true mountainous topography. Even in the Selkirk and Cariboo mountains the placer-fields are found in topographic areas transitional between plateaus and typical mountain ranges.

Rocks of many varieties and formed over a considerable range in geologic age are found in the various placer-fields. In many of these areas a noticeable feature of the rock formation is the large number of quartz veins that are exposed. For the purpose of this discussion it is unnecessary to enumerate the types of rock formations occurring in the placer camps, but it is important to bear in mind that quartz veins are almost always present, varying in size from mere stringers up to ledges 100 feet in width. In some areas auriferous slates are mentioned by some writers, but these generally consist of slates containing small irregular quartz stringers, and it is in these that the gold occurs.

The great period of mineralization in British Columbia was in Jura-Cretaceous times following the intrusion, or series of intrusions, of batholithic rocks expressed in the Coast range, Bulkley mountains, Nelson batholith and other batholiths and stocks which form a dominant feature of the western and southern geology of the Province. It is believed that the quartz veins of the placer-fields stretching from South-east Kootenay to Yukon were formed by this agency. Although occurring in host rocks of a wide variety, these quartz veins are characterized by the presence of small amounts of sulphides (in particular pyrite and arsenopyrite) which are in part gold-bearing. It is further believed that the erosion of these quartz veins and later concentration and reconcentration of the contained gold gave rise to the placer deposits. It follows, therefore, that in all cases of rich placer deposits the gold had a local origin, but that the fine gold (flour-gold) from this source had a widespread distribution throughout the gravels of the Province.

Following mineralization in the Jura-Cretaceous, a long period of erosion took place in the late Cretaceous and Tertiary periods, and it is believed that extensive placer deposits were formed then in the stream-valleys. For a description of the processes by which the gold in the sulphides of the quartz veins was concentrated in the veins by solution, precipitation, and repetitions thereof, thereby deposited at the water-level, eroded and finally concentrated in the stream-gravels, the reader is referred to the convincing and elaborate discussion in the Report on the Barkerville Area, by Johnston and Uglow, Memoir 149, Geological Survey of Canada, 1926.

While this report is confined to the Barkerville area, it is believed that this is an excellent description of what has taken place in many placer-fields of the Province. Similar conditions are noticeable in East Kootenay, Granite Creek, Atlin, and other camps.

It is assumed that at the close of the Tertiary there were a number of rich and continuous placer deposits in the various fields of the Province. Then the Glacial age arrived and immediately much havoc was created with the placer deposits. In large part they were obliterated and the placer-gravels transported far and wide and the gold content so admixed with barren gravels as to make them of no economic value.

It is generally agreed that British Columbia was covered with a large ice-sheet and that there was a recurrence of this condition at intervals, with interglacial periods between. It is also evident that in the Central Belt the ice-sheet was not particularly active, but was more or less stagnant, in contrast to the active glaciation that prevailed in the more rugged mountainous belts of the Province where glaciation was a potent force of erosion. With the exception of valley glaciers at the end of the Glacial age or in interglacial periods, the great ice-sheet did not actively erode the rock formations of the Central Belt. To this is due the fact that there are any placer-fields left and also explains (at least, in part) the virtual absence of important placer deposits in the Western Belt, where glaciation had a much greater erosive action. The Eastern Belt is also lacking in placer deposits, but this is probably due mainly to the lack of original gold mineralization in the rock formations.

Plenty of evidence is to be found in the Cariboo district to show that glaciation did not erode rock formations to any great extent, and in places there are remnants left of what undoubtedly

are original Tertiary gravels. Glaciation, however, did profoundly affect the gravels of the area by eroding them in part, distributing them, and by means of glacial streams roughly resorting and partially concentrating them.

The writer would like to emphasize the point that the most important feature of placer geology in British Columbia is the effect of glaciation. It is the cause of many perplexities, and a lack of knowledge of glacial geology is the reason that so many ill-advised placer ventures have been attempted, with consequent financial failure.

It is confidently asserted that all bonanza placer deposits in British Columbia were either in original Tertiary gravels or in gravels which represent a direct reconcentration by Glacial or Post-Glacial streams of original Tertiary gravels.

Placers in British Columbia may be broadly divided into the following classes:—

(1.) Original Tertiary gravels. Only remnants and fragments of these are left and in following a Tertiary channel it may be cut off abruptly; this sudden termination is due to erosion by glaciation. They occur on bed-rock and are usually buried beneath glacial gravels. This is the "lead" gold of the old-timers.

(2.) Interglacial gravel deposits. In many instances these gravels are deposited on a previously deposited glacial clay, but may occur on bed-rock. These are derived by interglacial stream-action concentrating glacial gravels robbed from original Tertiary channels.

(3.) Post-Glacial gravel deposits. The Pleistocene or Glacial epoch scattered enormous masses of gravels across the country and particularly in the main stream-channels. In the zones of original Tertiary placer deposits these glacial gravels contained more or less gold, but almost always the original placer-gravels were so diluted with extraneous material that the final depositions of glacial gravels were of no economic value as placer deposits. In this connection it should be remembered that ice-erosion did not concentrate. In places these glacial gravels have been concentrated by Post-Pleistocene stream-action, but as a rule these deposits are low grade, with the exception of bar deposits, which sometimes have rich shallow ground.

Variations of these three types occur, but in a broad general way this classification includes all placer deposits in the Province. In some cases ancient channels have been left stranded through diversion of the waters by glaciation, covered by glacial gravels, and later these ancient channels were robbed by recent stream-action giving rise to rich placers in the present streams. This was well exemplified by Keithley creek, Quesnel Division, and in part on Lightning creek.

Masses of Tertiary gravels with a rich gold content have apparently in places been plucked out by glaciation and deposited almost intact away from the original source and entirely surrounded by glacial gravels. This has been suggested as the explanation of the rich patch at Cedar creek, Cariboo Division.

Enough has been said to show that the dominant feature of British Columbia placer geology is glaciation and that much cautiousness must be used in assuming continuity of any placer deposit. Much futile work has been done on the assumption that a rich pay-streak in an ancient channel should continue for miles. The channels often do continue, but in many instances are barren of pay-gravels.

The Graham Island deposits are probably of type 3, but have been mainly concentrated in the present deposits by wave-action.

ANCIENT CHANNELS.

The history of every placer camp in British Columbia is filled with stories of ancient channels, and many channels are theorized running in all directions. While such theories are valuable if reasonably based on proper field evidence, undoubtedly they are responsible for much work that was in no way justified.

In the Cariboo district it is apparent that the main lines of drainage in Tertiary times were very similar to what they are now. Local variations, however, were considerable, particularly in the smaller streams. Many of the present streams have stranded channels in the benches which represent various positions of the stream from Post-Pleistocene back to the Tertiary age.

Glaciation undoubtedly reversed, altered, and changed the local drainage in many places, but did not materially affect the master drainage of the country. Theories of ancient channels that parallel or diverge at slight angles from the present drainage are worthy of investigation and possible testing, but those ideas that postulate large channels, running at random across the country, should be dismissed as highly improbable.

It is apparent that a necessity for the future intelligent testing of the placer deposits of the Cariboo and probably of other placer areas in the Province is a careful study in detail of placer geology. This work was commenced in the Cariboo by the Geological Survey of Canada, but never carried to a conclusion. Reconnaissance-work was started by B. R. MacKay. Later, the Barkerville area was topographically and geologically mapped by W. A. Johnston and W. L. Uglow. This report contains much useful information on the placer deposits of that area, including a detailed discussion of their origin and physical occurrence.

An extension of this topographic mapping to take in the area extending to Quesnel, Quesnel lake, and Horsefly, to be followed by the mapping of the superficial geology (gravels, clays, and soils), would be of great assistance in sizing up the areas that warrant testing. Such geological work should afford much information regarding ancient channels and the former drainage, and it is in these ancient channels that the more important possibilities lie of further profitable placer deposits.

PLATINUM.

Metals of the Platinum group occur in sparing and irregular quantities in the placer-gravels of the Province. The most important area has been the Tulameen section of the Similkameen Division. The history of the discovery and mining of the platinum in this section is given under Similkameen Division.

The origin of this platinum is in a belt of peridotite rocks cut by the Tulameen river and its tributaries. In the gravels of this section there is a considerable content of black sand carrying varying amounts of fine gold and platinum which is difficult to recover by ordinary methods. An efficient and economical process for treating this black sand to recover these metals would probably make possible the profitable operation by hydraulicking or dredging of certain of these gravel-deposits which cannot be worked otherwise.

In this connection, if the Lorentsen precious-metal separator, now in the experimental stage, proves successful, it will be of material assistance in helping placer-mining in this and other areas. This machine is described by J. T. Mandy in his report in this bulletin on Graham island, under the heading of Queen Charlotte Mining Division.

Platinum also occurs in the gravels of the Quesnel river and its tributaries, but very irregularly distributed. Similarly, small amounts have been detected in black-sand concentrates from gravels of the Fraser river. No appreciable production of platinum has ever been recorded from these localities. The Quesnel River gravels in many places, however, carry in places a high content of black sand and a proper treatment system might show values in fine gold and platinum in these sands which would pay to recover.

Small amounts of platinum also occur in Atlin Division and Graham island, but are not of great importance. Other Platinum group metals, such as iridium, osmium, and palladium, occur in small amounts associated with the platinum, especially in the Tulameen section.

FINENESS OF PLACER GOLD.

In 1900 a comprehensive set of specimens of British Columbia placer gold was collected and exhibited at the Paris Exhibition. A complete detail record of the specimens is given in tabular form in the 1899 Annual Report. The information is interesting now to show the value to the ounce or fineness of the placer gold produced from various creeks and districts of the Province. The following table gives in abbreviated form this information:—

FINENESS OF PLACER GOLD.

Mining Division and Locality.	How worked.	Nature of Specimen.	Value per Ounce.
Lillooet—			
Fraser river		Gold-dust.....	\$16.50
Upper Bridge river		Gold-dust.....	17.00
Lower Bridge river		Gold-dust.....	17.00
Cariboo—			
Fraser river		Gold-dust.....	16.00
Smoky river		Gold-dust.....	16.50
Cottonwood river		Gold-dust.....	17.00
Shepherd creek	Hydraulic	Gold-dust.....	17.00
Coffee creek	Hydraulic	Gold-dust.....	17.25
Slough creek		Gold-dust.....	17.25
Lightning creek		Gold-dust.....	17.25
Nelson creek		Gold-dust.....	17.25
Lower Williams creek	Hydraulic elevator	Gold-dust.....	16.00
Williams creek		Gold-dust.....	15.87
Upper Williams creek		Gold-dust.....	15.50
Cunningham creek		Gold-dust.....	16.50
Grouse creek		Gold-dust.....	16.00
8-Mile lake		Gold-dust.....	17.00
Stout gulch	Sluice	Nuggets.....	17.25
Mosquito creek	Sluice	Nuggets.....	17.25
Williams creek	Sluice	Nuggets.....	15.75
Lowhee creek		Nuggets.....	17.25
Lightning creek	Sluice	Nuggets.....	17.50
Summit creek	Hydraulic	Gold-dust.....	18.33
Stevens creek	Hydraulic	Nugget.....	18.50
Quesnel—			
Quesnel Forks	Hydraulic	Nugget.....	16.80
Horsefly river		Gold-dust.....	16.90
Keithley creek		Gold-dust.....	17.40
Quesnel Forks		Gold-dust.....	16.50
Golden—Quartz creek		Gold-dust.....	18.00
Liard—			
Thibert creek		Gold-dust.....	16.00
McDame creek		Gold-dust.....	18.00
Dease creek		Gold-dust.....	15.00
Messetoe creek	Sluice	Gold-dust.....	18.00
Rosella creek	Sluice	Gold-dust.....	18.00
Snow creek	Sluice	Gold-dust.....	18.00
Quartz creek	Sluice	Gold-dust.....	18.00
Walker creek	Sluice	Gold-dust.....	19.00
Atlin—			
McKee creek	Sluice	Gold-dust.....	16.25
Spruce creek	Sluice	Gold-dust.....	16.25
Pine creek	Sluice	Gold-dust.....	16.25
Birch creek	Sluice	Gold-dust.....	16.25
Willow creek	Sluice	Gold-dust.....	16.25
Pine creek	Sluice	Nuggets.....	18.00
Wright creek	Sluice	Nuggets.....	18.00
Boulder creek	Sluice	Nuggets.....	18.00
Ashcroft—			
Fraser river	Dredging	Gold-dust.....	17.89
Texas Creek mouth	Dredging	Gold-dust.....	17.89
Greenwood—Rock creek	Sluice	Gold-dust.....	16.50
Fort Steele—Wild Horse creek	Sluice	Gold-dust.....	18.00
Arrow Lake—Fire Valley creek	Sluice	Gold-dust.....	16.00
Yale—North Bend	Dredger	Gold-dust.....	17.27
Revelstoke—			
Big Bend	Bed-rock flume	Gold-dust.....	18.00
Smith creek	Sluice	Gold-dust.....	18.00
Columbia river	Sluice	Gold-dust.....	18.00
French creek	Drifting	Nugget.....	18.00
Ashcroft—Lytton	Dredging	Medium gold (2)	19.00
Omineca—Manson creek	Hydraulic	Nuggets.....	16.50

EXPERIENCE FROM RESULTS OF PLACER-MINING IN BRITISH COLUMBIA.

By studying the record of placer-mining in British Columbia it is seen that in every camp some good pay-ground was first discovered, which was easily worked at a satisfactory profit. Later on, extensions of the shallow bonanza ground were explored with varying degrees of success.

As a rule, when costly plants were installed to work by drifting methods deep ground with heavy water-pressure, no success was attained. On the other hand, many successful hydraulic plants have been operated on ground too low grade for drifting, or in places where a rich pay-streak had been partially drifted out by the old-timers.

It is quite apparent that deep-drifting operations in many instances were unsuccessful because the pay-streak or "lead" of rich gold gravel ceased owing to various causes. Pay-streaks of coarse gold, which undoubtedly were of direct local origin, could not be expected to extend to any great distance from the source of gold; secondly, many of these pay-streaks terminate abruptly through the gravels being eroded by glaciation.

The whole history of placer-mining in British Columbia shows that, in the majority of instances, altogether inadequate testing of the ground was carried out before proceeding with installation of costly equipment and construction-work. In the early days testing of ground was primitive, and in the bonanza fields probably unnecessary. Later, testing was done by pits, shafts, and tunnels, and on the results of one favourable test extensive plans were frequently laid out and executed. In many cases far too much was assumed without thorough testing.

In later years the use of churn-drills—such as the Keystone and others—have been used to test placer-ground, but, owing to many prejudices, not as full use has been made of this excellent device as would be desirable. Drilling, if properly conducted, is the most economical and efficient method of testing placer-gravels. It gives information as to values, character of gravels and clays, and depth of bed-rock; but it only gives this information if the work is systematically carried out by experienced operators. The writer has knowledge of much testing of placer-ground in British Columbia which is entirely valueless so far as reliability of results is concerned; some of this was by drilling and some by other methods.

Without elaborating further, it is quite evident that the moral to be taken from the results obtained from much money spent on unsuccessful placer enterprises in British Columbia is that careful and adequate testing of the ground is essential before assuming that any ground will pay to work. In some instances it is argued that the cost of drilling the ground would be as great as installing a hydraulic plant, and that if a reasonable assumption can be made that the ground carries pay-gravel, then the plant should be installed without testing. Such cases are extremely rare, and as a rule ground can be tested for a small percentage of the cost of plant and equipment to work it.

FUTURE POSSIBILITIES.

While the record of placer-mining in the various camps in British Columbia shows that after the originally discovered rich ground was exhausted many unsuccessful enterprises have been started, it should not be concluded that there are not many possibilities for the future. These opportunities may be listed as follows:—

(1.) The discovery of new untested deposits in the vast area of the Central Belt. It is not likely that bonanza deposits on unmined creeks will be as easily found as in the early days of the Province, but there are undoubtedly many creeks that have never been properly prospected.

(2.) The major possibility for the future is probably the finding of ancient channels (Tertiary drainage) which have not been recognized. Many of these channels may be barren of pay-gravels through ice-erosion, but some of them may contain workable placer deposits.

(3.) Low-grade Post-Glacial deposits occur in many places which have been formed by concentration of Glacial gravels by Post-Pleistocene stream-action. While many of these are too low in gold content to be profitably worked, it is probable that adequate testing will show many deposits that could be hydraulicked, provided there is an adequate supply of water and physical conditions are suitable. Some of these deposits, as well, may provide suitable ground for dredging.

(4.) In some areas, particularly in the Tulameen and Quesnel sections, the efficient handling of the black-sand concentrates from placer operations to recover the gold and platinum content

may make possible the working of present known deposits which cannot be profitably handled by present methods.

If further detail geologic work is done in the various placer areas, particularly in the Central Belt, it seems probable that many interesting possibilities will be brought to light and capital will be encouraged to test out various gravel-deposits now unknown.

METHODS OF WORKING.

Practically every method of working has been used in the placer-fields of British Columbia. The early miners in each camp started with pans and rockers; and this was followed by deep-drifting methods, the pay-gravels being washed in sluice-boxes. The old-timers of the Cariboo did wonderful work in deep-drifting operations; Cornish pumps and water-wheels were used to handle the water and ground heavy with slum and water-pressure was successfully handled. In the Cariboo after 1864 many elaborate deep-drifting enterprises were commenced to mine continuations of channels worked by the old-timers. It was assumed that with more modern machinery areas unprofitable to the old-timer would pay to operate, but practically none of these projects have been successful.

Later, hydraulic operations were commenced and in recent years the bulk of the placer production of the Province has come from hydraulic operations. Variations of ordinary hydraulic practice have been used, including hydraulic elevators and the so-called "pump-hydraulic." This latter system is used where water is scarce and the water is caught in dams below the operation and pumped back to be used again under a pressure-head; it is a costly and generally inefficient system, only suitable for rich shallow ground. Some excellent hydraulic systems have been installed in the Province, particularly in the Cariboo, Quesnel, Liard, and Atlin Divisions.

Dredging has been tried in several places, but nearly all the dredges have been of poor design or a new unproven invention that proved unsuitable for the work. Probably the only really modern dredge installed in the Province was the one at Antler creek, Cariboo Division, operated by the Kafue Copper Development Company. Mechanically this dredge was successful, but the operation unfortunately was not a financial success. This dredge has now been scrapped and the machinery shipped out of the country.

Variations of dredging, such as steam-shovels, gas-shovels, and drag-line scrapers, have also been used to dig placer-gravels. Generally, every available device has been used in attempting to exploit the latent wealth of the placer deposits of the Province.

DESCRIPTION OF PLACER-PROSPECTING METHODS.

When entering a new field in search of placer-gold deposits the miner was at first restricted to the use of such tools as he could transport on his own back or on a horse. These were generally axes, picks, shovels, and gold-pans, with which sands and gravels could be tested and, in favourable circumstances, gold recovered.

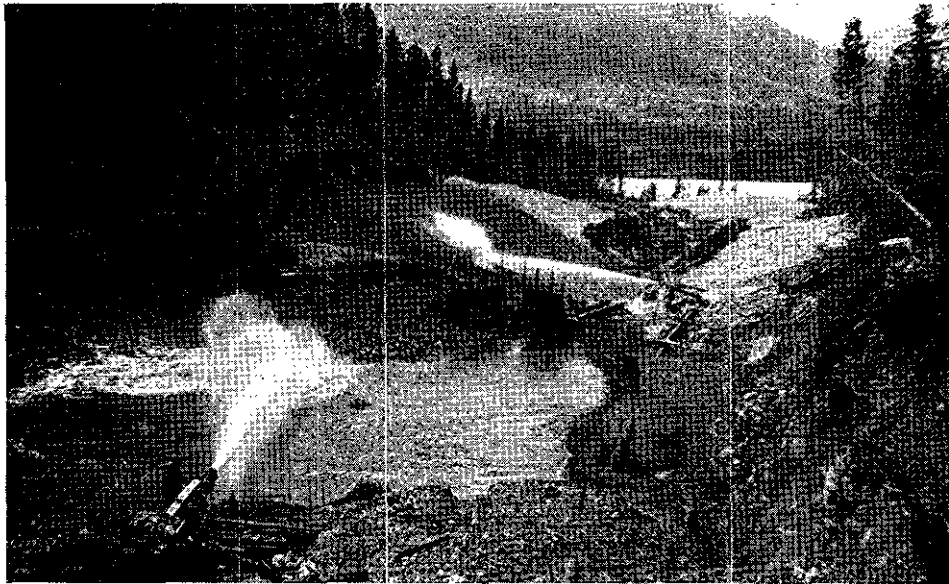
If the results warranted further exploration and heavier work, other apparatus was constructed to suit the requirements of the location. Rockers (dollies), long toms, and sluices of various forms were arranged to treat the sands and gravels.

When necessary to deal with large amounts of water in the larger creeks, devices such as the following were constructed: Boomers or shooters; dams with a hinged gate which, when the impounded water created sufficient pressure, opened and released the water to scour the creek-bed and uncover the gold-bearing bed-rock; wing-dams extending part way across the creek to dry the bed in part and permit working the bed; and eventually a large wooden flume capable of carrying the whole creek and permitting work on the bed.

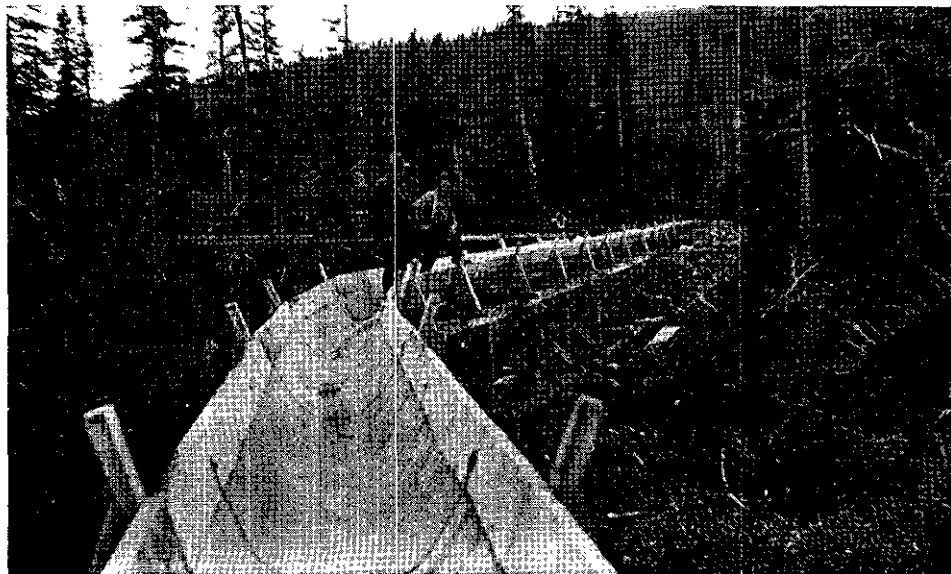
From these beginnings larger works were undertaken. Drift-mining in the banks and under the creek as seemed necessary; hydraulicking on the banks and large dredges on rivers and lakes.

A description of the simpler methods may be of interest. As the gold occurs in the heavier sands and gravels which accumulate in favourable spots in the creeks and on the surface and in the consolidated gravels, it may be recovered by the washing of these materials in such a way as to retain the gold separate from the rest.

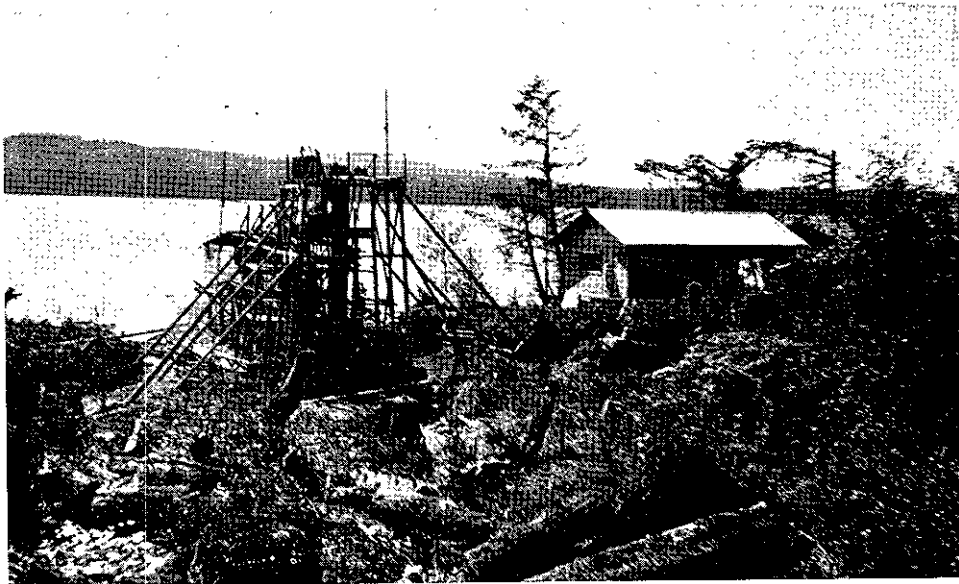
The simplest and most effective tool is the gold-pan. This is 18 inches in diameter, 3 inches deep, and has sloping sides and is made of sheet iron. It will be found in almost any general



Compagnie Francaise des Mines d'Or du Canada, Atlin—Otter Creek.



Compagnie Francaise des Mines d'Or du Canada—Metal Flume.



Golden Star Mines, Ltd.—Placer on Graham Island.



Nord Bros.' Cascade Method of Sluicing, Wright Creek.

store in British Columbia. This will hold from 15 to 25 lb. of dirt, according to the character of the ground. A smaller pan 10 inches in diameter will hold from 3 to 5 lb. of dirt and is easier to handle. A good placer-miner by continuous washing may in ten hours pan from $\frac{1}{2}$ to 1 cubic yard, depending on the situation with regard to water and dirt.

The process of panning may be soon learned by watching a skilled operator at work. The dirt including the gold is put in the pan, the whole then immersed in water and gently shaken to loosen the material, while the large gravel is washed by hand and thrown out. The clayey material is broken up by hand and caused to leave the pan by a swirling and to-and-fro combined motion given the pan after it is lifted from the water. When by this peculiar motion all the gravels, sands, and clay have been removed from the pan the remainder will be found to consist of black sand and gold nuggets and coarse dust. The particles will consist of gold, platinum, chromite, magnetic iron, and, according to the conditions, rubies, garnets, zircon, tungsten, tin, and many other heavy minerals.

Of these, pyrite and mica flakes will, by their glitter, confuse the inexperienced. They are, however, easily proved by the brittleness when crushed.

It will be readily seen that the gold will only be saved which is of a reasonable size of particle. Dust and flakes may escape with the water owing to their inability to sink quickly, while fragments which are partly quartz or have cavities in or which are covered with clay or talc will also be liable to be lost owing to the lesser gravity.

When the heavy particles have been collected and dried in the pan magnetic separation with a magnet will leave practically clean gold-dust. This is put in a small chamois-leather bag and is ready for sale. The separation of platinum from the black sand is more difficult, but by skilful panning and the use of the magnet can be accomplished.

The value of nuggets and gold-dust is found to be, in British Columbia, about \$17 an ounce, as it all carries a proportion of silver. Every creek in the placer area carries gold of a certain variety and the experts can tell at a glance from which creek it was obtained and the probable value.

After testing the ground with a pan it may be decided to carry on with heavier work, involving the construction of a cradle or rocker, of which the following is a description: A rocker, sometimes called a cradle or dolly, consists of a box on rockers similar to the old-fashioned baby's cradle. The general dimensions may be, conveniently, 48 inches long, 18 inches wide, and 18 inches high. The long sides are cut at a slope from about the centre to a height of 4 inches at the front end. In the higher or rear end is placed a tray or sieve with a tin bottom containing $\frac{1}{2}$ -inch holes; under this and sloping towards but not touching the rear wall is supported a frame holding a canvas apron slightly sagging or a sloping board covered with burlap and riffles. On the floor of the rocker, which should be of one piece, are fastened several cross-cleats or riffles. A handle is attached to stand up above the box, by which the apparatus is agitated sideways during operation. It will readily be seen that the details of the dimensions of the rocker may be varied according to the character of the dirt to be treated and the supply of material available.

In operating the rocker the sieve is filled with dirt and water is poured in by a ladle or small stream and the whole rocked. This clears the feed of fine sand and muddy water, when the larger gravel can be lifted out after a final cleaning. The fine material passes through the sieve on to the apron canvas; here the gold is mostly caught, leaving the rest to pass down to the floor and run over the riffles and out the front end to waste. This will result in a good deal of the coarser gold being saved. Some of the fine dust and flakes will escape with the water. The inclination of the apron is important. A diagram of a dolly is given herewith.

Mercury can be placed on the apron, but the miner is not likely to be provided with this. Mercury has the valuable quality of collecting gold into itself and is used a great deal in the larger gold-saving operations. A plentiful supply of water is essential to placer operations. The "dry-blown" methods of separation as used in Australia, whereby the sand is blown away from the gold, are not used in British Columbia.

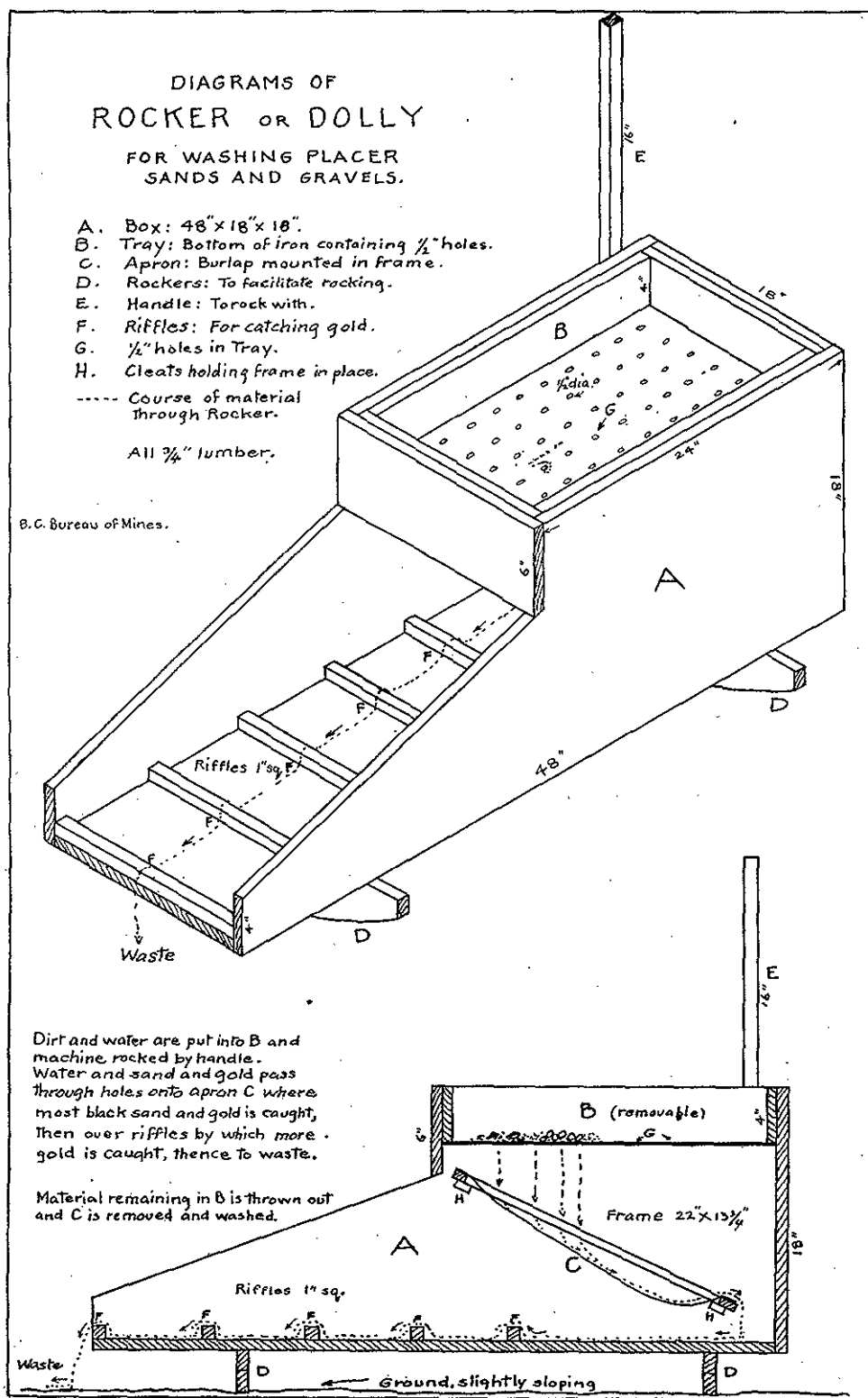
Larger quantities of dirt can be treated by means of long toms. This apparatus consists of a series of troughs open at one end and set to empty one into another in a series of steps. Open grids, called grizzlies, and various arrangements of riffles are added in the endeavour to intercept and hold all the gold present in the feed-dirt.

DIAGRAMS OF ROCKER OR DOLLY

FOR WASHING PLACER
SANDS AND GRAVELS.

- A. Box: 48" x 18" x 18".
- B. Tray: Bottom of iron containing $\frac{1}{2}$ " holes.
- C. Apron: Burlap mounted in frame.
- D. Rockers: To facilitate rocking.
- E. Handle: To rock with.
- F. Riffles: For catching gold.
- G. $\frac{1}{2}$ " holes in Tray.
- H. Cleats holding frame in place.
- Course of material through rocker.
- All $\frac{3}{4}$ " lumber.

B. C. Bureau of Mines.



The supply of water is generally the most important problem and many ingenious devices are constructed by the miners for the purpose of raising water and conveying it to the deposit.

When the pay-dirt is in the banks of the river hydraulicking is resorted to. This method is carried out by means of water brought from a suitable height above the work in a pipe-line to a large monitor or nozzle by which the water is directed in a powerful jet against the bank. The resulting washing of the gravel in a sluiceway separates the gold, which settles in the sluices and is recovered at the end of the season. This method may be used by one man with a canvas hose-line or in a large way with steel pipes and 9-inch monitors which tear down masses of gravel.

SYNOPSIS OF MINING LAWS OF BRITISH COLUMBIA AS RELATING TO PLACER-MINING.

Under the "Placer-mining Act" lands may be taken up for mining purposes either as claims or leases. The former are relatively small in area—a claim in "creek diggings" being 250 feet in length by 1,000 feet in width measuring from the general course of the stream 500 feet on either side from the centre thereof—while the latter usually contains about 80 acres.

To hold the claim it must be worked continuously by the owner or an agent, subject to "lay-over" privileges, while to keep the lease in good standing rentals must be paid annually and development-work done and recorded each year.

Further particulars as to procedure in respect of staking, recording, etc., are contained in the appended synopsis. It must be understood, however, that no attempt is made here to cover the details of the placer-mining law of the Province. Any person who plans a prospecting-trip and proposes locating and taking up placer-mining ground is advised to read carefully the provisions of the Act and to be guided by the same. Copies of this Act may be obtained at the office of any Mining Recorder and from the King's Printer, Victoria.

It may be said generally that the mining laws of British Columbia, both lode and placer mining, are liberal in their nature and can compare favourably with those of any other part of the world.

The fees attending the taking-up of placer claims are as low as possible consistent with proper administration and are generally lower than those of other Provinces of Canada. The same may be said in respect of placer leases, which are granted for a period of twenty years with the privilege of extending them should there remain a part of the area to be worked at the end of the period. An annual rental of \$25 for a bench lease and \$37.50 for a creek lease, with development-work requirements of \$250 a year, are extremely reasonable, especially when compared to the statutory requirements of other placer-mining countries. As to assessment-work on placer-mining leases, attention is directed to the fact that excess work may be recorded for three years in advance, providing the application for the record of such excess work is made in the year in which it is performed.

The following synopsis will give the miner or intending investor a general knowledge of the scope and requirements of the laws affecting placer-mining in the Province:—

FREE MINERS' CERTIFICATES.

Any person over the age of eighteen, and any joint-stock company, may obtain a Free Miner's Certificate on payment of the required fee.

The fee to an individual for a Free Miner's Certificate is \$5 for one year. To a joint-stock company having a capital of \$100,000, or less, the fee for a year is \$50; if capitalized beyond this, the fee is \$100.

The Free Miners' Certificates all expire at midnight on May 31st in each year. Certificates may be obtained for any part of a year, terminating on May 31st, for a proportionately less fee.

The possession of this certificate entitles the holder to enter upon all lands of the Crown, or upon any other lands on which the right to so enter is not specially reserved, and to prospect for minerals, locate claims, and mine.

A free miner, in the case of placer claims, can hold only one claim by location on each creek, ravine, or hill, and not more than two in the same locality, only one of which shall be a "creek" claim. He may acquire others by purchase.

In the event of a free miner allowing his certificate to lapse, his mining property reverts to the Crown, but where other free miners are interested as partners or co-owners the interest of

the defaulter becomes vested in the continuing co-owners or partners *pro rata*, according to their interests.

It is not necessary for a shareholder, as such, in an incorporated mining company to be the holder of a Free Miner's Certificate.

PLACER CLAIMS.

Placer-mining is governed by the "Placer-mining Act," and by the interpretation clause its scope is defined as "the mining of any natural stratum or bed of earth, gravel, or cement mined for gold or other precious minerals or stones." Placer claims are of four classes, as follows:—

"Creek diggings": any mine in the bed of any stream or ravine:

"Bar-diggings": any mine between high- and low-water marks on a river, lake, or other large body of water:

"Dry diggings": any mine over which water never extends:

"Precious-stone diggings": any deposit of precious stones, whether in veins, beds, or gravel deposits."

The following provisions as to extent of the various classes of claims are made by the Act:—

"In 'creek diggings' a claim shall be two hundred and fifty feet long, measured in the direction of the general course of the stream, and shall extend in width one thousand feet, measured from the general course of the stream five hundred feet on either side of the centre thereof:

"In 'bar diggings' a claim shall be:—

"(a.) A piece of land not exceeding two hundred and fifty feet square on any bar which is covered at high water; or

"(b.) A strip of land two hundred and fifty feet long at high-water mark, and in width extending from high-water mark to extreme low-water mark:

"In 'dry diggings' a claim shall be two hundred and fifty feet square."

The following provision is made for new discoveries of placer-mining ground:—

"If any free miner, or party of free miners, discovers a new locality for the prosecution of placer-mining and such discovery be established to the satisfaction of the Gold Commissioner, placer claims of the following sizes shall be allowed to such discoveries, viz.:—

"To one discoverer, one claim.....600 feet in length;

"To a party of two discoverers, two claims amounting together to.....1,000 feet in length;

"And to each member of a party beyond two in number, a claim of the ordinary size only.

"The width of such claims shall be the same as ordinary placer claims of the same class:

Provided that where a discovery claim has been established in any locality no further discovery shall be allowed within five miles therefrom, measured along the watercourses."

Every placer claim shall be as nearly as possible rectangular in form, and marked by four legal posts at the corners thereof, firmly fixed in the ground. On each of such posts shall be written the name of the locator, the number and date of issue of his free miner's certificate, the date of the location, and the name given to the claim. In timbered localities boundary-lines of a placer claim shall be blazed so that the posts can be distinctly seen, underbrush cut, and the locator shall also erect legal posts not more than 125 feet apart on all boundary-lines. In localities where there is no timber or underbrush, monuments of earth and rock, not less than 2 feet high and 2 feet in diameter at base, may be erected in lieu of the last-mentioned legal posts, but not in the case of the four legal posts marking the corners of the claim.

A placer claim must be recorded in the office of the Mining Recorder for the mining division within which the same is situate, within fifteen days after the location thereof, if located within ten miles of the office of the Mining Recorder by the most direct means of travel. One additional day shall be allowed for every ten miles additional or fraction thereof. The number of days shall be counted inclusive of the days upon which such location was made, but exclusive of the day of application for record. The application for such record shall be under oath and in the form set out in the Schedule to the Act. A claim which shall not have been recorded within the prescribed period shall be deemed to have been abandoned.

To hold a placer claim for more than one year it must be recorded before the expiration of the record or rerecord.

A placer claim must be worked by the owner, or some one on his behalf, continuously, as far as practicable, during working-hours. If work is discontinued for a period of seventy-two

hours, except during the close season, lay-over, leave of absence, sickness, or for some other reason to the satisfaction of the Gold Commissioner, the claim is deemed abandoned.

Lay-overs are declared by the Gold Commissioner upon proof being given to him that the supply of water is insufficient to work the claim. Under similar circumstances he has also the power to declare a close season, by notice in writing and published in the Gazette, for all or any claims in his district. Tunnel and drain licences are also granted by him on the person applying giving security for any damage that may arise. Grants of right-of-way for the construction of tunnels or drains across other claims are also granted on payment of a fee of \$25, the owner of the claims crossed having the right for tolls, etc., on the tunnel or drain which may be constructed. These tolls, however, are, so far as the amount goes, under the discretion of the Gold Commissioner.

CO-OWNERS AND PARTNERSHIPS.

Provision is made for the formation of mining partnerships, both of a general and limited liability character. These are extensively taken advantage of and have proved very satisfactory in their working. Should a co-owner fail or refuse to contribute his proportion of the expenditure required as assessment-work on a claim he may be "advertised out," and his interest in the claim shall become vested in his co-owners who have made the required expenditure, *pro rata* according to their former interests.

It should not be forgotten that if any co-owner permits his free miner's certificate to lapse, the title of his associates is not prejudiced, but his interest reverts to the remaining co-owners.

LEASES.

Leases of unoccupied Crown lands may be granted by the Gold Commissioner of the district after location has been made by placing a legal post at each corner of the ground applied for. The locator shall post "a notice on the post nearest to the placer claims then being worked in the immediate locality (if any), and within thirty days thereafter shall also post a notice on the office of the Mining Recorder." This notice must state the name of the applicant, the location of the ground to be acquired, the quantity of ground, and the term for which the lease is to be applied for. Within thirty days an application, in duplicate, with a plan of the ground on the back, must be made in writing to the Gold Commissioner, and the application must contain the name of each applicant, the number of each applicant's free miner's certificate, the locality of the ground, the quantity of ground, the terms of the lease desired, and the rent proposed to be paid. A sum of \$20 must accompany the application, which is returned if the application is not granted. The term of leases must not exceed twenty years. The extent of ground covered by leases must not be in excess of the following: Creek leases, on creek or river, half a mile; bench leases, 80 acres; for dredging leases, 5 miles; precious-stone diggings, 10 acres.

Under the "Placer-mining Act" the annual rental and amount to be expended annually on development-work on all leases is as follows:—

Bench lease, annual rental, \$25; annual development-work, \$250.

Creek lease, annual rental, \$37.50; annual development-work, \$250.

Dredging lease, annual rental per mile, \$25; annual development-work per mile, \$1,000.

It is further provided that all development-work must be recorded with the Mining Recorder during the current year, similarly as is done with a mineral claim, and in default of such record being made the lease becomes automatically forfeited.

Leases may be "grouped" and annual development-work performed on one or more of the leases for the whole group. Excess work may be recorded three years in advance. Payment in cash of like amount to the development-work requirements may be made in lieu of such development-work.

For more detailed information the reader is referred to the complete "Placer-mining Act," which may be obtained from the King's Printer, Victoria, B.C.

"MINES DEVELOPMENT ACT."

When it is shown to the satisfaction of the Minister of Mines that the possibilities of a mining property are such as to warrant the expenditure of public moneys, the Minister of Mines may authorize the expenditure of so much of the public money as may be required for the con-

struction, reconstruction, or repair of trails, roads, and bridges to facilitate the operation and development of placer claims.

Furthermore, the Minister of Mines may authorize the expenditure of public money towards the building or repairing of trails and bridges in or to any mineral district for the purpose of facilitating the exploration of the mineral resources of the district. If such roads, trails, or bridges have been built by any person or company having mining interests in the district, the Minister of Mines may refund to such persons a portion not exceeding 50 per cent. of the cost of such construction.

"MINERAL SURVEY AND DEVELOPMENT ACT, 1929."

Part I.—Mineral Survey.

This Act divides the Province into six Mineral Survey Districts, to each of which district a Resident Mining Engineer, with such assistants as necessary, has been appointed, who shall devote his whole time to the carrying-out of the provisions of this Act and shall report to the Minister of Mines.

Part II.—Aid to Prospectors.

The Resident Engineer in each district shall aid the prospectors, etc., therein by such advice, information, and directions as may be of assistance to them; by examining and testing samples of mineral and advising as to the same; by reporting as to such trails, roads, and bridges as may be desirable for the development of the mineral resources, with the approximate cost thereof.

The Minister may provide from time to time at suitable places short courses of instruction in practical geology and mineralogy.

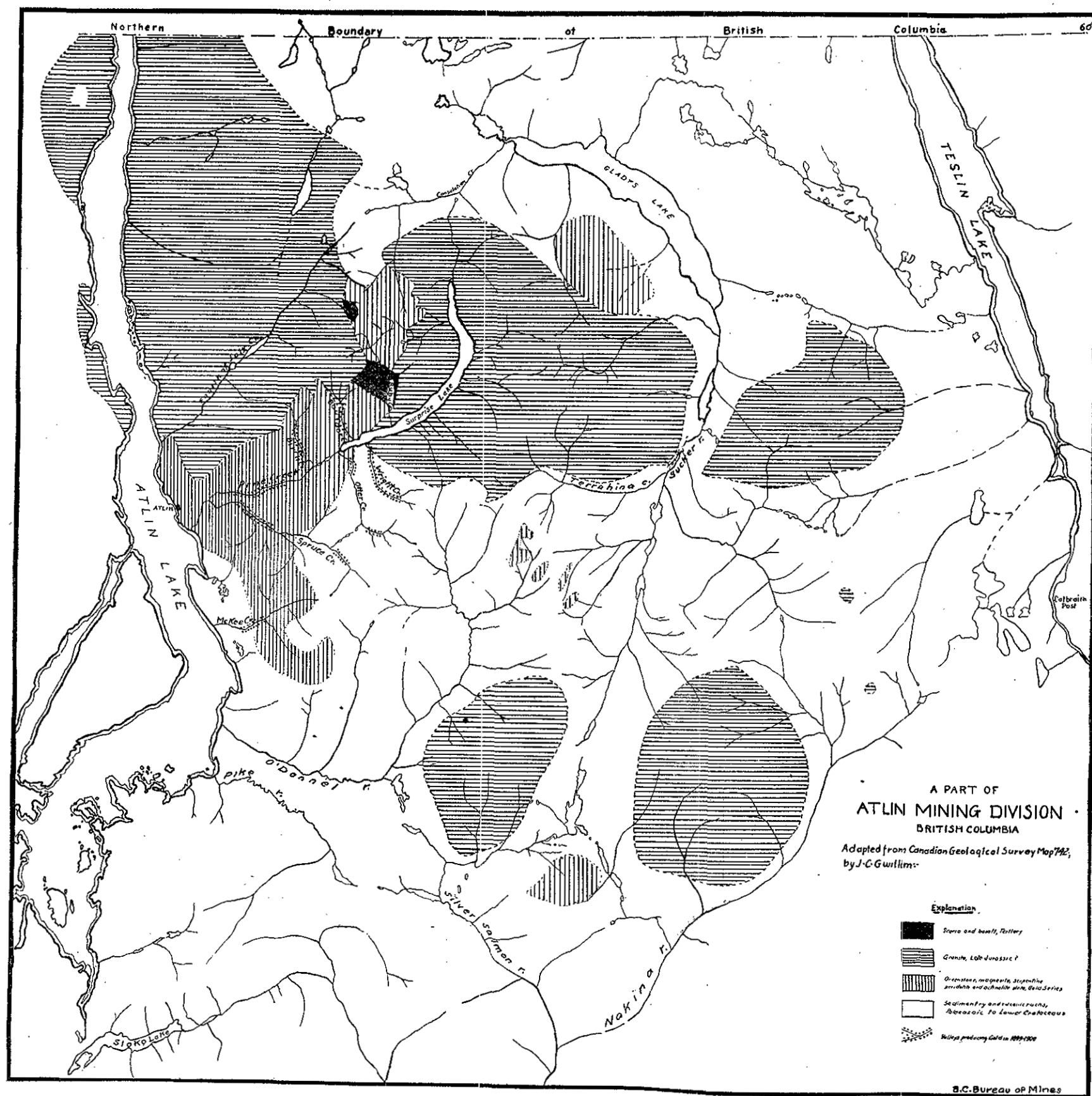
Part III.—Protection of Wage-earners.

1. Every person giving or making a working bond or lease, with or without any option for sale, of any mining property shall insert therein a provision that during the currency of the bond or lease all free miners and wage-earners employed on or about the mining property shall be paid their wages semi-monthly, and shall demand and receive a letter, to be procured by the holder of the bond or lease from a Gold Commissioner or Government Agent or Mining Recorder, stating that security for such wages has been given pursuant to this section, otherwise the person giving or making the bond or lease shall be under personal liability to pay all such wages.

2. Every person taking a right or option to work or purchase any mining property shall furnish to the nearest Gold Commissioner, or Government Agent, or Mining Recorder adequate security from time to time for the payment semi-monthly of wages of all free miners and wage-earners employed on or about the mining property, on the terms that every such security shall be forthwith realized and payment of wages made upon any default; and every Gold Commissioner, Government Agent, and Mining Recorder shall have full power and authority to realize upon the security lodged with him so as to make payment of any wages in default, and shall make payment thereof up to the amount realized.

Part IV.—Protection of Investors.

Each Resident Engineer shall, upon receiving notice of any advertised or solicited sale of shares in any company or in any claim or mine or mineral property whatsoever, upon statements or terms not in accordance with actual facts and conditions, notify the Minister of Mines, who, upon investigation, may, if found necessary, give such notice, either personal or public, as may be necessary to prevent any injury to investors; and every notice given under this section by the Minister of Mines shall be absolutely privileged.



NORTH-WESTERN MINERAL SURVEY DISTRICT.*

HISTORICAL SUMMARIES AND DESCRIPTIONS.

BY HERBERT CARMICHAEL.

(Extracts reprinted from Bulletin No. 2, 1930.)

ATLIN MINING DIVISION.

Before 1898 very little was known of Atlin Division beyond the fact that it contained a number of large lakes and big game; early in that year Fritz Miller, a German, and Kenneth Maclaren, a Canadian, left the Klondike trail at Bennett and, travelling on the ice, crossed Taku arm and Atlin lake to find gold in Pine creek. This stream they followed up, prospecting as they went, and finally decided to stake a claim about 6 miles from the mouth of the creek, where Pine City was eventually established. Dearth of supplies forced them to return to Juneau and from there the discovery of gold in the district was made known.

Public information concerning the new "strike" reached Alaskan ports about August 5th, 1898, and at the close of that season it was estimated that over 3,000 people were in the new field, and \$75,000 in gold had been taken out. All the principal gold-bearing creeks and rivers seem to have been discovered and claims staked on them during the summer and fall of 1898, and very few new ones appear to have been added to the list since that date.

On December 1st, 1898, J. D. Graham was appointed Gold Commissioner for the Atlin and Bennett Lake Mining Divisions. Messrs. Rant and McKenna had acted as Mining Recorders for the district during the year. At this time there was a certain amount of trouble in the camp, as it was at first thought to be in the North-west Territories, the mining laws of which allowed a placer claim 250 feet square instead of 100 feet square as in British Columbia. During 1899 Mr. Justice Irving was sent to open a Court at Atlin to adjudicate on mining disputes, and it says a great deal for the good order of the district that no serious disturbances occurred in those early days.

Pine creek in 1899 produced by far the largest yield of gold; while Spruce creek had the most work done on it, but the pay-ground was found to be too deep for the individual miner. Most of the other creeks were mined in 1899 by ordinary placer methods, but in many cases the 100-foot claim was found to be a useless size, due to the great depth to pay-gravel on many of the creeks, and only those were being worked where bed-rock was comparatively shallow, the costs of operating being excessive for value contained in the case of single 100-foot claims.

Wm. Fleet Robertson, Provincial Mineralogist, made a trip to Atlin in 1900, leaving Victoria on August 15th, and some of his remarks are now reproduced, as they may have been forgotten even by residents of Atlin.

"From the cursory survey which time alone permitted, it would appear as if there had been two distinct 'runs' of gold over the area indicated. The first 'run' is associated with a peculiar yellow gravel caused by the oxidation of the iron which seems to have penetrated the smaller boulders and pebbles to the very centre. The gold from this 'run' appears to be of higher value than that of the later run and has a peculiar reddish tinge.

"This yellow wash was being worked by various tunnels on Spruce creek and there are indications that it extends for some distance into the bench claims of this section. The first run, which may be said to have travelled westward, was followed by a period of heavy deposits of clay and gravel accompanied by some denudation and seemingly barren of gold.

"The second run, which was accompanied by bluish gravel, seems to have come from Boulder and Birch creeks and to have extended to McKee creek, the gold being bright, but not as high grade.

"After this second run came a period of general subsidence, followed by another general lowering of the water-level or raising of the land and accompanied with the wearing-down of the present channels of the creeks, which in places cut through the previous gold runs and con-

* Report by Joseph T. Mandy, Resident Engineer, on placer activities in the North-western District in 1931 commences on page 30.

centrated the gold in the present channels. At this period the rocky barriers across both Pine and Spruce creeks were broken and the streams were enabled to cut out their present channels."

The year 1901 shows the beginning of the abandonment of the individual placer claims; this is in accord with the history of every placer-field on the Northern Pacific slope. There is the transition from the placer claim of 100 feet to an association of a group of claims to provide a bed-rock flume to supply the group with water, dump, and a generally cheaper handling of the ground; for the reason that the individual placer claims had become too low grade to give reasonable returns for the method in which the labour was applied.

Then there comes the day of the small hydraulic mining company, usually with a limited field and limited capital. At the same time there are the small companies who drift to bed-rock or drift to old channels; both companies often work under very disadvantageous circumstances with varying success.

When these companies begin to realize that they have no longer a paying proposition, then the stage is set for the final large hydraulic mining company. Atlin seems to have now reached this period. Experience has amply shown that there are numerous requisites for the success of a large hydraulic mining company, which might be stated as follows:—

The control of an entire creek or a long section of a river free from adverse claims by individual miners.

Sufficient ground to pay a profit on the undertaking. Efficient prospecting of such ground, to make sure that it does carry the values it is supposed to have, before any large sums of money have been spent. This is the rock on which many companies have come to grief.

Sufficient water to wash the ground during the period of the enterprise. Sufficient head to bring the water effectively to the highest point of working.

Sufficient grade in the creek so that the work is not retarded by the flume becoming choked.

Sufficient capital for the undertaking. Efficient management.

To offset the above, a sales organization for the product is not required.

Progress from the individual placer claim to the large hydraulic mining company is slow, usually covering a period of many years. A few individuals who are not in a position to do any effective work for themselves can hold up a camp and retard the progress of a district for years.

As to the actual quantities of gold shipped out of Atlin, the following figures will give very close information:—

	Oz.		Oz.	
1898 (discovery of the camp)	3,750	\$75,000	1915	18,850 \$377,000
1899	40,000	800,000	1916	18,025 360,500
1900	22,500	450,000	1917	15,600 312,000
1901	15,000	300,000	1918	11,025 220,500
1902	20,000	400,000	1919	8,850 177,000
1903	22,000	440,000	1920	6,930 138,600
1904	26,500	530,000	1921	7,210 144,200
1905	23,750	475,000	1922	7,450 149,000
1906	22,750	455,000	1923	7,570 156,500
1907	20,400	408,000	1924	8,647 147,000
1908	10,150	203,000	1925	2,896 49,229
1909	10,000	200,000	1926	2,607 44,318
1910	13,750	275,000	1927	2,428 41,276
1911	11,250	225,000	1928	3,174 53,958
1912	14,500	290,000	1929	2,408 40,936
1913	15,750	315,000	1930	3,141 53,397
1914	16,000	322,000		
				\$8,628,414

LIARD, STIKINE, AND SKEENA MINING DIVISIONS.

LOCALITY.

In the Annual Report for 1874 the following appears: "The name Cassiar is given to a large tract of land in a north-westerly direction from Omineca, just south of the 60th parallel of north latitude." There seem to have been no definite boundaries to this country, and in fact as late as 1890 the whole of northern British Columbia was known as Cassiar to the western side and Peace river or Liard to the east, with no definite mining boundaries between each other or to the south. Cassiar is a corruption of Kasha, the Nehane name for McDame creek.

Two very good maps were published in 1873—one by Captain Wm. Moore of the "Stekin and Cassiar Goldfields," and the other showing the Stikine and its tributaries from Wrangell to near Dease lake; the name of the surveyor is unknown.

By a series of Orders in Council the district of Cassiar became defined and subdivided until eventually the name disappeared entirely as a Mining Division, and the area is now covered by Atlin, Liard, Stikine, Omineca, Peace River, and Portland Canal Mining Divisions.

HISTORICAL.

THIBERT CREEK.

The story of Cassiar is largely the story of Thibert creek. Two distinct periods are noted. First, the period from 1873 to the eve of the Yukon rush. Those were the days of shallow diggings and the individual miner who needed no other capital than his pan and grub-stake. Second, that period following the Yukon rush and extending to the present—a period that witnessed the passing of the rocker and the wing-dam, the coming of machinery and the hydraulic miner, and the advent of capital and business methods. This latter is more truly the period of the Thibert Creek hydraulic workings.

THE DAYS OF SHALLOW DIGGINGS.

THIBERT'S DISCOVERY.

Prospectors had been taking gold from the sands and bars of the Stikine for more than a decade before the strike on Thibert creek in 1873. But these takings were small and the Cassiar goldfields still awaited their discoverer—a stranger coming from the far Mackenzie. In 1869 Henry Thibert left Minnesota with one companion, intending to hunt and trap along the Mackenzie river for a few seasons, then cross the Rockies and traverse British Columbia to the coast. His journey was one of hardship and privation. In the spring of 1872, having crossed the Rockies during the autumn of the year before and wintered at a Hudson's Bay post on the Deloire, he was in the company of McCulloch, another intrepid explorer, making his way down that stream to the Liard. Together they followed the Liard to the northern boundary of British Columbia and then struck out for the Stikine by way of the Dease river and Dease lake. They spent that winter at Buck's bar on the Stikine, and here Thibert parted with McCulloch in February (1873) to retrace his steps and do a bit of prospecting.

Finally, at the mouth of the creek which bears his name, his efforts were rewarded and he found coarse gold on the bed-rock, running 2 or 3 oz. to the pan at a depth of little more than 18 inches.

Another party, in 1872, left Victoria, deciding to try their luck in that little-known Cassiar country; they were William Moore and his two sons, John and William. The elder Moore was later known as Captain Bill Moore, and I believe the White pass to the Yukon was discovered by him.

Moore and his party met Thibert and McCulloch at the head of Dease lake and went down the lake together. Moore and his sons stopped at the mouth of the first large creek they came to flowing into the lake from the west. Thibert and McCulloch went on to what is now Thibert creek.

THE STAMPEDE.

By August of that year twenty miners had arrived. In Cariboo and in Omineca the miners heard the news and left their diggings. By 1874 the population of the district had increased to 1,600; perhaps 2,000 persons in all visited the country that year. Other streams, now called after their discoverers, were prospected and proved as rich as Thibert creek. Claims on Dease creek averaged \$20 a day to the man. One company took out 200 oz. in a week; another, \$2,700 in five days. A single pan went \$49, while two men together washed 50 oz. in a day. Laketon, at the mouth of Dease creek (or "Laketown," as it was called in the seventies), sprang into being overnight and became at once the centre of the district's activities. During the summer, rumours spread that Thibert creek was "spotted." This led to further explorations and resulted in the discovery of gold on McDame creek, some 90 miles north of Laketon and a tributary of the Dease. Of all the miners arriving in that season, scarcely a hundred remained to face an Arctic winter, and these suffered great hardship from disease and lack of food.

SUBSEQUENT EVENTS.

The first Gold Commissioner, J. P. Sullivan, was appointed in 1874, the year of the creation of the Provincial Department of Mines. He issued 825 licences that season and reports especially on the difficulties of the trail and the excessive cost of transportation. The charge from Wrangell to Telegraph Creek was \$110 a ton, and it cost 45 cents a pound to move stuff from there to Laketon. Labour received generally about \$9 a day, but in some cases as high as \$16 was paid where the diggings were remote from the mining camp.

The following season brought fewer miners and conditions were generally better. Walsh and Rogers came in over the Ashcroft trail from Fort Fraser with 300 head of cattle. The total production of gold was almost up to the million mark of the year before and most of the claims were yielding from 1 to 3 oz. to the man.

THE DECLINE.

But there were far too many miners for the country to support and the claims, most of them, were paying little better than wages. In 1878 the population stood at 1,500; a third of whom were Chinese, who generally worked the ground which the white man had worked and abandoned. Other creeks were found, enjoyed a brief notoriety, and were left. Most of the prospectors continued work on Dease, McDame, and Thibert. By 1879 it was known that the diggings were becoming worked out and the population commenced to fall off. Perhaps other strikes elsewhere, like Granite creek in 1885, or the beginnings of lode-mining in 1886, made possible by the coming of the Canadian Pacific Railway, enticed the miners to more profitable fields. When the Cassiar country was visited by G. M. Dawson in 1888, most of the claims were not even paying wages, although the population had dwindled down to but 125 and nearly all of these were Chinese. In 1895 there were a dozen white men and fifty Chinese on the creeks and production had fallen to scarcely more than \$22,000.

PRODUCTION OF GOLD IN LIARD MINING DIVISION.

The sudden rise and gradual subsidence of gold production during the period is shown by the tabulation below:—

Year.	Dease.	Thibert.	McDame.	Various.	Total.
1874.....	\$400,000	\$400,000	\$200,000	\$1,000,000
1875.....	350,000	150,000	300,000	\$30,000	830,000
1876.....	160,300	139,700	163,700	463,700
1877.....	81,300	173,700	144,800	399,800
1878.....	62,800	65,600	101,300	290,000	519,700
1879.....	56,000	71,000	113,200	165,000	405,200
1880.....	60,900	57,900	120,000	60,000	298,800
1881.....	37,500	29,900	95,000	36,500	198,900
1882.....	29,000	39,600	70,500	43,700	182,800
1883.....	14,000	29,000	65,000	11,000	119,000
1884.....	10,000	30,000	49,100	12,500	101,600
1885.....	12,400	12,600	16,500	9,200	50,700
1886.....	21,500	14,200	20,600	7,400	63,700
1887.....	18,400	10,000	22,800	4,000	55,200
1888.....	13,600	6,700	19,000	4,000	43,300
1889.....	11,200	10,800	28,400	4,500	54,900
1890.....	12,000	10,000	18,000	4,000	44,000
1891.....	12,000	10,000	13,000	5,000	40,000
1892.....	8,700	6,500	8,500	5,300	29,000
1893.....	6,500	4,400	8,800	3,200	22,900
1894.....	8,300	4,000	9,700	700	22,700
1895.....	8,500	4,000	9,600	500	22,600
	\$1,394,900	\$1,279,600	\$1,597,500	\$696,500	\$4,698,500

From 1896 to 1915 \$410,040 was produced, of which \$121,250 came out of Thibert creek.

These figures have been taken mainly from the annual reports of the Gold Commissioners, which appear in the published reports of the Minister of Mines. It should be remembered that

gold in its raw, uncoined state is always the medium of exchange throughout placer-diggings. Wages are paid with it, balances with the trader are settled with it, and it is squandered over the bar. It is therefore impossible to get accurate figures. Some of the amounts in the table must be far too low. It is safe to say they are all too low—perhaps from 10 to 20 per cent.

The biggest nugget ever found in British Columbia was taken from McDame creek in 1877. This nugget was valued at \$1,300, greatly exceeding the \$300 record which had been established by Dease creek two years before.

GEOGRAPHICAL.

THE ROUTE.

From Wrangell up the Stikine to Telegraph Creek is 150 miles by river-boat. Thence by road to the head of Dease lake is 75 miles, and the traveller here enters the heart of Liard Mining Division. Porter, at the lake's outlet, some 25 miles northward, is reached by scow, and the mining camp on Thibert creek is 6 miles west by trail from Porter. There are other routes besides. The most famous is the old Ashcroft trail to Dease lake from Cariboo, over land by way of Fort Fraser and Hazelton, on the Skeena. Then there is the route of the Yukon telegraph-line to Telegraph Creek from either Hazelton or Atlin. The trail from Atlin is the winter mail route to Telegraph Creek.

THE JOURNEY IN.

Wrangell is reached by any of the steamers that run from Puget sound, Vancouver, or Victoria. Enterprising citizens of Wrangell as well as the Hudson's Bay Company operate boats upon the Stikine in season, for trade is brisk with the interior.

Given a dependable river-boat, light of draught and well powered, the Stikine is navigable with reasonable safety as far as Telegraph Creek. The boats travel only by daylight, for the current is swift and there is always danger from snags. Three days is the usual duration of the journey from Wrangell.

The Stikine finds its way to the sea through a wide delta of its own deposit. Here the current is sluggish and entrance is at times difficult because of bars. Once in, however, the channel rapidly narrows and the current becomes swifter. The Coast range is entered abruptly, where towering mountains covered with glaciers are seen, which at places extend to the water's edge; 100 miles beyond the Great Plateau is reached, lying beyond the Coast range.

At Glenora, about 12 miles below Telegraph Creek, the waters become shallower, though still navigable. Hence Glenora used to be the head of navigation and goods were forwarded by trail to Telegraph Creek. A lively town in 1898 was this old-time administrative centre of the district, but Glenora lies now abandoned. All that remains are deserted buildings, evidences of its former grandeur, and a few miles of uncompleted railway-grade to mark the beginnings of a transportation enterprise of the late nineties, which died at its inception.

Glenora's former importance has been usurped by Telegraph Creek, the present seat of government. Here is the Gold Commissioner, Magistrate, and Government Agent all in one, and postal and telegraphic communication with the outside world. Telegraph Creek undertakes to outfit the traveller for the trail.

The Dease Lake trail was built for the Provincial Government in 1874 by Captain William Moore, before mentioned, who came into the country with the first gold-rush. It remained a pack-trail until its relocation in 1912, when a substantial sum became available by Government appropriation and work was commenced upon a permanent wagon-road. For many miles above Telegraph Creek the Stikine cuts its way through the basalt formation forming the Great canyon, and further navigation is impossible. Leaving Telegraph Creek, the formation of the canyon forces the trail at once to the hillside and it soon reaches an altitude of 1,000 feet above sea-level—500 feet above Telegraph Creek—though not too rapidly for easy transport. Except for two well-bridged river crossings, the Tahltan and the Tuya, and a detour to tap Ward's ranch on the Stikine, this altitude is maintained and gradually increased as the trail climbs out upon a wide plateau bordered by the Tanzilla, and this stream is paralleled almost to the Arctic divide a few miles from Dease lake. The trail crosses the divide at an elevation of 2,730 feet, whence it gradually descends to 2,660 feet, the level of Dease lake.

MODERN TRANSPORTATION.

Now the trail from Telegraph Creek to Dease lake has been graded and bridged by the Provincial Government into a good road, on which there is a regular service of tractor and "caterpillar" tractors right into Dease lake, the heart of the gold-producing area—a distance of 75 miles. Hydroplanes have flown in from Prince Rupert and landed on Dease lake.

Dease lake, a deep, narrow strip of mountain lake of many feeders, the centre and heart of the Cassiar country, drains part of the great Mackenzie basin. The lake and its outlet bear the name of Peter Warren Dease, who explored the Northern Interior with Simpson in 1837, when British Columbia was called "New Caledonia."

A rough pack-trail has been built along the western shore of the lake, but is little used except in winter. Scows are operated on the lake by each of the two trading companies of Telegraph Creek, both of whom also maintain posts at Porter. Unless a head wind is blowing, the trip by scow presents no difficulties, for these scows are propelled by Evinrude motors, aided by sail, and are supplied with oars in case of break-down. In the golden seventies machinery was brought over the trail, and the steamer "Lady of the Lake" was built and did good service and kept down transportation costs until she foundered.

Porter is at the end of the lake, a Hudson's Bay post just south of the mouth of Thibert creek. It is the supply-point for posts along the Dease and the Liard and it marks the beginning of the Thibert Creek trail.

The first hydraulic leases on Thibert creek were acquired by the Cassiar Central Railway Company in 1889; in 1901 they were held by the Thibert Creek Mining Company, Limited, and there were then no other hydraulic mining companies in the district.

In 1902 some high values in platinum and osmiridium were taken from Thibert creek in the black-sand concentrates, but much of the values were lost before it was found out what the concentrates contained.

The Thibert Creek Mining Company had serious trouble with the carrying-away of their ditch and flume by mud-slides, and in 1904 the Berry Creek Mining Company took over the leases and put in a small plant on Berry creek, a tributary of Thibert. In 1906 this company worked fifty days and took out \$17,000 in gold. In 1907 the same company was working Thibert creek, when slides occurred, breaking the flume and burying the pipe-line and machinery. The same year the manager and principal owner of the Rosella Hydraulic Mining and Development Company, Limited, died and work on that creek was suspended. Since that date no hydraulic work of any extent has been done in the district, work being largely confined to individual placers and some drifting to old channels.

Wm. Fleet Robertson, Provincial Mineralogist, visited the Cassiar field in 1912, and his trip is described in the Annual Report of that year. He states that hydraulicking on Thibert creek could not be carried on profitably without a larger water-supply which could be obtained by a longer flume up Thibert creek.

In the Geological Survey of Canada Summary Report, 1925, Part A, there are very good reports on the district by W. A. Johnston and F. A. Kerr. These contain the latest official information available and from which the following quotations are made:—

"The general possibilities for placer-mining in the region include hydraulicking on Dease, Thibert, Deloire, and Mosquito creeks, dredging on Little Eagle river, and individual mining on Goldpan creek and at other places. The lava-buried placers of the Stikine and somewhat similar deposits in the Eagle River country, although they are not known to contain pay-streaks of any great value, appear to be worthy of further prospecting. There is a vast region north-east and east of Dease lake, drained by Turnagain and Kechika rivers, in which a great deal of prospecting has been done with no very important results, but it is very improbable that all the streams in this region have been prospected, and the discovery of Goldpan creek showed that, although some prospecting had been done on the creek, the pay-stream had been missed.

"Dease and Thibert creeks were the main gold-producing creeks of the region, because parts of the old channels of the creeks were preserved in the form of drift-covered rock benches along the sides of the present stream-valleys.

"Valleys that have the rounded U-shape of glacially eroded valleys should be avoided. In narrow, youthful-appearing valleys, such as Goldpan creek, placer gold, if it occurs, is likely to be most abundant in the bed of the stream in places where the surface gravels extend down

to bed-rock. If boulder-clay occurs beneath the surface gravels in the bottom of the valley there may be some concentration of gold on the surface of the clay, but there is likely to be little beneath the clay. Narrow and deep V-shaped valleys, with moderate gradients, even if they do not have rich benches of the old channel along the sides, are more favourable than wide valleys. If boulder-clay occurs in the bottom of these, there is a possibility that a pay-streak lies beneath the clay. The recent rock canyons, which are usually easily recognized by their nearly vertical sides and youthful appearance, are unfavourable for the occurrence of placer gold, unless they happen to have been cut down directly below the old channel of the stream. Many of them indicate that a buried channel, in which placer gold is more likely to be found, occurs alongside the new channel.

"If the bed-rock in the vicinity of a creek-basin is mineralized even to a slight extent, it is possible that placer deposits occur in the creek-bottom, providing other conditions are favourable. If the bed-rock, as in parts at least of the granitic areas and in other areas, shows no signs of mineralization it is improbable that placer deposits occur."

This brings us to the present date; the placers have nearly all been worked out on the older creeks and hydraulic mining has not yet been begun by any of the bigger and efficiently managed companies.

It is, however, a large district and there is ample field for the discovery of some new gold-bearing creeks which will give a fresh impetus to prospecting.

SKEENA MINING DIVISION.

After the Cariboo excitement was over, miners followed up the rivers and creeks north of the Fraser river, prospecting them as they went. Ascending the Skeena they came to Lorne creek, about 100 miles from the mouth of the Skeena.

The first return from Lorne creek was in 1884, when thirty-five miners were working and produced \$17,000; in 1885 there were about 108 men and the yield was \$18,000. In the following year the Mining Recorder says the miners had considerable difficulty on account of high water; the yield for the year was \$13,400. During 1887 only twenty-one men were at work, but those getting down to bed-rock made fair wages, the yield being \$5,280; this is the last year in which any returns were made. About this time the Stikine river was also prospected, but no important production was made from it.

QUEEN CHARLOTTE MINING DIVISION.

BLACK-SAND DEPOSITS OF GRAHAM ISLAND.

The Queen Charlotte group of islands lies in the Pacific ocean, the southern point being 140 miles north-west of Vancouver island and the north-eastern point is 60 miles west of Prince Rupert. Graham is the largest northerly island and Moresby, the southern. The east and north shore of Graham island is low-lying and has beaches which extend for miles. The western shore is bold, with few beaches, and the southern islands are practically devoid of the low-level shores seen on Graham island.

Numerous reports have been received by the Department of Mines of gold- and platinum-bearing black sands on Queen Charlotte islands, and recently a machine was mentioned as having been more successful in the recovery of the precious metals than some of the former appliances. I started my examination of these deposits with a considerable amount of scepticism as to a favourable report, as I had previously been over the black sands of Vancouver island and had investigated a number of black-sand gold-saving machines. The machines were often in the hands of persons who had only a vague knowledge of what the machines were supposed to do and were occasionally mere toys; in other cases they were no doubt designed to extract gold from an unsophisticated public.

When I investigated the Graham Island deposits I found the black-sand deposits are much more extensive than any I have seen on Vancouver island. It is probable that they cover all that part of Graham island on which glacial drift has been deposited to any extent; this approximates an area of 800 square miles.

It is unlikely that all this area will contain black sands that will pay to work, but there may be places where the sands might be so concentrated that they will pay, depending on the size of the undertaking and the area of sands that will be remunerative for such undertaking. There

are places where the sands have been so concentrated by present-day streams that they have paid fairly good wages with a line of sluice-boxes and the most primitive method of moving the sand with shovels. Such areas are of limited extent and number. There are other less concentrated areas, but of much greater extent, which would probably support a larger undertaking in which the gravel would be entirely handled by mechanical power; this will be referred to later. The black sands carry both gold and the platinum group of metals. This has been proved by many assays made on samples from widely separated districts.

The origin of this gold and platinum is still a matter for speculation; it has been suggested that it came from quartz veins that existed on Graham island and that had been eroded. It seems, however, much more likely that the precious metals were carried by glaciers from farther north and deposited with glacial drift which forms the major portion of the eastern side of Graham island. South-eastern Alaska is known to contain many quartz veins carrying values in both platinum and gold, and it is more than likely that these were eroded by glacial action and millions of tons carried down and deposited on Graham island and the surrounding coast.

It is probable that these black sands have become concentrated by three different methods. First, by the action of glacial rivers when the sands were first laid down; the tendency of these rivers would be for a moderate concentration over a considerable area. Secondly, by wave-action; there is evidence that this has extended for a considerable distance beyond the present shore-line, probably by the elevation of the shore above the present high-water level. This is evidenced in test-pits which have been sunk 100 feet or more back from the beach at Masset inlet. The level of the ground where these pits have been dug is 15 to 20 feet above present high-water level; they have been sunk to a depth of 8 or 9 feet and clearly show bands of black sands from 1 to 12 inches thick and have every appearance of wave concentration; there are layers of black sand with siliceous sand in between. There are large trees on this ground which must be 500 or 600 years old. Thirdly, there is the concentration of present-day streams which cut through these sands; none of these streams are rapid and the area concentrated is therefore not great.

NORTH-WESTERN MINERAL SURVEY DISTRICT (No. 1).

PLACER OPERATIONS IN 1931.

REPORT BY JOSEPH T. MANDY, RESIDENT ENGINEER (HEADQUARTERS, PRINCE RUPERT).

ATLIN MINING DIVISION.

ATLIN SECTION.

The placer-gold mining industry of the Atlin area, which showed a pronounced decline from the conclusion of the World War in 1918 to 1929, has the actual potentiality of a substantial expansion. The figures covering this period portray a psychological condition resultant from the World War, rather than a potential condition of the field, and are contradictory to the promise of the area. High wages, high cost of commodities, decrease in gold value, the employment of funds in other endeavours returning high profits, the depletion in the ranks of prospectors by the war or their change of occupation to other lines of endeavour offering high and more easily won reward, the temporary attraction of the cities as gold-mines of commerce, ease, and affluence, were all potent factors in retarding activity in this still potentially rich field. To-day conditions are reversed again; capital is once more turning to gold with its increased value, and unemployed men are searching for the opportunity to dig the only metal that is always readily traded for the things they want. For these the Atlin area still offers much promise in its unexploited opportunities.

The section is easily accessible by regular and frequent steamer service to Skagway, Alaska, from where Atlin is reached via the Whitepass and Yukon Railway, and lake steamers. From Atlin good automobile-roads lead to all the main placer activities and make the trails leading to the more remote areas conveniently accessible.

The placer-gold production of the Atlin Division for 1930 was 3,141 oz., valued at \$53,397, as compared with \$40,936 for 1929. This shows a significant increase, and on account of the growing interest and still latent possibilities in this phase of mining in the section, expansion of output may be expected in the future. With the exception of the Compagnie Francaise des Mines d'Or du Canada, which came into partial production in 1930 and promises a sustained production during the 1931 season, the larger operations are still engaged in preparatory work, but have made considerable advances nearer the production stage. Considering all factors, it is apparent that with increased interest in prospecting, sounder mining and exploration methods that are being introduced, and the tendency to a more careful appraisal of values in the ground, the Atlin section promises a substantially increased placer-gold production in the future.

Although increased interest in prospecting for "pay" placer-ground in the Atlin area is evident, the section is not yet receiving the attention it warrants. Since the active placer-days of the old-timers, new gold-bearing creeks have not been seriously prospected for, and operations have practically been confined to the creeks originally worked by the old-timers. A tendency to assume that if other creeks were richly gold-bearing the old-timer would have discovered them seems to have prevailed. This is a false assumption.

Operations of the old-timers were necessarily confined to the shallow and rich creek-ground that was amenable to the crude methods employed and the difficulties of transportation that had to be confronted. Although most of this type of ground on the original creeks has been worked out, it is equally true that practically no serious effort has been expended by prospectors in an attempt to discover similar deposits on other creeks of the area.

West and east of the divide between the Surprise Lake and Gladys Lake drainage-basins, over a length of about 60 miles, numerous creek-troughs would seem to warrant intensive investigation for virgin deposits of both shallow rich ground tractable to the individual operator and deeper ground suitable for drifting or hydraulic operations. In this respect the drainage area of Consolation creek, Lincoln (Chehalis) creek, Zenazie creek, and the numerous creeks draining easterly into Sucker river are worthy of particular mention. All these drain from the easterly side of a divide on the westerly side of which are the numerous creeks known to be gold-bearing. As geological and erosional conditions on both sides of this divide are similar, it is logical to assume that the gold-bearing potentialities of the creeks on the west of the divide may possibly be duplicated in those on the east side. The same reasoning would apply to the several creeks draining westerly into Fourth of July creek, the southerly and easterly draining creeks, and those of the upper reaches of the O'Donnell river. Some of this area has received cursory prospecting only, and its systematic investigation, particularly with regard to possible hydraulic operations, would seem to be warranted.

In the known gold-bearing creeks, operations subsequent to those of the old-timers have been continued in drifting and hydraulicking in the bench and deeper ground, with some shovelling from remaining virgin patches in the creeks, and in some cases the reworking of old tallings. This practically embraces the activity of recent years, with its confinement to the originally prospected area. Considering that the greatly improved transportation facilities into this area have made the outlying territory easily accessible, it is unfortunate no serious consideration or effort has been given to the possibilities for important placer-gold discoveries in likely new sections.

It must, however, also be considered that even from the present known gold-bearing area a substantially increased production is not only possible, but latent potentialities are still unexploited. These possibilities may produce a greater quantity of gold in the future than has been won from this area in the bonanza days of the past. The successful outcome of this phase is, however, dependent upon:—

(1.) *Methodical and sound methods of initial exploration by drilling.*

(2.) The co-operative introduction of drainage-tunnel systems to make possible the mining by drifting of deep ground not otherwise efficiently workable by this method.

Concerning item (1), several sections of the immediate Atlin area would appear to be worth drilling for the possible discovery of old and lost channels. An attempt to trace the continuation of the old Gold Run channel along the Pine Creek valley by systematic drilling at intervals across the valley appears to be warranted. Between the end of what seemed the abrupt termination of the Gold Run "pay" and Surprise lake, the ground has only been prospected by shallow pits. This is reported as having yielded discouraging results. However, as the rich

"yellow wash" which was the chief source of "pay" at Gold Run is shown near that point to occur at an appreciably lower level than that of the present creek, the shallow test-pitting carried out has practically proved nothing. It would seem that the gold in Pine creek, at least partially, has been derived from the cutting of the old Gold Run channel by the present creek. That no gold occurs in Pine creek above the point of intersection is significant, but easily explained by the fact that above that point the old Gold Run channel lies considerably below the level of upper Pine creek. The several miles of this unknown ground between Gold Run and Surprise lake would appear to warrant systematic drilling.

Attention is also directed to the significant depression of Trond gulch running north-westerly at the foot of the southerly slope of Munro mountain. This lines up with the projection of what appears to be the original line of flow of Spruce and Pine creeks beyond the point of their probable ancient intersection at about opposite Stephendyke. This ground would also seem to be worthy of exploration by drilling. In connection with this area, however, it would seem that the introduction of a water system for hydraulicking would necessitate heavy expense. However, if the values are present, some other system of mining may be worked out to meet conditions.

Concerning the introduction of drainage-tunnel facility, attention is especially directed to the upper area of Spruce creek, about 3 miles below the junction of this creek with Dominion creek, and to the valley of Dominion creek itself. An examination of rim-rock attitude in this section indicates that the continuation of the main Spruce Creek old channel follows approximately the trough of Dominion creek, and occupies a much flatter gradient than that of the present creek system. Consequently, the depth to bed-rock of the old channel gradually increases as Spruce and Dominion creeks are ascended. For instance, at the Morse & Company workings, about 2 miles below the Spruce-Dominion confluence, the shaft to bed-rock is 73 feet deep; about 1,500 feet above this point McPherson and Buchanan have sunk a shaft 82 feet to bed-rock. About 1,000 feet above this the Marco Pini & Company shaft is sunk 93 feet to bed-rock. About 1,000 feet up-stream from this point an old shaft was sunk by Beaton Bros. to a depth of 104 feet. On the Joe Yonaites lease on Dominion creek, about 4,000 feet easterly of the Pini shaft, bed-rock is estimated at about 160 feet depth.

Good values are being extracted from the bed-rock gravel of the old channel right up to the easterly end of the Pini workings. At the extreme easterly end of these workings some of the richest ground containing increasingly coarse gold has recently been encountered. In the Pini drifting the best "pay," averaging about \$4 a car (7 cubic feet), occurs across a width of about 45 feet. On each side of this rim there is a width of about 40 feet that is reported to yield about \$1 a car, and it is estimated that, with reduced costs that could be achieved by drainage, an increased area of bed-rock, yielding about \$10 a set (6 feet high, 10 feet wide, 4 feet deep), could be made to yield a good profit.

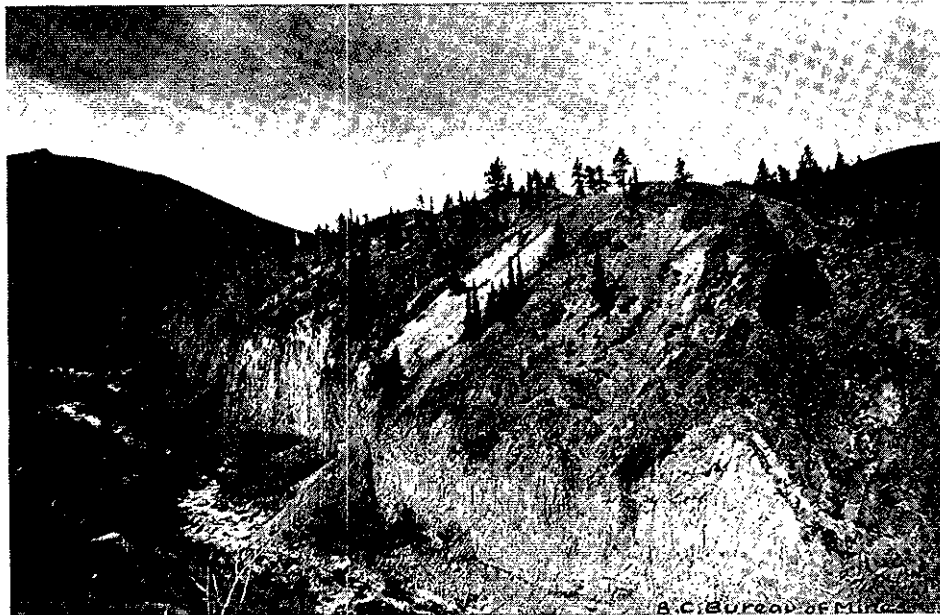
It is a logical probability that this condition continues along the old channel, which appears to head across and below the present bed of Spruce creek at about the point of its junction with Dominion creek, and then on up the Dominion Creek trough for a distance of about 3 miles. Although the ground at present being worked in the leases referred to stands well in mining, and at most needs only to be stilled, it is in places wet, and water in excess of the capacity of the Cornish pumps, particularly in the Pini operation, has caused frequent shut-downs and consequent interference with production. The upper ground beyond Pini's and up on Dominion creek is unworkable without drainage.

Operations on the Morse & Company ground during the 1930 and 1931 seasons have been largely confined to the driving of a drainage-tunnel with intervals devoted to mining in order to meet expenses. About 200 feet of this tunnel remains to be driven to connect up with the drifting operations on this lease. About 900 feet of virgin ground extending to the McPherson-Buchanan line remains to be mined beyond the present working-face. On the McPherson lease about 800 feet of virgin ground extends to the Pini & Company line. On the latter ground, mining of the upper section of the 4,000 feet of virgin ground extending to the next lease above will be greatly handicapped without drainage.

With the extension of a drainage-tunnel through the three above-mentioned operations, not only will the chief obstacle to the efficient mining of this ground be removed, but costs will be markedly reduced and the opportunity will be presented, by continuing this tunnel as required, of opening up the appreciable potentially productive deep ground of Dominion creek, otherwise doomed to remain dormant. The immediate effect of this will not only be possible production



Spruce Creek, Atlin—Placer-workings.



Ruby Creek, Atlin—Lava overlying Gravels.



B. C. Bureau of Mines.

McKee Creek, Atlin—General View of Workings, with Atlin Lake in Distance.

from the now dormant section, but through the lowering of costs the "pay" bed-rock area of the at present active operations will be increased by the inclusion of portions of the 40 feet of low-grade material lateral to each side of the present "pay" area.

Appreciable virgin deep-drifting ground is also indicated on Birch creek that would become available by the driving of a drainage-tunnel. Ruby creek also offers some opportunity in this respect. These conditions are referred to again in the separate descriptions of these creeks.

Attention of examining engineers is directed to the possibilities of the appreciable area of O'Donnel river and its tributaries, and to Pike river on the south-easterly side of Lake Atlin, in regard to the potentialities of these stream areas for sizable hydraulic operations. In this respect the possible importance of the Consolidation and Lincoln Creek areas draining to Gladys lake are also stressed. For individual operators and small drifting syndicates or partnerships the smaller tributaries of these main drainage-streams, particularly those of the upper reaches, are suggested as worthy of prospecting. In the Surprise Lake area attention is directed to Cracker and Boyd creeks at the north-westerly end of the lake as being likely streams for prospecting. On the older-known streams of the Atlin area the attention of individual operators willing to work systematically and continuously is also directed to the possible existence of likely sections of ground now vacant from which at least wages may be expected. Information regarding these may be acquired by addressing inquiries to the Gold Commissioner at Atlin.

During the first half of the 1931 season, interest in placer-gold operations in the Atlin area has been exceptionally active, and will probably be sustained throughout the season with some drifting continuing during the coming winter. Generally, very promising clean-ups have been achieved all around. Several prospectors have penetrated into the upper reaches of the streams, and it may be expected from this that additional individual workings will materialize.

Good progress has also been achieved by the larger preparatory operations. It is unfortunate, however, that in some cases inadequate drilling and testing preceded this work, on account of which estimated output when the production objective is achieved cannot be safely made. Of these operations, however, the Compagnie Francaise des Mines d'Or du Canada on Otter creek has struck rim-rock and is possibly on the edge of the old channel. Promising clean-ups have been made which indicate the possibility of a sustained production from this operation. On McKee creek, George Adams, financed by Vancouver capital, has completed extensive and very efficient prospecting, and has apparently worked out the location of the rim of the old channel. This operation looks quite promising for some gold production this season. On Wright creek the Moran & Hodges hydraulic operation is rapidly nearing bed-rock, and clean-ups from this operation may be expected before the close of the season. The Consolidated Mining & Smelting Company of Canada is energetically hydraulicking into a very tenacious hard-pan on Boulder creek in an attempt to get to bed-rock beyond. At the end of June about 250 feet remained to be cut through, and production from this operation is doubtful this year. The Pine Creek hydraulic operation continued in 1931 by the Golden Centre Mines was closed at the end of June on account of this work having to be carried out blindly through the absence of any preliminary drilling guidance. It is possible that this ground may now be drilled.

Generally in the Atlin area an increased tendency to sound mining principles is apparent in the placer-gold activities and improved methods are being worked out and applied. The industry is in a healthy condition and promises substantial expansion in the future.

DESCRIPTION OF PLACER PROPERTIES.

Pine Creek.

Twenty-one leases of about 40 acres each were being operated by the Discovery Mining and Power Company, sponsored by C. V. Bob, of New York. Financial difficulties under these auspices which arose during 1930 were adjusted, and operations continued at the opening of the 1931 season, by the Golden Centre Mines. Due to the absence of preliminary drilling which necessitated the conduct of the work without a definite objective, the hydraulicking operations were closed at the end of June.

An excellent water-supply is derived from Surprise lake, where there is a dam and intake to the ditch. Water is delivered by about $8\frac{1}{2}$ miles of ditch and about 11,000 feet of 28- to 20-inch pipe-line. The working-lines take off at 20 to 18 inches and finish at 16 inches. An electric power plant for lighting is operated by a water-wheel driven by a $2\frac{1}{2}$ -inch monitor reduced from 12 inches, and with water tapped from the main pipe-supply. In order to achieve

grade, prospecting-work was initiated by cutting through a barren glacial gravel bank 80 to 90 feet high and running a bed-rock flume for about 2,000 feet back from the creek. Operations were under the personal direction of C. L. Hershman.

Birch Creek.

Birch creek flows into the north side of Pine creek, about 2 miles from the southerly end of Surprise lake, at about 2,950 feet altitude. It flows southerly approximately parallel to Boulder and Ruby creeks, and, like these, rises in the Coast Range granitic intrusives of the southerly slopes of Leonard mountain and cuts through the overlying Palaeozoic "Gold Series" bordering Munro mountain, Pine creek, and Surprise lake. The average grade of the lower section of the creek is about 6.5 per cent.; towards the upper reaches, however, it flattens somewhat. For moderate hydraulic operations a fair water-supply is available, although on account of inadequate storage some shortage may materialize during dry periods.

From about 1902 to about 1913 there was appreciable activity on this creek and a substantial gold yield rewarded hydraulic operations by the Dominion Trust Company under the superintendency of H. P. Pearce. At about this time the working had reached a point where the "pay" gravel of the creek-bed entered the bench-covering, necessitating the removal of much overburden. Further success of this operation was handicapped by water-shortages and the subsequent working of this ground by H. P. Pearce on a lay up to about 1922 was not profitable. In 1913 a nugget weighing 73 oz., valued at \$1,200, the largest discovered in the district, was found on Birch creek.

The creek-bed is shallow ground varying from 7 to 8 feet in depth. At present some virgin patches remain on the east side that may repay shovelling. It is also reported some gold still remains on bed-rock under the old tailings. Towards the creek-mouth on the Joe Yonaites lease a comparatively fair-sized area of virgin ground remains. This is at present being prospected by Joe Yonaites. If this ground proves to contain values, and as the tailings-ground above is all loose gravel requiring a minimum pressure to move it, it is suggested that the whole of the creek-bed from the Yonaites lease to the bench, a distance of about 2 miles, may repay a moderate and conservatively conducted hydraulic operation. For this a good water-supply prevails during the spring and early summer.

It is also suggested that the old channel, which appears to swing across the creek-bed and under the bench of the west side about 2 miles up, should be prospected for by drifting under the high bank. To carry out this work efficiently a good opportunity exists for its conduct in combination with a drainage-tunnel. The fact that in the old operations the best values were found below Plum creek, which flows into Birch creek on its west side, suggests that Plum creek may have cut across the old channel somewhere in the high bench area on the west side of Birch creek. Striking south from this point on Plum creek, the old channel appears to have conformed to the present bed of Birch creek on the old hydraulicked ground, and at approximately the Yonaites lease to have swung into the east bank, where, towards the mouth, rim-rock sloping west again swung it into the present location of Birch creek.

Joe Yonaites Lease.—This operator has one bench and one creek lease at the lower end of Birch creek, at about altitude 3,200 feet. During the 1931 season he has been prospecting this ground with a crew of three men with the objective of the possible installation of a small hydraulic operation should indicated values appear to warrant this. A considerable amount of work has been completed in drain-construction and banking the creek to the west side away from the working-site.

At the east side, at about the point where the old channel appears to swing under the east bank, a shaft has been sunk to bed-rock, a depth of about 31 feet. Two additional shafts have also been sunk south-easterly and south of this point where the old channel appears to swing back into the present creek-site. These, however, were too near the creek and were flooded before any extensive drifting could be undertaken. Small-scale hydraulicking was also undertaken in this area. Some coarse gold (assaying \$16 to the ounce) was recovered from the operations, and sufficient promise indicated to warrant the thorough prospecting of the leases. At present, ground-sluicing of overburden on virgin ground towards the east side of the creek-bed is being carried out at altitude 3,200 feet, preparatory to shovelling-in the gravel on bed-rock. At this point bed-rock is about 10 to 12 feet below the creek-bed. The work is being very efficiently carried out and the whole scheme of operation is a commendable example of intelligent exploration.

Billy McDonald Lease.—This prospector owns one creek lease at altitude 3,800 feet, about 2 miles up Birch creek from Joe Yonaites' ground. The ground starts on the main stream of Birch just below the forks and continues up the North fork. Lying between this lease and the Yonaites lease, H. P. Pearce owns one creek lease.

Billy McDonald is ground-sluicing overburden in the creek-bed and shovelling-in about 6 feet of gravel lying on hard-pan. The depth of bed-rock below hard-pan is not definitely known. It is expected that fair wages will be earned from this work. There is a good cabin at the property.

George Gash Lease.—This creek lease of half a mile adjoins the McDonald ground on the north at about altitude 3,900 feet. In this locality the North fork of Birch creek is confined to a width of about 100 feet, with steeply pitching rim-rock on each side. George Gash is ground-sluicing overburden in the creek-bed preparatory to shovelling-in. It would seem that this work is being carried out across the creek-bed where it would be somewhat difficult to get any depth toward bed-rock. If this were conducted in an up-stream direction and parallel to the creek-bed there would be a better chance to turn in the water above, and in subsequent shovelling-in up-stream some depth towards bed-rock would be gained. In this area bed-rock appears to be deep and the ground is wet.

Boulder Creek.

Boulder creek flows into Surprise lake near its southerly or outlet end. Good results were achieved from this creek in former old workings, and some length of virgin ground, from which good "pay" is anticipated from hydraulicking operations, still remains to be worked along the westerly side of the creek-bed.

Consolidated Mining and Smelting Co. of Canada, Ltd.—The Consolidated Mining and Smelting Company of Canada, through control of the Boulder Creek Placers, is operating an extensive stretch of Boulder creek. The objective of the present preparatory work is to get into anticipated "pay" in virgin ground lying westerly of the present creek-bed.

In order to attain tailings-grade to bed-rock in this area it was necessary to start cutting up the creek from near Surprise lake, a distance of about 2,500 feet. This necessitated a cut about 55 feet deep at the lower end through barren ground. At the upper end of this cut a very tenacious and deep hard-pan has been encountered which has considerably impeded progress. At the time of the examination in July, 1930, it was estimated that about 500 feet still remained to be cut through. Due to water-shortage and the hard-pan that has to be blasted, advance is slow. In July, 1931, it was estimated that about 250 feet of hard-pan still remained to be cut through to hit bed-rock beyond.

Piping is being carried out with a 4-inch monitor operating under a head of 100 feet. Some trouble is also realized from insufficient grade for dump-disposal into the lake, causing frequent blocking and necessitating continuous moving of the dump-flumes. The cause of this difficulty is excessive high water in the lake, resultant from the inadequate escape through the dam at the foot of Surprise lake, particularly during the period of spring freshets. It is suggested that this condition would be eradicated by allowing sufficient escape through the dam during this period to lower the lake-level in accordance with the immediate necessity of water-consumption by operations on lower Pine creek.

In the old workings on Boulder creek "pay" was reported to be mined in gravel up to about 18 feet above bed-rock, with an overburden of about 50 feet. It is anticipated that future operations will be by both underground and hydraulicking work, a combination of which may offset to some extent the water-shorage. During the 1931 season a crew of fifteen men was employed, with McLeod White as superintendent and H. P. Pearce as foreman. As the cut is gradually working up towards the old camp-site, the camp has been moved and a new cook-house erected on a splendid site about 300 feet west of the old site. With the natural difficulties of this operation it cannot be accurately forecast when it may reach production.

Ruby Creek.

This creek flows into the north side of Surprise lake about 3 miles east of Boulder creek. It is somewhat unusual in the Atlin section, in that it has a granite bed-rock where it is worked, whereas most of the other creeks have a slaty or schisty bed-rock. An interesting feature also is a bed of young, though possibly pre-glacial lava about 100 feet thick, that buries the old channel-gravels bordering the banks of the present creek-bed. About 18 inches to 2 feet of the

buried gravel roof is baked and cemented and consequently stands well for mining operations. Between this and bed-rock is from 10 to about 45 feet of cemented gravel, the thickness diminishing up-stream from the mouth of the creek.

Towards the mouth of the creek there appears to be a steep drop-off to bed-rock. This is indicated below the Matson-Schulz shaft, which penetrates 12 feet of gravel-drift on top of the lava; then 27 feet of lava; then 45 feet of gravel to bed-rock. Below this shaft, which is about 1,500 feet from Surprise lake, the depth to bed-rock in the creek-bed is unknown. About 800 feet northerly from this shaft about 15 feet of gravel lies between the lava and bed-rock in the creek-bed. At the Tornquist operation, about 2 miles up-stream from Surprise lake, the gravel is from 12 to 16 feet thick between the lava and bed-rock. At the McKay, Johnson & Morrison operation, about half a mile above Tornquist, the gravel in places attains a thickness of about 30 feet between bed-rock and the lava roof. These figures indicate a widely varying thickness of gravel under the lava, but a possible tendency to diminish towards the upper reaches of the stream. On both banks (east and west) the lava-covering increases with the slopes of the hills towards Ruby creek, and, as would be expected, also increases as the crater source is approached up-stream on the divide between the headwaters of Ruby creek and Fourth of July creek. On the east bank above McKay, Johnson & Morrison, and about 3 miles up-stream from Surprise lake, Arno Krumbeigel has sunk a shaft for 120 feet through lava in an attempt to reach bed-rock and the old channel, the bottom of this shaft being still in lava.

The present creek-bed has a gradient of about 7 per cent. 3 miles from the mouth, but flattens somewhat towards the upper reaches. In the lower section the old channel follows approximately the present trough in a more or less winding line, but with a flatter gradient (3 to 4 per cent.), sometimes swinging under the lava bank; then out again into the present creek-site in accordance with the attitude of the rim. At about 2 miles up-stream, just below the Tornquist operation, it finally swings under the lava of the east bank, and follows close to and approximately parallel to the present creek-bed and at about 25 feet lower elevation. The old channel attains a width of about 40 feet between rim-slopes and sometimes exceeds 60 feet. The best "pay" is on bed-rock and yields \$6 to \$10 gold to the cubic yard. In places the ground is wet, but drains quickly when crosscut into blocks.

Good "pay" has been struck in the most northerly drifting operations, and it is logical to conclude that this condition will continue for an appreciable distance up-stream under the lava beyond the present worked ground. To work the upper area efficiently, however, particularly under the increasing thickness of lava, it would seem that a bed-rock drainage-tunnel would be necessary. This would conveniently commence from about the Tornquist operation, and with incline shaft connections at intervals through the up-stream lava-ground affording adequate ventilation, the opportunity would be presented of opening up an appreciable length of very likely ground towards the upper reaches of the creek. It is also suggested that in prospecting the lava-buried old-channel area of Ruby creek the chance for appreciable subsidiary channels lateral to the main channel should not be overlooked. The discovery of these would entail crosscutting at right angles to the present known old channel.

It would seem that the lava-buried gravels of upper Ruby creek have not yet been exploited to the point commensurate with their indicated potentiality. The opportunity is indicated for several additional and adequately financed small syndicate operations, or for a sizable company drifting operation. (See photograph showing lava-beds.)

The best "pay" is found up to about 2 feet above bed-rock. The granite bed-rock is well fractured and weathered for a thickness of about 12 to 18 inches, and in the old channels contains good "pay" and "slugs" which have worked down into the fractures and crevices. In mining, this consequently has to be picked off and bed-rock carefully cleaned. The creek is also unique in that it contains the coarsest gold in the Atlin Lake section. Operations on this creek are conducted by both hydraulicking in the creek-bed in the lower section and mining under the lava farther up.

Matson & Schulz Lay.—Up from the mouth of the creek Matson and Schulz are working a lay on the ground held by the Lake Surprise Mining Company, Limited. Bed-rock was imperfectly cleaned during the former operation and it is expected that a good recovery will result from reworking this old ground. It is also intended to work some virgin ground under the lava. During the early part of the 1930 season 2,000 feet of sluice and 2,000 feet of main pipeline, 40 inches at the pressure-box to 16 inches at the monitor, was completed and operations were in full swing. Early in July, 1930, however, a severe cloudburst and attendant flood

destroyed the plant about a week before a clean-up was planned. The boxes were subsequently recovered, repairs completed, and work was under way again before the close of that season. During the 1930-31 winter months mining operations were carried on through a shaft 84 feet deep, under the lava, with a crew of five men.

During the 1931 season piping was continued in the creek-bed and at the time of examination (July 4th) good clean-ups had been achieved. On July 3rd a nugget $3\frac{7}{8}$ inches long, $3\frac{1}{4}$ inches wide, and $2\frac{1}{8}$ inches thick, weighing 47 oz. 13 dwt., was picked up. This apparently had rolled through the boxes of the former operation.

Hydraulicking is carried out with a No. 6 giant, equipped with a 6-inch nozzle under a head of 90 feet. Four gold-saving boxes are installed at the pit-mouth, and at about 400 feet down the sluice one or two boxes are installed at intervals.

All gold-saving boxes are equipped with angle-iron riffles, and in the lower section of the sluice wooden-block riffles are installed. All piped material is run through the sluice-boxes, which are carried at a grade of 4 inches to the box (12 feet).

The crew consists of five men operating one monitor for one shift. Subsequent to the freshet season low pressure on the line does not permit of the operation of the second monitor. Hydraulicking is carried on until freeze-up, about October 15th. During the latter part of the season, however, only sufficient water is available for three or four hours' run. At the start of the season enough water is available without conservation in the dam. From about July 15th, however, conservation becomes necessary. During the 1931-32 winter months, drifting under the lava will be continued.

Emil Tornquist.—Above Matson and Schulz, Emil Tornquist owns two leases and is working a lay on another lease. The operation consists of drifting under the lava and is meeting with good success. During the latter part of the 1930 season, work was concentrated on the project of installing the boxes underground, admitting water from the creek to these, and carrying the sluice underground through a drainage-tunnel to a tailings-dump exit at a lower level down the creek. This has been completed and the result is a well-centralized operation involving a minimum of tramping, workable summer and winter continuously, and free from all flood danger; altogether a most commendable and efficient piece of work.

The new incline shaft portal is about 10 feet above the creek on the east bank. It extends through the granite west rim of the old channel, at a slope of about 15° for a slope distance of about 60 feet to the drift-workings. About 30 feet south of the incline portal the creek is tapped by a short tunnel to the incline. Sufficient water for sluicing is let into this tunnel by a small wing-dam gate that can be regulated according to requirements and cascades down the granite floor of the incline to the sluice entrance. From here the sluice is carried down an incline drainage-tunnel at about a 6-per-cent. grade to the tailings-dump into the creek at the portal of this tunnel about 600 feet south of the new shaft. A minimum grade of 4 inches, and where possible 9 inches, to the box has been sustained in the installation of this sluice. Five 12-foot gold-saving boxes with parallel pole riffles are used. From these the sluice is 12 by 12 inches lined with lagging. It is found, however, that the lagging wears rapidly and it is being replaced by blocks. Much of the gold in these gravels is quite coarse and practically all of this is collected in the riffle-boxes. However, as some flake and fine gold can be seen on the lagging, it will be found that a greater saving of this will be made by the blocks being installed.

Drifting is carried about 4 feet into bed-rock and from 2 to 3 feet of gravel is also taken. The total thickness between the bed-rock and the lava is 12 to 16 feet. Where the bed-rock is soft more is taken than where it is hard. "Pay" is generally best where there is a thin layer of clay in the gravel just above bed-rock, and this is used as a guide by Tornquist. "Pay" will average about \$3 to \$6 to the car (about $\frac{1}{2}$ cubic yard) with the gold estimated at \$15.85 per ounce. In the operation it is estimated that one man will produce about twelve cars per day. Work is carried on by two men mining and one man tramping, giving an estimated production, at this capacity and grade, of about 144 cars, yielding from \$332 to \$664 a week. Clean-ups are made about every two weeks. For the two weeks previous to June 27th, 1931, a clean-up of 54 oz. was recovered, and for the two weeks up to June 27th, 1931, 104½ oz. of coarse gold was recovered, as well as an appreciable quantity of fine gold in the black sand. In the latter clean-up the heaviest nugget weighed 3 oz. 10 dwt., two weighed over 2 oz. each, and several over 1 oz.

McKay, Johnson & Morrison.—Above Tornquist these operators are mining under the lava on a lay on the Frank Fitch *Ophir* lease. At the time of examination (June 20th, 1931) drifting in a N. 23° W. (mag.) direction was being carried on parallel to the creek and good values were being encountered. The workings consist of an incline and a crosscut to the north from this at about 10 feet below the creek-level. The rim is encountered at about 50 feet from the portal, sloping north-east. Further crosscutting encountered bed-rock at about 650 feet from the portal, and the drift on this had been extended to about 800 feet in, about vertically below the first old dam, with about a 30-foot back to the creek-bed at this point. At present a cross-cut is being driven west towards the creek and the drift-face is also being advanced. In the present location an occasional very large boulder is being encountered.

The ground runs up to about \$5 to the car (about ½ yard, or 65 shovels) and bed-rock grade is 3 to 4 per cent. The old channel is from 40 to over 60 feet wide, and in the present working the east rim is about 25 feet from the centre of the drift. There is about 30 feet thickness of gravel between bed-rock and the overlying lava. In mining, about 3 feet of bed-rock and 2.5 feet of gravel above bed-rock is taken out. Since the striking of bed-rock in September, 1930, to the middle of June, 1931, \$10,594 has been extracted.

Otter Creek.

Otter creek flows into Surprise lake on the south side, near the outlet of the lake. Considerable hydraulicking was carried out on this creek in former years in the attempt to attain bed-rock up from the mouth. For this purpose a deep cut, about a mile long, through glacial drift was carried up the creek proper, but with the exception of some gold recovered in places on the high steeply sloping rim and from above hard-pan, results were generally unsatisfactory and bed-rock of the old channel was never reached. Similar work, with the same results, was also carried out higher up the creek. However, results from drilling indicate the possible occurrence of good values over an appreciable area warranting systematic exploration and development. A study of the rim attitude, as exposed in the present creek, also indicates that an old channel strikes diagonally across the present creek-site, at a bearing of approximately S. 40° E. (mag.) and at a considerably lower level.

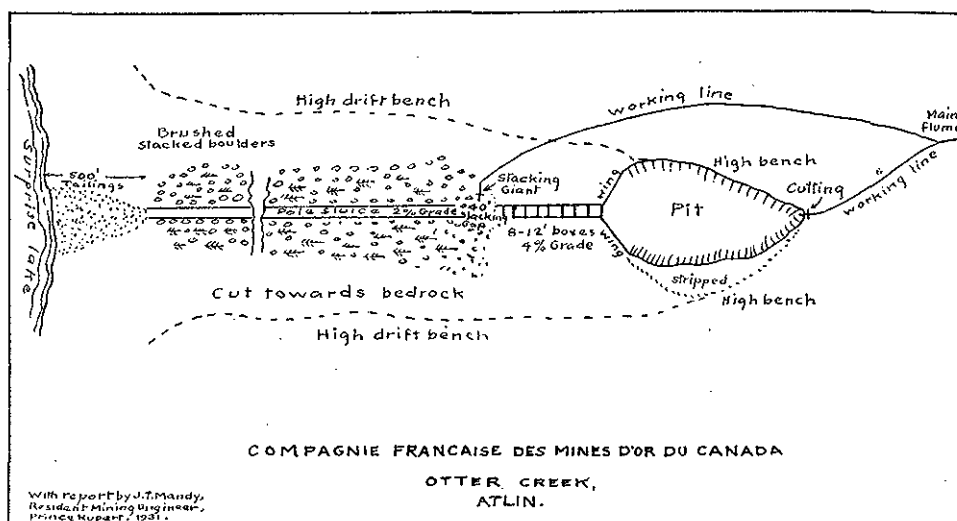
In 1928 the old interests were taken over by the *Compagnie Francaise des Mines d'Or du Canada*, and a totally new and more logical plan of attack inaugurated under the direction of J. E. Moran. This entailed starting in at the lake-level at a point about half a mile east of the old sites and cutting in towards the old channel in a south-easterly direction.

Compagnie Francaise des Mines d'Or du Canada.—This company controls a considerable section of the Otter Creek area and is operating under the local management of J. E. Moran. The method of operation for cutting-in towards bed-rock being conducted by the *Compagnie Francaise* consists in starting the workings at the farthest possible point down-stream and as near as possible to Surprise lake. In this way, when the sluices reach bed-rock, a maximum area of the valley-gravel will lie ahead. All the heavy debris from the moving of the gravel from the sluices is stacked by monitors working at the dump. A large yardage of the finer and lighter material finds its way into Surprise lake. Two monitors, one cutting-in and the other stacking, equipped with 5- and 6-inch nozzles, work under a head of 165 feet with a water-supply of 1,200 miners' inches drawn from Otter and Wright creeks, or other creeks of the extensive water system, as the supply is needed.

The extensive scale of operation planned necessitated initially, however, the collecting of a sufficient supply of water. This has been achieved by tapping the water from Otter, Snake, Wright, Idaho, Casino, and Union creeks into the main system of ditch and flume. Should it be found necessary, it is also intended to tap Quartz creek, situated about 2 miles north of Union creek. The present system totals about 8 miles, commencing at Union creek at the north end, about 830 feet above Surprise lake (altitude 2,700 feet). Of this, more than 3 miles is of metal flume carried along a rough and broken mountain-side where ditching is impossible. This is constructed of No. 36 galvanized Economy metal flume shipped by the Engineering Corporation of Vancouver. This material is delivered in flat 24-gauge sheets, and is easily bent on the ground to the required half-round curve and mounted (nailed) on a skeleton lumber frame that can be very flexibly adapted to practically any contour of rough terrain. The joints are secured by galvanized bands drawn tight by a patent lock-nut. The edges contacting with the lumber frame are made water-tight with a packing-strip of tar-roofing. It is under-

stood that this Economy flume costs 43 cents a foot at Vancouver, complete with bands, tar-roofing, staples, nuts, and washers, and about 51 cents a foot delivered at Atlin. Installed at the operation, the cost is estimated at about \$1 a foot, which is about the same as the cost of the ditch-construction. The Economy flume is installed at this operation on a grade of 5 feet in 1,000 feet, and will carry 800 miners' inches, with 4 inches of free-board. The ditch is carried on a grade of $\frac{1}{10}$ foot per 33 feet and is 18 inches deep and 4 feet wide at the bottom.

During the 1930 season energetic preparatory work was carried on, yielding at the same time significant gold recovery. Besides construction, piping-work was concentrated on advancing the drain-sluiice towards bed-rock, and good progress was achieved. For a portion of the season the direction of this cut traversed gravel carrying remarkable values in comparatively fine gold from the surface down. This occurs in the glacial drift above a layer of hard-pan, and is probably an interglacial layer resulting from concentration of the drift by streams emanating from the melting ice between periods of glacial recession and subsequent advance. Towards the end of August the sluice cut through this exceptional deposit, the continuation of which will be explored at some future time. About \$10,000 in gold was recovered in cutting through this section. At the conclusion of the 1930 season the drain-sluiice had penetrated up to a stratum of gold-bearing gravel about 40 feet below the surface.



At the opening of the 1931 season piping was carried on, and at the time of examination (July 1st) the drain-sluiice had been advanced to about 1,500 feet from the lake. At this point a sheared and decomposed serpentine and pyroxenite rim, striking S. 50° E. and dropping off to a flat bed-rock dipping northerly, is encountered. This is overlain by cemented wash-gravel with sizable boulders, the whole having the appearance of a river-wash. It would appear from the attitude of the rim at this point, and its correlation with that cutting across the old working to the south-east, that there is a good likelihood of this working being at the edge of the old channel. The projection of this cut south-east at its present grade would carry it through the old workings at approximately 90 feet lower elevation. Promising clean-ups have been made at the beginning of the 1931 season.

In this operation the excellent progress achieved is augmented by the fact that in the stripping operation only the fine material is run through the boxes, at the end of which there is a 40-foot stacking interval or gap. The heavy debris is stacked at this point by horizontal benching and the light tailings continue on down the pole sluice to the dump at the lake. An angle of repose of about 60° is achieved for the stacked boulders by "brushing" with fallen trees. Eight 12-foot long gold-saving boxes with block riffles are installed at the pit-mouth and carried at a grade of 6 inches to the box, making the outlet from the boxes 24 inches higher than the pole sluice. The pole sluice is installed at a 2-per-cent. grade, which is found more than ample for the disposal of the light material carried in the tails-race. It is indicated that

with this system of stacking the pole sluice could be carried at 1.4 per cent. grade and the boxes lowered about 10 inches, which would give an additional 10 inches depth in the pit.

Attention is particularly directed to this system as offering the means for tailings-disposal where the grade is lacking and making available ground for hydraulicking that could not otherwise be worked. The system also offers a rapid means of stripping preparatory to pitting.

Interesting figures regarding the cost of pole-sluice construction are also given by the management. It is estimated that this sluice is installed at a cost of about 80 cents a foot as compared with a cost of about \$5 a foot for lumber. In a pole sluice riffle-blocks for conservation are also unnecessary. For lumber sluices these blocks, cut to 10-inch lengths and boarded to 7 in a set, cost about \$1 a set, with 14 sets for each 12-foot box. In the construction of a pole sluice, as the posts are 4 feet apart, the poles are cut into 8-, 12-, or 16-foot (multiples of 4) lengths and nailed to the posts. This makes possible rapid construction.

The operation is being carried on with a crew of twenty-one men working two shifts, with thirteen engaged on the hydraulicking and eight on the flume and ditch-line.

Wright Creek.

This creek flows into the south side of Surprise lake about 2 miles easterly of Otter creek. It flows approximately parallel to Otter creek and drains from the northerly and westerly slopes of Dixie mountain. In former years the upper reaches of Wright creek received some attention from individual miners who worked spots of shallow ground in the creek and on the rim-slope of the upper section of the creek, with good results. These workings were carried down the creek until the ground became too deep. In the deeper area two old shafts were sunk to bed-rock on the rim about 4 miles up-stream from the mouth. In the most northerly of these bed-rock is indicated about 40 feet below the present creek-surface. About 60 feet south of this a shaft sunk on the west rim with a crosscut to the east under the creek showed bed-rock at about 29 feet under the present creek-bed, with the gravel yielding in places 72 cents a square foot of bed-rock. This indicates high-grade ground that would make good drifting were it not for excessive water necessitating drainage or extensive pumping. A likely small hydraulic operation is, however, indicated in this deeper section, and the ground is being opened up by J. E. Moran and L. T. Hodges. About 2 miles up the creek some individuals are ground-sluicing and shovelling-in from the shallow ground on the west rim-slope.

The old channel seems to conform approximately to the present creek-valley, but an apparent peculiarity is the number of small areas on the high rim-slope carrying coarse gold. It would seem that in the upper section of the creek there may still be appreciable patches of "pay-ground" on the rim from which individuals might make fair wages by shovelling-in. On account of the reported occurrence of coarse angular gold in grass-roots of the high rim-slope, it would seem that the higher altitude of the upper creek area would also be worthy of prospecting for lode-gold outcrops.

Moran-Hodges Lease.—These operators with a crew of four men are hydraulicking on three leases on Wright creek, about 4 miles up-stream from the mouth of the creek. The camp at 4,025 feet altitude is reached by motor-road connecting with the main Surprise Lake road at Otter creek.

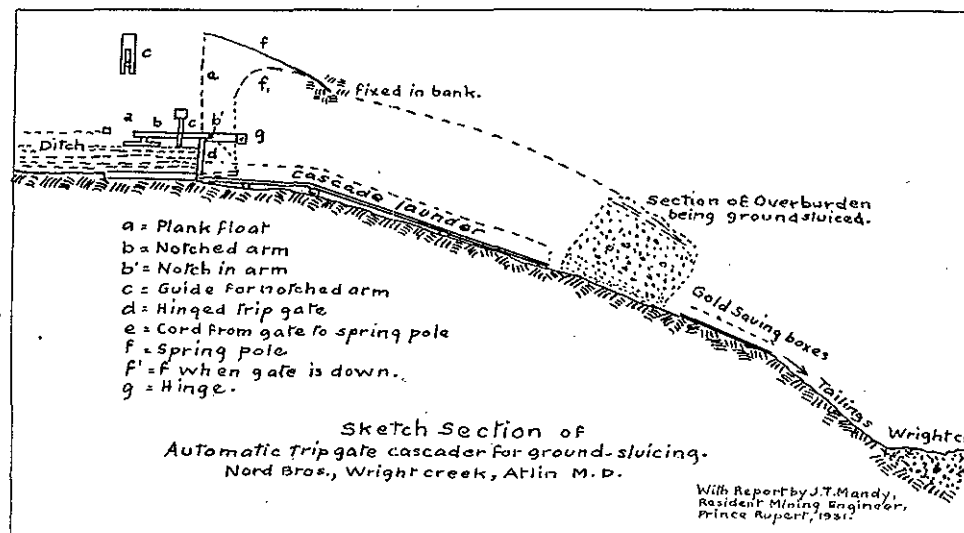
Water for the operation is conserved by two small dams, about a mile apart, across the creek-bed at altitude 4,500 feet and 4,200 feet. The intake is at altitude 4,185 feet, about 300 feet below the second dam. From this there is 250 feet of box flume, with a sand-box at half-way, and 1,250 feet of ditch to the pressure-box at altitude 4,150 feet. About 1,500 feet of pipe-line, starting at 16 to 14 inches and finishing at 12 inches, leads to the monitors at 3,950 feet altitude.

The same method of hydraulicking as that described under the heading of "Compagnie Francaise des Mines d'Or du Canada" is being applied on the Wright Creek operation. For this purpose two 4-inch monitors are operating under a 200-foot head, one cutting-in and the other stacking by horizontal benching from a 40-foot long stacking-gap at about 15 feet lower elevation. The angle of repose of the stacked boulders is increased by "brushing." About 600 feet of pole flume carried at a 2-per-cent. grade leads from the stacking-gap to the fine tailings run-off. Three 12-foot gold-saving boxes carried at a grade of 6 inches to the box have been installed at the pit-mouth ahead of the stacking-gap.

Bed-rock at the present piping is estimated at about 40 feet from surface, which should bring it about 10 feet below the present pit-mouth. At the present rate of advance, bed-rock should be encountered some time in August, 1931, and if the values are there the property should then come into production.

Nord Bros. Lease.—At the opening of the 1931 season Charles and Peter Nord, of Atlin, acquired the *Curly Bob* bench lease from Frank Brown, of Atlin. This ground is situated about 2 miles up Wright creek from the Moran-Hodges ground. For the two previous years the ground had been worked by John Hyland on a lay from Frank Brown and some remarkably coarse gold extracted. The ground being worked overlies the high rim of the east side of the creek, that slopes down to the creek-bed at an angle of about 15°. The workings are at 4,400 feet elevation and about 175 feet above the creek. The camp is at elevation 4,250 feet.

It is reported that coarse angular gold nuggets occur on this ground in the 12-inch surface layer of reddish-brown loam overlying 8 to 10 feet of glacial drift with small boulders. Between the glacial drift and the quartzite bed-rock is 12 to 18 inches of fine gravel-wash, which, together with the bed-rock, is reported by the operators to contain no gold. If this can be definitely substantiated, it is a somewhat remarkable occurrence and would point to the gold being eluvial in origin and resultant from the down-hill creepage of surface soil from the vicinity of lode-outcrops at higher altitude. In this case the upper slopes would be worth prospecting for lode occurrences.



In the placer operation being carried on the light material is all ground-sluced off the 15°-sloping hillside down to bed-rock. This drops all the heavy material and boulders off to bed-rock. The lighter debris drains off into gold-saving boxes where the finer gold that may be present is caught. The boulders are then stacked and bed-rock cleaned by shovelling-in to the sluice. Water for ground-slucing is tapped into a ditch higher up the creek. The ditch-outlet is at elevation 4,425 feet.

As sufficient water for a continuous ground-slucing stream is not available from the ditch-flow, an ingenious contrivance has been constructed to garner sufficient water, which is automatically cascaded at regular intervals through a sloping box flume which leads the water against the gravel bank. For this purpose the ditch-outlet is blocked with a pressure-box equipped with a hinged trip-gate, to the top of which is attached a cord connected with a springy sapling planted into the bank above the gate. The gate is held shut by a notch in a narrow plank arm extending from a 2-foot square plank float. When the water rises in the ditch to the level of the plank float, it gradually raises this together with the notched arm and releases the gate. This is flung open by the pressure of water behind it, in the process of which it pulls on the cord and bends down the sapling attached to it in much the same way as a fish on the end of a rod and line, and the water cascades out down the box flume. The gate is

automatically pulled back into place again by the sapling spring, when the weight of water running over it has diminished sufficiently, and is held shut once more by the notched arm which drops over it. At this operation the gate is automatically opened in this way and the water cascaded every four minutes. It would seem that this ingenious contrivance could be developed and applied at even larger-scale operations.

Spruce Creek.

This creek flows into the south side of Pine creek about 4 miles from its outlet into the east side of Lake Atlin. The main creek is about 17 miles long, and with its chief tributaries, Little Spruce creek and Dominion creek, drains an extensive area of the northerly slopes of the divide separating this creek from McKee creek and the upper reaches of the O'Donnel river. Spruce creek has been one of the chief sources of the Atlin section gold-output. It has been worked continuously by individuals since the discovery of gold in this area in 1898. The Discovery claim is situated about 3 miles from its mouth, and very rich shallow ground in the creek-bed extends in places for about 2½ miles above this. Above this the old channel passes under the deep bench-ground of the banks and mining by drifting is resorted to. In places in the lower bench section some hydraulicking was carried out, and in the neighbourhood of Blue canyon, about 12 miles up the creek, some hydraulicking yielding good "pay" was undertaken on high benches. A Bucyrus dredge operated a short time in the Blue Canyon section, but was not successful on account of boulders and uneven bed-rock. The creek has, however, always been the stronghold of individual miners, and perhaps in no other easily accessible area can so many ingenious and picturesque installations of hand-made equipment be seen in actual operation. Water-wheels for power, water-supply, and drainage, gurdys, scraper-drains, and Cornish pumps, are still a feature of the operations. An appreciable proportion of the Atlin placer-gold production of to-day is yielded by the operations of individuals on Spruce creek.

The old channel of lower Spruce containing the so-called "yellow deposit" appears to be comparatively straight, but is cut at intervals by the winding channel of the present creek. Below these points of intersection good values, probably derivative from the old channel, are found in the present creek-bed. In the deep bench areas the old channel is reached by mining from shafts. A study of rim-rock conditions of the lower Spruce Creek area indicates that the main old channel continues on up Dominion creek as described in the introductory section of this report on the Atlin Division. It would seem also that another gold-run, now deeply buried below the high bench, emanating from the upper Spruce Creek area beyond Blue canyon, may have continued on down north of the "Dry canyon," skirting the southerly slope of Bald mountain, with a "slop-over" into what is now the main Spruce Creek trough at about "Dry canyon."

In the upper Spruce Creek area, towards the source, the valley is comparatively flat and marshy, with bed-rock at probably an appreciable, though varying depth below the surface. Gold has been found in this area comparatively high up above the creek on the sloping rim, and worked in places with varying success by small-scale hydraulicking, ground-sluicing, and shovelling-in. A few prospectors have gone in to look over this ground again during the 1931 season. In this section there is a good chance still for the discovery of rim-ground on which at least fair wages may be earned by the individual miner by shovelling-in. With the construction of ditch-drains, there is also a good chance for shovelling-in operations in sections of comparatively shallow ground above bed-rock or hard-pan, lateral to the main creek-bed. This area is easily accessible by 14 miles of motor-road to Blue canyon. The deep creek-bed ground of the upper Spruce Creek area should be drilled to ascertain its values and character in connection with suitable methods of mining.

As intimated in the introductory portion of this report, this creek and its tributaries still holds unexploited possibilities. In the central portion these will be opened up by the introduction of bed-rock drainage-tunnels. In the upper area there seem to be good prospecting opportunities for company operations and for individuals in shovelling-in operations, from which there is a chance of at least fair wages. In the lower area several individual outfits are at present mining, carrying out preparatory work, shovelling-in old tailings or virgin patches of the creek-bed. Regarding these the reader is referred to the 1930 Annual Report.

Koppacher, Morse & Co.—This company of individuals has acquired the westerly adjoining ground formerly operated by J. Brown, and from the old workings on this are excavating a bed-rock drainage-tunnel to connect with their easterly drift-workings. At intervals mining is

carried out to meet the expense of driving the drainage-tunnel. This is through a shaft on the bench 73 feet deep to bed-rock and drifting south-east and north-west along the old channel. Pumping is by means of a Cornish pump. The channel is about 40 feet wide and the best "pay" on bed-rock averages about \$4 to \$5 to the car. In mining, 1 to 2 feet of bed-rock is taken out with the pay-gravel.

It was estimated at the end of June, 1931, that about 200 feet of drainage-tunnel remained to be excavated to connect up with the drift-workings. Arrangements are being discussed for the possible continuation of this drainage through the operations above. If this can be consummated, production from these operations will be greatly assisted and deep virgin ground above all present operations will be made available for exploration.

McPherson & Buchanan.—These men are operating a bench lease above the Koppacher ground. This work is through a shaft 82 feet deep to bed-rock and a crosscut to the old channel.

Marco Pini & Co.—This company of individuals is operating a creek and bench lease above the McPherson ground on a lay from Angus Beaton. The work is carried out through a shaft 93 feet deep to bed-rock. The old channel in these workings seems to strike S. 35° E. (mag.) and consists of 8 to 12 feet of "chicken-feed," with small boulders lying below glacial drift. Drifting south-east is being carried out to connect with the old Beaton Bros. shaft. Good coarse-gold ground was encountered during the 1930-31 winter operations and the workings were still in this at the commencement of the 1931 summer season. Unfortunately, however, at this period recurring break-downs on the Cornish pump caused frequent flooding of the works and serious interference with production. The old channel is about 40 feet wide, with the best "pay" averaging \$4 to \$5 to the car (about 7 cubic feet), across a width of about 20 feet. It is estimated by the operators that the rim for 40 feet on each side of the channel would yield about \$1 a car, which, if drainage were available, would become available for mining through the consequent lowering of costs. Progress in this operation on a 50-foot heading is reported by the operators to be 2 feet (half a set) a day with two men working.

H. G. Marshall.—This fine old-timer is shovelling-in alone from creek-bed claims on upper Spruce creek, about half a mile west of Blue canyon. The property is reached by 13½ miles of motor-road from the town of Atlin. The operation is somewhat unique in the Atlin area, in that this prospector has been working this ground continuously since 1900. A great amount of ground has been moved during this time and extensive work has been accomplished in drain-ditch excavation. During this period fair wages have been made. Depth of bed-rock below surface is not known. A pit dug by Wallace & Wright in 1926, about 50 feet to the north of Marshall's works, went 36 feet without striking bed-rock. Fine gold occurs, however, on a hard-pan 6 to 11 feet below the surface. At present Marshall is shovelling from a pit about 11 feet deep to hard-pan and handles about 7 cubic yards a day. The gravel is being handled twice, by shovelling first from the pit-bottom to a bench and from there to the sluice about 7 feet above. Formerly all material was shovelled into the boxes, but now only the material about 5 feet above the hard-pan is sluiced. The gold is fine and assays \$16 to the ounce. Although better ground is encountered, it is estimated by the owner that the ground being worked in June, 1931, would yield only about 30 cents to the cubic yard.

Alfred T. Abbot.—This is another old-timer who owns a half-mile lease and a creek claim about half a mile west of Marshall's ground. At the time of the 1931 examination of this area he was on the way in to continue work on this ground.

McKee Creek.

McKee creek flows into the east side of Lake Atlin 8 miles south of the town of Atlin. It is reached by a good motor-road from Atlin. The creek is only about 7 miles in length, but has a gradient of 10 per cent., and the creek-gravels are featured by exceptionally large boulders. With its main tributary of Eldorado, it drains the northerly slopes of the divide to O'Donnel river and the southerly slope of the divide to Spruce creek.

In the lower area towards the mouth the old channel conforms approximately to the present creek-trough. Extensive hydraulicking and some drifting was conducted in this section in former years, and from a stretch of about 1 mile above the bridge substantial recoveries were made. Above this stretch hydraulicking in the creek-bed was not generally successful. Much speculation has since existed regarding the location of the lost old channel, with the ground

under the right and left banks of the creek having its champions. Some old drifting under the high bench of the right bank, however, seemed to indicate that section as being the most likely.

Persistent and efficient hydraulic prospecting in recent years under the personal direction of George Adams has, however, at last uncovered a rim-rock condition that very plausibly indicates the old channel to have swung under the right bank at a point about three-quarters of a mile above the bridge. The distance in from the present creek at which the old channel may lie can only be determined by further work, but a study of the rim-slope exposed by this recent work along the edge of the right bank indicates its possible close proximity. A study of the high rim-slope in this area also tends to strongly support this conclusion.

Delta Gold Mining Co., Ltd.—Work on the ground controlled on McKee creek by this company is being energetically continued by George Adams. Efficient and methodical prospecting by means of hydraulic stripping has revealed a rim-slope condition towards the right bank of the creek, indicating the logical conclusion that the lost old channel may lie at no great distance in under the high bench of this bank and that the present workings may be close to the edge of this channel. Rapid progress in the preparation of this ground for possible production during the 1931 season has been achieved.

Piping is being carried on by two No. 4 monitors equipped with 6-inch nozzles operating intermittently in two pits 300 feet apart at elevation 3,100 and 3,250 feet. The regular crew consists of twelve men working two shifts. At present six extra men are cutting timber, which is being shaped at a small sawmill on the ground.

Water is conserved by dams on the main McKee creek and also on Eldorado creek. The first dam on McKee is 4 miles above the pressure-box, which is at 3,250 feet elevation. This dam has a maximum height of 15 feet at the 3,314-foot contour, a length of 500 feet, with a flooded area of 7.14 acres, and a capacity of 18,450 miners' inches. At the 3,308-foot contour the dam is 9 feet high, the flooded area 2.46 acres, and the capacity 4,470 miners' inches. About 3 miles up Eldorado creek there is practically a duplicate of the lower McKee Creek dam. From about the middle of May to the end of July an average of about 3,000 miners' inches of water is available. From the beginning of August the water-supply gradually drops to about 700 miners' inches, which, with conservation, gives sufficient water for a few hours' daily run until freeze-up. The lower pit (altitude 3,100 feet) is about half a mile distant from the pressure-box at altitude 3,250 feet.

The property is well equipped with residence, office, several cabins, cook-house, bunk-house, store-rooms, carpenter-shop, blacksmith-shop, stable, 4-compartment garage, and a very efficient sawmill. Near the pit-workings there is also a mess-house, blacksmith-shop, and a Fordson gasoline compressor.

The sawmill is the complete No. 2 unit of 7,000 B.M. feet capacity supplied by the American Sawmill Company of Vancouver. This is a very efficient and compact outfit, costing about \$4,000 landed and installed on the ground. It consists of one circular cutting-saw, one butting-off saw, travelling-table, planer, boiler, and steam-engine. A small Worthington fire-pump is also installed. The sawdust is run off by a launder and hose to the creek. Logs are hauled 3½ miles by truck to the mill, at the rate of about 500 B.M. feet to the load. About three-quarters of an hour is consumed in a round trip.

O'Donnel River.

O'Donnel river flows into the east side of Lake Atlin about 15 miles south of the town of Atlin. This is the largest stream flowing into Atlin lake. It is about 30 miles long and, with its many tributaries, drains an appreciable extent of the southerly slopes of the divide between it and the Surprise Lake drainage-trough. In the early days of the Atlin camp some gold was taken out by small hydraulic outfits and by individuals from the main river-valley and from several tributaries.

In 1912 rich "pay" was discovered on a high bench in the central section and during 1913 a sizable rush to this stream materialized. Considerable hydraulicking, drifting, and sluicing carried out on the bench-ground and in the creek-bed during that year yielded good values from scattered patches. Although an appreciable quantity of gold was extracted, a combination of factors, chief of which was insufficiency of water for the operations, prevented the hopes for an extensive and sustained output being realized. Since that time small-scale drifting, some shovelling-in, and some spasmodic prospecting have been carried out.

In the section beyond Wilson creek the river strikes north-eastward and the banks are composed of 100 to 200 feet of glacial drift and clay, with areas of rim-rock exposed at intervals, particularly along the left bank. The grade of the river-bottom is rather flat, but sufficient for hydraulic purposes, and sufficient water might be ditched or flumed to working-sites from tributaries.

In this section high rim-rock is frequently extensively exposed along the left bank, and although some gold may be found in the gravel patches covering this rim-slope, there seems to be little chance for any ancient channel that may exist to have broken through in this direction. On the other hand, a low rim outcrops at intervals along the base of the high drift-bench of the right bank. This strikes generally N. 70° E. (mag.) and dips at varying though flat angles to the north-west. This condition indicates that in this section the old channel would most certainly lie under the high drift-bench of the right bank. The old and present drifting operations strengthen this conclusion and also indicate that the ancient stream was of considerably greater extent than the present river. These workings also indicate that the ancient channel was a wide compound channel; that is, composed of a wavy bed-rock, between the humps of which were several subsidiary channels of varying width, rim-slope, and depth.

This condition would also explain what appeared to be the patchy occurrence of "pay" in the old workings. It is also quite likely that in this area the present stream has cut across the easterly edge of this ancient channel in places, and in so doing has produced varying concentrations of gold on the present creek-bed.

Another interesting feature of this central area is the occurrence of layers of bedded river-wash of appreciable thickness in the high glacial-drift bank. Two of these were observed and they undoubtedly represent interglacial stream deposits formed between the periodic advance and recession of the ice. They may contain "pay" resultant from the reconcentration of gold originally scattered in the drift from which they were formed.

O'Donnel river is recommended to examining engineers as offering a likely area for a hydraulic operation of appreciable extent, providing sufficient water can be garnered for this purpose without too great expense. It is also recommended to small drifting syndicates and individual prospectors as offering a large area for intensive investigation with a fair chance of earning at least good wages. The area is conveniently reached by 30 miles of good automobile-road from the town of Atlin.

Nathan Murphy.—This prospector, assisted by Mrs. Murphy and Melvin Beckman, is operating one bench and one creek lease on the O'Donnel river about 12 miles from its mouth. Operations are being carried on by drifting and crosscutting along the ancient channel from the base of the high bench of the west bank.

This work indicates an appreciable width of channel composed of a wavy bed-rock and several subsidiary channels of varying rim-slope and depth. Bed-rock consists of an extremely decomposed, very ferruginous schist and has a general westerly dip. Drifting is progressing in a general north-westerly direction. The workings extend about 400 feet under the bench in a westerly direction, but at no place can it be said that the west rim of the extensive compound channel has definitely been attained. The workings are dry and good values are being encountered, and in places the owner reports ground running \$20 to the set. The gold is comparatively fine. Shuice-boxes are installed at the tunnel portal and the water is tapped from Gold creek.

Tom Prpich.—This prospector owns one creek and one bench lease above Murphy's ground. Shovelling-in is being carried out on the flat west bank of the present creek-bed, along the base of the high bench. The ferruginous schist bed-rock of this area is covered by about 6 feet of gravel. The gold is comparatively fine, but in the low spots, where bed-rock is covered by a yellow gravel hard-pan, some coarse gold occurs, but does not penetrate this to the bed-rock below it. Fair wages are being earned.

During the winter Prpich plans to drive a tunnel through the base of a rim-rock outcrop at the foot of the high bench, with the idea of achieving sufficient depth to penetrate the bed-rock to the ancient channel under the bench.

H. W. Miller.—This prospector is exploring two leases below Nathan Murphy's ground. At the time of examination (June 24th, 1931) a shaft was being sunk high up on the bench of the right bank. The collar of this shaft is at altitude 3,060 feet and only about 70 feet below the top of the bench. The shaft is at present 20 feet deep in glacial drift and filled with water.

From an examination of surrounding bed-rock conditions it would seem that a depth of at least 60 feet would have to be achieved before encountering bed-rock. Near the site of this shaft an old drift excavated by Larry O'Connor starts into the bench alongside a piece of rock that may have been mistaken for rim-rock. An examination of this shows it to be a large lava boulder erratic embedded in the glacial drift. This occurrence may possibly have misled prospectors of this locality into the belief that rim-rock was at hand.

STIKINE AND LIARD MINING DIVISIONS.

Up to the time of the compilation of this report this Division was not examined during the 1931 season. This examination will be undertaken later in the season and the information available incorporated in the 1931 Annual Report. The following notes are descriptive of some of the operations and indicate the 1931 progress:—

No placer gold was produced from the Stikine Division during 1930. From the Liard Mining Division, however, 322 oz. of placer gold, valued at \$5,474, has been recovered.

Prospecting for placer-gold possibilities has been comparatively inactive in the Stikine River area in recent years. It would seem there are latent possibilities in this respect worth investigating in both the Stikine and Liard Divisions. Activities have been practically restricted to the streams originally discovered by the old-timers. Although the old-timers were exceptionally good placer prospectors, it cannot be concluded they discovered the only gold-bearing streams existing in the region. It must be realized that gravels passed up by the old-timers as not of sufficient grade for their purposes may quite possibly be amenable to modern methods of placer-mining. In this connection it is suggested that the lava-buried gravels occurring along the banks of the Stikine river in the region around Telegraph creek may warrant extensive exploration. In a section of the canyon above Telegraph creek the present river-course is seen to cut through a lava-buried gravel that has the appearance of occupying an old channel of the river. It is significant also that from the bars of the present river below this section old-timers recovered appreciable quantities of gold. Some of the depression and trough areas on the east side of Dease lake also do not appear to have been investigated. No apparent reason is evident why this drainage section should not contain gold-bearing gravels along old buried channels, as well as those on the west side of the lake. From reports there also seems to be a very extensive area of the Liard River section worthy of intensive prospecting.

STIKINE RIVER SECTION.

Barrington Co., Ltd.—During the 1930 season this company employed a crew of five men drilling the Stikine River bars at the mouth of Glacier creek, about 25 miles below Telegraph creek. Nothing of importance was discovered up to the time of closing operations for the season. This work is being continued during the 1931 season.

On its holdings up the North fork of the Chutine river, about 12 miles by wagon-road from the Stikine river, this company undertook the installation of a dredge at the commencement of the 1931 season. Appreciable assistance was rendered by the Department of Mines and the Department of Public Works in the reconditioning of the road to facilitate equipment transportation. Operations with a crew of twenty men in charge of R. J. O'Reilley are being energetically carried out, and it is expected that the dredge will be digging by September 1st.

Seven lines of holes in which good values are indicated have been drilled on the left side of the river. In former small-scale operations \$20,000 was recovered from 8,400 cubic yards (about \$2.25 to the yard) and from another small pit \$2,300 was recovered from 800 yards. In 1926, 4 yards of gravel was rocked and yielded \$50 and J. M. Jackson recovered \$900 from 50 yards. Several other small clean-ups indicating rich ground have also been made. Drilling has disclosed that overburden is a heavy wash-gravel with granite boulders and fair gold values and does not extend below water-level. Below water-level there is finer wash-gravel and sand containing good values and lying on a deep deposit of clay. The clay bed-rock is uneven in contour, but on the whole is considered favourable for dredging. The gold is generally fine and flaky. Depth to clay bed-rock indicated in the drill-holes is from 7 to about 40 feet. Actual bed-rock was not penetrated in any of the holes and the rock-wall of the bank-confines slopes at about 80°. A sufficient yardage of "pay" is indicated for a small dredging operation and the outlook for success appears promising.

DEASE LAKE SECTION.

Dease Creek Mines Corporation.—This company was engaged during the 1930 season in drilling its ground on Dease creek and is continuing in 1931. Future operations will be based and planned according to the result of this work.

Cassiar Hydraulic Mines, Ltd.—This company took advantage of high water and started operations during the snow run-off early in the spring of 1930, and about 68 oz. of gold was recovered. The result of this work was sufficiently encouraging to warrant a continuation and the completion of the ditch as planned. In piping the gravel off the outlet seven buried old-timers' tunnels were uncovered. In moving the sluice-flume to a more advantageous position it was found necessary to blast through rim-rock for a distance of about 100 feet. This work was completed and a sluice-flume of seven boxes, 12 feet long and 5 feet wide, was installed and angle-iron riffles placed in readiness to run gravel in the spring of 1931.

The pipe-line consists of 400 feet of 30-inch and 400 feet of 26-inch diameter, 12-gauge pipe to the gates, from which three field-lines of 16-, 14-, and 12-inch pipe run to the giants. It is planned to put three No. 4 monitors in service under a head of 300 feet to bed-rock. With the exception of 1,625 feet of flume to be built in 1931, all ditching was completed. During the 1930 season 9,716 feet of ditch and 1,400 feet of flume was constructed. The total length of the main water-supply system is 30,625 feet, made up of 26,520 feet of earth ditch and 4,105 feet of flume. The ditch is 2 feet deep and 7 feet wide and has a capacity of 75 second-feet. Operations are continuing energetically during the 1931 season. The Cassiar Hydraulic Mines, Limited, is privately financed by Wrangell people who were familiar with this property.

MOSQUITO CREEK.

The property operated on this creek by the Gibson Hydraulic Association was described in the 1929 Annual Report. During the 1930 season the bed-rock flume was extended. About 100 oz. of gold was recovered by picking from bed-rock during the course of this work. Work is being continued with a crew of eight men during the 1931 season.

MCDAME CREEK.

Some prospecting is being carried out in this area during 1931 by several parties and three small operations are proceeding on a lay.

SKEENA MINING DIVISION.

All this area lies within the scope of the intense Pleistocene Coast Range glaciation and there is but little chance for the preservation of gold-bearing placer deposits of appreciable extent that may have existed in Tertiary time. However, small remnants of these may exist. On Douglas creek, in the Kitsumgallum Lake section, one or two individuals are making wages, and in this section it may be found that the adjoining Wesach (Hall) creek, Clear creek, and Maroon creek, draining from an area geologically similar to that of Douglas creek, may also be gold-bearing. They are worth prospecting for small individual prospects that may yield wages.

DOUGLAS CREEK.

Placer-mining had been carried on in a small way on Douglas creek by old-timers and remains of these workings are seen in several places. In recent years work has been done spasmodically in a small way and some gold has been recovered. Douglas creek is a small stream flowing into the north end of Kitsumgallum lake and draining the northerly slopes of Goat mountain and the southerly slopes of Couture mountain.

Half a mile up the creek from its mouth the stream continues east to the Skeena River divide in a narrow canyon which is particularly confined for the first 3 miles of this distance. The formation is bedded argillaceous sandstone, sandstone and quartzite. The bedding strikes N. 70° W. (mag.) and dips 10° to 15° E. As the creek consequently flows almost at right angles to the strike and the bedding dips up the stream, there is little chance for bed-rock riffles to be formed. Consequently there is a great tendency for slippage of concentrates along the slightly sloping bedding-shelves of the smooth bed-rock. Much of the gold might in this way be carried a considerable distance down the stream towards its mouth. It would seem that the section of the creek and its old channels in the neighbourhood of the mouth would be worth prospecting.

The source of the gold is probably quartz veins lying structurally below a conglomerate-bed horizon that follows around the slope of Goat mountain to Douglas creek, from about altitude 3,500 feet at its south-easterly end where it crosses Douglas creek about $6\frac{1}{4}$ miles from the mouth of the creek and about $1\frac{3}{4}$ miles from the divide of the North fork of Lorne creek. On the north side of Douglas creek the conglomerate-bed horizon probably curves around the southerly slopes of Couture mountain from about 2,500 feet altitude at the creek crossing to about 3,500 feet altitude on the westerly slopes of this mountain. (See G. Hanson, Geological Survey of Canada, Summary Report, 1923, Part A.)

Nightwine Lease.—About 2 miles up Douglas creek, Mr. and Mrs. Nightwine, who hold a creek lease, are shovelling gravel from the creek-bed in a narrow canyon. At the time of examination (August 30th, 1930) bed-rock had not been reached. The outfit consists of eleven sluice-boxes and twenty-eight sections of flume. A daily clean-up of about \$3 was being made. Better values will probably be encountered if bed-rock, which is about 6 feet below the present shovelling, can be reached. In the spring of 1931 it was reported that some high-grade spots had been encountered.

Stevens-Cavanagh Lease.—About $2\frac{1}{4}$ miles up Douglas creek, W. A. Stevens and W. H. Cavanagh, of Terrace, have two placer claims. At the time of examination they were shovelling ground worked over years ago by old-timers. About 6 feet of this ground remained to be shovelled before entering virgin ground and about 150 feet of what is probably an old channel on the east bank of the creek. About \$3 to \$5 was being recovered from every three days' shovelling. The equipment consists of eighteen 10- by 12-inch sluice-boxes 12 feet long and eighteen sections of flume. There is also a very ingeniously constructed sawmill made of old Ford car parts and odds and ends of home-made accessories.

Egan Lease.—About $1\frac{1}{2}$ miles above the Stevens workings, A. Egan, of Terrace, is sluicing for bed-rock in deep-channel ground.

It is reported that several more prospectors have taken up ground in this area at the commencement of the 1931 season with a view to the discovery of wage-producing sections.

QUEEN CHARLOTTE MINING DIVISION.

BLACK-SAND DEPOSITS OF GRAHAM ISLAND.

For a description of these deposits the reader is referred to the report by Herbert Carmichael on page 29.

It would seem that profitable recovery of the gold from these sands by sizable company operations does not hold much promise for success. However, there appears to be a good chance for individuals or small syndicates of two or three men to earn wages from rich patches by even sluicing methods of concentration, where water is available, from which 50 or 60 per cent. of the values may be recovered.

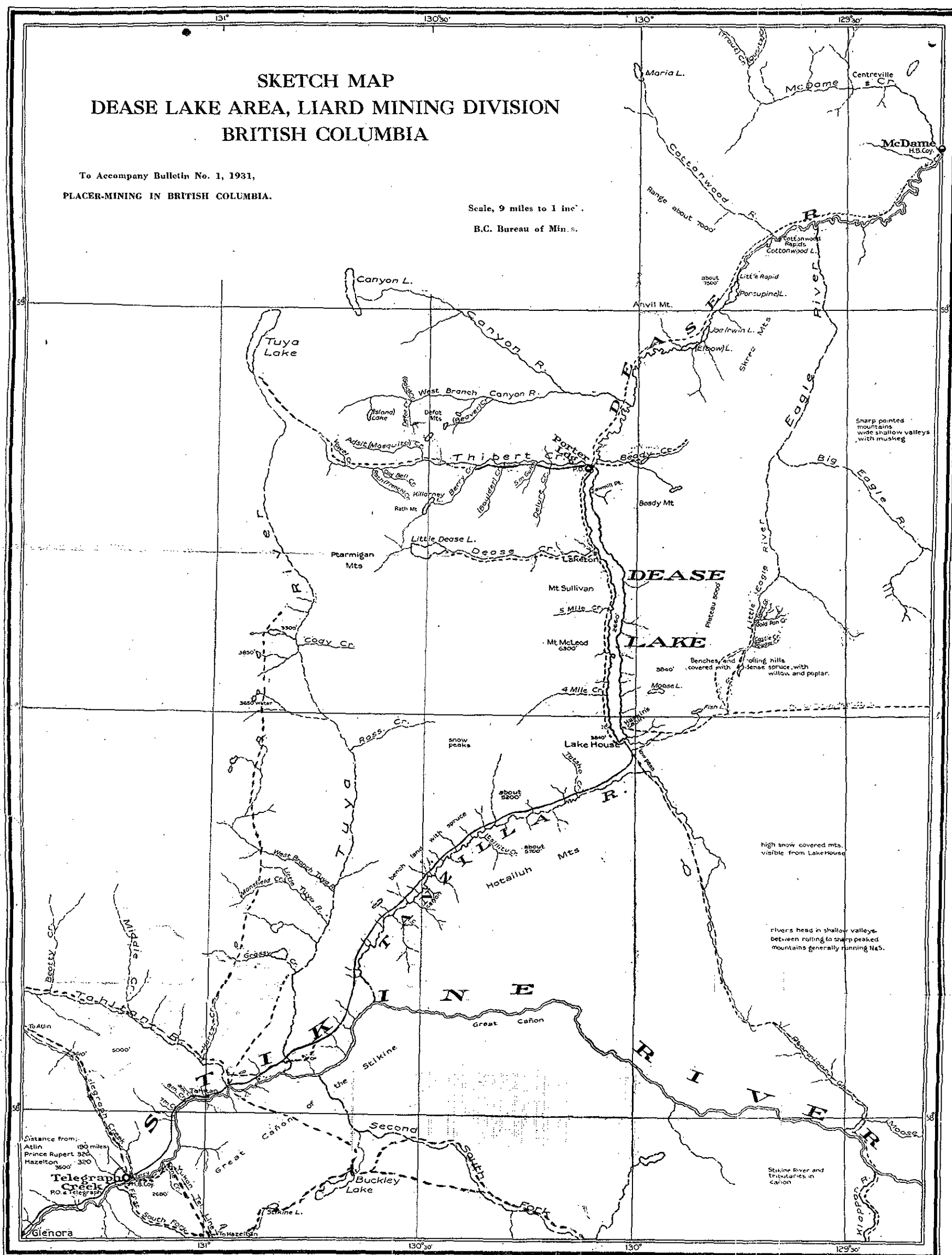
Hanssen Positive Separation Mining Co., Ltd.—The Queen Charlotte Syndicate, which had been conducting tests in extraction of gold from the black sands on the east coast of Graham island, in the neighbourhood of Martell creek, with the Hanssen Positive machine, was merged with this company. The tests were continued for a short period during 1930. The report of the engineer conducting the experiments indicates an economic extraction of gold values. A recovery of about \$325 in gold during 1930 was reported. The success of the venture on the Graham Island beach-sands is, however, dependent upon the quantity of black sand available, which factor is both doubtful and periodically variable. As is pointed out in Herbert Carmichael's report, successful application of this machine to the Graham Island deposits is dependent on the introduction of some feasible portable method of preliminary concentration. Difficulties confronting this are: A system yet to be worked out; difficulty of procuring a continuous water-supply; tailings-disposal.

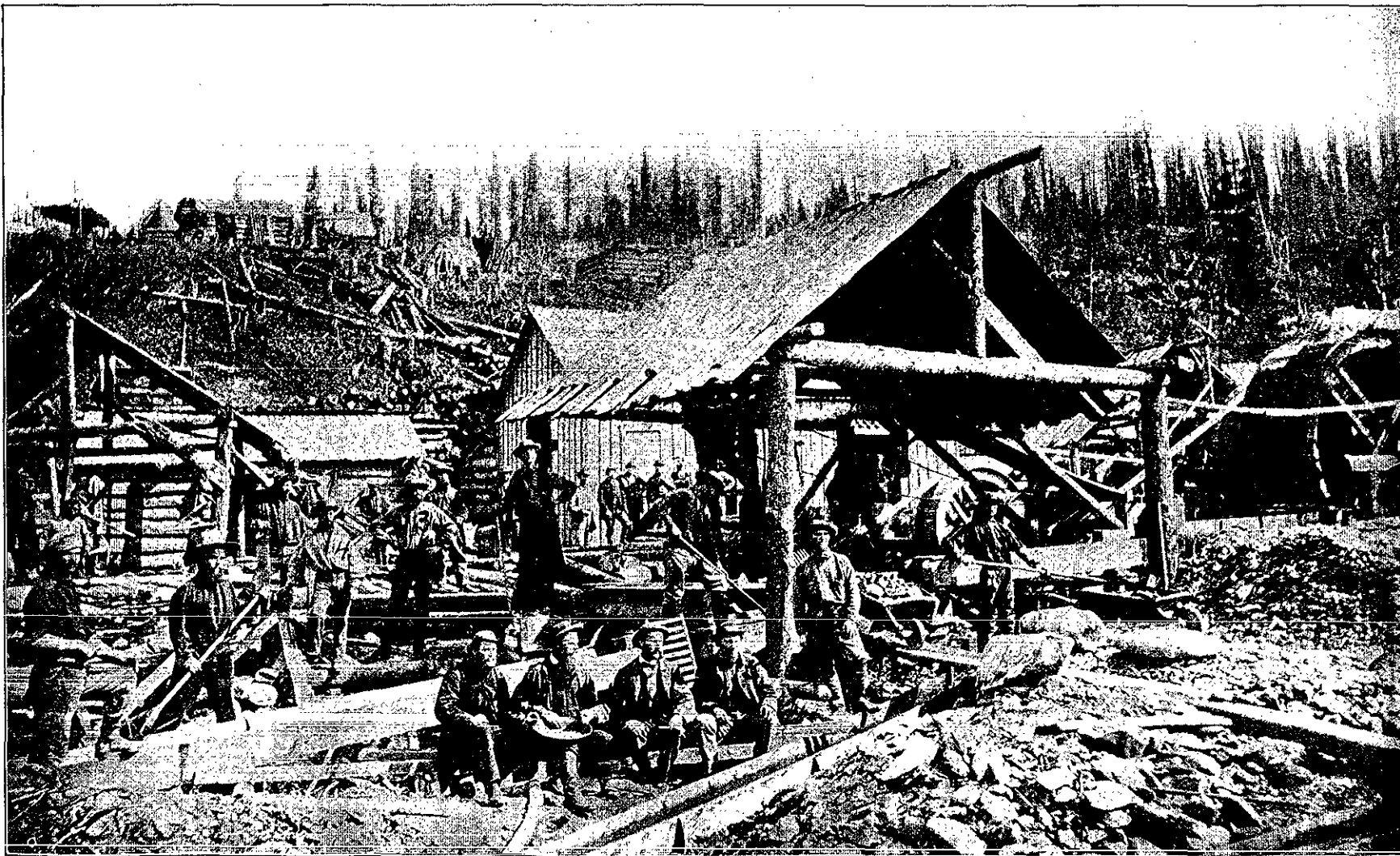
On November 27th, 1930, a petition for the winding-up of the Hanssen Positive Separation Mining Company was granted. During the 1931 season no further work was carried out on the beach-sands of this locality.

Several improvements and alterations in the mechanism of the machine have been worked out and applied by L. L. Lorentsen, and the machine is now called the Lorentsen Centrifugal Force Amalgamator. This machine is controlled by Gold Savers, Limited, 311 Dominion Bank Building, Vancouver, which is in the market to receive and treat black-sand concentrates and free-milling gold ore for recovery of values.

To Accompany Bulletin No. 1, 1931,
PLACER-MINING IN BRITISH COLUMBIA.

B.C. Bureau of Min. s.





Williams Creek, Cariboo—Placer-mining on Cameron's Claim in 1863.



Horsefly River—Keystone-drilling of Placer-gravels.



Quesnel River, South Fork—Monitors in Bullion Pit.

The Lorentsen machine was moved from the Martell Creek location to Cape Fife for use on a royalty basis by a company called the Golden Star Mines, Limited.

The following description of the Lorentsen gold-saving machine is taken from a circular issued by Gold Savers, Limited: The device in which the principle of centrifugal force is applied consists of a bowl mounted in a casing. The bowl rotates at any desired speed. In the operation of the machine, mercury is placed in the bottom of the bowl. When the bowl is rotated, the mercury is caused to flow upward on the inner wall by centrifugal force, until it forms a lining on the inside of the bowl. The auriferous and platiniferous sands are then fed into the feed-pipe with water. A centrifugal pump specially devised delivers the pulp from the bottom of the bowl in such a way that the angular velocity of the pulp exceeds that of the bowl. This facilitates an even distribution of the pulp on the surface of the quicksilver, and a greater accentuation of the pulp to that of the quicksilver. Attached to the feed-pipe of the centrifugal pump are four arms which are so constructed that they revolve with the pump and at the same rate of speed. To these arms are attached flexible devices which, as the machine revolves, throw out blades which travel parallel with the mercury wall, and in close proximity to the same, thus performing the function of agitation for the materials as they travel upward toward the top of the bowl. As soon as the gold and platinum-bearing material is subjected to the action of centrifugal force a separation takes place, the heavier particles (gold, etc.) moving to the outside; that is, they penetrate the quicksilver and are held against the wall of the bowl. Clean gold of course will be quickly amalgamated, while dusty or greasy gold and platinum will be retained against the wall until the machine is brought to rest. The sand or other material, of less specific gravity than quicksilver, will pass over the surface and out over the top of the bowl. The remainder of the process is merely to scoop out or run off the quicksilver when the machine is brought to rest; strain it in the customary manner and retort the balance. A machine capable of handling a yard of concentrates or 2 to 3 tons of milling-ore an hour will require about 50 gallons of water per minute; this will also be sufficient for the removal of the tailings. Where it is desired that the water shall be conserved, it could of course be circulated, in which case some other method would need to be adopted for the removal of tailings.

Golden Star Mines, Ltd.—This company owns some leases in the neighbourhood of Cape Fife, on the east coast of Graham island. The company originally applied for incorporation as a public company, but subsequently changed its organization to the status of a private company, and withdrew its application. The company is constructed of 10,000,000 shares, par value 1 cent, and the office is at 316 Credit Foncier Building, Vancouver, B.C. Questionable methods of financing carried on by F. S. Munson, the then president of the company, by which several individuals were induced to advance money on the promise of employment and the receipt of promissory notes covering the cash and advance wages, created hardship and disappointment for those involved. It is understood, however, that Munson has disappeared and is not further connected with the company.

The leases are situated about 28 miles from Masset and are reached by automobile route via the Tow Hill road and north beach to Carpenter's ranch, and from thence 3 miles by trail to the location. Supplies and equipment can be hauled from Carpenter's along the north beach and around Rose point to the locality on the east coast.

Gold values occur in black-sand concentrates of a specific gravity of about 4.2, accumulated during high tides, and particularly during storm periods. These concentrates emanate from reconcentration of several streaks occurring along the base of a wind-blown sand-dune bank about 100 feet high. The base of this bank is reached by extreme high tide, and the black-sand concentrates form in lenticular patches or lenses varying from one to several inches thick. In some cases at the recession of the tide they will be covered with a streak up to several inches thick of ordinary grey or yellow beach-sand which would have to be scraped or stripped off to avoid dilution of the underlying black-sand streak. Concentrate lenses also collect in the eddy-pools and behind drift-logs. The lenses would vary from about 3 to about 20 or 30 feet in length and from about 3 to 6 or 7 feet in width. Very fine gold colours can sometimes be seen by scraping away the surface of the fresh damp lenses. During excessive storm periods the concentrate lenses may possibly form in patches of greater dimensions than the above-mentioned figures. The gold is very fine, possibly 60 or 70 of the average colours making 1 cent.

Although estimates of available yardage of concentrates have been made by various authorities, it is the opinion of the Resident Engineer that any even roughly dependable estimate is an absolute impossibility under the circumstances of the formation of the deposits. They may be

here to-day and entirely obliterated to-morrow. Likewise their size would vary from day to day, dependent on the height of the tide and the weather conditions. Consequently, no dependable yardage could be even roughly relied upon for any permanent or continuous operation.

The plant on the property consists of a 1-cubic-yard-an-hour rated capacity Lorentsen Centrifugal machine. The principle of the machine appears to be practical, and the extraction it makes from the concentrates appears, from the figures examined, to be good. Values that may escape from the machine are saved by riffles and blankets in the tail-race sluice. For the type of the deposit and the company organization, the capacity of the machine appears, however, to be too restricted to return a profit. Power is supplied by a 12-14-horse-power Petter semi-Diesel engine. Salt water is pumped to a storage-tank at the head of the mill from a well 30 feet deep; it circulates through the mill and back to the well. Work has been carried on very intermittently during the spring and summer of 1931, with short runs and long intervals of idleness, and some small clean-ups have been made. On May 17th about 6 oz. of gold, valued at about \$17 an ounce, was brought into Masset. It is understood that from that time to the end of July no further gold has been produced.

In a fifty-minute test run carried out for the Resident Engineer at the time of examination (May 18th, 1931), 1,530 lb. of sand was put through. This was estimated to contain 60 per cent. magnetite sand (Sp. G. 5), 30 per cent. garnet-epidote sand (Sp. G. 3.5), and 10 per cent. quartz sand (Sp. G. 2.5), giving an average gravity of about 4, or about 7.8 cubic feet to the ton. Allowing for air-space and moisture, this works out to 218.75 lb. a cubic foot. The test run based on these figures only gave a machine capacity of 0.31 cubic yard an hour.

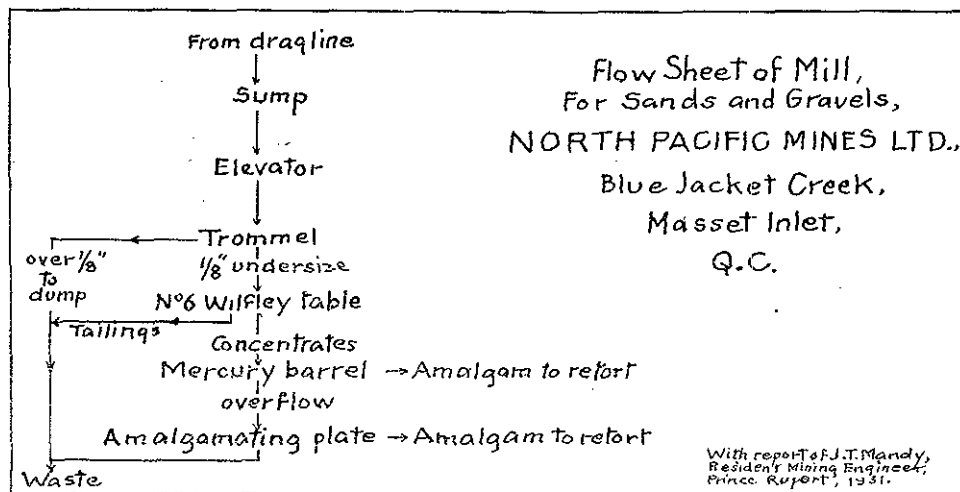
Three men were busy running the machinery and shovelling into the hopper, and two men were wheeling the sand in barrows from a point about 700 feet distant from the mill. One man, including the cook, was in camp—all supposed to be drawing \$4 a day and board. This would entail a minimum cost of \$45 a day at the works alone. Reliable average estimates of these sand concentrates have been established at about \$3 a cubic yard (some patches may contain from \$5 to \$10 on occasions). Allowing 1 cubic yard an hour capacity for the machine, a continuous supply of sand (which is not probable) and a regular eight-hour-a-day run, an average grade of even \$4 to the cubic yard, and a complete extraction, a total of only about \$32 a day would be recovered. It is apparent that with the present system employed, the scope of the equipment, and the expense and personnel involved, there is no possibility of profit in the operation.

North Pacific Mines, Ltd.—This company was incorporated in 1931 under the laws of the State of Delaware and is composed of 5,000 shares of \$10 par value. All capital is reported to be furnished by United States shareholders, of which there are stated to be about twenty-four. The local office is on the property, which is situated about 1 mile south of the town of Masset, on Masset inlet, Graham island. A. Brown, of New York, is president of the company and is resident on the ground in charge of operations.

The company has acquired by staking the old *Blue Jacket* placer-gold property, formerly owned by Peter Kay, on Blue Jacket creek, which flows into the east side of Masset inlet about 1 mile south of the town of Masset. On the north side this small creek flows through a high sand-bank in which are layers of black sand from 1 to 12 inches thick. On the left bank there is a layer of fine bedded gravel from 4 to 6 feet thick overlying a bed of clay and apparently dipping southerly at a flat angle. Some small-scale drifting and shovelling-in was carried out on this by individuals about 300 feet up the creek from the mouth, and good wages reported recovered by sluicing and rockers. The gold is generally coarser than that of the beach black-sand deposits, and although some of it may have originated from a reconcentration of the gold in the black-sand streaks of the elevated beach on the north bank, it is quite possible the alluvial creek-gravel may itself be gold-bearing, and that the original creek was of greater dimensions than the present, with an old channel lying southerly of the present bed.

It is intended to clear off the timber, windfalls, and underbrush on the left (south), and drag-line the gravel to a small mill that has been erected at the creek-mouth. Promising values are reported to have been obtained from panning and from some test channels and pits. The mill consists of a Goodyear style "C" elevator-belt with 12- by 7-inch buckets, which elevates the dragged gravel 25 feet from the sump to a bin feeding to a trommel 6 feet long and 90 inches in circumference. The trommel rotating at 56 revolutions a minute screens to a $\frac{1}{8}$ -inch undersize. The oversize goes to the dump. The undersize flows through a launder to a No. 6 Wilfey table with a capacity of 20 tons in 24 hours. On this it is planned to try to make a

gold-streak and platinum cut as well as a rough concentrate. The concentrates flow through a launder into a wooden amalgamating-barrel, the residue from which discharges over a 5- by 6-foot amalgamating-plate, the tailings from which are discharged into the dump-launder. A 5-horse-power Le Roy gasoline-engine supplies the power for the elevator, trommel, and barrel, and a 2½-horse-power Hercules gasoline-motor drives a centrifugal pump which elevates water collected in a sump to two feed-barrels at the head of the mill. Drag-lining and cleaning will be carried out by a 16-horse-power double-drum Novo gasoline-driven donkey-engine. Altogether this is a complete little outfit, and with perhaps some minor alterations should make a good extraction if the values are in the ground and the yardage is available. Some difficulty will be experienced from stumps and roots in the ground while drag-lining.



Construction of the mill by a crew of four men was started about May 15th, with J. A. Brett, of Vancouver, in charge of the work, and it was completed about August 1st. At this time a shortage of water materialized over the dry season, and the commencement of milling will be delayed for a short time until this condition is relieved.

William Duncan, Lawn Hill.—William Duncan's ranch is situated on the main Queen Charlotte City-Port Clements road, about 2 miles north of Lawn hill. At this locality a gravel bench fronting the beach and overlying a blue clay has been found to be gold-bearing. By sluicing in a small way in former years William Duncan has taken out small amounts of gold. From one small pocket he reports having recovered \$200. He has, however, not worked this ground in recent years. The character of the gold is generally fine, but some \$1 and 50-cent nuggets are reported to have been recovered. Water is led in from a small creek, but during the dry season is not plentiful.

The bench is about 200 feet wide, 800 feet long, and from 8 to 12 feet deep to the clay-bed. Colours can be panned in sparse quantities throughout the gravel, but "pay" occurs in the basal section of small boulders and gravel about 8 inches thick above the clay-bed. This yields about ½ cent to the pan, about 30 colours. Pan concentrates are about 40 per cent. magnetite and 60 per cent. garnet sand. Work has been carried out in spots along the bench-front where it breaks off to the beach. At about half-tide mark the beach is strewn with small boulders of the basal section which form natural riffles. Some rich patches of concentrates have been "sniped" from among these.

This bench appears to be the remnant deposit of what was a fairly large meandering ancient stream flowing approximately parallel and close to the old shore-line in much the same way as do the present Tlell and Oeanda rivers lying to the north. The stream possibly possessed a comparatively wide meander-belt, and the encroaching sea has eroded the bulk of the old channel and left patches of its bed at the spots of greatest westerly meander between steep and jutting rim-rock. The bench at Duncan's ranch would represent one of these westerly meanders and northerly of it, immediately beyond what appears to be a gentle subsequent anticlinal fold, there appears to be a good chance for the occurrence of another. These benches are worth prospecting with a good chance of the operation returning wages.

NORTH-EASTERN MINERAL SURVEY DISTRICT.

HISTORICAL SUMMARY.

BY HERBERT CARMICHAEL.

(Reprint from Bulletin No. 2, 1930.)

CARIBOO AND QUESNEL MINING DIVISIONS.

The name Cariboo was apparently derived from the French Cerfbœuf or deer-ox, which became Caribœuf and then Cariboo, the name being applied to the country inhabited by Cariboo deer.

The first mention of placer gold on the Mainland of British Columbia seems to be in 1852, when Chief Trader McLean, at Kamloops, procured gold from the natives which they got from the banks of the Thompson river at Nicoamen.

From 1855 to 1857 gold was reported from the region of the Thompson and Fraser rivers, and also in 1856 on the Columbia river near Colville, on the United States side. From there parties proceeded up the Columbia, the first placer gold being found at the mouth of the Pend d'Oreille river, and then over to the Thompson river. It was the exaggerated report of these discoveries that started the great gold-rush of 1858 from California.

The first ship-load of 450 adventurers left San Francisco on April 20th, 1858. Between April 20th and June 9th 2,500 miners, mostly from the interior of California, had taken passage by steamer from San Francisco; and it is estimated that 5,000 more at the same time collected in Puget sound on their way to the Fraser river.

Gradually the miners worked higher up the Fraser, past the junction of the Thompson with the Fraser at Lytton, to Cayoosh and Bridge rivers at Lillooet; then to the Chilcotin, and thence on past Fort Alexandria to the mouth of the Quesnel.

Late in the season of 1859 definite reports came that the search for gold had proved successful on the Quesnel, and in 1860, by the time the pioneers of the column reached Antler creek, 600 white miners were said to be engaged on this river, making \$10 to \$25 a day.

The significance of the discoveries in Cariboo did not become apparent at Victoria until the closing months of 1860, but at the end of the 1861 season this district, with a population of only 1,500 people, had shipped \$2,000,000 worth of gold to Victoria.

In the spring of 1860 Keithley, Harvey, Antler, and Cunningham creeks were discovered; Keithley and Antler creeks seemed at first to be the most important, but were afterwards greatly surpassed by Williams and Lightning creeks. A party of five men in June, 1861, on Keithley creek, divided \$1,200 between them as the product of a single day's labour, and their daily average for some time was said to be 1 lb. weight of gold.

Williams creek received its name from William Dietz, a German, who prospected from the headwaters of Willow river in the summer of 1861. This creek has a history similar in many respects to the other creeks; its first discovered rich deposits were shallow and in the bed of the present stream above the canyon. Below these diggings was a flat supposed to have been the bed of a former lake in which the channel sank and was lost. Here the problem of working the deep ground by means of shafts and pumping was for the first time systematically attempted.

On the completion of the road along Lightning creek in 1865, Barkerville, on Williams creek, became the principal distributing-point for the Cariboo region, the aggregate product of which amounted in seven years to \$25,000,000.

The enterprising men who worked the bars of the Quesnel in the summer of 1859 were most successful in the valley of the main stream on the South branch opening into Quesnel lake.

Proceeding on rafts along the shores of that lake, they came to a large river entering from the south which was named Horsefly river. They ascended the stream until it branched, and on the smaller tributary, Horsefly creek leading to Horsefly lake, they discovered the richest placers found up to that time in the basin of the Quesnel. One party of five miners, working near the close of the season of 1859, with two rockers took out 101 oz. of gold in a week, after which they were obliged to abandon their operations on account of the severity of the weather.

Towards the close of the season of 1861 all previous discoveries were exceeded by the developments in the rich ground lying 50 or 60 feet under the flat below the canyon of Williams creek. To the Barker company belongs the credit of having sunk the first paying shaft into the new deposit and from this company the town of Barkerville was named. The Diller company was next in order to bottom a shaft into deep ground, washing out in one day, it is said, 200 lb. weight of gold, the largest yield recorded for one day in Cariboo.

Large as was the yield in 1862, the following season was even more prosperous, as numerous new claims were staked and forty produced handsomely, though some of them only reached bed-rock in 1864. By the end of 1864 the big excitement was over and the exodus had begun.

In the early days there were several routes to the Cariboo diggings. When the miners came the first route used by them was up the Fraser river, following the old Kequeloose horse-trail away from the river some distance and then descended along Anderson river to the Fraser at Boston Bar. From five to eight days were usually expended between Langley and Boston Bar.

Another route was the Whatcom and Smess trail along the Fraser to Hope and thence along the plateau to the Thompson river, by which it was possible to reach the mines above the Fraser canyon independently of the canyon and canoe navigation.

On July 21st, 1858, the American boat "Umatilla" succeeded in reaching Yale and made this the steamer terminus; the achievement of the "Umatilla" decided the question in favour of the more direct road along the west side of the Fraser and the "Douglas" trail between Yale and Spuzzum was opened for pack-trains in August, 1858.

At Spuzzum a bridge had been constructed by Frank Way and a mile above he constructed the ferry which could carry ten loaded animals. Although the road was not quite clear for the 500 miles, it reached the Quesnel Forks on September 10th, 1858. Pedestrians still preferred the foot-trail along the bluffs, and in 1859 a ferry across the Fraser was established at Boston Bar which enabled them to pass by Spuzzum. This trail had the disadvantage of being blocked by snow early in the winter, a difficulty averted by the opening in November of the Harrison-Lillooet road. This land and water route became for a considerable time the main line of traffic for the upper country.

The McLoughlin trail by way of Priest rapids was followed by the regular Oregon packers, ascending the Similkameen river to Red Earth fork (now Princeton), then across a divide to Nicola valley, reaching the Thompson river at Nicoamen, 13 miles above its mouth.

By October, 1860, a new and easier road, practicable during winter, was opened between Yale and Lytton; its transformation from a trail to a wagon-road was begun by cutting and blasting in 1862. This road was gradually extended and by 1864 the era of freight-wagons had set in.

Much of the above information on routes has been taken from Bancroft's "History of British Columbia."

In the years following 1863 the richer placer claims became worked out or at least much less productive, and there was a steady decline in mining, until in 1874 there were only 1,086 men working and the production was \$682,560; in 1875 the output increased to \$766,255, but fell off again the next year.

Hydraulic mining on any large scale began in 1879, when two projects were started—one by the Waverly Hydraulic Mining Company on Grouse creek and the other by the Cariboo Lake Ditch and Mining Company on the North fork of the Quesnel river. Largely due to hydraulic mining the output increased \$100,000 over the previous year. In 1880 several hydraulic mining companies were started and in 1884 there was a considerable influx of Chinese. From 1884 to 1889 several of the small hydraulic companies and deep placers paid well and in 1891 there were fewer placer miners and more hydraulics.

Prospecting for deep channels was commenced about 1892, one being found on Slough creek at 245 feet from the surface, and considerable activity was displayed in this direction. In 1893 this activity rather increased and several large projects took shape, notably on the Horsefly river, the South fork of the Quesnel, and Williams creek.

The Cariboo Hydraulic Mining Company started work at the *Bullion* mine near Quesnel Forks, and some of the older claims were still paying well.

In 1897 Wm. A. Carlyle, Provincial Mineralogist, made an examination of the district and fully described the mines at work at that time, which were principally hydraulic mines and deep diggings. His description will be found in the Annual Report for 1897.

Wm. Fleet Robertson, Provincial Mineralogist, made a reconnaissance of the Cariboo in 1902 and his comprehensive survey will be found in the Annual Report for that year, from which the following extracts are taken:—

"The whole of the Cariboo district may be generally and roughly subdivided into two parts—namely, that portion of the country which has an elevation above the sea-level of from 2,000 to 4,000 feet, and that which lies at a still higher elevation. The first-mentioned, low-lying section comprises the large valleys and plateaus of pre-glacial days, with the larger old river-channels which cut them, such as the Quesnel River district. The latter or elevated portion was in pre-glacial days, as it is to-day, the mountainous region of the district, where the streams had their source, and is represented by the Barkerville district, of which the town of Barkerville is the centre. Behind the town Mount Agnes rises to a height of 6,200 feet above sea-level, and from this centre most of the important gold-bearing creeks seem to have radiated. In this high-level district the valleys are above 4,000 feet altitude; they are narrow and are more clearly defined by definite rock formations. These same rocks defined in a general way the older channels, so that, more or less, the drainage-channels of to-day follow those of the time when the gold-bearing gravels were being deposited. It is not meant by this that the ancient and modern streams flowed in the same channels, for they did not, nor did they often flow at the same level, but they were both confined within bounds by the same higher mountains of solid formation and within valleys with solid bed-rock at no very great depth. To quote from Dr. G. M. Dawson on this point: 'The old stream-courses of the Cariboo district are found to have pursued very much the same directions as their present representatives follow, crossing often from side to side of the valley with different flexures, and occasionally running through below a point of drift material projecting into the modern channel, but never, I believe, actually leaving the old valley or running across the modern drainage system, as is so often the case in the deep placers of California and Australia.'

"This very confining of the channels effected that concentration of the values which made the rich placers of the early days, and to-day renders workable and profitable a number of small hydraulic propositions, operating on comparatively limited deposits of gravel containing unusually high gold values and occurring as old, high channels, or benches, or as ancient and buried outlets of creeks, where the modern creek has cut a new channel for itself. The ancient gravel-bearing streams, after leaving the confined mountain valleys, issued into the wider, more level valleys or plains, spreading out more, their courses being less sharply limited, their flow slower, and their channels larger. These latter represent the great gravel-deposits of the Quesnel and its tributaries, of Willow river, Cottonwood, etc., which are, on the whole, larger and lower grade, while their course is more obscure, having in many cases been covered with subsequent flows or lake deposits."

J. D. Galloway, while Assistant Mineralogist in 1914, came through Cariboo district by way of Prince George; he states in the Annual Report for that year that there were three large hydraulic properties at work—namely, Lowhee, Stouts Gulch, and Mosquito Creek claims.

Prospecting by drilling was under way on Williams creek and Willow river, and Mr. Galloway stated then that "It cannot be said that a sufficient quantity of ground has as yet been proven up on Williams to warrant the expenditure necessary for a complete dredge installation, but in the event of a similar area being proven up on Willow river, then the two together might form an attractive dredging proposition."

From 1914 to 1924 a considerable amount of hydraulic mining was carried on, showing a yield round \$200,000 per annum; the Resident Engineer for the district reports a very satisfactory year in 1924 and the installation of a dredge on Antler creek, which was working the following year with good results, the recovery for the year being \$95,066, and in 1926 the gold returns for the year were \$170,993, mostly contributed by the Antler Creek dredge.

An operation for dredging the bars of the Fraser river at Lillooet was started in 1925. A company acquired 6 miles of dredging-ground and installed a drag-line scraper as well as a patent device for saving gold. This method, however, did not work out in practice and was abandoned.

In 1927 and 1928 there was considerable activity amongst the smaller hydraulics and a large amount of Keystone-drilling done in prospecting new ground.

CARIBOO, QUESNEL, AND OMINECA MINING DIVISIONS.

REPORT BY C. W. MOORE.

(Reprint from Bulletin No. 2, 1930.)

SUMMARY AND CONCLUSIONS.

From August to November I examined a number of placer areas in the Cariboo, Quesnel, and Omineca Divisions, with the object of ascertaining the possibilities of stimulating and reviving activity in placer-mining. In the following report the description of properties is divided under the three Mining Divisions of Cariboo, Quesnel, and Omineca.

There are signs of a revival of interest in placer-mining in the Cariboo district, which has undoubtedly been stimulated by the action of the Department of Mines in actively aiding the industry. All indications point to a great deal of drilling and other methods of prospecting during the year. Not only will there be more prospecting, but, should the ground warrant, there is capital available to equip it and bring it into production. There are companies prepared to finance any undertaking big enough to show promise of a fair return on the money invested. It is to be hoped that these companies will tackle the problem in a businesslike way with the best geologists and engineers obtainable. This shows a healthy condition and we may look forward, confidently, to excellent results.

I would emphasize that practically all the placer-mining done in the Cariboo Division during the past fifteen years has been done within a radius of 12 miles from Barkerville. Geologists and engineers all recognize that if the industry is to be revived we must look for placer-fields outside this small area. This is what is now being done and with good results.

The cause of this new interest generally and more particularly in the Cariboo is easily accounted for: The Government has been supporting the placer industry, particularly in the matter of more and better trails. In some sections it started and practically completed a system of trail-building. These trails will make it possible for prospectors and engineers to take pack-horses to or near any area which they may wish to prospect or examine. In doing this work the Government has shown confidence in the future of the country, and by doing so has encouraged the capitalist to proceed with the work of investigation.

The Cariboo has the advantage of having good trunk roads to all its centres. The Omineca is not so fortunate in this respect. However, upon the completion of the road from Fort St. James to Manson Creek, we can look for improvement in that section.

The great need of the Cariboo is a *good topographical map*, linking up Horsefly, Quesnel river, and the Barkerville areas, extending north to the Fraser river and easterly to a point which would take in the whole of the Stony Lake area. This map should be on a scale of not more than 4 miles to the inch. Such a map would be of undoubted assistance in helping to trace out the old drainage systems and connecting up different sections of channels still in existence.

The population of the Manson Creek section (Omineca Division) at the time of my examination consisted of six white men and six Chinamen actually engaged in placer operations. Scattered through the district there were four men moving machinery to Germansen creek, four prospectors looking for quartz-showings, a Deputy Mining Recorder, and two or three trappers.

There are many reasons why this district is so depopulated. The main one is probably the condition, or perhaps I should say lack of condition, of the trails. This fact has been recognized for some time by the Department of Mines, but lack of funds has prevented as much trail-work as would have been desirable. During the season of 1929 a start was made on a road from Fort St. James to Manson Creek, and generally the Department of Mines is fully alive to the necessity of building roads and trails in this section.

Upon completion of the road now under construction from Fort St. James to Manson Creek, it will be possible to get heavy drills into the country, and thus encourage capital to drill the larger areas. It will also provide the individual prospector with an opportunity to earn a grub-stake without having to travel hundreds of miles to do so. I would suggest that this road be completed with all possible dispatch.

There are several small creeks in this section which are well worth prospecting and some larger areas which are sufficiently attractive to warrant examination with a view to dredging. It requires a Keystone drill to prove the ground, and until there is a good road into the country a drill of this type cannot be taken in, except at an almost prohibitive cost. The few light drills

which have been taken in have demonstrated that their usefulness is confined to a very limited amount of scout drilling.

In the Cariboo, Quesnel, and Omineca Mining Divisions there are without doubt many excellent opportunities, other than those mentioned in this report. It will, however, require considerable time and investigation to secure sufficient data to present a comprehensive description of the many points of interest to the mining industry.

Owing to the interest being taken in placer-mining at the present time, it is more than likely that advantage will be taken of the many opportunities in these Mining Divisions which, upon investigation, should offer every prospect of satisfactory remuneration for both the prospector and operator, and will in all probability enable the Cariboo to regain its former place as a large placer-gold producing district.

As an instance of the possibilities, there is a high channel paralleling the Horsefly river on the north which probably has never had a pick in it. There is another channel running from Little Swift river to an outlet on Lightning creek, about 2½ miles below Wingdam, which is cut by numerous creeks and is quite likely to prove the source of the gold, found above the clay, on Peters creek and Lightning creek.

There are miles of old channels in the Cariboo in which no hole has ever been drilled to bed-rock. As a matter of fact, detail knowledge of the Cariboo and Omineca is limited to certain areas.

The excellent report of W. A. Johnston and W. L. Uglow (Memoir 149, Geological Survey of Canada) covers but a very small area in the vicinity of Barkerville. It is, however, a valuable report as it is a key to the placer geology of a much larger area.

As a result of my examinations I have reached the following conclusions:—

(1.) That there are large areas in Cariboo and Omineca which can be worked by dredging and hydraulicking.

(2.) The indications are that there are sufficient values, if properly managed, to pay handsome returns on money invested.

(3.) That every consideration should be given capital, during the next few years, in order that the greatest possible activity will take place, to the end that the industry will be placed on a firm and permanent foundation.

(4.) That the building of roads and trails for mining purposes should be continued and in a systematic way.

(5.) That a good topographical map of the Cariboo district should be made as soon as possible.

CARIBOO MINING DIVISION.

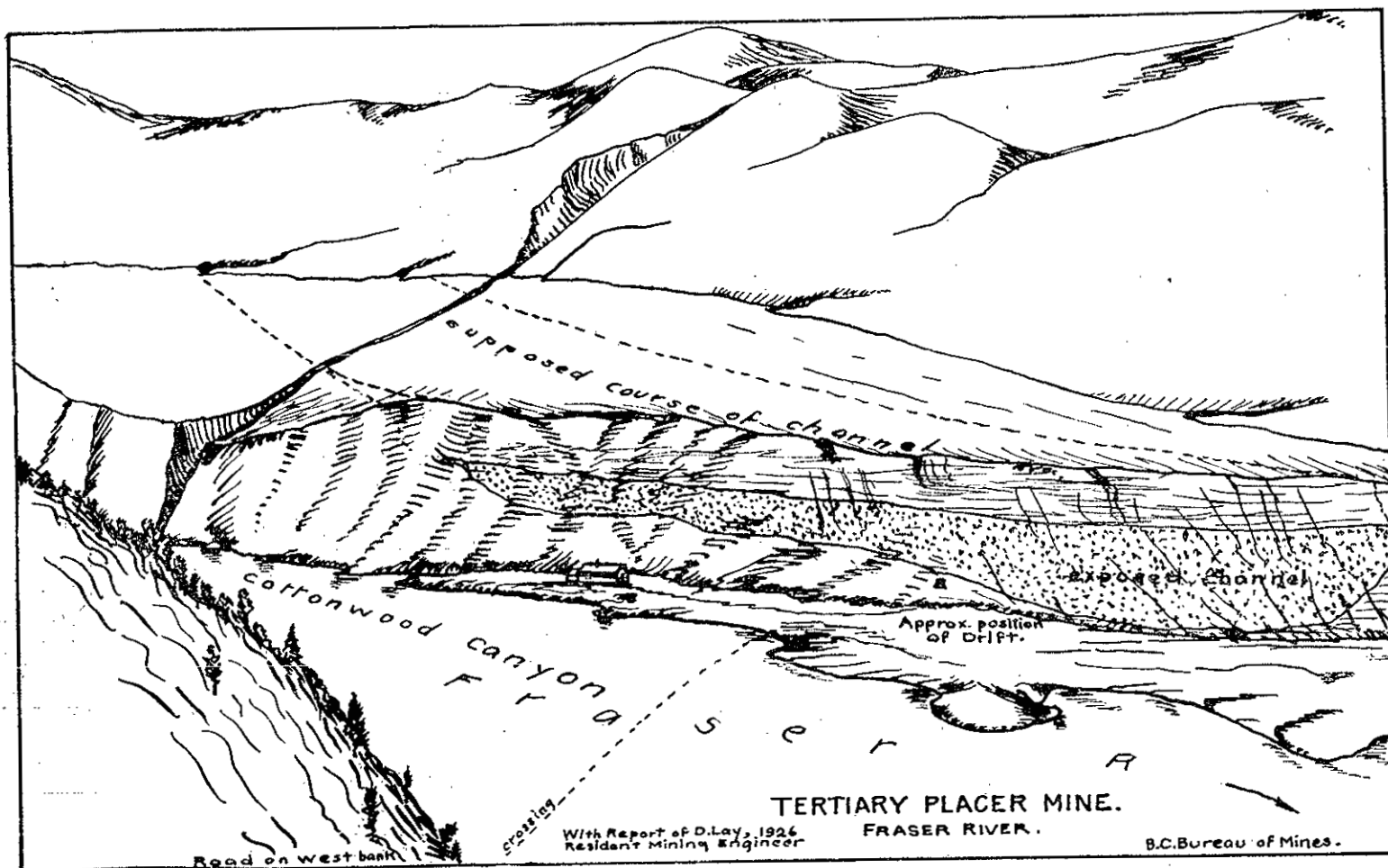
PRINCE GEORGE SECTION.

Hixon Creek.

H. Brisco interested some Victoria people in the spring of 1929 who have examined the property, but I was unable to learn with just what results. For some years E. Hann and J. Strbac have been the principal producers on this creek. During the summer of 1929 they did some ground-slucing and also worked on some quartz-showings on the creek.

Tertiary Channel.

D. D. Fraser and James McHardy have been prospecting the Tertiary channel at Canyon creek, about 38 miles north of the town of Quesnel. The Quesnel-Prince George highway runs through the leases, giving them good transportation. At Cottonwood canyon on the Fraser river, where the channel is between 800 and 900 feet wide, the ground has been worked intermittently for twenty years without any great success. D. D. Fraser claims that due to bed-rock conditions existing at this point the concentration action was poor and that the recovery of gold was only 13 per cent. of the total bed-rock values. They are now attacking the channel 20 miles north of the old workings, where they expect higher values as well as improvement in the bed-rock conditions. If this proves correct as to values and they are able to recover 50 per cent. of the gold they should have a paying proposition. The drilling will give them valuable information which will be of benefit when prospecting other Tertiary channels. They have sunk a shaft to a depth of 85 feet, and from the bottom of the shaft sunk a 5-inch drill-hole to a total depth of 175 feet. They claim to have had rim-rock at that depth and are now making arrangements to drill a section of holes the full width of the channel.



BARKERVILLE SECTION.

Antler Creek.

The only work being carried on at present in this vicinity is on California creek. Pete McLanders has a small hydraulic plant and at present is endeavouring to get up the creek beyond the point where the old-timers drifted. He is recovering some coarse gold on the rim and hopes to get good "pay" when he arrives beyond the old workings.

There is an old channel of the creek which starts somewhere near the lower end of Maloney flat. This parallels the present creek-channel on the west and joins it between the wagon-road and the lower end of the old China Creek hydraulic pit. About three-quarters of a mile below Sawmill flat a section of this channel has slid away, and I believe that this accounts for the very rich ground found at Antler Creek discovery. About $2\frac{1}{2}$ miles of the old channel is still intact, although the lower half-mile may have been eroded by a local glacier. This channel is located in one of the richest sections of the Cariboo and is one of the major possibilities of the whole district. The cost of proving the ground is small, as there is a good wagon-road to Sawmill flat, over which drills could be taken, reaching to a point within half a mile of the upper end of the old channel. There is another road up Wolf creek, over which drills could be taken to within about 500 feet of the lower end.

Sawmill Flat.

This flat offers another possibility in the vicinity. At one time it was the drainage system for Victoria gulch and Nugget gulch, as well as part of the area now drained by upper Antler creek. At present about $1\frac{1}{2}$ miles of this flat drains to Antler creek and the remainder to Swift river. The flat will average about 500 feet in width. There are no big boulders in sight, but there are a few big slide-rocks. This location should be sufficiently attractive, to any one seeking dredging-ground, to drill at least two sections of holes. This will give all preliminary information required regarding values, depth, bed-rock, etc.

Cunningham Creek.

Trehouse Hydraulic Mining Syndicate.—A description of this property is given in the Annual Report for 1928. The roads to the property have been greatly improved during the past year and autos and trucks can proceed right up to the camp. This work was done jointly by the Departments of Mines and Public Works.

This is one of the most promising properties in the Cariboo. The old channel parallels the present channel of Cunningham creek, with both rims well defined. There has not been sufficient prospecting done below the present operations to give any idea as to how far the channel will extend down-stream before it is cut by the present channel of the creek. It is quite possible that it will extend down-stream approximately 2 miles.

There is sufficient water available in Cunningham creek to work this property twenty-four hours a day for three months, and to work twelve hours a day for the remaining three months of the season. The present ditch is so small that during the very hot weather, which causes heavy evaporation, it is impossible to get sufficient water to the penstock to supply a 3-inch nozzle with a 150-foot head.

Eight-mile Lake.

The road from Barkerville to this lake has been so greatly improved during the summer that automobiles and trucks can easily be driven to the lake.

M. McComish and Morris Anderson have been working all summer on the old Eight-mile Lake property, lowering the flume to enable them to get out some of the rich gravels still left in these leases. This property was one of the most spectacular finds in the latter days of the Cariboo. The pay-dirt was found on the top of hard boulder-clay. Due to the lack of sufficient grade and a limited supply of water this became a very expensive operation. When the ground was worked back from the lake, which was used for dumping purposes, the grade of the flume gradually rose above the clay, which made it impossible to secure the values, and consequently the work was discontinued for a time. There is known to be rich pay-dirt under the bank, where the previous operations ended, and it is this ground which the present owners are trying to recover.

Willow River.

This river drains the largest area of rich placer-ground in the Cariboo. Williams creek is the headwaters of the East fork of this river, while Jack of Clubs creek and Slough creek form the West fork. The two forks converge at the north side of Island mountain, about 10 miles north-west of Barkerville. Practically all of the creeks draining into the river have been worked.

The Willow River Mining Company endeavoured to work the river itself just below the junction with Mosquito creek, but with little or no success, due, principally, to the depth and cost of pumping water. It did, however, prove that there were good values on the bottom, as some of the ground went as high as \$7 to the square foot of bed-rock. Apparently the deep ground does not extend any very great distance down-stream, as the river flows over bed-rock 6 miles below the mining company's works. The rim-rock shows at several points above Valley (Big Valley) creek. Between Dragon creek and Valley creek, a distance of about 16 miles, there is some of the most promising ground for dredging operations in the Cariboo.

From where Valley creek empties into the Willow river to a point about 5 miles north, the valley is very wide and is probably an old lake-bottom. From this point for about 45 miles (as the river flows) there are excellent possibilities of finding dredging-ground. In the early days of the Cariboo there was considerable rocking done on the bars of this section.

There is an old channel, the source of which is very problematical, but which crosses Dragon creek about half a mile from the mouth. It runs almost parallel with Willow river, although in a slightly more westerly direction, for some miles, turns easterly, and joins Willow river about 16 miles from Dragon creek. Mr. Ford, of Dragon Creek, believes that this is the old channel of Lost creek, which is very likely correct. The channel is so deeply covered with glacial drift that it is impossible to determine its source.

From knowledge gained at the Dragon Creek exposure and from other evidence, I believe that it crosses Tregillus creek about $4\frac{1}{2}$ miles from its mouth and is quite likely to be the source of the gold found in Rushon and Baldhead creeks, as well as the rich spots found on the right limit of Tregillus creek. From this point to about 10 miles north, where it empties into the Willow river, as a hanging valley, the old channel is well defined. Deadwood creek, which empties into the Willow river about 2 miles north of Tregillus creek, cuts the old channel and was worked from this point to its mouth. Canyon creek, which empties into the Willow river from the same side, about 2 miles farther north, did not cut the channel and carried no values. Archer creek, north of Canyon creek, cut the channel, and from this point to its mouth was worked with success. Willow river, below the mouth of Tregillus creek, was wing-dammed and the ground also worked with success. With this evidence it is natural to conclude that the source of the gold was in the old channel and that there should be values in Willow river. All creeks emptying into Willow river on the east side carried gold. There is a good trail from Beaver Pass House to the mouth of Tregillus creek and from there up Willow river to Sugar creek and down-stream to Big Valley creek. There is a good trail from Ahbau lake to Willow river.

AHBAU LAKE SECTION.

There is a good pack-trail from Cottonwood House on the Quesnel-Barkerville road to the lower end of Ahbau lake. From here a good trail follows the easterly side of the lake for about 4 miles and then running almost due east to Willow river. Another trail follows the westerly side of the lake to Ahbau House, Hay lake, Lodi lake, Willow river, and Stony lake. Lodi lake is the head of the drainage system of the Little Cottonwood river, which flows in a westerly direction to the Fraser river.

Ahbau creek, between Lodi lake and Ahbau lake, has produced considerable gold. The chief producer was a Chinaman, for whom the creek was named. His workings were about half a mile below Alder gulch, which comes in on the west side of the creek. About half a mile up Alder gulch from Ahbau creek there is an old shaft about 80 feet deep. I was unable to secure much information about this work. However, Robert Cresswell (an old-timer known as Mountain Bob, now deceased) was credited with the statement that had the property been rightly managed it would have proven successful. The property was abandoned after a small amount of drifting. This shaft is of interest, inasmuch as all the gravel worked on Ahbau creek was from 4 to 12 feet deep. This Chinaman, Ahbau, had ground about 5 feet deep, to where the rock pitched to the west. His "pay" was close to the right limit, and as the gold was coarser than

that found on any other part of the creek he was very probably working on the east rim of the deep channel found on Alder gulch. This deep channel shows that the old drainage-channel of this area was much deeper than the present one, likely with a reversed gradient north-westerly to Canyon creek. All the creeks, including Alder gulch, draining from the west into Ahbau creek have been worked on the surface and are reported to have paid better than wages.

In looking over this section during the summer I was impressed with its possibilities and consider it one of the best places in the Cariboo for a man to take out a grub-stake. The low cost of transporting supplies, the abundance of rainbow trout in the lakes, and the great number of deer, moose, black and grizzly bear in the vicinity tend to reduce the cost of living to a minimum in this section. This district was practically depopulated during the war and has remained so ever since.

Lower Swift River.

In the year 1922 a group of leases on this river were drilled by the Gold Dredging Syndicate, of Vancouver. M. M. Kerr was the secretary-treasurer of the company as well as manager in charge of field operations. The ground was drilled by G. A. Dunlop and the following results were reported: 5,000,000 cubic yards with an average value of 40 cents a yard. In my opinion, the yardage that would be dredged is much smaller than this and that the values claimed are much too high.

In 1924 this company installed a suction-jet dredge, but for some unknown reason did not operate this dredge until 1926. After about two months' trial they found that it was useless, as are all other contraptions of a similar type. This operation had one very serious aspect, inasmuch as those who were not familiar with the situation were led to believe that as the undertaking was not a success the ground could not be profitably dredged. Careful investigation has established an entirely different view, and with a modern dredge the ground would be found very easy to dig. It is regrettable that in a placer-mining country there is nothing to prevent the formation of companies whose sole effort, apparently, is to dispose of stock in what purports to be a gold-dredging company, when the equipment or methods used are so absolutely useless that its mining efforts are doomed to failure almost before their inception. I believe that at least two of the leases in this group warrant further investigation, to the extent, at any rate, of checking some six or eight of the holes drilled by G. A. Dunlop. The gold in this section is on, or just above, the boulder-clay, and the gravel would average something under 20 feet in depth and should be suitable for a small dredge of modern type. Should the investigation prove the area to have sufficient values to make modern dredging profitable, there would be available a large area under similar conditions, which would probably carry values about the same as these two leases.

On lower Swift river and on Lightning creek, as well as on the flats around Coldspring Ranch and Cottonwood House, there is a layer of gold-bearing gravels at a depth of from 8 to 20 feet on top of the clay. In the early days of the Cariboo, Chinamen worked large areas on the surface. In many instances the gravel was rich, as is proven by the records of the late John Boyd. The drilling on Swift river is the only work in this section which has tested the ground.

QUESNEL MINING DIVISION.

HORSEFLY SECTION.

On October 7th, in company with Douglas Lay, Resident Engineer for the North-eastern District, I visited this section. We examined the ancient channel where it is cut by Moffat creek and found the gravels to be overlain with volcanic rock. We also visited Triplet lake and inspected the work done last winter just east of the lake by J. R. Williams and Mikkelsen Bros. They had made two attempts to reach bed-rock by sinking shafts, but due to the great amount of water encountered were unsuccessful, although they did get below the lake-level. From the surface to the point at which they were compelled to stop they found Miocene gravels, with the exception of one stratum of lignite coal. This work is of value for the reason that it proves that the channel runs towards Star lake. To the south-east of Star lake they claim that the old channel can be traced. Since there appears no good reason for doubting this claim, then somewhere near Star lake the old channel may be found intact, and if so would be the proper place to start drilling.

I believe that the rich gravels found at Wards Horsefly originated from an old channel and that this old channel runs through Beaver valley to the Quesnel river. It then followed the course of the present Quesnel river for some distance and probably flowed west in the vicinity of Dragon mountain into the Fraser river, 7 miles below the town of Quesnel. It is believed this old channel was the source of the gold found at the well-known rich bar on the Fraser river at this point. It is to be hoped that some company will be sufficiently interested to test this channel in the vicinity of Star lake. Should such drilling prove the direction, then it could be followed and, if not too much disturbed with ice, would offer wonderful possibilities. Should the Central B.C. Mines Development, Limited, get to bed-rock at Beaver valley, it will be of very great assistance in helping to prove direction of this old channel.

New Era Mining Co.—About the first of December this company started drilling north of Horsefly, with the expectation of locating the extension of the rich "pay" found at Wards Horsefly hydraulic. It appears that they have succeeded. To date ten holes have been drilled. B. F. Lundy, the manager, reports the average result from drilling is about \$1 a cubic yard. The average depth is 36 feet, which is ideal for dredging. There is an area of about 50 acres at least, or about 3,000,000 cubic yards. The area worked at Wards Horsefly was less than 5 acres, with a reported production of about \$500,000. Mr. Lundy reports that the values are on or above hard blue clay, which acts as a false bed-rock.

The interesting feature of the discovery is that the gold found must have come from a higher level than the bed-rock under the clay. The gravels carrying the gold therefore must have been resorted from a higher level. The ancient channel near the mouth of Moffat creek shows signs of erosion and is quite likely the source of the gold. If this is the case the old channel at Triplet and Star lakes should offer good inducements for drilling.

Moffat Creek.

For further description see Annual Reports for 1927, page 180, and 1928, page 203. At the time of each of my two visits to this section the owners of the leases were away. The only portion of the creek examined was that below the falls. The following information on Moffat creek is from the report of Douglas Lay, Resident Engineer, in the Annual Report for 1928:—

"*Ancient River-channel cut by Moffat Creek.*—In the Annual Report for 1927, page 180, mention is made of the fact that Moffat creek apparently cuts through an ancient river-course. This was further investigated during the year. A short distance below the falls on Moffat creek there is exposed on both banks what appears to be an ancient river-channel. The gravel is residual and is composed almost entirely of well-worn quartz, closely resembling that from the deposit at Star and Triplet lakes, on which are the leases of J. Williams and G. Kuchan, and also that of the old *Miocene* property at Horsefly.

"Where intersected by Moffat creek the direction of this channel is N. 65° W. (mag.). The level of the bed of Moffat creek at this point is 235 feet vertically above Horsefly Post-office. On the left bank of Moffat creek at this point the gravel is overlain by volcanic lava-flow, but it is not certain whether the latter is in place. It is understood that some years ago a Keystone drill-hole was put down in this gravel at a point somewhat down-stream from this exposure, but bed-rock was not reached. This is obviously a point at which drilling should be carried out, because of the hydraulic possibilities which may exist, and which can only be proved by ascertaining the depth of the channel at this point as well as the values. Moffat creek would furnish a good supply of water for hydraulicking if the presence of the other conditions essential to success can be established by Keystone-drilling."

Antoine Creek.

This creek flows out of the eastern end of Beaver valley into the Horsefly river. It has never been properly tested and has been overlooked for years by prospectors. In 1928 R. N. and John Campbell staked ground on the creek and when doing their annual development-work last July found good "pay." R. N. Campbell reports good values in all their pits. In places the gravel went as high as \$3 a cubic yard.

On October 8th, while on the creek, the ground was panned at several different places over about 1½ miles of the creek, and while I did not get values as high as reported by Mr. Campbell, the gravels did show high values over a large area. Although the pits put down by Campbell Bros. were from 6 to 7 feet deep, there is nothing known about the actual depth to bed-rock; consequently it is not possible to make any accurate estimate of yardage. If the ground is 20

feet deep, with the values holding to that depth, it will make a good hydraulic property. Physical conditions are ideal for hydraulicking. There is unlimited room for tailings in Roberts lake (Anderson). There are no big rocks in sight, nor is there likely to be in the ground. The water-supply was not investigated. R. N. Campbell states that they will have sufficient water to supply a No. 6 hydraulic plant for a season of six months. Campbell Bros. were more fortunate than the average prospector with regard to financing. This was quickly arranged with B. F. Lundy, who in consideration of a one-half interest agreed to furnish material and complete certain stipulated work. They have their storage-dam completed and it is their intention to start work on the ditch as soon as the frost is out of the ground. The ditch will be short and, as they have a road to the mouth of the creek over which to transport plant and material, the cost of equipping the property will be small. With any kind of luck they should be piping in July.

Beaver Valley.

R. N. Campbell, of Horsefly, was successful in interesting B. F. Lundy in his leases in the valley, with the result that Mr. Lundy formed the Central B.C. Mines Development, Limited, which started drilling in July. Mr. Lundy reports that the results to date have been very satisfactory, but sufficient drilling has not yet been done to develop any extensive area. The company intends to start drilling again in the early spring.

Black Creek.

Black creek empties into the Horsefly river about 20 miles east of Horsefly Post-office, from which point there is a good motor-road to the mouth of the creek.

The MacKeracher leases were taken over about a year ago by the Rountree Mines, Limited, of Vancouver. About $1\frac{1}{2}$ miles from the mouth of the creek there is a drop of about 200 feet. Above the falls the creek flows through a narrow rock canyon 280 feet long and the leases are located just above this canyon. There is no sign whatever of bed-rock, or rim-rock, for 1,000 feet. The company claims to have good prospects in the gravel in this portion of the creek. Since taking over the property this company has installed a good No. 4 hydraulic plant and built a storage-dam. It has also lowered the rock canyon to a depth of 20 feet at the upper end, putting in a flume on grade, all of which has entailed a considerable expenditure of time and money. In the rock-cuts, or canyon, a 2-compartment flume has been installed, each compartment 3 feet wide.

This work was not completed until near the end of July, at which time the water-supply was nearly exhausted. Sufficient piping was done, however, to show that the rock-cut was not deep enough to get the flume on bed-rock. It is claimed that bed-rock will be reached at from 40 to 50 feet from the mouth of the flume. Should this be correct, the flume should be on the rock within thirty days of the starting of operations in the spring. I have been advised by Mr. Arms, the manager, that the company intends to send three men to put down some pits in order to locate the bed-rock. At the present time there is a limited supply of water, but the company claims that it can secure an unlimited supply at a very small cost. In my opinion there is nothing to justify any further expenditure until more definite information is acquired as to the depth of rock. It is quite likely that the flume will have to be lowered to get bed-rock or find the old outlet to the creek.

QUESNEL SECTION.

Quesnel River.

One of the major possibilities of the Cariboo district is Drummond flat. The mouth of the flat is located 28 miles east of the town of Quesnel on the Quesnel river. A road which starts near the Quesnel River traffic-bridge runs across the ground, but it is not in a very good condition at the present time.

This property was prospected in the early nineties by Thomas Drummond, of Montreal, and would have been worked years ago had there been a sufficient supply of water available to justify the cost of constructing a ditch and flume. Physical conditions for hydraulicking are ideal. The Quesnel river is about 100 feet below the bed-rock in the channel, providing ample room for tailings. A certain amount of drilling is necessary to establish the exact yardage, but there should be about 40,000,000 cubic yards available.

The Quesnel Hydraulic Gold Mining Company discontinued operations on its property at Birrel creek (20-Mile creek) some years ago. This company had a water right on Swift river, but at the present time this water right is open to staking. The company also owns a ditch which carried the water from Swift river to Birrel creek. This ditch will carry 200 second-feet of water and the minimum flow in Swift river is above this amount. I believe that this ditch could be secured from the company at a very reasonable price. This water system could then be utilized to hydraulic the Drummond Flat deposit.

The valley of the Quesnel river is one of the warmest spots in the Cariboo district. The hydraulic season would be approximately nine months in the year, somewhat longer than at Barkerville. The gravels in this channel date back to a very early period, as a proof of which I have a section of a mammoth's tusk and a fragment of a molar tooth which were found in these gravels.

OMINECA MINING DIVISION.

HOUSTON SECTION.

Buck and Bob Creeks.

These two creeks are about 10 miles south of the town of Houston, on the Canadian National Railway. They can be reached by a fairly good auto-road from Houston. The leases are owned by W. A. Johnston, of Prince George.

There are small prospects on the surface and in the canyon just below the property. Some coarse gold has been taken out. The property extends over some 20 miles of creek-bottom and, while there has not been enough development-work done to prove values, it warrants at least three sections of drill-holes. The physical conditions are ideal for dredging.

MANSON SECTION.

The term "Manson section" is used to designate that portion of the Omineca Mining Division which in former years had some importance as a placer camp and which centred about the old town of Manson Creek. In recent years this section has been dormant, but signs of returning activity are apparent.

In Dawson's "Mineral Wealth of British Columbia," published in the Geological Survey of Canada Report for 1888, mention is made of the Omineca placer-field and some information given in regard to the early mining operations.

In 1893 McConnell made a trip up the Finlay and Omineca rivers and examined the Omineca placer-diggings. His report is Part C of Vol. VII. (1894) of the Geological Survey of Canada.

A month's trip was made into this area by Camsell in 1915. His report, entitled "Explorations in the Northern Interior of B.C.," is contained in the 1915 Summary Report of the Geological Survey of Canada.

The main routes of travel are from Hazelton and Fort St. James. The trail from Hazelton goes through the Babine range to the foot of Babine lake; thence to Takla lake, which is crossed by ferry; and thence 65 miles farther, easterly, to Manson Creek.

Another route which is now much used to get into this section is from Vanderhoof, on the Canadian National Railway, to Fort St. James, 40 miles by motor-road; then by boat or canoe to Takla Landing. This water route is via Stuart lake, Tachie river, Trembleur lake, and Middle river to Takla lake. Twenty-ton scows can be taken in this way and it is a feasible route for transporting heavy machinery. From Takla Landing the Hazelton-Manson trail is used to Manson. The construction of a sleigh-road from Takla Landing to Manson would in connection with this water route make a fair transportation system for mining in the Manson section.

The following excerpts are taken from the report of John D. Galloway in the Annual Report for 1924:—

Geologic Features.

The Babine range consists dominantly of considerably metamorphosed volcanic and sedimentary rocks, which are as a rule closely interbedded and intercalated. Wherever the range has been closely examined these rocks are found to be members of the Hazelton formation of Jura-Cretaceous age, and it is believed the whole range is largely made up of rocks of this formation.

Intrusive into these older rocks are small bodies—dykes, sills, and small batholiths—of granitic rocks; basic, lamprophyric, dykes also occur. Igneous intrusions in the range have not been on nearly as large a scale as in the Coast range and its subsidiary mountains, but are more comparable with those of the Bulkley mountains directly to the west.

The geologic conditions are excellent for the occurrence of mineral, and in many parts of the range mineralized areas have been discovered. Descriptions of the character of the Hazelton formation and intrusive granitic rocks as exposed along the Bulkley, Skeena, and tributary valleys can be found in several reports of the Geological Survey of Canada and in previous Annual Reports of the British Columbia Department of Mines.

Between Babine lake and Takla lake the rock formations have not been studied in detail. It is probable that the Hazelton formation continues easterly for some distance. On Takla lake there is a series of sedimentary rocks, consisting of conglomerate, sandstone, shale, and some coal, which has been classified by Camsell as being of Cretaceous age. These rocks are very similar to the Skeena formation, which overlies the Hazelton formation in the Hazelton-Telkwa sections. So far as is known, Hazelton formation rocks are continuous from Babine lake until within a few miles of Takla lake, where the Cretaceous sediments come in. Associated with these sediments are some beds of volcanic rocks.

East of Takla lake the Cretaceous sediments continue for about 5 miles. At this point the schistose series of rocks, which have a widespread distribution in the Manson section, commence. These rocks, which are tentatively classed by Camsell as being of Carboniferous age, consist of a schistose complex, including limestone, argillite, chert, slate, quartzite, and some highly altered volcanic rocks. Intrusive into this series are small bodies of granite. One of these crops out on the trail beyond Silver creek and another a short distance south of Manson Creek.

Quartz veins are of common occurrence in this formation and it is believed that gold from these veins is the source of the placer gold in the different creeks in the area.

Economic Geology.

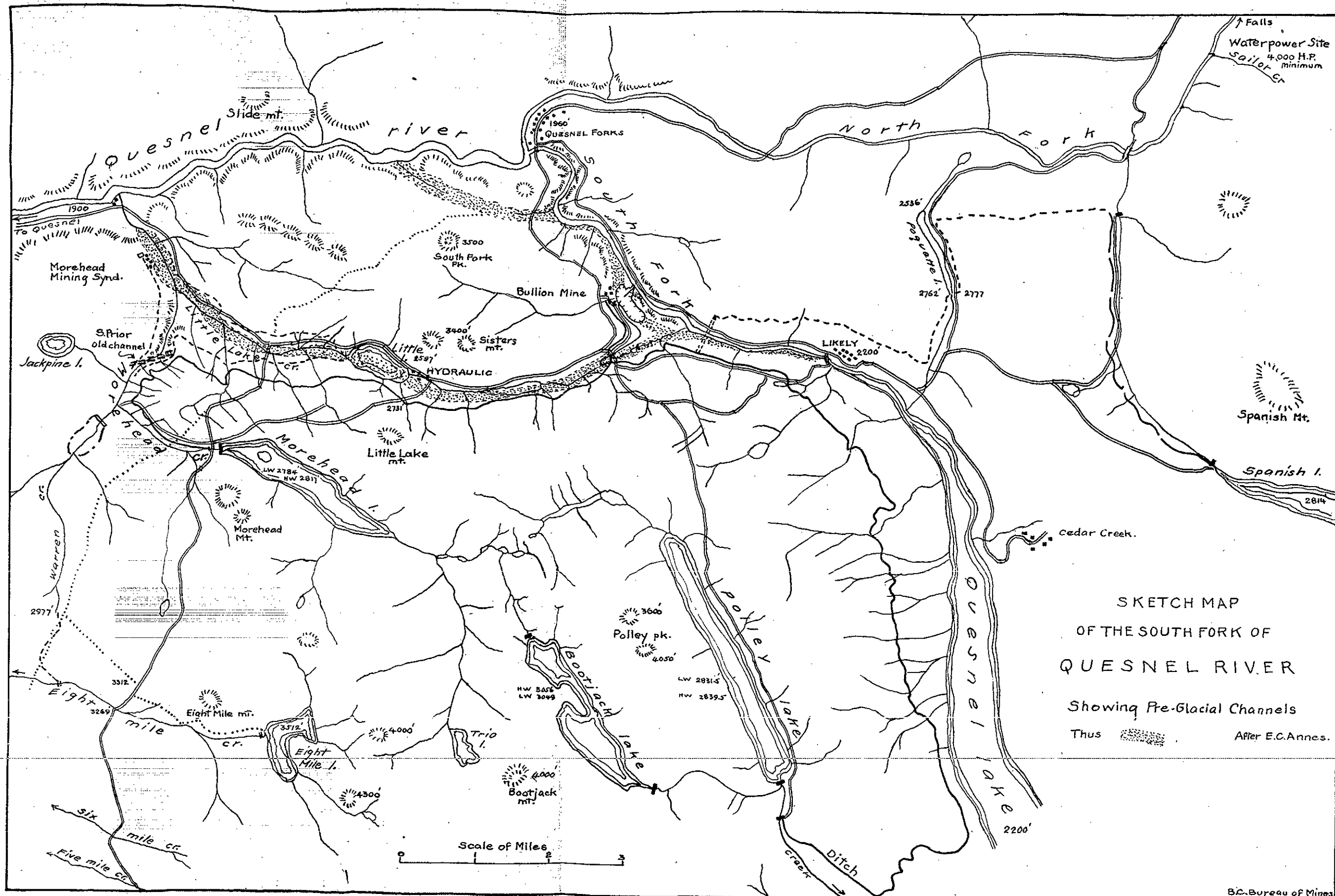
The important mineral-deposits of the Manson section so far known are the gravel-deposits in which placer gold occurs. Prospecting for gold in "The Omineca," as the section was known in the early days, commenced in 1864, but very little production was made until 1869. The area within which the greater part of the mining has taken place is scarcely more than 50 miles in its greatest diameter, and includes the upper portions of the Germansen, Omineca, and Manson rivers and their tributaries.

After a few years of mining the area was practically abandoned owing to the placer discoveries in the Cassiar district. In 1879 the Omineca again attracted attention, but in 1887 was once more nearly abandoned, and since that time has only been worked more or less intermittently for placer.

The following table shows the placer returns for this district from 1874 to 1929:—*

Year.	Amount.	Year.	Amount.
1874.....	\$38,000	1909.....	\$15,000
1875.....	32,040	1910.....	15,000
1876-78.....	*	1911.....	10,000
1879.....	36,000	1912.....	8,000
1880.....	45,800	1913.....	6,000
1881.....	39,300	1914.....	6,000
1882.....	25,330	1915.....	12,000
1883.....	21,000	1916.....	17,000
1884.....	12,000	1917.....	12,000
1885.....	16,500	1918.....	8,000
1886.....	17,600	1919.....	8,000
1887.....	13,000	1920.....	3,000
1888-97.....	*	1921.....	3,000
1898.....	15,000	1922.....	5,000
1899.....	8,600	1923.....	4,000
1900.....	12,527	1924.....	5,000
1901.....	19,100	1925.....	4,560
1902.....	40,000	1926.....	1,000
1903.....	28,000	1927.....	4,012
1904.....	11,600	1928.....	3,995
1905.....	10,000	1929.....	2,040
1906.....	10,000	1930.....	2,499
1907.....	10,000	Total.....	\$542,503
1908.....	20,000		

* No returns.



SKETCH MAP
OF THE SOUTH FORK OF
QUESNEL RIVER

Showing Pre-Glacial Channels

Thus  After E.C. Annes.

The important streams that have been worked for placer are Germansen and Manson rivers, Tom, Vital, Slate, Blackjack, and Lost creeks. Much coarse gold was obtained, but generally the diggings were said to be "spotted" or irregular. Some work was also done on the Nation river and tributaries, and in recent years a few prospectors have been at work there.

In addition to placer gold in the gravels, small quantities of arquerite, a native amalgam of silver, and native copper have been recovered in the sluice-boxes. These minerals occur in greatest abundance in the Vital Creek gravels, but are of scientific interest only, as the total amount is too small to have commercial value. They are, however, valuable indicators of the possibility of lode deposits of these minerals occurring in the district, and as such they should be noted by prospectors. Platinum has been reported as occurring in the black-sand concentrates from the gravels, but this cannot be definitely verified. In any case the platinum content is not of commercial importance.

The placer-gravels of this section do not carry much black sand; in fact, the percentage of black-sand concentrate to the gravel washed is very much lower than in many placer camps. A number of samples of black sand were taken from different creeks and assayed; these were obtained by panning and by taking samples from the discarded black sand from previous sluicing operations. The assays of these samples show that the actual black sand does not contain appreciable gold or platinum values. The black sands from sluicing operations return on assay varying amounts of gold, but careful examination shows that the gold occurs as fine gold associated with black sand. Thorough cleaning of the concentrate by amalgamation will recover practically all this gold content. It is therefore considered that the black-sand content of the placer-gravels of this district is not of much commercial importance.

So far as can now be observed, the placer-gold concentrations occur principally in the present stream-gravels. This concentration is from the reworking by stream-action of glacial gravels, which were slightly auriferous. It is possible that some of the rich ground mined by the old-timers consisted of remnants of Tertiary gravels, but no evidence to support this idea is obtainable.

The beds of the streams have in part been worked, but very little prospecting of benches has been done. There is a noticeable absence of old channels having been worked. In the Cariboo the phenomenally rich concentrations of placer gold that were mined on Williams, Lightning, Keithley, and other creeks were in large part contained in old channels or present stream-beds below a point where an old channel had been robbed by the modern stream. These places represent remnants of Tertiary channels containing Tertiary gravels which were not eroded by glaciation; in most instances, however, glaciation had concealed the Tertiary gravels under a thick mantle of glacial clays and gravels.

It is quite possible that in the Manson section similar remnants of Tertiary channels will be found to exist, and this fact should be kept in mind by prospectors. The discovery of rich ground in the Cedar Creek camp shows that placer gold may be found in what has been considered an unlikely place and at a considerable elevation above the modern stream-valleys.

It is also believed that the Manson section provides good opportunities for gold-dredging. The beds of the streams that have been worked have only been mined at what are relatively rich places and low-grade ground has been left. This ground is too low grade to be worked at a profit by small-scale individual mining, but will make good "pay" for dredging. Besides the stream-beds, the benches in places are believed to carry low values. Streams that were not worked by the old-timers carry more or less values and are worth investigation with a view to outlining dredging areas.

Streams such as Kenny, Silver, Upper Manson, and others have wide flat valleys, with, in places, small lake expansions, which have never been tested for placer gold. In many places there is undoubtedly a very considerable thickness of glacial clays and gravels, which are practically barren of values. But where stream-action has to some extent concentrated these glacial gravels low-grade auriferous gravel has been formed.

The average depth of gravels along the creeks are in many instances not great and well within the dredging limit. The gravels generally do not contain large boulders and the schistose bed-rock is very suitable for dredging. Although at some distance from the railway, good enough transportation could easily be provided for taking in dredging machinery.

Summing up, it may be said that the Manson section presents favourable opportunities for investigating the placer-gravels with a view to proving suitable dredging areas.

COMMENTS ON REPORT OF C. W. MOORE.

BY DOUGLAS LAY, RESIDENT MINING ENGINEER.

(Reprint from Bulletin No. 2, 1930.)

For some considerable time past the view has been expressed in the Annual Reports of the Minister of Mines, in the face of a declining placer-output, that field-study indicates a more hopeful outlook than that which might be inferred by mere scrutiny of statistics concerning the output. Such a view is very considerably strengthened by the investigations carried out by C. W. Moore in 1929, appointed for the purpose. His report is of great importance and should be closely studied by all interested. The purport of these remarks is to summarize the most important features of that report and to direct attention to certain facts which have an important bearing on placer occurrence in this district.

* Outputs from 1925 to 1930, inclusive, added in compiling.

In some cases the report directs attention to specific properties or dredging areas, such, for example, as Drummond flat (hydraulic) and Sawmill flat (possible dredging area), which offer very clear-cut and definite objectives to the initiation of mining enterprise. In other cases the report mentions certain old and possibly gold-bearing channels many miles in length which offer a field for much detailed investigation; such, for example, as the Pre-Glacial Horsefly river and the ancient buried channel parallel to the Willow river, cut by Dragon creek and other creeks north of this.

Among hydraulic possibilities of major importance, C. W. Moore places Drummond flat, and he is also impressed with the Trehouse hydraulic on Cunningham creek. The property of Morehead Mining Syndicate also possesses the earmarks of magnitude if an adequate supply of water can be procured. Hixon creek, in the Fort George section, also merits close study.

As to a promising field for prospecting, C. W. Moore stresses the importance of the region between Willow river and Fraser river, pointed out in the 1928 Annual Report.

It is perhaps germane to remark that, if success is to be met with in prospecting for placer in a glaciated country, knowledge of elementary glacial geology is essential, whether such has been acquired through long practical experience and has become instinctive, or through study.

There is every reason to suppose that the decline of the placer-output is due in large measure to the lack of interest shown in this branch of the mining industry by capital, and it is hoped that the investigation during 1929 by the Department will lead to a revival. Signs of an awakening of interest was manifested in the Horsefly section during the year. This section, with its remarkable potpourri of mineral occurrences, has probably been less studied than other sections of the Cariboo, but gives promise of growing in importance.

The broad basis upon which all placer-gold field-study rests in a glaciated country is that of the location of the Pre-Glacial and gold-bearing drainage systems. From the commercial point of view this is of the utmost importance, and as a preliminary it is desirable to establish the approximate position, at any rate, of any Pre-Glacial master-drainage systems. Pre-Glacial channels may or may not be markedly different from those occupied by the present drainage, and their importance lies not only by reason of their possible gold content in situ, but because, by more modern stream-piracy, they may be the source of gold on more modern creeks which cross their course and which have robbed and reconcentrated a portion of their gold contents. While careful study by the experienced observer may indicate with great exactitude the probable course of a gold-bearing channel, values and yardage are largely unknown quantities, and the final appeal must be to the Keystone drill before heavy expenditure on plant for the recovery of the gold is justified.

As the result of investigation in the Cariboo and Quesnel Mining Divisions to date, the existence of three Pre-Glacial master-drainage systems have been established at one or more points in their respective courses. These are:—

- (1.) The Pre-Glacial Fraser river.
- (2.) The Pre-Glacial South fork of the Quesnel river.
- (3.) The Pre-Glacial Horsefly river.

Of these, the Pre-Glacial South fork of the Quesnel river is of outstanding importance and has originated the important placer deposits exemplified in the *Bullion* mine, the property of Morehead Mining Syndicate, and Drummond flat. The importance of the other two Pre-Glacial rivers has not yet been fully gauged, but they both merit much further investigation.

(1.) Pre-Glacial Fraser river. In Pre-Glacial times it seems likely that there were two Fraser rivers—one flowing north-west in the Rocky Mountain trench, coinciding with the present upper reaches of the Fraser, but continuing north-westwards in the Rocky Mountain trench in the channels now occupied by the Crooked, Pack, and Parsnip rivers, and the other having its source somewhere north of Prince George, and flowing approximately due south, as has been indicated by authorities. It is now apparent that this southerly flowing and gold-bearing Pre-Glacial Fraser river is cut by the present Fraser river in the Cottonwood canyon above Quesnel, where is situated the *Tertiary* mine (refer to 1927 Annual Report). This channel has apparently been traced northwards by D. D. Fraser, who this year has been sinking a shaft and drilling on Canyon creek close to the main highway, at a point about 20 miles north of the *Tertiary* mine. He is endeavouring to trace this channel northwards, in the hope that it may be picked up in the vicinity of the known gold-bearing terrain cut by Hixon and Government creeks.

(2.) Pre-Glacial South fork of the Quesnel river. This offers more apparently obvious commercial possibilities than the other two mentioned. There are several different channels. Whether these were occupied simultaneously or successively by the ancient stream is not clear, nor is this point of any apparent importance. One channel, the shortest, is that of the *Bullion* mine. Another followed the depression now occupied by Long and Little lakes and Morehead creeks. On this is the property of the Morehead Mining Syndicate (see 1927 Annual Report, with map), largely a virgin property possessing an appearance of some size. Still a third phase of this ancient river branched from that just described near the upper reaches of Morehead creek, which cut through it, exposing the property of S. Prior (see 1927 Annual Report) and apparently joining the Quesnel river at Drummond flat, there constituting one of the major hydraulic possibilities. In fact, it is considered by C. W. Moore as being of outstanding importance.

(3.) The Pre-Glacial Horsefly river. Of this there is not a great deal of positive evidence. Its gravels, where exposed at the Miocene mine, Horsefly, and near by at Star and Triplet lakes, and on Moffat creek, indicate a stream of great age and proportions. It affords the only known instance, probably, of a residual gravel (that is, a gravel composed almost wholly of one resistant constituent, in this case quartz) in the Cariboo district, and its course is extremely difficult to follow owing to the fact that it is probably older than the surrounding volcanic rocks and is probably capped by them in places. Its course is largely a matter of conjecture, but evidence indicates that the Pre-Glacial Horsefly river had two branches, one following perhaps more or less the course of the present Horsefly river as far as the settlement of Horsefly, and the other a tributary north of this draining in part the area now drained by Moffat creek. These two streams united at or about Horsefly to flow through the Beaver valley into the Quesnel river at Beaver mouth; from that point it followed more or less the course of the present Quesnel river, then flowed westerly in the vicinity of Dragon lake, and originated the rich bar on the Fraser river about 7 miles below the town of Quesnel.

The tracing of this ancient river in the vicinity of the settlement of Horsefly has quite likely an important bearing on gold distribution in the Horsefly section, and quite possibly the deposits of Ward's Horsefly and Hobson's Horsefly originated from stream-piracy of this ancient river. Keystone-drilling in the vicinity of Star and Triplet lakes and on Moffat creek would doubtless throw much light on this matter. Further information on this subject will be found in the Annual Reports for 1927, 1928, 1902, and 1920.

Other important ancient channels, indicated by C. W. Moore, are:—

- (1.) Upper Antler creek, fully described in the report.
- (2.) An ancient channel west of the Willow river, of considerable length, cut by Dragon creek and various creeks north of this to Archer creek.
- (3.) A channel running from Little Swift river to a point on Lightning creek in the vicinity of the old *Bonanza* mine, on which end are the leases of W. C. Slade.
- (4.) The old channels of Slate creek in the Manson section, Omineca Mining Division.

Among possible dredging areas in the Cariboo and Quesnel Mining Divisions mentioned are:—

- (1.) Sawmill flat.
- (2.) (Big) Valley creek (see also 1926 Annual Report).
- (3.) Willow river, fully described in the report.
- (4.) Lower Swift river and lower Lightning creek.
- (5.) Horsefly river.

To which might be added Milk Ranch Pass meadows, which appear to merit some preliminary investigation in view of proximity to Lightning creek. Further drilling between Shepherd creek and 8-Mile lake also seems justified. There seems a possibility of a gold run between the property of R. D. Rees and 8-Mile lake.

In the Omineca Mining Division the following are mentioned as areas having dredging possibilities:—

- (1.) The Manson section proper (see also Annual Reports for 1924 and 1927).
- (2.) The Nation river and tributary, Philip creek.
- (3.) On Buck river and Bob creek, near Houston.

Placer on Bob creek attracted attention some years ago and during 1929 some promising prospect-pits were sunk at the mouth of Bob creek, but water prevented anything but rim-rock being reached. On Buck river below the mouth of this creek promising values are also said to

have been obtained. The source of the gold on Bob creek appears to be the large "Porphyry Dyke," fully described in the Annual Reports for 1916 and 1928. Some preliminary drilling here seems warranted.

The investigations of C. W. Moore for the Department were primarily directed to new areas and points of particular promise, with the view of securing the development of such. Sight must not, however, be lost of the fact that well-established operations are likely to contribute materially to the future placer-output. In this class may be mentioned the Lowhee Mining Company, Limited, the most important contributor to the placer-output in 1929. The future of Cedar creek is largely an unknown quantity, but the operations of B. Boe in 1929 were gratifying.

Finally, it should be borne in mind that, as in the past so in the future, the sum total of the contributions of the individual small placer-owner operators to the placer-output is likely to be very material. This class consists chiefly of small hydraulics. The owners are men who, for the most part, thoroughly understand their business and bring to bear upon it the experience of many years. Their efforts, individual and collective, are of real assistance to the placer-mining industry and merit appreciative recognition.

APPRAISAL OF THE PLACER RESOURCES, PACIFIC GREAT EASTERN RAILWAY LANDS.

REPORT BY R. W. BROCK.

Note by Provincial Mineralogist.—In 1929 a survey of the natural resources of the Pacific Great Eastern Railway Lands (four blocks) was undertaken jointly by the Government of the Province of British Columbia, the Canadian Pacific Railway Company, and the Canadian National Railway Company. These blocks of land consist of the West Cariboo Block, lying west of the Fraser river in the vicinity of Quesnel; the East Cariboo Block, lying east of the Fraser river, including the Quesnel Lake area; the West Lillooet Block, lying west of the Fraser and south of the Chilcotin river; and the Peace River Block, covering a large area on the upper Peace and Parsnip rivers.

The Commission on Mineral Resources of the Resources Survey consisted of R. W. Brock, M.A., LL.D., F.G.S., F.R.S.C., Chairman; and S. J. Schofield, M.A., B.Sc., Ph.D.; J. M. Turnbull, B.A.Sc.; and M. Y. Williams, B.Sc., Ph.D., all on the staff of the University of British Columbia.

The following report by R. W. Brock consists of his appraisal of the ultimate resources in the unworked and largely untested placer-gravels contained in these blocks of land. Following his appraisal, excerpts from his geological report are given.

APPRAISAL.

GOLD PLACERS.

The old Cariboo was one of the very best placer camps ever discovered. It was the extraordinarily rich creeks of the Barkerville area that made the colony of British Columbia; that excited the imagination of Eastern Canada to visualize a Dominion that would include this Pacific land of gold, and that inspired the confidence necessary to undertake the stupendous task of traversing by a railroad the vast wilderness separating Western from Eastern Canada.

East Cariboo Block.

The East Cariboo Block, at least as far south as the Moffat Creek basin, belongs to this Cariboo placer-field.

The conditions in this northern portion of the block for large accumulations of placer gold are perfect—namely, large areas of mineralized rock and long-continued weathering and erosion to separate and concentrate the gold from vast masses of such rock. The mineralization here seems to be at least as heavy as in the Barkerville area, and the old maturity of the topography, everywhere manifest except in the Cariboo mountains of the extreme north-east, is a witness:

to the great amount of erosion. The bulk of production from the Cariboo to date has been from the creeks within a few miles of Barkerville. But this must not be taken to prove that these creeks contained more gold than all others, but only that their gold was easier to discover and extract. That rich concentrations were not confined to Barkerville was demonstrated in 1921 by finding near the head of Cedar creek, 1 mile from Quesnel lake, what was perhaps the richest little patch of ground so far discovered in the Cariboo. This discovery lies just outside the northern boundary of, but in the same placer area as the East Cariboo Block. The chief reason for the Barkerville production is that conditions there were simpler. In the miner's phraseology, "they were good honest creeks." Further, pay-dirt was not deeply buried and could be reached and handled by crude methods or light machinery. The creeks were worked down-stream until the overburden became too heavy for such methods and work was stopped.

To-day conditions are improved. The railway and good motor-roads have reduced costs and permit heavy modern machinery to be brought in, so that what was impossible to undertake in the old days may to-day be feasible and profitable.

Except in the Cariboo mountains, and here local glaciers have in all probability removed the old gold-bearing Tertiary gravels, natural conditions in the East Cariboo Block are much more complex than in the Barkerville area. The plateau is much lower than in the Barkerville area, the topography is more mature, the valleys broader, and a mantle of glacial drift and outwash gravels has buried the old gravel and often completely hidden the old channels. But the Cordilleran ice-sheet has not removed or greatly disturbed the Tertiary gravels in the Cariboo, but merely buried them under its debris. Local valley glaciers from the Cariboo mountains have, however, run out on to the plateau and these are likely to have had a destructive effect upon any of the old gravels that lay in their path.

A further complication lies in the alterations in the drainage-lines. Some changes were probably effected in Tertiary times, but most were produced as the result of glacial damming, either temporarily by ice itself or by its deposits. This switching of drainage is the most striking physiographic phenomenon of the area. But it means there are a great many old channels to be located. The conditions just outlined are different from those in any other known placer-field; consequently placer experience is not sufficient to enable one to discover and trace many of these old channels. Highly detailed, refined geological study as outlined in the geologic discussion is required.

A few old channels have been revealed by the present trough of the South fork and Quesnel river, and one or two are known inside the block itself, but they may be looked for throughout the area. A shaft on Moffat creek, 10 miles above Mikkelsen's ranch, 108 feet deep, is reported by the owners to have found 7 feet of gravel on bed-rock that averaged \$1 per cubic yard. The bed-rock was dipping so the shaft did not reach the bottom of the channel. What appears to be an old channel carrying values has been located recently on Star and Triplet lakes south-east of Horsefly Post-office. At Star lake this gravel is overlain by basalt. A similar gravel also overlain by basalt is exposed in the canyon of Moffat creek a couple of miles south of Horsefly Post-office. Quite possibly this is a continuation of the Star and Triplet channel.

Ward's Hydraulic at Horsefly from about 5 acres of ground containing Tertiary gravel produced gold to a value estimated from \$500,000 to \$1,000,000.

Horsefly Hydraulic, 6 miles farther down the valley, had similar Tertiary gravel, but unfortunately this gravel was too much consolidated for successful hydraulicking. In a bulletin* just published by the Provincial Mineralogist it is stated that drilling north of Horsefly started last December, in the hope of finding an extension of the rich "pay" found on Ward's, has located ground estimated to contain 3,000,000 cubic yards running about \$1 per yard, at a perfect depth for dredging.

It is highly probable that there are many old channels in the area of low ground surrounding Horsefly. Hypotheses regarding these channels might be advanced, but the numerous possibilities make such speculation valueless. A shaft at Horsefly over 500 feet deep revealed an old deep channel, but work was discontinued before this channel was tested. Beaver valley and Gravel Creek valley (this is the southward continuation of the main Beaver valley) have manifestly been eroded by a large stream that for a considerable time must have carried the drainage from the country to the south and east, and may contain old Tertiary gravels. Beaver valley is at present being drilled, and from a drill-hole gravel very similar to the Star-Triplet Lake gravel was obtained. Prospecting on Antoine creek this summer is said to have revealed good

* Bulletin No. 2, 1930, Placer-mining in B.C., p. 40.

values. (Antoine creek, entering Beaver valley at Robert lake, occupies an old transverse valley, between Beaver and Horsefly valleys.) Tisdall, McKinley, and Crooked creeks, tributary to Horsefly river from the south-east, are in wide old valleys that are likely to contain Tertiary gravels. The best evidence of the possible volume and potential values of the old Tertiary gravels in the block comes from ground just north of the block where considerable prospecting and mining has been done. The rich bars and benches of the South fork of the Quesnel river got their gold from these gravels. The rich ground on the plateau of Cedar creek, already referred to as discovered in 1921, produced from two patches of about 100 feet in diameter over \$500,000. Between December 15th, 1922, and January 16th, 1923, the ground worked averaged \$120 per cubic yard.

The lower mile of Cedar creek itself, from its delta on Quesnel lake up, was worked in the early days and produced about \$100,000. This portion of the creek no doubt got its gold through the present creek robbing the northern continuation of the Plateau pay-streak. Cedar creek demonstrates not only that there are rich gravels yet to be discovered, but that there are shallow easily worked gravels that have escaped the eye of the old-timers, even where there was a clue that might have been followed up.

The *Bullion* mine is in an old channel of the South fork, separated from the present river by a narrow wall of rock. This channel is about 1,000 feet wide at the top and 300 feet wide at the bottom and about 400 feet deep. The present face is about 1,500 feet up-channel from Dancing Bill gulch, where the channel was discovered and the workings begun. Operations on such a scale (15,000,000 cubic yards washed) afford a basis upon which to estimate gold content. J. G. Hobson, under whom most of this work was done, estimated that in this and neighbouring channels his company had 500,000,000 cubic yards of workable gravels containing \$100,000,000 in gold. This estimate would require approximately 10 miles of channel comparable to that already worked, which, considering the length of channels in the ground held, does not appear to be wholly unreasonable. This is over twice as much gold as the Barkerville area has produced. The known or probable channels such as those mentioned above in the East Cariboo Block should contain roughly about six times as much gravel. Computed at half Hobson's tested value the gold content is \$300,000,000. (Minerals of the Platinum group (platinum, palladium, and osmiridium) occur with the gold. Hobson speaks of 1 oz. of these to 100 oz. of gold.) This gold just outside the block has come from it and the gravels in the block itself should normally carry much more gold. These figures, while obviously very rough and not to be considered as engineer's estimates, suggest the general order of magnitude of quantities of gravel and gold content that may be present in the block.

Quantity and gold content, however, are only two of the factors that are necessary for successful operation. Not all the gravel will be available. Depth of covering to be removed, water, lack of dumping-ground, dissemination of values, and other vital factors will rule out much of the ground for at least a long time to come. There are difficulties, too, in the way of discovery. But after due allowance for all this there must be a great deal of ground that could be profitably handled and that might support large enterprises over a long period of time. But to be successful it must be undertaken in a scientific businesslike manner. It first requires intensive geological study followed by geophysical testing to determine the old channels which the Geological Survey of Canada and the B.C. Department of Mines might well undertake. The determination of the distribution of gold in them by drilling and other methods of testing and determination of the quantity and distribution of available water should follow. The precise engineering problems to be solved would in this way be outlined.

Efficient exploration of this kind, on account of its cost, could easily be justified by the expectation of subsequent mining operations on a large scale, and could only be undertaken by an organization that owned or controlled the rights to a sufficiently large area of productive ground and that could handle the water-supply and similar problems on a broad and efficient basis.

The maximum chance of success and the maximum recovery seem to lie in large-scale operations of this kind.

West Cariboo and West Lillooet Blocks.

The Fraser River trench was in existence in Tertiary times and Tertiary gravels are still preserved in it. It was the gold-bearing bars and benches of the Fraser that lured the early miners on to the Cariboo. From 1857 to 1859 it is estimated that \$1,700,000 was obtained from

them. The more attractive Cariboo then took the white miners from the Fraser to the Barker-ville area and since then mining on the Fraser has been desultory. Notwithstanding, the Fraser has been productive. Its gold production must have been of the order of \$4,000,000. Hill's bar alone yielded about \$2,000,000. Metals of the Platinum group occur with the gold.

The bars have been worked by skimming. Water and other difficulties have prevented bed-rock mining where the greatest values are to be expected; for, as Dr. G. M. Dawson pointed out, throughout its long history this river has acted as a great ground-sluice, separating the precious metals from the gold-bearing rock debris that it has been carrying seaward. Bed-rock can be seen at many points, so that it is not likely to be very far below the present river-bed, and it is quite possible that by a careful study of the problem of engineering might devise a successful method of exploiting the bed-rock gravels. The gold possibilities fully warrant such a study.

Throughout the entire length of the river bordering these blocks, bench deposits extend without any great breaks in continuity. The fresh deposits of gold left on the bars after each flood bear witness to a gold content in the bench deposits, for the gold must come from this source. But direct evidence of the value of some of the bench-gravels is furnished by the records of old workings, which show that some of them are rich. A great many of these benches have never been touched and in such a long stretch there must be many areas of rich bench-ground to be located. There are tributary streams with sufficient water and suitable head for large-scale hydraulicking and the river itself will take care of the waste. The conditions, therefore, for hydraulicking warrant careful investigation of the bench-gravels.

In addition to the above the bars are being replenished continually with fine gold. Research-work on the best method of recovering the fine gold might be also of considerable assistance as the amount of fine gold is very large not only on the Fraser, but in other parts of British Columbia, including the Cariboo and Peace.

Old Tertiary Channel of Fraser.—Below Hixon creek the Fraser, which has been flowing south-eastward, suddenly bends south-west (as if in the old channel of the Blackwater) until it meets the latter, when it swings south-east to the Cottonwood, then southward in a wider trough to Quesnel. In Cottonwood canyon near the mouth is an old river-channel with cemented gravels from which \$16,000 has been recovered. Here conditions for mining are not favourable, but northward on a continuation of the channel operations are proceeding with some chance of making a commercial success.

The same channel is believed to have been traced for 10 miles north; similar gravels have been found 20 miles north, and the channel is thought to continue to the neighbourhood of Hixon creek. It is quite probable that this is the old channel of the Fraser before it wandered off into the Blackwater. Old channels of the Fraser might perhaps be found in the trough between the Cottonwood and Quesnel. Outside this section of the block, east of the Fraser river, the prospects of finding payable Tertiary channels in these west blocks are poor. In this respect they differ very materially from the East Cariboo Block.

Some Tertiary streams of these blocks furnished a little gold in the early days, but they are considered to possess little or no present possibilities. There is little alluvium on the Taylor property, Battlement creek, that is estimated to contain \$20,000 in gold.

Fossil Placers.—Closely allied to the placer-gravels are the conglomerates at the base of the Fraser River beds. Where the material of these deposits has been obtained from gold-bearing districts there is a possibility of pay-streaks being found in them. Being consolidated they would have to be worked by lode-mining methods, and so to be of commercial importance would have to run considerably higher than normal placer-ground. But such high-run deposits may occur. So, too, the Cretaceous conglomerates found in gold-bearing districts are worthy of prospecting.

Peace River Block.

For a time during the early days the lower portion of the Parsnip, and the Peace river, were highly remunerative. Bars on the Peace were reported to have yielded \$10 to \$15 a day per man. The gold was fine and uniform throughout. Some platinum occurs with the gold. These bars were worked by skimming the surface. This fine gold has been transported for some distance and is probably derived from glacial material. But some Tertiary gravels occur along these rivers and these may be auriferous and are worth prospecting.

It is generally assumed that only the surface fine gold is present, but this is scarcely likely to be the case. While a little work has been done, attempting to prove sufficient pay-gravel for

dredging, without satisfactory results, it has by no means exhausted the possibilities. The gravels, particularly of the Parsnip, are remarkably free from large boulders and should be exceptionally suitable for dredging should their gold content warrant operations. The gravels are considered worthy of thorough testing.

The tributaries of the Parsnip from the western slope of the Rockies, while not particularly promising, should be prospected.

The Nation river and its tributaries afford some rather promising placer areas. A group of miners are working on the Nation at the mouth of Philip creek, where they have $\frac{1}{2}$ mile on Philip creek and $3\frac{1}{2}$ miles on the Nation. Test-pits about 25 feet deep are down to bed-rock and the values are reported to be about \$1 per cubic yard. The gold is fine at Philip creek, but it is reported to be coarser up the Nation. The ground seems suitable for dredging, but the district is at present inaccessible. Some mining has been done on the tributaries of Philip creek. There has been some shifting of drainage, so old channels floored with Tertiary gravels may be discoverable. Sections of old channels should be looked for at least near present canyons of stream. Since both the Nation river and Philip creek are gold-bearing, any section of an old channel of one of these is worth investigating.

EXCERPTS FROM GEOLOGICAL DISCUSSION.

PHYSICAL FEATURES.

British Columbia is made up of an Eastern Mountain belt that embraces the Rockies and Gold ranges, an Inter Plateau country, and a Western Mountain belt embracing the Coast ranges and the Vancouver (Island) system. The Cariboo placer area lies along the eastern margin of the Interior plateau, flanking the Cariboo mountains, the name given to the westernmost range of the Eastern Mountain belt in this part of the Province. Thus the Cariboo mountains lie to the east of the Barkerville area, cross Quesnel lake about the forks of the North and East arms, and cross the head of Horsefly lake, occupying the north-east corner of the East Cariboo Block.

In the Barkerville area the plateau has an elevation of about 6,600 feet in the east, but slopes westward, so that its elevation is about 5,500 feet. It is well dissected by streams whose valleys quickly descend from their heads to an elevation of a couple of thousand feet below the plateau-level. The summits between the valleys in their upper portions are steep-walled and narrow, but going northward or westward they gradually widen, so that at about the elevation of 4,000 feet they have become wide and drift-filled. Almost all the plateau areas from 4,000 feet down are covered with drift and outwash gravels, sands and silts, except where these have been removed by stream-action.

In the East Cariboo Block the dissection of the plateau is more advanced. There is less of the high plateau flanking the mountains, the valleys soon become wide, great areas are below the 4,000-foot level, with only island ridges or remnants of the higher ground remaining. This can be well seen on the geological map on the sheet where the colour of the till and alluvium bring out the areas of low ground. Areas of the high plateau may be recognized between the North fork of Quesnel river and Quesnel lake, between Horsefly lake and Horsefly river, and in the eastern portions of the area underlain by the resistant Boss Mountain batholith.

GEOLOGY.

The gold-bearing creeks of the Barkerville district lie in or head in the Cariboo schists, most of them in the Bald Mountain plateau, much as the creeks of the Klondike head in the Klondike schists and generally in the Dome. The Cariboo schists are slates, schists, quartzites, and limestones that are traversed by quartz veins. The schists of these two great placer camps have many points of resemblance. The Cariboo schists are certainly pre-Carboniferous in age and may be pre-Cambrian, to which age they are usually assigned.

As the geological map of East Cariboo shows, the Cariboo schists extend into this block underlying the greater part of its north-eastern half of the block. The western boundary of the schists crosses Quesnel lake east of the forks, and Horsefly lake about 4 miles from its head. From here the boundary swings westward, returning eastward, north of Horsefly river, to Crooked river, and then runs southward to within 6 miles of Canim lake. In the block quartz veins are still plentiful in the schists. They have an additional chance of being mineralized through the dykes, sills, and bosses of granitic rocks which intrude them. In the East Cariboo

Block, south-west of the Cariboo schists, are Carboniferous and Triassic rocks and the Porphyrite groups which have been mineralized by the Boss Mountain intrusive, and have no doubt also supplied gold to the placers.

The placers have resulted from long-continued and deep erosion of the old bearing rocks, the streams accumulating and concentrating the gold from a great thickness and area of mineralized rock. Some of the gold may have been released by erosion in Cretaceous times, but most of it was freed and concentrated during Tertiary times. The topography, with its deep valleys, flowing outlines, and dome-shaped ridges, bears evidence to this long-continued erosion. The Cariboo, like the rest of British Columbia, was overridden by the Cordilleran ice-sheet, but here its erosive power was not sufficient to completely clear out the Tertiary gravels or to cut away the unconsolidated Tertiary sediments, and weathered and rotted surface rocks.

Whether this was due to its proximity to the névé of the ice-sheet where erosion is light, or to its being a "dry belt" even in glacial times, so that there was not so much ice to be drained away and evaporation to a large extent took care of this drainage, or whether the ice in the valleys was stagnant and the movement and therefore the erosion was confined to the upper stratum flowing over the ridges, is not clear, but the flat surfaces of the high plateau and the glaciated surface of Boss Mountain plateau suggest the latter explanation.

If the ice-sheet was not an effective agent of erosion, it was of deposition. Boulder-clay was laid down almost everywhere in the blocks, and moraines, drumlins, kames, eskers, kettle-topography, glacial erratics, outwash gravels, sands and silts, over all the lower ground, testify to its former presence.

The glacial debris buried to a considerable depth the Tertiary gravels and boulder-clay in the valleys. In the principal valleys of the Barkerville area this debris has been largely removed at their heads by local valley glaciers, farther down by stream-action which cleaned out the valleys down to the tough boulder-clay. About the 4,000-foot level, where the gradient of the valleys lessens and the valleys widen, stream-erosion became inefficient and the debris still buries the old Tertiary gravels; it is at these points that the mining came to an end.

Following the retreat of the ice-sheet, valley glaciers developed and these were destructive agents. In the Barkerville area they developed at the heads of the creeks and cleaned out the valleys near their heads, widening and deepening them, but they did not develop to a sufficient size to affect the valleys for any great distance down-stream. Consequently the Tertiary gravels that yielded the bulk of the gold of the Barkerville area were preserved.

In the East Cariboo Block much larger valley glaciers developed in the Cariboo mountains, gouged out at least many of the valleys in these mountains, including the North and East arms of Quesnel lake, and ran out through the plateau valleys of Quesnel and Horsefly lakes, and perhaps for some distance beyond these lake-basins.

In the Barkerville area W. A. Johnston noted a lower boulder-clay, then gravel-beds, sometimes auriferous, followed by a second boulder-clay.*

This does not necessarily mean two ice ages with an interglacial period between, as the seeming interglacial gravels may be the gravels from the head of the valley, dug out by the advancing valley glacier and transported and deposited by the stream draining the ice-front; and the upper boulder-clay might be the ground moraine deposited by the valley glacier when it reached this point in its advance, but with its energy so spent that instead of eroding it was depositing material. This would explain the gold in the interglacial gravels, as it would be the gold from the Tertiary gravels removed by the valley glacier near the head of the valley.

Dawson, however, observed a boulder-clay 60 feet thick above 125 feet of stratified sands and gravels resting on a lower boulder-clay 30 feet thick, and below this again, 30 feet of Tertiary gravels to bed-rock in the old South Fork pit on the *Bullion* high-level channel of the South fork of Quesnel. Here the chance of the upper boulder-clay being the ground moraine of a valley glacier is not very great, so that a second advance of the ice-sheet is indicated.†

Since mining in the Cariboo has been mainly in the Barkerville area, the facts regarding the occurrence of the gold brought out by mining there are of value to indicate what may be looked for in East Cariboo.

Mr. Johnston points out that gold placers have been found to occur in five different ways.‡

1. In Tertiary gravels resting on bed-rock in many cases beneath glacial drift (as described above). This has furnished most of the gold so far won in the Barkerville district.

* Memoir 149, G.S.C., p. 41, Gold Deposits of Barkerville, B.C., by W. A. Johnston and W. L. Uglov.

† G.S.C., Vol. VII., p. 24, A.

‡ *Loc. cit.*, pp. 50-52.

2. In interglacial gravels (as described above).
 3. In glacial gravels on bed-rock benches at various heights above the present creeks and in a few places in abandoned or partly abandoned stream-channels high above the present creeks. This seems to be somewhat similar to 2, except that instead of being deposited on boulder-clay the gravels are deposited on the bed-rock wall of the valley.
 4. Occasionally, in irregular masses of gravels included in the glacial drift, as if patches of Tertiary gravels had been moved bodily.
 5. Post-glacial or surface gravels. While these have been mined at many places, they are not extensive and have not, as a rule, been profitable.
- A sixth type might be mentioned similar to type 1, but covered with a thick overburden of glacial drift as in Lowhee creek.

As previously mentioned above, there is not very much of the dissected high plateau country in the East Cariboo Block, and in consequence it lacks the deep clean-cut valleys with the Tertiary valleys still preserved without much overburden, such as have furnished most of the gold so far obtained from the Barkerville district, and the deep clean-cut valleys in the Cariboo mountains of the block, although incised in the gold-bearing Cariboo schists, are likely to have had their old Tertiary gold concentrates removed by the valley glaciers. Thus gold placers of the type called 1 above are scarcely to be expected, but there may be some of the type of Lowhee creek, Tertiary gravels covered by a thick mantle of glacial drift. There are undoubtedly many stream-beds with untouched auriferous Tertiary gravels buried under glacial debris just as in the valleys of the Barkerville district below the 4,000-foot level near the points where mining was discontinued. These old Tertiary placers are not necessarily below the present streams. In the well-marked valleys they must lie within the valley-walls, but in the low plateau there is great uncertainty regarding their position and courses, the more so because there has been notable switching of drainage.

In the East Cariboo Block there are undoubtedly many old channels similar to the old channel of the South fork of the Quesnel river on which the *Bullion* mine is located.

In addition to these Tertiary gravel possibilities, one may expect deposits corresponding to the types 2, 3, and 4 of the Barkerville area—namely, glacial gravels deposited on benches or in stream-beds, in which gold is redeposited that has been derived from Tertiary placers dug up by valley glaciers. Since these valley glaciers in the East Cariboo mountains have been more active than in Barkerville and the valleys that they scoured should have been gold-bearing, the chances for gold in glacial gravels are distinctly promising. Concrete proof of this is afforded by the very rich ground found on Cedar creek in 1921. These glacial gravels are not confined to the valley-floors; they are apt to be found on benches high above as the Cedar Creek occurrence is. For while they may be formed by water discharging from the snout of the glacier and flowing down the bottom of the valley, they may be formed upon the side-walls of an ice-filled valley through the agency of lateral streams from the ice.

NORTH-EASTERN MINERAL SURVEY DISTRICT (No. 2).

PLACER-MINING IN 1931.

REPORT BY DOUGLAS LAY, RESIDENT MINING ENGINEER (HEADQUARTERS, HAZELTON).

Placer-mining in the North-eastern District is experiencing an active year in 1931. The producing hydraulic and other mines are being steadily operated and it is expected that larger outputs of gold will be made from many of them than in 1930. Prospectors have been busy in many parts of the district, but their efforts have been more directed towards small-scale operations to make a grub-stake than in actually prospecting in new areas. Development operations for the testing of placer-ground are being carried out in several places and success is reported by some.

Many promising opportunities for capital in testing and proving large areas of low-grade gravel which could be mined by hydraulic methods and dredging exist throughout the district. More interest is being taken in these and during the next few years it is expected that many investigations will be commenced.

CARIBOO MINING DIVISION.

PRINCE GEORGE SECTION.

A syndicate financed by Robert Garrett, of Baltimore, and under the management of G. F. Dickson has continued the investigation of placer-gravels contained in a number of leases on the Goat river and the Fraser river near the confluence of these streams. This work was started in 1930 and consists of drilling and other test-work. As a result of this drilling it is stated that certain bars on the Fraser have shown satisfactory values. This year a plant is being installed consisting of a caterpillar gas-shovel to dig the gravel and suitable gold-saving equipment. While this construction is being carried out further testing of the leases on the Goat river is also proceeding.

On Hixon, Government, and Terry creeks, prospecting by individuals and testing-work by companies is being carried on in several places.

BARKERVILLE SECTION.

The largest operation in this section is that of the Lowhee Mining Company on Lowhee creek. Steady hydraulicking has been carried on this season and as water conditions have been favourable it is expected that a good return will be obtained.

Trehouse hydraulic on Cunningham creek has had a good year, it being reported that the first clean-up yielded \$1,600. The water-supply on this property is not large, but could be increased. Good-grade ground encountered this year will compensate for the handicap of a small water-supply. During the winter some drilling was done on this property when it was under option to C. W. Moore. Further drilling might indicate a sufficient yardage to warrant equipping the property with a better water system. The owners are J. F. Tregillus and partners, of Barkerville.

Messrs. Houser, McDougall, and associates worked the *Ketch* hydraulic property with satisfactory results, better clean-ups being made than in previous years.

The *Point* hydraulic and other Chinese operations on Slough creek have been worked steadily with about the usual results.

Len Ford and R. McDougall on Dragon creek have a sluice on bed-rock and are now ready to pipe an old channel of Dragon creek, previously drifted by old-timers. They have also shown up interesting possibilities in connection with an old channel thought to be a continuation of the *Point* and other workings, paralleling the Willow river.

C. W. Moore again commenced operations on the New Waverly Hydraulic Mining Company's property which was worked some years ago. A number of holes were put down with a Keystone drill in order to trace up the continuation of different pay-streaks. This drilling is reported to have been satisfactory in showing pay values for hydraulic mining. The old flume and ditch lines are accordingly being rehabilitated and it is hoped that the hydraulic plant will be ready for operation in the fall.

The *Last Chance* property near Stanley has been taken up under option and it is proposed to operate it as a hydraulic.

On Coulter creek, which runs into Slough creek above Dragon creek, Julius Powell is operating his small hydraulic. This is a most interesting small mine, as the plant, equipment, and everything about the place has been entirely "hand-made" by the owner. This includes a miniature electric-lighting plant, automatic equipment to control shutting off and restarting the water-supply, necessary buildings, sawmill, etc. Altogether, much ingenuity has been shown by the owner, who has practically built everything himself.

D. McIntyre and W. E. Thompson have been testing a supposed high channel on Valley mountain, on Downie pass, which has interesting but as yet unproven possibilities. J. Campbell also has a bench lease on the same run in Downie pass and is now sluicing.

E. W. Giddings has continued hydraulic work on the *Hurdy* claim on Williams creek.

The Consolidated Gold Alluvials of B.C., which now controls the Lightning Creek Gold Gravels and Drainage Company's property on Lightning creek, is proceeding with development-work. The No. 2 shaft near Wingdam is being retimbered with a view to reopening it and testing the bed-rock gravels. Further Keystone-drilling is reported to be planned to test other sections of the ground. This resumption of work at this old property is interesting and it is to be hoped that the possibilities of the area will be thoroughly appraised.

drainage systems at the close of the Glacial epoch brought about reconcentration of gold both on false bed-rock and on the true bed-rock of the creeks. Reconcentration on true bed-rock would take place in those cases where the gradients were such that the creeks were enabled to clear themselves to a large extent of glacial debris. In numerous cases, however, in placer areas, a creek, owing to the damming effect of glacial debris, may carve out a new channel for itself. A canyon or rocky channel on a creek in a great number of cases indicates the existence of a pre-Glacial channel segment lying on one side or the other of the canyon, and prospectors should bear this fact in mind. The gold may be recovered from such buried channel segments either by deep-lead mining or by hydraulicking, local conditions usually indicating which method of recovery is preferable. Keystone-drilling is almost invariably a necessary preliminary to determine bed-rock contours and values prior to actual mining.

Possibilities.—Dredging, hydraulic, and deep-lead mining possibilities are all indicated at various points throughout this section, but all such can only be accurately gauged by Keystone-drilling.

The section would seem to contain many old channels, some of which may prove extensive, and in old channel segments. The latter, of which that on Vital creek is an example, also in all probability occur at the following points: On Germansen river at the upper end of the leases held by Germansen Placers, Limited; on Germansen river in the vicinity of Plug Hat mountain on the lease held by W. B. Steele; on Lost creek in the right bank at the head of the canyon where "pay" ended on this creek; on Harrison creek (a creek flowing into Kenny creek between Tom and Humphreys lakes) about 1 mile above the mouth in the right bank in the region of Bodine's old workings. Search would doubtless disclose other such. The old channels of Slate creek, which are the subject of investigation by W. M. Ogilvie on the leases of the Consolidated Mining and Smelting Company of Canada, Limited, will be further described in the body of this report.

What appears to be an old channel of considerable width is seen to cross Lost creek in a direction about S. 60° E. (true) and to be practically continuous with the headwaters of Mosquito creek. It may be a portion of one of the Slate Creek channels, pointed out by W. M. Ogilvie, and the channel which crosses Government creek (which flows into the Manson river from the south about 4 miles below Lost creek) may be possibly the continuation of the same channel. It might be noted that gold was not found on Manson river above the mouth of Kildare gulch, and it is the view of some that gold found on Manson river below this point results from reconcentration from this old channel crossed by the more modern Manson river, which seems quite possible.

The old channel mentioned, likewise old channel segments, would seem to be matters for immediate investigation with a Keystone drill.

Germansen River.

Germansen Placers, Ltd.—This company, of which R. C. McCorkell is manager, owns a number of creek and bench leases, the property extending above and below the old townsite of Nabum, and including "Holloway's bar." A description of ground in the vicinity of the townsite of Nabum and of "Holloway's bar" will be found on page 159 of the 1927 Annual Report. The property includes bench deposits which are amenable to straight hydraulicking, and at the upper end of the ground, just above the "Mother Lode" cabin, the existence of a buried ancient channel is indicated in the left bank of the river.

It is the view of the management that the old-time miners were unable to wing-dam the river in this region and so mine the bed-rock gravels. Accordingly, present plans focus on hydraulicking the bed of the river, starting from a point slightly down-stream from the old townsite of Nabum. The bed-rock grade of the river being under 1 per cent., and sluice-flume grade being from 4 to 5 per cent., the method of straight hydraulicking is inapplicable. It is proposed to elevate the gravels by hydraulic elevator, diverting the entire river above the pit by a flume 16 by 4½ feet and 1,350 feet in length, and draining the pit by a 4- by 6-foot drain constructed of timber which at the start will be 2,200 feet in length and which will follow the workings up-stream. A caterpillar shovel is to be employed for digging the drain.

The water-supply for hydraulicking and elevating gravels is to be obtained from the West fork of Germansen creek, about 2 miles below Germansen lake, about the junction of the South fork, by flume and ditch-line. The latter was almost entirely constructed by early operators

in this region and is of great value to the present company. A certain amount of flume has to be constructed to connect with the ditch-line. The total length of ditch and flume-line is 42,000 feet and the head available at the pit is stated to be 255 feet.

A sawmill of 15 M. feet daily capacity, operated by an undershot water-wheel 8½ feet in diameter, has already been installed on the West fork of Germansen creek at the site of the old sawmill. All lumber required for the various purposes mentioned above will be sawn by this mill. A storage-dam 12 feet in height is also to be constructed at the outlet of Germansen lake.

The scheme is an ambitious one, necessarily so, and its success largely dependent upon very careful investigation of values and depths to bed-rock. The investigation along these lines which has already been carried out comprises sinking of five shafts in 1930 approximately ½ mile apart. The depth to bed-rock is stated to vary from 15 to 40 feet and the values are stated to average \$1 a cubic yard on a conservative basis. Drilling with a light drill employing 4-inch casing in the bed of the river below the proposed pit was in progress at the time of inspection. The river-valley is of considerable width where it is proposed to start operations, and it would have been desirable to have cross-sectioned the river with Keystone-drill holes by way of preliminary to more accurately determine values and depths to bed-rock, but this mode of investigation was not available.

So far as it is possible to form an opinion from superficial study, the property of this company would seem to exhibit distinct promise; the yardage of gravel is large and the water-supply good. It would seem advisable to investigate the old channel possibilities at the upper end of the ground at an early date, as quite conceivably such may have a bearing on the gold occurrence in down-stream portions.

This company is employing a force of upwards of thirty men and it is intended to carry on operations during the winter. The work in hand is being prosecuted with great energy and all necessary plant is said to have been placed on the ground. The progress made to date reflects much credit on the management.

The following supplementary details are kindly supplied by the management:—

Drain.—Timbered and covered drain starting about post (12) at water-level, continued up-stream to pit location at post (1), a distance of 2,200 feet. Drain at pit will be 19 feet deep. Size of drain 4 by 6 feet, lagging round timbers. This drain will remain intact and follow up workings on bed-rock.

Diversion-flume.—All creek-water (not required in ditch-line) will be carried past workings by a lumber flume 16 by 4½ feet, with a drop of 1 per cent. to carry 30,000 miners' inches. Flume will extend below workings to point of sluice-dump and will be covered with timber intact as work progresses. Total length of this flume will be 1,350 feet, which will be extended up-stream yearly as work progresses.

Ditch-line.—Total length 42,000 feet, to carry 1,000 miners' inches, starting just below sawmill location on West Fork canyon, following south bank by flume and ditch with grade of 9 to 12 feet per mile, giving a head of 255 feet opposite pit (adding to this pit depth gives total head 275 feet). Ditch fed by two small creeks at different points to take up possible loss through seepage.

Elevator.—Hydraulic elevator with 8-inch throat and to drive gravel up to 8 inches in diameter from bed-rock to sluices, using 4-inch nozzle on No. 3 giant, requiring 375 miners' inches, maximum lift 35 feet. This allows for a 200-foot sluice with a 6-per-cent. drop. One No. 2 giant will be used in pit to drive gravel to elevator, using 200 miners' inches. Another No. 2 giant will be used to pile tailings with steel tail-race, using 200 miners' inches.

Rock-lift.—A self-dump rock-winch operated by Leffel turbine will be installed at a point 225 feet below penstock, the overflow of which will be repiped to sluices. This unit will require 50 miners' inches when in use. It consists, besides turbine, of a 100-horse-power double-gear winch attached to 1,000 feet of 1¼-inch slack cable, fed through a tightener of six heavy sheaves. The cable spans the pit, and when drawn tight lifts the rock and platform, allowing a slight grade so that carrier runs clear of pit on dump-ground, and dumps unaided.

Sawmill.—A mill capacity of 15 M. feet daily, installed with an 8½-foot undershot water-wheel on West fork above ditch-intake, to cut all lumber. A dam to hold log-supply from lake and creek installed above mill.

Compressor.—An air-compressor with air-drills will be installed ready for use at pit. This only when required to clear any large boulders.

Lighting.—A full electric outfit will be installed in camp and pit, with powerful search-lights to illuminate pit for night shifts.

Telephone.—A telephone-line will follow ditch-line, connecting intake with pit and sawmill with camp.

Storage-dam.—A dam will be constructed at the outlet of Germansen lake, 12 feet high.

Lease of W. B. Steele.—This is situated on the south side of Plug Hat mountain, just below the old townsite of Germansen. Plug Hat mountain appears to consist almost wholly of glacial debris, and on the north side of it Germansen river turns sharply to the east, running through a canyon east of the mountain. There is every indication that a buried ancient channel of the river exists under Plug Hat mountain. On the south side of the mountain, early operators bringing in water by ditch from Plug Hat creek ground-sluciced gravels lying on a high-lying rock bench. The latter may or may not be the bed-rock of the buried channel mentioned. The owner proposes to set up an hydraulic plant at this point, to within a few miles of which the plant has been hauled. Conditions for hydraulicking are good. Although the property has not been systematically tested (such would necessitate Keystone-drilling), nevertheless it exhibits distinct promise.

Ah Lock's Bench Claim.—A description of this will be found in the Annual Report for 1927 on page 159, to which reference is invited. The owner works single-handed and naturally no very rapid progress is possible.

Slate Creek.

Leases of the Consolidated Mining and Smelting Company of Canada, Ltd.—Many rock benches at varying levels above the present bed of the creek render evident that Slate creek has deepened its bed at several periods during its history. A number of these benches occur on both sides of the creek, and overlying gravels were worked by the old-time miners.

Investigation by drilling of certain benches and channels, occurring, with one exception, on the right bank and at higher levels than those worked in the old days, is being carried out by W. M. Ogilvie. He has obtained evidence of the existence of five channels on the right bank and one on the left bank. Of these, two are very clearly defined and seem to be of major importance, their width being from 150 to 200 feet. They lie close to the summit of the ridge between Slate and Manson creeks. Evidence points to the likelihood that one crosses Manson river just above "Discovery bar," and it is W. M. Ogilvie's view that the gold on this bar was due to reconcentration of the gold in this channel effected by the cutting through it of the more modern Manson river. This is quite possible, and support of this view is afforded by the fact, as has been previously pointed out in this report, that there is evidence of a channel crossing Lost creek much in a direction continuous with the headwaters of Mosquito creek, which may be the continuation of the Slate Creek channel mentioned.

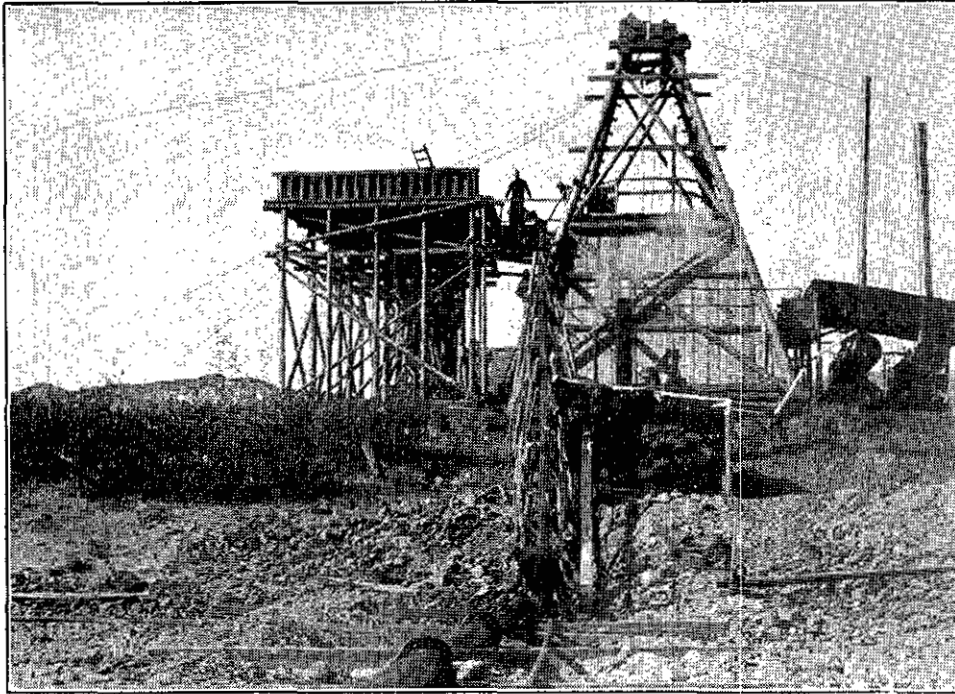
The other clearly defined Slate Creek channel referred to seems to emerge in the Manson River valley about opposite Blackjack gulch, but there does not seem to be definite evidence that it crosses Manson river, although it may of course do so.

This ground is of distinct promise, but its possibilities can only be fully determined by carrying to completion the systematic plan of drilling which W. M. Ogilvie has in hand. The drill employed is a Union Construction Company drill with 5-inch casing. It is operated by an 8-horse-power gasoline-engine.

Manson River.

Operations of J. H. Pomeroy and Associates.—These operators have set up the boom drag-line scraper, originally brought into the country by G. W. Otterson, on the left bank of the river at the mouth of Dry gulch. A certain amount of digging was done during the year, but it was not in operation at the time of the visit of the Resident Engineer, for reasons which are not known. It is understood that several creek leases are held by this ownership. The ground would seem to warrant careful investigation, both as to values and as to depth to bed-rock. There are several feet of surface gravels in this region, which have resulted from early mining operations at higher points of Manson river and tributaries.

Bench Claim of W. Basil.—This ground is situated about half a mile below Dry gulch and is portion of an extensive flat on the left bank of Manson river, which extends to Wolverine lakes. The total height of this bench above the river is about 20 feet. In this bench three pay-streaks are found at successive levels, each resting on some false bed-rock of glacial clay



Peace River—Drag-line Scraper Operations.



Smilkameen River—Steam-shovel on Placer-ground.



Perry Creek—Steam-shovel in Placer-gravels.



Rock Creek—Dam and Boomer for sluicing Gravels.

and silt or cemented gravel. The owner, by putting a wing-dam in the river, obtains a head of water for sluicing and shovels the gravel into the sluice. The mode of occurrence exhibited is a characteristic post-Glacial run. The extensive bench in this region would seem worth further investigation, with a view to determine possibilities for larger-scale operations.

Claim of A. E. Hayward and S. Rosetti.—This is situated on the right bank of Manson river a short distance below Skeleton gulch. The owners have opened up a ground-sluice at a considerable height above the river to test what seems to be a gulch or depression in bed-rock, and were getting a certain amount of gold.

Blackjack Gulch.

Claim of Luke Fowler.—Blackjack gulch is another example of the modern creek running in a canyon-like channel on one side (in this case the north side) of the pre-Glacial channel. It is the latter which engaged the attention of the early miners, and on this claim is an area which apparently escaped the attention of the latter. Nice, coarse, well-worn gold is obtained in crevices in the bed-rock and in a few feet of gravels immediately overlying the latter. The method of recovery is by shovelling into a sluice-flume.

Vital Creek.

Claims of Gow Sing, Lee Tong, and Associates.—On this property there is afforded another instance of a buried pre-Glacial channel, with the modern creek running on one side of it. In this case the old channel is 75 feet or more below the modern channel, which is situated on the right rim of the former. The latter is deeply buried beneath a bank of glacial debris between 250 and 300 feet in height. Formerly an attempt was made to work the old channel by ground-sluicing, a method which proved unsatisfactory for many reasons. Some two or three years ago the Chinese syndicate carrying on operations took into partnership Gow Sing, of Barkerville, an experienced deep-lead miner, who has been in charge of operations since and who commenced to drift the old channel. The total length of the tunnel is now 450 feet. In general the gold is well worn and coarse, nuggets being obtained up to $2\frac{1}{2}$ oz. in weight. It is obtained in cracks and crevices in bed-rock and in the gravels immediately overlying bed-rock. Gravels are poorly sorted glacial gravels with a considerable amount of clay, so much so that they stand up extremely well, and inasmuch as surface waters are almost completely sealed off, mining conditions are ideal. Neither face-boards nor side-lagging are required. The channel has been mined in places to a width of from 40 to 60 feet, but it seems unreasonable to expect that good values can occur over such a width, and more likely that the cream of the values occur over a much narrower width. This tunnel with its ventilating-shaft and hydraulic box ventilator gives evidence of skilled mining.

It is purely problematical just for what distance this gold-run is likely to continue, possibly for a very considerable distance. Some distance up-stream from the portal a small tributary creek flows in from the north, and there may conceivably be two separate channels from this point onward.

This mode of occurrence suggests that the pre-Glacial gravels and their gold burden have been disturbed but not completely eroded by glaciation.

Tom Creek.

Lease of W. McCormick.—The topography very strongly suggests that a buried pre-Glacial channel exists on this property, but its exact course, likewise depth to bed-rock, cannot be accurately determined without Keystone-drilling. The owner has for some years past been endeavouring by tunnelling to reach bed-rock, but so far without success. He is at present engaged in running a tunnel at the upper end of the old channel and hopes by sinking from this tunnel to reach bed-rock. He is an experienced deep-lead miner and has carried out much work on his property, and it is hoped that his efforts will be rewarded by success.

RAINBOW CREEK, NATION RIVER SECTION, OMINECA MINING DIVISION.

REPORT BY JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST.

INTRODUCTION.

In 1929 a discovery of placer gold was made on Rainbow creek by George Snell. In 1930 further prospecting on the creek was carried out by Snell and his partner, Ed. Moore. They considered the showings sufficiently encouraging to warrant taking in during the following winter, with team and sleigh, sufficient supplies to commence mining in 1931. A very rough sleigh-road was slashed out for about 18 miles, connecting with a point on the northerly route from Fort St. James, which permitted sleigh transportation in winter-time and formed an indifferent pack-trail for summer use.

As a result of these activities considerable interest was aroused in the placer possibilities of Rainbow creek during the spring and summer of 1931. It is estimated that during the season nearly 100 men went in to the creek. The whole length of the creek—some 25 miles—was staked as creek leases; bench leases were also staked covering most of the valley-rims and some additional leases were staked on small tributaries and areas supposed to contain old channels of the creek.

In August the writer, accompanied by Douglas Lay, Resident Engineer, went in by pack-train from Fort St. James to the lower end of the creek. Two days were spent in examining the Snell, Moore, and other leases at this end of the creek; Mr. Lay continued on into the Manson Creek section and the writer continued the examination of Rainbow creek, travelling up to the head where the old Robinson (Philip) Creek trail provides a connection back to the route from Fort St. James. A thorough examination of the ground along the creek was made, not entirely because of the possibilities of the creek itself, but also as it was believed that this creek was a good example of several creeks in this district.

SUMMARY AND CONCLUSIONS.

Rainbow creek is a small stream traversing a wide valley in the Nechako plateau. It rises in meadows and flows in a general northerly direction to the Nation river, a distance of approximately 25 miles. The valley is almost flat, the stream meandering greatly, and in many places beaver-dams and meadows are the predominating features.

One and one-half miles from the mouth, the creek goes through a rock canyon, formed by the original course of the stream having been dammed by glacial debris, forcing the creek to cut a new channel through a rim of basaltic rock. In the canyon the stream has a grade of from 2 to 3 per cent. and above the canyon it is much less. It is obvious, therefore, that hydraulicking on the creek is impracticable owing to lack of grade.

Good prospects were obtained near the foot of the canyon by George Snell, and by taking in supplies from Fort St. James last winter actual mining of the ground by hand methods was commenced in 1931. As a result of this effort and the publicity attending some rather high assays in platinum resulting from an extreme concentration of black sand contained in the gravels, a small rush developed in to the creek. At the time of examination about thirty men were at work on the creek and it is estimated that probably 100 went in and out during the season. Practically the whole creek has been staked in creek leases and most of the valley-rims as bench leases.

The gold found on Rainbow creek is flat, well-worn gold, which is not of local origin, but has travelled a long distance from its original source. The largest piece so far found is valued at 75 cents and most of the gold recovered in actual mining in the canyon is relatively fine.

The ground which has been worked at the canyon is shallow ground from 2 to 8 feet deep to bed-rock, occurring either in the bed of the present stream or on benches just a few feet above the creek. It is evident that this occurrence represents a concentration of gold from large quantities of gravel carried down through the canyon due to stream-diversion. From examination of the gravels up-stream from the canyon it is evident that the glacial gravels with which the valley is filled contain small amounts of gold and the reconcentration of these gravels in the canyon formed the placer deposit which attracted attention to the creek.

The ground in the canyon so far mined has not yielded sufficient gold to pay for operating by hand-shovelling methods. The best place so far worked yielded approximately 56 cents a

yard, and while some patches may show still higher results, it is quite apparent that hand operations will not yield better than a grub-stake. The total yardage of pay-gravels in the canyon section of the creek—consisting of the stream-bed and narrow benches, slightly above the creek-bed—is relatively small and is quite insufficient to warrant the equipment required for large-scale mining; hydraulicking in the ordinary way is impracticable owing to lack of grade.

Above the canyon the test-work so far carried out has not reached bed-rock in the valley of the creek, although at intervals up to Money (5-Mile) creek rim-rock has been reached. The general condition disclosed by this work is a top run of gravel from 2 to 10 feet thick overlying glacial clay. These overlying gravels always show colours of gold, which, however, are so fine that the value per yard is quite low. From results of test-work, and panning and rocker tests by the writer, it is evident that these top gravels will average from 2 to 10 cents a yard. In many places the glacial clay has much gravel in it in the shape of small pebbles and sand. Wherever this condition occurs colours of gold and some black sand are found in this clay. In one instance 40 cents a yard was obtained from this material, which may be described as a boulder-clay, with small gravel taking the place of boulders.

Interesting possibilities are indicated from the presence of low values in the top gravels throughout the length of the creek. It is quite possible that, below the clay, gravel will be found resting on bed-rock and this gravel may be comparable in richness with that found in the canyon. In fact, considering that this area was one in which glaciation was relatively inactive in erosion, it is quite possible that parts of the Rainbow Creek valley still contain portions of Tertiary gravels intact. The inference is that Rainbow creek from the canyon up-stream well warrants drilling to determine bed-rock values. Disregarding the possibility of original Tertiary concentrations, it is apparent that values may be found in the lower gravels of Rainbow creek above the canyon at least equal to those found in the reconcentration in the canyon.

From the nature of the creek with its flat gradient and relatively small water-supply, the large-scale working of placer-gravels would necessitate either dredging or some method using a power-shovel. In considering dredging, factors to be taken into account are the percentage and size of the boulders, the thickness and texture of the clay encountered, and particularly the nature of the bed-rock. The available evidence would indicate that the bed-rock may consist almost entirely of basalt, andesite, and possibly granitic rocks at the upper end. Information as to the physical conditions would be obtained by drilling as well as the values.

At the time of examination the creek was carrying about 3,000 miners' inches of water and in the spring is said to be considerably larger. Boulders are numerous throughout the gravels, but, except for a few glacial erratics of considerable size, are as a rule relatively small and would present no particular difficulties for large-scale operations.

From the results of assaying about forty samples of black-sand concentrates, obtained by panning, rocking, and from sluicing operations, it has been determined that the platinum content in the gravels is not of major importance. As was expected, black sand in the top gravels and clays carries practically no platinum. This is true when as large a percentage of black sand occurs in these top gravels as in any place in the bed-rock gravels.

Sluice concentrates from the Snell pit (first operation) had been so thoroughly cleaned of gold as to yield only a trace on assay. Calculating the assay results on a sample of these concentrates on a per pound basis gave 4.51 cents in platinum and 0.17 cent in irridium, a total of 4.8 cents a pound value, or \$96 a ton.

Several samples were taken of concentrates from the Moore sluicing. These had not been thoroughly cleaned of the gold content. The average of the assays of samples calculated to the basis of value per pound of concentrates was: Gold, 5.84 cents; platinum, 2.3 cents—a total of 8.14 cents, or \$162.80 a ton. These concentrates could be almost entirely cleaned of gold by amalgamating, which would leave them only worth \$46 a ton for the platinum content. Only traces of irridium were found in these concentrates.

By careful panning down, the sluice concentrates could be brought up to a grade of several hundred dollars a ton or higher in platinum, but the total value obtainable in this way would not be of great importance. From the results of panning on the Snell and Moore leases and assaying of the concentrates, the ratio of platinum to gold averages 1 to 12, or, assuming the ground worked to have averaged 50 cents a yard in gold, there is an additional 4.2 cents a yard contained in the platinum content. These figures are averages and admittedly approximations, but they give an idea of the relative quantity of platinum to gold present in these gravels.

Above the canyon a platinum return was obtained in only one place—1.5 cents a cubic yard. Platinum may be found, however, with the black sands of the bed-rock gravels above the canyon. The platinum occurs as minute flat grains accompanying the black sand. No irridium was detected and it is probably alloyed with the platinum.

It is believed by the writer that Rainbow creek presents an opportunity for the consolidation of the leases along the creek and testing of the gravels by Keystone-drilling.

An old channel of Rainbow creek is definitely discernible to the west of the canyon. This warrants testing either by pits or drilling. Panning of top gravels at the northern end of this channel near where the present creek rejoins it yielded 14 cents a cubic yard. Many other old courses and channels of the creek probably occur along the length of Rainbow Creek valley. A campaign of drilling along the valley would probably indicate some of these old channels. Disregarding, however, the possibility of old channels containing Tertiary gravels, the evidence of miles of top gravels containing low values—say, 2 to 10 cents a yard—warrants the drilling of these gravels with the expectation of finding pay-ground in sufficient quantity for dredging.

LOCATION AND TRANSPORTATION.

Rainbow creek is a small stream rising in broken plateau area and flowing northerly to join the Nation river. The map accompanying this report shows the creek and its position relative to Fort St. James and the Nation river. Fort St. James is connected by a good motor-road with Vanderhoof, a station on the Canadian National Railway, 70 miles west of Prince George.

From Fort St. James a motor-road was commenced in 1929 to go northerly to the Nation river and eventually through to Finlay Forks. This road has been completed for 27 miles and is a well-laid-out, graded, and ditched motor-road. It will, however, require gravelling in places to be serviceable under wet-weather conditions.

From this point a rough sleigh-road, known as the Ogilvie route, continues on to the Nation river and on in to the Manson Creek section. This route follows to some extent the old pack-trail from Fort St. James to Manson Creek. Four miles south of Gidegingle lake the Otterson sleigh-road diverges from the Ogilvie route and continues to the Nation river and on in to Manson creek. Both of these routes lie to the west of Rainbow creek. From Gidegingle lake, a point on the Otterson route, a rough sleigh-road was cut out by George Snell last winter, to his camp on Rainbow creek, 1½ miles above the mouth. This road is about 18 miles in length and goes through a low divide south of Milligan peak and gradually descends into the Rainbow Creek valley.

Work is now proceeding to complete the road from Fort St. James to the Nation river as a sleigh-road. This will not follow the Ogilvie route, but will go nearly due north to a place on the Nation river where a suitable bridge crossing has been found. From the north side of the Nation it will be comparatively easy to connect with the sleigh-roads in the Manson Creek section.

From the Snell camp a rough trail extends up Rainbow creek to near the head where the old Robinson (Philip) Creek trail is encountered. This trail goes up Rainbow creek to its head and across broken plateau country to a point near Sheshenadji lake, where it connects with the Ogilvie sleigh-road from Fort St. James.

These various roads and trails are shown on the map accompanying this report.

PHYSIOGRAPHIC FEATURES.

The area in which Rainbow creek lies is a part of the Nechako plateau. This is a continuation northerly of the Interior plateau of British Columbia. This area, however, has a much lower relief than the typical Interior plateau to the south. It is characterized by an undulating surface which represents an area of nearly mature peneplanation, only broken by isolated hills, mountains, and small ranges rising from 1,000 to 3,000 feet above the general level. The Nechako plateau has an average elevation of about 3,000 feet and the principal river and creek valleys are not deeply incised into the plateau.

The plateau area is covered almost entirely with glacial debris. It is probable that the continental ice-sheet when covering this area was extremely slow-moving or practically stagnant, so that glaciation was not an active erosion factor. Glaciation, however, completed the area with vast quantities of glacial gravels and clays. Morainal deposits, eskars, pot-and-kettle structure, and small morainal lakes and ponds are the most striking feature of the topography. The Nechako plateau as a whole is the greatest lake region in British Columbia, a feature due

to the lack of relief and the damming action of glacial debris. The Rainbow Creek section has numerous lakes and innumerable ponds.

Rainbow creek rises in a long meadow and flows northerly as a meandering stream in a wide valley, having a total length of approximately 25 miles. It is apparent that the wide valley was caused by the meandering of the stream and it seems likely that this valley was substantially the same in Tertiary times.

The valley proper is from one-quarter to three-quarters of a mile wide, but in places it is apparently much narrower, due to almost complete choking with glacial material, through which a recent narrow valley has been carved by the present stream. The valley-rims are featured by gravel terraces, which run for long distances almost horizontal.

To the west Rainbow creek is bounded by the low range of hills of which Milligan peak is the most conspicuous mountain. To the east is plateau country with another low range of hills at some distance, lying between Rainbow and Philip creeks.

Rainbow creek is fair-sized, carrying approximately 3,000 miners' inches of water at the time of examination in August. Reliable information indicated that the stream does not get much smaller at any time and carries much larger volume of water in the spring and early summer.

Boulders are fairly plentiful in the workings in the canyon and a few large glacial erratics occur throughout the length of the creek. Generally speaking, throughout the creek the boulders are not large enough to impose any serious handicap in working the gravels on a large scale.

GEOLOGICAL FEATURES.

Owing to the covering of glacial drift that mantles this part of the Nechako plateau, rock-outcrops are so infrequent that only a very rough idea of the general geology is obtainable. Bed-rock is exposed in Rainbow creek at the canyon, 1½ miles above the mouth, and rim-rock in places up to Money creek. Farther up-stream no rock-outcrops occur and traverses back from the stream as a rule show nothing but gravel-covered benches and hills.

Three major rock formations were recognized at different points on the route traversed going in to and coming out from Rainbow creek. The oldest is a volcanic series, predominantly andesitic, but showing the usual variations. Throughout the central part of British Columbia the Hazelton formation (Dawson's Porphyrite group) has a wide distribution and these older volcanic rocks probably belong to this series. In other parts this Hazelton group has been assigned to the Jura-Cretaceous age.

On the lower easterly slopes of Milligan peak, granitic rock outcrops and apparently a considerable area of this rock stretches to the north-west. This granite is a fresh-looking rock containing quartz, hornblende, and a slightly pinkish feldspar. Although no contacts were seen, it is probably younger than the andesitic volcanic series.

Basalt forms the canyon of Rainbow creek and is exposed on the rims at intervals for about 5 miles up from the mouth of the creek. This is a recent volcanic rock, in places vesicular, and lying in a nearly horizontal attitude. It is undoubtedly similar to the Tertiary volcanics which have a widespread distribution throughout Central British Columbia.

Just below the canyon an interesting occurrence of consolidated sands and gravels can be seen. In one section in a high cut-bank just below the Snell workings, on the east side of the creek, a complete progression from unconsolidated gravels through cemented gravel to consolidated sandstone and conglomerate can be seen. In the bed of the creek in the Snell workings a similar formation consisting of a light-coloured consolidated silt (shale) occurs. This is locally called volcanic ash. No contact between this silt and the basalt bed-rock was exposed, but it is undoubtedly underlain by the basalt. The age of this formation is not clear. The lower portion is a definite rock formation consisting of shale sandstone and conglomerate, but the upper part passes into unconsolidated clays and gravels. The lower portion may represent an interglacial formation, although possibly of Tertiary age, and capped by partially cemented and loose gravels originating from the reworking by recent stream-action of glacial material.

Near the head of the creek diorite occurs on the valley-rim, which may be a phase of the granitic intrusive noted on the lower slope of Milligan peak.

No evidence of mineralization was seen in the rock-outcrops observed and the information obtained from prospectors was that quartz veins and mineralized outcrops were unknown in the area. The gravel in the creek carries but little quartz; in fact, it would be difficult to find another creek in British Columbia with less quartz pebbles in the gravel.

At the lower end of the creek basalt boulders and pebbles are plentiful in the creek-gravels. Farther up-stream volcanic rocks of all kinds, greenstone, granite, and diorite were noted in the gravels, but schists and sedimentary rocks are not plentiful.

From geological evidence it is highly improbable that the gold or platinum found in these gravels is of local origin.

OCCURRENCE OF GOLD AND PLATINUM.

The upper gravels almost everywhere on Rainbow creek show fine colours of gold and varying amounts of black sand. Although up to fifty fine colours of gold may be seen to a pan, the actual value to the cubic yard is not commercial. The original discovery of somewhat coarser gold was made by George Snell in the vicinity of the canyon. This coarser gold was found on bed-rock, but this also is flat, well-worn gold, the largest piece so far recovered being valued at about 75 cents.

The gold along the creek does not have a local origin, but has undoubtedly been transported long distances. The gold in the canyon represents, at least in large part, a reconcentration of small amounts of gold in glacial gravels.

The canyon is a good example of reconcentration of gold-bearing gravels. The stream at one time flowed to the west of its present course. Damming by glacial gravels diverted the stream and forced it to cut a canyon through the basaltic rock. Through the canyon different levels of the creek can be seen where it successively cut down lower, leaving stranded benches. The original Snell pit worked this summer was one of these benches. It is about 10 to 15 feet above the present stream-bed and is flat near the lower end of the canyon. From 2 to 4 feet of top gravels were first removed by team and scraper and the remaining gravel to bed-rock was scraped and shovelled into the sluice. From 2 to 4 feet of gravel on bed-rock was mined in this way. The total material including top gravel moved was approximately 1,000 cubic yards, from which 32 oz. of gold was recovered. The gold is worth approximately \$17.50 an ounce, so that the ground averaged 56 cents a cubic yard. It is apparent that this grade of ground will not pay for hand-shovelling methods, but if occurring in quantity and handled on a large scale would be very profitable ground.

A full discussion of the platinum content of the gravels is given in the "Summary and Conclusions" and will not be repeated here.

As with the gold, the platinum content is not of local origin. Some small specks of platinum were noted in pans taken from bed-rock gravels in the canyon. These are flat and well worn and from their appearance may have travelled long distances. No rocks were noted in the area that would likely be the source of the platinum, but in the older volcanic series such may occur.

The placer-ground that has been worked in the lower part of the stream—the canyon—is shallow ground, from 2 to 10 feet of gravel lying on basalt bed-rock. Up-stream from the canyon, bed-rock has not been reached anywhere in the valley proper, although rim-rock of basalt is exposed on bench leases in the vicinity of Money creek, which is a tributary of Rainbow creek, 5 miles up from the mouth.

While it is difficult to get evidence on which to base an estimate, it is thought by the writer that the depth of bed-rock throughout the length of Rainbow creek is not likely to exceed from 20 to 50 feet. Deep Tertiary rock channels may occur along the valley that are quite deep, but no definite evidence is available.

DESCRIPTION OF WORKINGS.

Snell Lease.—The Snell lease covers the lower portion of the canyon and down-stream for a short distance. The first operation was the mining of a piece of ground nearly at the foot of the canyon. Approximately 1,000 cubic yards was mined, of which about one-half was removed by team and scraper and the remainder washed in sluice-boxes. The recovery was 32 oz. of gold.

Operations were then commenced in the creek just below the canyon. At this point the creek-valley is about 500 feet wide and the work was really a prospecting operation to determine a pay-streak if one existed. By damming the creek and ditching it was diverted as required and water obtained for sluicing. Owing to lack of grade the boxes had to be elevated, the bed-rock gravels shovelled up, and the scraper used to clear the tailings-dump at the end of the boxes.

Up to the time of examination no ground had been worked at this point that was nearly as good as the original Snell pit. The basaltic bed-rock of the canyon had not been found at this point, but a fine-grained, consolidated but soft rock formed the bed-rock. This is locally called volcanic ash, but it is probably a consolidated silt containing some material representing the erosion of volcanic-ash rocks and other products of vulcanism. The evidence does not indicate the age of this material and it is an open question as to whether it rests directly on the underlying basalt or is underlain by gravel. It would be worth while prospecting down through this material to the basalt formation. If this silt-rock is an interglacial formation it may be underlain by Tertiary gravels, which quite probably would be auriferous. If, however, the silt-rock is of Tertiary age it is unlikely that it would be underlain by gravel.

It was the intention of Mr. Snell to prospect right across the creek at this point and during the winter to sink pits to the basalt bed-rock.

Moore Lease.—This lease adjoins up-stream the Snell lease. It is being worked by Ed. Moore, G. Sharpe, and Norman Cull. By damming, the creek was diverted so as to permit shovelling into elevated sluice-boxes the stream-bed. At this point the depth of gravel on bed-rock is only from 2 to 6 feet. Returns from working a small bench just above the creek were fairly satisfactory, but very little gold was obtained from the creek-levels.

After testing several pieces of ground in this vicinity it was decided to move operations to a point near the head of the canyon. Here the creek makes two right-angle turns and at each turn there is a small flat bench which testing had indicated to carry good "pay" on bed-rock. Sluice-boxes were being rigged up at this point and it was intended to carry them up-stream, working out these two pieces of ground. From panning results fair returns should be obtained.

The Moore lease extends to the upper end of the canyon. From this point no important work has been done until Money creek is reached. The ground is all staked, and a few test-pits have been sunk on the Dickinson, Affie, McMullin, Rae, and other leases. Bed-rock was not reached at any point, but fine colours are found in the top gravels.

Engelland Lease.—This is a bench lease lying between Money creek and Rainbow creek. Basalt bed-rock outcrops on the bench and pits put down show from 2 to 6 feet of gravel and sand overlying the bed-rock. Farther back on the bench a shaft shows 5 feet of gravel and then gravel-filled clay for 10 feet down to the bottom of the shaft. This clay, on panning, yielded 40 cents to the cubic yard. The gravel lying on rim-rock yielded 10 cents a yard and the fine sand no values.

Rosen Lease.—This lease extends half a mile up Money creek from the mouth. Open-cuts, pits, and small-scale sluicing operations for testing have been carried on. From 2 to 6 feet of interbanded gravels and clays occur lying on bed-rock. Only fine colours of gold occur, without any particular concentration of gold on bed-rock.

Money Leases.—Over twenty leases have been staked in this area by A. K. Money. These consist of creek leases on Money creek, bench leases on Rainbow creek, and a number of leases covering a portion of a supposed old channel of Rainbow creek. A tent camp had been established and two men were at work. Ground-sluicing in the bench near Rainbow creek had failed to find bed-rock. In one pit back on the bench basalt bed-rock was found with about 3 feet of gravel on it. Other work consisted of various shallow pits for testing. Panning indicated fine gold but no pay-gravels.

At this point Rainbow Creek valley is broken up to some extent. Small rock canyons in places and masses of glacial debris indicate that the stream has followed various courses in post-Glacial time.

Above Money camp desultory testing has been done along Rainbow creek up to the Smith record claim. Here a pit was sunk about 10 feet in the valley-bottom, but bed-rock was not reached.

Erickson Lease.—This lease, owned by Gus Erickson, adjoins the Smith record claim up-stream. A commendable effort is being made here by Erickson and English to test the ground. After preliminary testing it was decided to sluice into the creek-bank, angling into the bench in order to reach bed-rock if possible. At the time of examination sluice-boxes of sturdy construction made of whip-sawed lumber were being set up. A beaver-dam was raised in order to supply a sluice-head of water and sluicing and shovelling-in was about ready to commence. Fair prospects in fine gold had been obtained and the testing of the bed-rock gravels seemed justified.

Watson Lease.—This lease adjoins the Erickson lease up-stream. Watson and Erickson joined forces in whip-sawing lumber some 2 miles up-stream and floating it down to their respective operations; their placer-workings are, however, quite separate.

After preliminary testing Watson put in a dam and started a sluicing operation, going back from the creek into the bench. When inspected he was installing his boxes and expected to be able to carry a sluice back into the bench for some distance and get bed-rock.

The pits sunk on this property to a depth of about 6 feet show gravel containing fine colours of gold but no clay, and nowhere has bed-rock been reached. Boulders are not large and are not as plentiful as lower down the creek. Comparatively little black sand is found in the gravels, but the amount of fine colours in the top gravels warrants the effort to test the bed-rock gravels.

Seyfarth Lease.—Above the Watson lease there are three or four leases on which little or no testing has been done, and then the Seyfarth ground, on which the owner has done considerable prospecting. As in other places, the operation here has been to start at the creek-level and carry a cut back into the bench with the hope of reaching bed-rock, or rim-rock. At the face this cut is 9 feet deep. The section shows 4 to 5 feet of sandy silt underlain by good-looking stream-gravels, with no sign of bed-rock at the bottom. The sandy silt carries practically no values, but 30 cents a yard was obtained from the gravel below from a panning test.

Winram Camp.—The next important testing-work up-stream has been carried out by Winram, Chambers, and Allen, who have a block of four creek leases adjoining two record claims just above the Seyfarth ground. Bench leases have also been staked by this partnership.

The operations on this ground have consisted of testing bench and creek gravels, but so far bed-rock has not been reached. In one place where an old channel of the creek apparently joins up with the present stream a shaft has been sunk 14 feet in depth. This shows 7½ feet of gravel, then 2½ feet of brown clay, and 4 feet of blue clay containing some gravel. This shaft was sunk with the aid of a hand-pump and it is intended to continue deeper to bed-rock.

A test by panning of the average gravel from a pit 7 feet deep returned 6.7 cents a yard in gold and no platinum content.

Smedley Lease.—This is a bench lease lying down-stream from the Winram ground. A sluice-ditch has been started from the creek, going westerly into a flat bench and up to a small tributary stream. A small head of water was obtained for sluicing from springs in the side-hill and boxes were being installed to test the ground at this point. Only a few fine colours are found in panning the top gravels.

Clark Lease.—This lease is about 2½ miles above Smedley's camp by trail and about 5 miles following around the large bend the creek makes. A sluice-ditch has been run back from the creek-level into the flat bench for a distance of 100 feet. The face shows a depth of 8½ feet of gravel. Fine colours are obtained in these top gravels, but not much black sand.

Montgomery Lease.—About 2 miles above the Clark lease are the Montgomery and Bruggy camps. Creek leases are held here by Debrisay, Montgomery, McKenzie, Bruggy, and Macfarlane and Lee. Messrs. Montgomery and Bruggy were on the ground carrying out testing-work. Numerous test-pits have been sunk to a depth of 6 to 8 feet, but nowhere has bed-rock been reached. In a rocker test on the Bruggy lease 13 cents a yard was obtained from the top gravels.

Above Montgomery's camp about 3½ hours' travel is Lewers's camp, the last on the creek. A number of leases are held here by Lewers and partners. Testing has been done in many places, but so far as could be learned only the usual fine colours of gold have been obtained. Panning the top gravels by the writer showed only fine colours of gold and the black sand, on assay, carried no platinum content.

Owing to the flat nature of the creek ordinary hydraulicking or sluicing is not possible. All operations along the creek have been by hand methods. By damming and diverting the stream, elevating sluice-boxes, and working back into the benches, at different points the creek-gravels and bench-gravels have been tested and worked.



Rainbow Creek, Omineca—Snell's Old Workings.



Rainbow Creek, Omineca—Snell's Lease.



Rainbow Creek, Omineca—General View at Canyon.



Rainbow Creek, Omineca—G. Moore's Lease.

PEACE RIVER MINING DIVISION.

NOTES BY JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST.

In 1923 an examination of the Peace River Mining Division was made by the writer and a fairly full account of the area and its mining possibilities is given in the Annual Report for that year. The following general statement on placer-mining is contained in that report:—

" PLACER-MINING.

" Varying amounts of placer gold are found in the gravels of the Parsnip, Finlay, and Peace rivers and their tributaries. Some placer platinum occurs with the gold, but as a rule the amount is very considerably less than the gold and in many places it is practically negligible. The gold occurring in these gravels is always fine and some of it may be classified as 'flour' gold. It is quite evident that this fine gold has not had a local source, but has come long distances from the headwaters of the rivers. The deposits in which this gold in appreciable quantity is found are typical bar concentrations; in some cases these bars are the present ones in the streams, while in others they are old bars forming flats and low terraces along the valleys. The gold has been transported by glacial action and also by normal fluvial action in both Pleistocene and Recent time. In the working-over of the clays, sands, and gravels in the stream-valleys the gold becomes concentrated at suitable places and a deposit is formed which is relatively much richer in gold than the bulk of the material. This action is going on continually, so that new auriferous bars are being formed in the rivers. In deposits of this nature only the upper parts are enriched and as a rule there is little or no concentration of gold on bed-rock.

" Small-scale mining of bars and flats along these rivers has been carried on for years. In this work rockers are used and in some places a small creek supplies water for ground-sluicing and washing. In a few instances power-pumps have been used to supply water from the river for the sluice and the gravel mined by hand. As the gold is fine and flaky, care has to be taken in saving it, for much of it has a tendency to float and is thereby lost. The yearly production of gold from this hand-mining is, however, small, and as a rule no record of it is obtainable.

" It has been considered by many that some of the gravel flats along the Peace river would pay to work by large-scale methods, such as dredging of some type. Two such attempts have been made and these will now be described."

The two large-scale mining enterprises referred to were the Peace River Gold Dredging Company, using a drag-line scraper and accessory equipment at Branham flat on the Peace river, and the operation of a single-bucket type dredge at Fort St. John. Both these operations were failures and nothing further has been done.

The most important deposit worked in this area was Pete Toy bar (this is in Omineca Division, not far from the boundary-line of Peace River Division), which yielded fair returns to individual efforts for some time. The following note is from R. G. McConnell's report on the Finlay and Omineca rivers in the Annual Report for 1894, Geological Survey of Canada:—

" The first discovery of gold in the Peace River country was made on the Parsnip, about 20 miles above its mouth, by Bill Cust in 1861. In the following year Pete Toy bar on the Finlay, a few miles below the Omineca, was found, and for some time proved wonderfully productive, the yield amounting to about \$50 per day to the man."

In recent years small-scale individual work has been carried on at various places and some testing has been carried out on bars and flats with the objective of proving sufficient pay-gravels for dredging.

CENTRAL MINERAL SURVEY DISTRICT.

NOTES BY JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST.

The Central District includes the seven Mining Divisions of Kamloops, Clinton, Lillooet, Ashcroft, Vernon, Nicola, and Yale. The district covers an area of approximately 44,000 square miles, or, roughly, one-third of the territory of the mainland of Southern British Columbia, lying between the 53rd and 49th parallels of north latitude.

Active placer-mining in the Province commenced in this district with the discovery of gold on the Thompson river in 1857, and shortly after many creeks and rivers were being prospected and mined. Placer operations have been carried on ever since in the district, but the various camps were not as spectacular as the Cariboo, Cassiar, and Atlin diggings. In the aggregate, it is estimated that \$6,000,000 worth of placer gold has been produced by the whole district. It is impossible to arrive at exact figures, through lack of official records, but it is believed this estimate is approximately correct.

The district is in the heart of the Central Belt, but the most important deposits worked have not been original placers formed close to the source of the gold. Many rich bar deposits have, however, been worked; these represent reconcentrations of gravels containing small amounts of fine gold that have been transported long distances by glaciation and stream-action.

Numerous rich bars were worked on the Fraser and Thompson rivers, such as Cornish, Emory, Hill, Baxter, Foster, French, and Mormon, the latter being above Lillooet. Those below Yale carried no "scale" gold at all. These deposits are as a rule shallow and by the nature of their origin do not extend to bed-rock. It has been thought by many that rich values should occur on bed-rock in the immediate vicinity of these bar deposits, and various unsuccessful enterprises have been based on this erroneous theory. It is quite evident that, as a whole, the gravels of these large rivers do not carry an appreciable economic gold content, but that only where physical and topographic conditions have been suitable are the gravels concentrated into workable placer deposits. Careful testing should therefore precede any large-scale attempt—such as dredging—to work these gravels.

In the placer literature given in the bibliography at the end of this bulletin there are many descriptions and references to the placer deposits of this district, so that only a brief further account will be given.

The Fraser River and Thompson River bars were worked by thousands of miners who made the original rush in 1858-59. Some of these men pushed on, examining every part of the bars and banks, and, in the belief that coarse gold lay in the ground farther from the rivers, did a large amount of sluicing which resulted in some coarse gold being found in small quantities. Harrison and Bridge rivers also yielded some coarse gold.

Those not winning fortunes in the lower Fraser River area either returned to California or went on, finally opening the Cariboo and Quesnel areas, to which the Cariboo road was completed in 1863.

CENTRAL MINERAL SURVEY DISTRICT (No. 3).

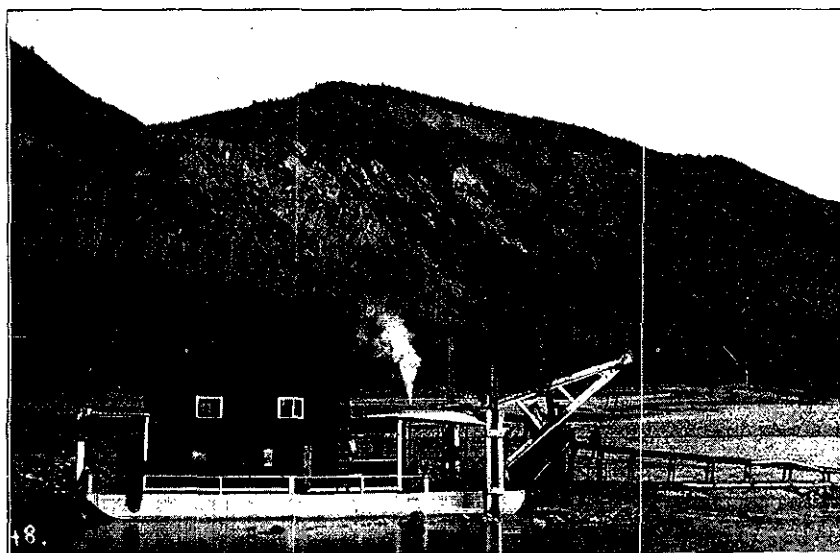
PLACER OPERATIONS IN 1931.

REPORT BY H. G. NICHOLS, RESIDENT MINING ENGINEER (HEADQUARTERS, KAMLOOPS).

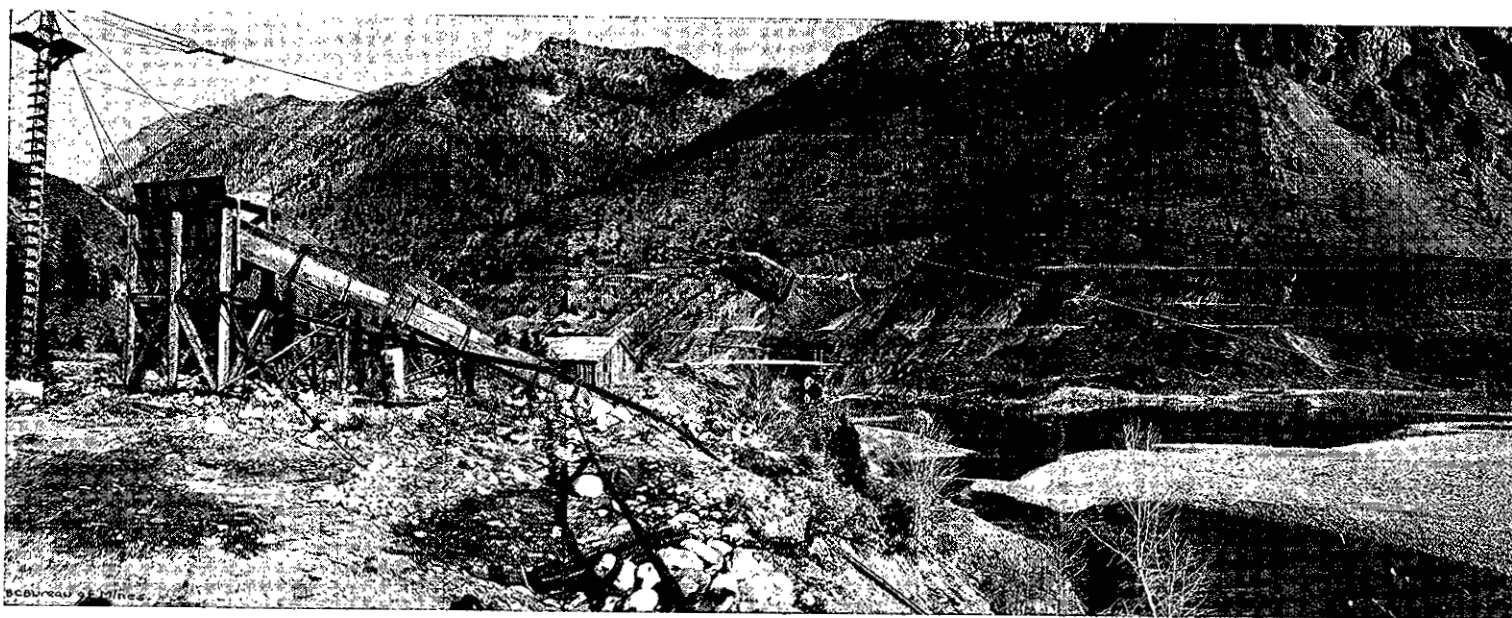
A number of operations in the valleys of the Thompson and Fraser rivers have afforded examples of local concentrations in glacial debris and of the difficulties attendant upon economic recovery upon a scale of any magnitude. Among these instances is the placer-ground on Louis creek, flowing into the North Thompson river about 38 miles north of Kamloops, where some elaborate preparations for hydraulicking-work have not as yet resulted in any commercial production; a bar on the North Thompson river, opposite Heffley creek, where a locally constructed dredge, installed by Kamloops Placer Mining Company, operated under difficulties for some weeks and finally broke from its moorings; and an attempt to employ suction-dredging upon a bar, below Spences Bridge, which was abandoned early in the summer. Some practical operations on a small scale have been carried on by Mount Olie Mines, Limited, on Eakin (3-Mile) creek, near Mount Olie, on the North Thompson river. This company holds creek and bench leases above the falls on this creek. A dam equipped with a boomer-gate has been installed and a channel blasted out in the rocky canyon to provide for the disposal of tailing. Some coarse gold has been recovered, but owing to difficulties in connection with uneven bed-rock no clean-up has yet been recorded.



Bridge River—Hydraulic Operations below Canyon.



Fraser River—Dredging near Lytton.



Universal Mining, Milling, and Reduction Co.—Scraper-dredging on Fraser River near Lillooet.

Other interests represented by J. Armes, of Vancouver, have secured five bench leases at McClure, on the east side of the North Thompson river, and have made certain preparations for operations. On the Fraser river, at Boston Bar, H. B. Mills, of Vancouver, is operating upon an area of 10 acres where encouraging values have been obtained.

In the Vernon Division placer-mining has not been active, but leases have been staked on the Shuswap river and Cherry creek, and the usual amount of activity has been shown by individual placer-miners along the creeks tributary to the Fraser river in the Clinton Division, such as Wards Bar and Watson Bar creeks.

Two operations on a larger scale are those of Hobson Creek (Cariboo) Mining Company, Limited, and Lower Bridge River Placers, Limited. In the former case the company, with headquarters in Vancouver, is proceeding actively with plans for hydraulic mining on Hemlock creek at the head of Hobson (the upper Clearwater) lake. Upon this creek, at a distance of about 2 miles above its mouth, encouraging prospects are reported to have been obtained from the creek-gravels lying below a bench reaching to a height of about 200 feet above the creek, from certain sections of which pay-dirt is also obtained. A considerable amount of work was done by old-time prospectors, including the driving of a tunnel for a distance of approximately 200 feet. This tunnel-working has been reopened by the present operators, and it is claimed that good values were obtained from several tests made, and also from certain more or less stratified sections in the face of the bench exposed by previous sluicing operations. It appears that the whole mass of this material represents a talus of glacial debris in which partial concentrations have occurred, and average sampling is difficult.

The company, which has already been at very considerable expense in connection with establishing a camp, etc., under conditions of transportation of considerable difficulty, has decided to proceed with the operations without attempting any further prospecting-work.

A metal flume 9,000 feet in length is being constructed capable of delivering water under a head of 280 feet, with a minimum flow of about 1,200 inches. Lumber is obtained from Likely, at the foot of Quesnel lake, from whence it, together with all other supplies, is transported by scow, a distance of 61 miles, to the head of the East arm; thence by wagon-road across the portage to Hobson lake, a distance of 6 miles; thence by power-boat to the head of the lake, a further 4 miles, and is then hauled up the trail to the property. Seventeen men are being employed, but it is not likely that washing operations will be commenced this year.

Lower Bridge River Placers, Limited, with headquarters in Vancouver, has acquired five bench leases and several creek leases covering a stretch of the Bridge river about 5 miles below Horseshoe bend and at a distance of about 12 miles above the mouth of the river.

On the north or inner side of the wide sweep taken by the river, there is a large accumulation of tailings from old-time operations along a lower bench reaching to a height of about 40 feet above the stream. On the opposite bank a series of three benches is covered by two claims. The upper bench reaches to a height of something over 100 feet above the stream; the middle bench, extending down-stream for about 600 feet, is approximately 50 feet in height and is 100 feet wide, and the lower, farther down-stream section, is occupied by a low bench which cuts out against bed-rock on the western extremity of the holdings.

A cable has been stretched across the river and operations have been confined to testing-work on this southern side. Twenty bore-holes have been put down with a small churn-drill, operated by an 8-horse-power gas-engine and using 4-inch casing. These holes have been spaced 100 feet apart along the rim of the benches and bed-rock is stated to have been reached in all cases, depths varying between 12 and 43 feet.

Good results are reported to have been obtained from the upper half of the middle bench and in all the holes on the lower bench. It is planned to continue the systematic testing of the ground by drilling another row of holes farther back from the river and the project is therefore being handled in an entirely praiseworthy manner.

The question of subsequent operation, should the results of drilling warrant proceeding further, presents some difficulties, and it is understood that plans provide for the use of a mechanical excavator, such as a gas-shovel, and for pumping water from the river for washing purposes.

In regard to the creek leases, practical operation of the river-gravels would appear to depend upon the diversion of the stream in connection with the completion of the B.C. Electric power project on Bridge river. A cabin has been constructed and five men are being employed on the property.

SOUTHERN MINERAL SURVEY DISTRICT.

HISTORICAL SUMMARY.

BY HERBERT CARMICHAEL.

George B. McClellan first found gold in the Similkameen river in 1853, but only in small amounts, and it was not until 1860 that regular placer-mining was carried on, the miners coming from the American side. The excitement of the rich diggings in Cariboo seems to have attracted most, if not all, of the miners and to have left this river deserted, as there is no mention of the district until placer gold was discovered on Granite creek, a tributary of the Similkameen, by John Chance in 1885.

In October of that year T. Elwyn, Deputy Provincial Secretary, made a special trip into the district and reported to the Minister of Mines in November, 1885. He says in his report: "Granite creek is a tributary of the Tulameen or North fork of the Similkameen, and falls into that river on its right bank, 12 miles above its junction with the South Similkameen at Princeton, perhaps better known as Vermillion Forks. From near the mouth of the creek to a point something over half a mile below the forks, a distance of 4 miles, no claim which has been tested on both sides of the bed of the stream has failed to yield good returns, and it may safely be said that the ground for that distance will average over an ounce a day to the hand.

"On October 31st, 1885, on lower Granite creek, there were sixty-two companies owning creek claims, averaging probably 300 feet to the company who were working. The gold admitted to have been taken out by the several white and Chinese companies from July 5th to October 31st amounts to the large sum of \$90,000, which, considering the great loss of time caused by the freshet and the difficulty of obtaining lumber for sluice-boxes, is a creditable showing.

"Chinese have for years been mining on the banks of the Tulameen many miles above the mouth of Granite creek.

"Chinese have been passing the mouth of Granite creek for years, and their failure to find out its value goes far to prove the assertion, often made, that they never prospect in any true sense of the word."

As to the yields on this creek, Mr. Elwyn says that Messrs. Briggs and Bromley took out \$400 in an afternoon with a rocker, and the Point Company washed up 45 oz., or over \$750, as the result of the labour of eight men for thirty hours.

It is noteworthy that platinum was first discovered in British Columbia in Granite creek, and in fact that creek has given by far the largest yield of platinum in the Province, the returns in 1891 being \$10,000 worth of platinum. Here is the report of the discovery by Mr. Elwyn: "There is associated with the gold on Granite creek a very hard, heavy, and whitish metal which is probably platinum or irridium, perhaps a mixture of both."

The origin of the platinum in the placers of the Tulameen section has been carefully investigated. In 1900 J. F. Kemp spent three months in the area examining the gold-platinum placers and investigating the source of the platinum. His report is contained in Bulletin No. 193, United States Geological Survey. In it he definitely shows that the platinum originated in the belt of peridotite rocks cut by the Tulameen river and its tributaries, being mainly contained as irregularly distributed minute grains in the magmatic segregations rich in chromite occurring in this belt of rocks.

In 1909 and 1910 the Tulameen district was geologically examined and mapped by Charles Camsell, his report appearing as Memoir No. 25 of the Geological Survey of Canada. In this report Camsell further discusses the origin of the platinum and endorses the opinion of Kemp that it originated in the peridotite rocks. The platiniferous rocks of the Tulameen map areas were also studied by Eugene Poitevin, his report appearing in the Summary Report, 1923, Part A, Geological Survey of Canada. He estimated the total yield of platinum in the district to that date as 20,000 oz.

The yield of gold for 1885 is reported as follows:—

Granite creek	\$54,000
Tulameen river	60,000
Similkameen river	3,500
Total	\$117,500

In the next year or two several other small creeks were discovered to have gold, but none as good as the three just mentioned.

The yield for these was as follows:—

1886	\$203,000
1887	128,000*
1888	96,000
1889	46,000
1890	49,450

* Platinum 2,000 oz., which sold for 50 cents an ounce.

From the year 1890 on, the usual transition from small-scale placers to hydraulics took place, the remaining small operations passing into the hands of Chinese. In 1895 flumes, ditches, and pipe-lines were constructed to work the benches, one ditch being 8,910 feet long and the flume 4,026 feet, the main pipe being 30 inches in diameter and 848 feet long.

From 1890 to 1898 the creeks in this district were worked with varying success, but the output gradually diminished until in 1898 it was \$7,560. Writing in 1889, the Gold Commissioner, referring to the first years of the camp, says: "No official record has been kept of the gold obtained from this Division since its first occupation, but it must foot up to a large amount. This Division has produced some of the largest nuggets found in the Province. In 1886 two pieces were taken from Bear creek worth \$400 and \$415 respectively, and the following year a Chinaman unearthed a nugget on Boulder creek of the value of \$900."

In 1898 the only important operations were either drifting for old channels or preparing for hydraulicking.

During the fall of 1901 Wm. Fleet Robertson, Provincial Mineralogist, visited the district. He reports very little hydraulic or any form of placer-mining, his time being principally devoted to the lode mines. In 1911 there was a revival of interest in placer-mining. Platinum Gold-fields, Limited, prospected ground on the Tulameen river and another company prospected Slate creek, which produced a considerable amount of platinum in the early days. J. D. Galloway, Assistant Mineralogist, visited the district in 1913, devoting most of his time to lode-mining. He states that only a few Chinamen were working on the Tulameen, and on Granite a placer lease was being prospected by Lambert & Stewart. In 1915 Wm. M. Brewer made a report for the Department of Mines, in which he describes Lambert & Stewart's hydraulic mine as being successful that year in making a clean-up of \$2,000.

A drag-line scraper was tried on some ground in 1923, but was not successful owing to the number of boulders. There was a revival in both hydraulic and deep placer-mining in 1924 due largely to the higher price of platinum, which had risen to \$115 an ounce; the output was \$2,100. Next year ground was being tested for dredging and not so much productive work was done, as the yield of platinum fell to \$1,000.

In 1926 a spectacular find was made by Garnet Sootheran on his placer lease about half a mile below Eagle creek, on the west side of the Tulameen river. He discovered a pay-streak along the side of and under the boulder-dumps of some old placer-diggings; this ran about an ounce of crude platinum to the cubic yard. Several other operators started to try out some of the old deep diggings. The next year the Resident Engineer reported a continued improvement in the outlook for placer-mining, though high water prevented Sootheran from working his lease; other operators produced over 15,000 oz. of crude platinum and gold.

Prospecting occupied the attention of most of the companies during 1928, and it was found that testing of ground by sinking shafts and pumping was not successful on account of the water which had to be handled, so churn-drilling has been used instead. A gas electric shovel was tried on the Similkameen river, but the returns were not high enough to warrant the operation of this type of machine. The results from deep prospecting in 1929 have been encouraging in several directions.

SOUTHERN MINERAL SURVEY DISTRICT (No. 4).

PLACER OPERATIONS IN 1931.

REPORT BY P. B. FREELAND, RESIDENT MINING ENGINEER (HEADQUARTERS, GRAND FORKS).

GREENWOOD MINING DIVISION.

ROCK CREEK.

Practically the entire length of Rock creek, excepting the narrow canyon from the village up to a point about 6 miles above the road crossing of the North fork, has been staked. Very little mining has been done up to the present, due to the fact that most of the easily worked stream-beds and high channels were worked many years ago.

Prospecting lately has exposed the rim and alluvial gravels; some distance above the present creek, of what appears to be other older channels evidently blocked by glacial drift. The cemented gravel, dipping steeply away from the present channel, contains comparatively coarse rusty gold. Two men dug and sluiced about 2 oz. of gold in one day on one of these rims.

According to the history of mining of the creek in the early days and evidence of work done, unsuccessful attempts were made to drive to bed-rock in the old channels, and water and quicksand drove the miners out. The necessity of first locating bed-rock by means of churn drilling appears evident, followed by sinking or drifting at a proper elevation.

The finds made are attractive and warrant exploration by those able to finance drilling. The present leaseholders appear to be willing to incorporate their holdings with any one interested and at a reasonable figure. The gold found is valued from \$17 to \$19.50 fine.

BOUNDARY CREEK.

A few leases have been staked near the mouth of Boundary creek and prospecting is being done. This area was also mined in 1865 and some gold won from the diggings.

SIMILKAMEEN MINING DIVISION.

SIMILKAMEEN RIVER.

Placer-mining has been carried on spasmodically by many individuals on the river during the summer. The activities have taken the form of "sniping" rather than deliberate working of claims or leases, and the results have been quite attractive considering that many of the men at work are entirely ignorant of placer-mining methods. Values recovered have not been estimated, but a considerable amount of platinum as well as gold was recovered.

TULAMEEN RIVER.

Slate Creek Consolidated Placers, Ltd.—Early in the year the tunnel, driven over 2,000 feet up and under the bed of Slate creek from below the falls, was abandoned owing to caving at the face and filling of part of the tunnel by water-soaked gravel. Another attempt is being made by the company under the management of Norman McCormick, Tulameen, to drift in under the creek from what is locally known as the "bluffs" below the mouth of Slate creek. This tunnel is being driven at a lower elevation than the one abandoned, but no data are on hand regarding the depth of bed-rock in the creek.

John Guest Leases.—Nothing has been done this year on these leases on the Tulameen river, a short distance below Slate creek.

Granite Creek Mining and Development Co.—During the early part of August this company commenced installing a suction-pump to work the gravels near the mouth of Granite creek, on the Tulameen river. It is the intention, it is understood, to employ a diver to guide the suction-hose on false bed-rock or wherever values are found. The operation should commence about the end of August.

There are numerous placer-miners working on the Tulameen and some gold and platinum is being found which is sufficient in quantity to warrant the effort.

Most of the easily worked deposits have been mined in this area, but there still remain the old channels underlying glacial debris which have never been thoroughly tested. Evidence of placer gold has been found along and below the outside rim of these old channels, but no testing has been done to find bed-rock in the centre or ends of the channel. A study of the topography shows that in several places the river has been forced by rock-slides and glacial drift into a new channel, and it is under these benches formed by drift that the best chances occur.

To attempt drifting or crosscutting the rim-rock without first churn-drilling the channel to find bed-rock is very poor practice as far as mining is concerned, because the tunnel may be started too high or too low to strike the right elevation. Hydraulicking is generally out of the question, because there is insufficient gradient or clearance for boulders. Whether or not these old channels can be made to pay is still a question to be decided by drilling, and no attempt has been made by any of the operators to ascertain this knowledge by this means.

GENERAL.

Besides the areas mentioned above, the following may be mentioned as worthy of intensive prospecting for placer gold: Streams flowing into the Similkameen river from the north-east between Hedley and Keremeos; streams adjacent to the old Fairview mining camp, close to Oliver; tributaries of the main Kettle river from its source and to the south 20 miles; the South fork of Rock creek; creeks with headwaters near Camp McKinney; the West fork of Pass creek, which flows into the Granby river about 10 miles north of Grand Forks (this creek evidently once emptied Jewel lake); any creeks with headwaters near Paulson.

EASTERN MINERAL SURVEY DISTRICT.

HISTORICAL SUMMARY.

By HERBERT CARMICHAEL.

FORT STEELE MINING DIVISION.

The bars of the Columbia river above Colville, in what is now the State of Washington, had been mined to some extent before the East Kootenay and Big Bend excitements attracted multitudes from a distance. Some gold colours had been found on the bank of the Columbia at Colville in 1855, and Angus McDonald's prospecting expedition found moderately remunerative diggings at the mouth of the Pend d'Oreille near the boundary-line. Miners having gradually worked their way up the Kootenay river from Idaho, rich diggings were at last discovered not far from the boundary-line, which gave rise in 1863-64 to the Kootenay gold-mining excitement. A trail from Walla Walla was built in to this point:

Wild Horse creek became the centre of the district when gold was discovered there in 1863, and in 1864 it became an important camp. The creek got its name from the number of wild horses there. By May, 1864, some 400 miners had distributed themselves along the creek. Prospects were obtained of \$1 to the pan and ordinary claims were paying \$20 to \$30 a day to the man; nuggets running from \$2.50 to \$78 were found. Fisherville was the name of the town, but in 1866 it was pulled down for the purpose of working the ground on which it stood, and the operation is said to have been highly remunerative.

In 1865 the Dewdney trail was built to the Kootenay river to give an outlet to Victoria without going south of the International boundary.

From 1864 to 1869 hydraulic mining was carried on and a number of new gold-bearing creeks had been found, the most important being Perry creek, a branch of the St. Mary river. On this creek three men took out \$225 in five days, while the ground generally gave an ounce a day to the man. Good prospects were found on Moyie river in 1869, but in 1872 A. W. Vowell, the Gold Commissioner, states that the principal mines were worked out, with the exception of those on Wild Horse and Perry creeks.

In 1876 most of the white men had left and the output had dwindled to \$25,000; the next year the output increased to \$37,000, being the yield from Wild Horse, Perry, and Palmer creeks, chiefly through the work of Chinese.

The estimated output of the district from 1878 to 1885 was \$188,380, with a total of \$500,000 from the first days of the camp until 1885, the gold being valued at \$18.25 an ounce. The official returns in 1884 were \$60,826, principally from Wild Horse creek.

In 1888 gold was discovered by Henry Lovewell and a small prospecting-party on Porcupine and Quartz creeks, near the confluence of those creeks. The party was not able to get to work until October 14th, but before the season closed they made \$11 a day to the man. From 1888 to 1895 hydraulicking and other mining were carried on, the yield of gold varying from \$12,000 to \$30,000; the year 1895 was fairly successful on Wild Horse creek, as from that creek alone the yield was \$22,500 and prospecting of further ground was actively carried on.

W. A. Carlyle, Provincial Mineralogist, visited the district in 1896, and reported an hydraulic operation of some size carried on by the Invicta Gold Mining (Placers) Company, Limited, on Wild Horse creek. The company hydraulicked that year 70,000 cubic yards of gravel which gave an average of 7 cents in gold; a bank 5,000 feet long was worked. This was the only alluvial operation of any size going on at the time of Mr. Carlyle's visit.

Wm. Fleet Robertson, who succeeded Mr. Carlyle as Provincial Mineralogist, in 1898 made his first reconnaissance for the Government in East Kootenay district, and he made an extensive examination which will be found in the Annual Report for 1898. He found that the principal work was being done on Wild Horse creek, where three hydraulic companies were operating. On McMillan's placer claim the owners were driving a tunnel towards what they believed to be an "old channel."

The Perry Creek Hydraulic Mining Company in 1903 started operations on a large scale to hydraulic a high bank, and this work is fully described by Wm. Fleet Robertson in the Annual Report of that year. Unfortunately their efforts were not successful and interest in placer-mining fell off until in 1914 only a \$1,000 yield was credited to the district.

In 1915 J. D. Galloway, then Assistant Mineralogist, visited South-east Kootenay. He found that placer-mining had dwindled to a small annual output, mining being largely confined to about 100 Chinamen working in groups of twos and threes.

This district became part of the Eastern Mineral Survey District in 1917, and A. G. Langley, Resident Engineer, in 1919 reported that the Gamble Mining Company and the Wild Horse Dredging Company were both starting operations, the former to sluice out an "old channel" parallel to Wild Horse creek and the latter to drain the creek with the object of getting at bed-rock.

From 1919 to 1925 a revival of interest in hydraulic mining is shown, and at least two companies have been at work either piping or opening up new ground, but this activity slackened off again, and with the exception of some prospecting on Quartz creek and Moyie river, no new work was in progress; the usual work was being carried on at Wild Horse creek.

REVELSTOKE MINING DIVISION.

The "Big Bend" of the Columbia river north of the Canadian Pacific Railway at Revelstoke is the important placer area in Revelstoke Mining Division.

Salmo creek, emptying into the Pend d'Oreille river near its junction with the Columbia just north of the boundary, was wing-dammed by John Thornton and coarse, bright gold obtained. Bars on the creek as well as on the Columbia were at the same time worked by a great number of Chinese, and Forty-nine creek, 90 miles above Colville, was a cause of excitement in March, 1867. About twenty miners wintered at this place in 1866 and 1867 and reported that the diggings were not only easily reached but readily worked, and produced coarse gold like that from Kootenay, yielding \$6 to \$18 a day to the man. In one instance 2 oz. was taken out of a small prospect-hole in the bank.

About 200 men ascended the Columbia, prospecting all the creeks flowing into that river until the Big Bend country was reached. The first rich placers were found on French and McCulloch creeks, branches of Gold creek. The pioneers were four Frenchmen, who had settled on French creek as early as 1865 and had obtained \$16 from eleven pans of dirt. All the bars along the Columbia as far as the Big Bend were found to yield well in coarse gold not unlike that found in East Kootenay. North of this no gold was found.



Wild Horse Creek at Fort Steele—General View of Workings started in 1863.



Wreck Bay Beach Placers, Clayoquot M.D.



Northern Pacific Mines, Ltd.—Beach Placers on Graham Island.

R. T. Smith, who acted as Gold Commissioner for the Big Bend district in 1865, left there in November and reported to the Government that the known yield of French creek for the season was \$32,000; of McCulloch creek, \$2,700; and Carnes creek, \$3,000; but on account of the gold-export tax then in force he did not believe more than half the real amount had been declared.

In the spring of 1866 miners were beginning to flock in and Portland was doing a large business with the upper Columbia. Finding the trail would be inadequate to compete with the roads from the south, the British Columbia Government improved the Shuswap route early in the year and the Hudson's Bay Company built a steamer, the "Martin," which on May 27th began to make semi-weekly trips on Shuswap lake to Seymour, on the lake. In April, 1866, this town contained twenty buildings. The route, however, got a set-back, as boats and steamers began to ply on the upper Columbia from Colville, in Washington, to Death Rapids (or Dalles des Morts), in British Columbia.

The steamer "Forty-Nine" made her first trip from Colville to Death Rapids with eighty-five passengers and arrived at the latter place on April 26th, 1866, being ten days in making the trip up through the ice, taking passengers for \$25 and freight at \$200 a ton; she paid for herself during the first season. From Death Rapids freight was carried in boats, being dragged through the rapids to Wilson's Landing, 25 miles farther up the river. On May 19th one of these boats containing twenty-three persons came down over the rapids, and being overloaded and carelessly handled, capsized, and all but five were drowned. The "Forty-Nine" continued to make regular trips from Colville to Death Rapids.

The yield for the season of 1866 was estimated at \$250,000, of which French and McCulloch creeks yielded each \$100,000. In 1867 there were 100 miners wintering on French creek alone, but by 1869 the prestige of the district had departed, the shallow diggings were becoming worked out, and the deep ground had to wait for the more favourable conditions of a new era. Some of the deeper ground was worked for a year or two, but by 1874 all interest in the district as a placer camp seems to have died, as no mention is made of any gold returns in the Annual Report for that year or for some time.

About 1885 interest became renewed, principally in the deep placer-ground of McCulloch creek; three tunnel claims were taken up above the falls. French creek attracted some little attention and a bed-rock flume charter was applied for on that creek.

In 1886 good progress was made with deep placer-mining, the miners making fair to good wages by sluicing and shovelling into boxes. Work of a similar nature was started on Carnes creek and work continued on French creek and McCulloch creek.

A decided improvement in the placer situation is reported by the Gold Commissioner at the end of 1887; he mentions a dozen large creeks being worked and paying \$3 to \$5 a day to the man. The Ophir Bed Rock Flume Company put in a flume on a 1½-mile lease on McCulloch creek and took out \$1,500 in coarse gold before the end of the season, but a flood prevented a final clean-up.

Several bed-rock flumes were put in on other creeks; on Carnes creek four men sluicing got out \$127 in one day; the result of this work is shown in the returns for 1887, which were \$8,550. From 1887 to 1890 placer-mining was steadily carried on and several long tunnels were run to tap old channels; the returns on the whole were fairly successful. Both work and prospecting fell off considerably between 1890 and 1896, due to lode-mining excitement farther south, but a number of claims and leases were steadily worked which paid good wages. In 1896 the *Consolation* mine on French creek paid \$6,000 by wing-damming and bench diggings on Gold Drop creek gave a return of \$2,000 to two men. A number of small operations were carried on, but the returns are not stated.

In the Annual Report for 1898 J. D. Sibbald, Gold Commissioner, gives a comprehensive account of the alluvial mining in the Big Bend district; most of the creeks were being worked to some extent, but the principal mention is of an hydraulic operation on French creek, where a substantial plant had been put in, the company spending on packing in alone in that year the sum of \$12,000 and the total investment being some \$100,000. On French creek the *Consolation* Company in the four or five previous years took out the sum of \$30,000 in coarse gold.

In 1899 the Gold Commissioner makes the following significant statement about an hydraulic plant on French creek that cost well over \$100,000: "On this creek is the large and expensive hydraulic plant laid out during the past two seasons by the French Creek Mining Company, but which has not produced returns to the extent anticipated, as the greater part of the gravels

had previously been worked out, a fact which was not discovered until after the completion of the expensive plant referred to." This mistake has unfortunately been repeated by other hydraulic operations in British Columbia.

For a number of years a limited amount of placer and hydraulic mining was carried on, but as the returns were all lumped together it is difficult to state the results of the work, but towards 1913 alluvial mining of any kind seems to have ceased. Some prospecting of deep ground by drilling was done in 1914 on French creek; this work was continued the following year and a shaft to deep ground was sunk on McCulloch creek, but had not reached bed-rock. Several of the other creeks had work done on them.

An hydraulic plant was working on French creek in 1916, but there was very little placering that year as the returns were only \$1,000.

From 1916 to 1925 placer-mining on the upper Columbia was at a very low ebb, but in 1925 a company called the French Creek Development Company, Limited, was incorporated to work the gravels of French creek by hydraulicking. Three placer claims were worked on McCulloch creek.

In the following year the company working on French creek had a crew building a flume and making preparations for hydraulicking. The placer leases on McCulloch creek gave very satisfactory returns to the operators in coarse gold.

By the end of 1928 the Big Bend wagon-road was completed as far as Carnes creek, about 26 miles from Revelstoke. This will afford much better transportation for both lode and placer mines. The French Creek Mining Company built 6,000 feet of flume and put in 2,000 feet of pipe-line to convey water to two No. 6 Hendy giant monitors under a head of 200 feet. Placer-mining was continued on McCulloch creek.

EASTERN MINERAL SURVEY DISTRICT (No. 5).

PLACER OPERATIONS IN 1931.

REPORT BY B. T. O'GRADY, RESIDENT MINING ENGINEER (HEADQUARTERS, NELSON).

References to past gold-placer operations in the East Kootenay are contained in Geological Survey Memoir 76, "Geology of Cranbrook Map-area," by S. J. Schofield, published in 1915, and in the Annual Reports of the Minister of Mines, the more extended references being contained in those for the years 1896 (W. A. Carlyle), 1898 and 1903 (W. Fleet Robertson), and 1915 (J. D. Galloway).

Placer deposits were formerly an important source of gold in East Kootenay. Gold was obtained from numerous streams, the more important being Wild Horse creek and Perry creek. Palmer Bar creek, Moyie river, and Weaver creek were also worked fairly extensively. Of recent years the only substantial activity has been on Wild Horse creek, where the Wild Horse Gold Mining Syndicate, under the management of W. A. Drayton, of New York and Fort Steele, has carried on hydraulicking operations intermittently since 1924. Latterly hydraulicking was discontinued and exploration undertaken by drifting on bed-rock.

Recently R. J. Gunther, of Fort Steele, is reported to have started work on the same creek with a crew of seven men. A trip is to be made shortly to visit this new undertaking. Other placer activities in the East Kootenay are at present limited to prospect-diggings by individuals at a few widely separated points.

WEST KOOTENAY.

Gold-placer deposits have in the past been worked in numerous localities in the West Kootenay, the most important having been French, McCulloch, and Carnes creeks in the "Big Bend" of the Columbia river, north of Revelstoke. Other sources of placer gold were Fortynine and Wild Horse creeks, in the Nelson Mining Division. Many other localities in the West Kootenay have yielded small amounts of gold. References to past placer-mining operations are contained in Geological Survey Summary Report, 1928, Part A, under "Geology and Mineral Deposits of the Big Bend Map-area," by H. C. Gunning, and in the Annual Reports of the Minister of Mines of British Columbia. With the exception of the Big Bend area, placer-mining, however, has never been very important in the West Kootenay.

REVELSTOKE MINING DIVISION.

With reference to the Big Bend area the following is quoted from pages 192A and 193A of the above-mentioned Geological Survey publication, under "Placer Deposits":—

"Placer gold is found in French creek, McCulloch creek, Camp creek, the lower reaches of Goldstream river, and in Carnes creek. All these streams, particularly the first two and the last, have been worked extensively in the last sixty-three years and an unknown quantity of gold, valued at least at several million dollars, has been extracted. At present operations are confined almost entirely to French and McCulloch creeks, although some work is done every season along the lower reaches of Goldstream river. Gold occurs in the quartz veins around the heads of McCulloch and Graham creeks and these veins are believed to have supplied the gold for the placers. As far as is known, no gold is found in Goldstream river above French creek. French and McCulloch creeks have been so extensively worked in the past that it is now exceedingly difficult to locate virgin ground.

"The gold occurs as rather coarse grains and nuggets, many of which are angular or slightly porous. Apparently they have not been transported for great distances. It is found principally on or very close to bed-rock, although finely divided colours are scattered throughout most of the gravels and much of the surface soil. Fine colours can be obtained from most of the small streams draining into McCulloch creek, from its source to its mouth. On French creek gold is known to occur from the mouth to the meadows about 6 miles up-stream. Galena is frequently found with the gold on the riffles. Boulders are a great hindrance to placer operations. The beds of French and McCulloch creeks are covered thickly with them in weights varying from a few pounds to 40 or 50 tons. To work the accompanying gravels requires much time, labour, and dynamite. However, past operations have proved that if an area of unworked bed-rock can be found in either of the channels good values may confidently be expected.

"During the past season Messrs. D. Fullmore and C. Williams were working in the middle of McCulloch creek about 1 mile from its mouth. They were confident that they had found a portion of the stream-bed that had not been worked before. Boulders were causing trouble, but from the gravels near bed-rock some gold was being obtained, including nuggets worth from \$1 to \$10, or more. No clean-up had been made at the time of the examination and it is not known whether the operations were a commercial success. Mr. L. Maley and an associate had staked several bench and creek leases farther up-stream and were doing some work.

"On French creek the French Creek Development Company, Limited, under the direction of president L. N. Remillard, was proceeding with extensive developments on the *Cougar*, *Gopher*, and *Goat* leases. Mr. Remillard has worked in the vicinity for some twenty years and, with associates, has prospected, by tunnels and shafts, a large area of bench land on the west side of the stream 1 mile from its mouth. These old workings could not be examined, but Mr. Remillard is confident that he has located an old buried stream-channel in which the values near bed-rock will be commercially profitable. At present the bench is covered with soil, boulders, and heavy timber. The company, working under a serious handicap due to lack of good transportation facilities, has erected a small sawmill and constructed 6,000 feet of 4- by 3-foot flume and a little more than 2,300 feet of pipe-line grading from 4 feet to 15 inches in diameter. It is intended to operate two monitors during the summer of 1929.

"With the exception of the ground being developed on French creek, there seems to be little chance of finding buried channels in the district around Goldstream river. Where French creek joins Goldstream river the main valley is broad and flat and heavily timbered. In 1924 Goldfields American Development Company of New York put down two holes, 50 and 89 feet deep, near the centre of Goldstream valley opposite the mouth of French creek. Mr. Eugene H. Dawson, who was in charge of the work, reports that at 89 feet the drill was still in fine gravel and sand and that no values were obtained from either hole. His conclusion is that the source of gold-supply (French creek in this case) is inadequate sufficiently to enrich Goldstream valley to make a profitable mining operation, and, further, that the depth of bed-rock is too great for dredging operations."

Since the area described was visited by H. C. Gunning in 1928, exploration by hydraulicking has been continued throughout the summer seasons by the French Creek Development Company, Limited, under the direction of L. N. Remillard, and late in the fall of 1930 a section of previously unworked channel was encountered which yielded approximately \$2,700 in gold before work was discontinued for the winter. Hydraulicking was resumed in June and gold to the

value of about \$2,100 was recovered in clean-ups to July 27th. The channel seemed to be heading for an old channel of French creek which was worked at the upper end for a few hundred feet westerly from the existing creek-bed. If this assumption is correct there would remain possibly 500 to 600 feet of unworked channel between the new and the old workings. It is considered possible, however, by the management that the pay-channel will turn northerly into a virgin area. In this case the location of the present flume and pipe-line could not supply adequate pressure for hydraulicking on higher ground. The operation has been conducted very efficiently and it is to be hoped that the gold recovered will be commensurate with the expenditures which have been made in equipping the property.

On McCulloch creek, which is the next tributary of Goldstream, going westerly from French creek, D. Fullmore and C. Williams, of Revelstoke, have been bulldozing large boulders to get at the bed-rock from which in past seasons they have obtained appreciable amounts of coarse gold. Farther up-stream L. Maley and P. Cowan are prospecting their ground.

On Camp creek, the first tributary of Goldstream going easterly from the Columbia river, Alec McRae, of Revelstoke, with J. B. Coughlan and associates, of Calgary, recently started work, six of the interested parties participating in the partnership, which includes the *Badger*, *East Crest*, *Theba Bara*, *Eagle*, *Bear Cat*, and *Jack Rabbit* creek leases.

On Smith creek, a tributary of the Columbia river from the west, R. Aikens and Gus. Hedstrom are working their bench and creek leases. Hydraulicking operations were carried out on this creek in past years.

ARROW LAKE MINING DIVISION.

Considerable staking activity recently developed on tributary creeks flowing easterly into Barnes creek near its headwaters. The area is most easily accessible from the point marked on Government maps as Wauchope, on the Edgewood-Vernon road, about 28 miles from Edgewood. A rough trail extends from the road (elevation 4,050 feet) easterly up to the summit (elevation 5,500 feet) and continues down Eureka creek to a point near its intersection with an unnamed tributary stream (elevation 4,760 feet). From this point, which is about 6 miles from Wauchope, the trail extends north-westerly and south-easterly some 5 miles, paralleling the area recently staked. At the time of the writer's visit at the end of July about 105 creek claims, 250 by 1,000 feet, had been staked, of which seventy-six had then been recorded at Nakusp. The distribution of the claims was approximately as follows:—

Sixty along the unnamed creek flowing into Eureka creek, forty from this intersection along Eureka creek to its intersection with Barnes creek, and five claims on Barnes creek adjoining Eureka creek. The discoverers were A. Holden and A. Brewer, who, after obtaining about ½ oz. of gold by panning, took in some associates from Vernon and formed a partnership, including twenty claims known as the *Lost Cabin* partnership. These claims are on the unnamed creek 1½ miles above the Eureka Creek intersection. Ten sluice-boxes, 12 feet long, made of whip-sawed lumber, had been placed in position and five men of the eight employed had been shovelling dirt from bed-rock. This work had been temporarily discontinued, but it is understood that about \$4 in gold had been recovered in 1½ days' work. Bed-rock here is quite shallow and the gold is associated with decomposed rock from the formation traversed by the stream. On the *Blazed Trail*, adjoining the *Lost Cabin* to the south-east, the owners are making preliminary tests of the ground. The next property, comprising ten claims, is known as the *Golden Marten*. Here A. O. Holmes, of Lumby, obtained about ½ oz. of fairly coarse gold by panning. With his associates he diverted the creek and was starting to put in sluice-boxes. At the lower end of the *Golden Marten* partnership, near the trail crossing, some work had been done to divert the creek and test the ground. From here along Eureka creek to Barnes creek and along Barnes creek a short distance the ground is staked continuously. At a point about 2½ miles below the unnamed creek-Eureka Creek intersection considerable work has been done on the *Forest* group of five claims by F. Layman and C. Anderson, of Lumby. They had diverted the creek and dug a trench about 40 feet in length, from which a small amount of gold, including a nugget worth about \$1, was obtained by panning. Bed-rock here is at a depth of from 3 to 4 feet. Numerous small boulders are mixed with the gravels. The gold is apparently also associated with a layer of decomposed rock lying on the bed-rock. Lumber was being packed in for sluice-boxes.

The total amount of gold recovered by panning on the claims was between 2 and 3 oz. The gold is from fine to fairly coarse, including a few nuggets of about \$1 value. Gold has been

found at widely separated points over a length of several miles, but in general the pay-streak seems to be very thin and confined to narrow limits.

The gold would seem to be derived from the dark calcareous rocks bordering the staked area, which in places are mineralized with numerous veinlets and seams of quartz and with pyrite and iron oxides. A composite sample of this rock taken from near bed-rock on the *Golden Marten* group assayed: Gold, 0.04 oz. to the ton; silver, 0.8 oz. to the ton. A specimen of pyritic material from the same vicinity assayed: Gold, 0.5 oz. to the ton; silver, 0.1 oz. to the ton. As a placer proposition at present there is no evidence that the deposits are of importance, but there seems to be a possibility that the adjacent rock formation may contain auriferous veins or zones of economic value.

Altogether there were about twenty-five men working on the various placer properties and temporary accommodation was provided by some seven or eight tents and an old cabin. D. McFarlane, of Edgewood, camped on the summit east of Wauchope, has three horses engaged in packing in supplies to the several camps.

AINSWORTH AND LARDEAU MINING DIVISIONS.

During 1930 and 1931 large areas have been staked along the Lardeau river as dredging and bench leases. The only appreciable activity which has occurred in connection with these consisted in a small amount of churn-drilling at Goldhill by Spokane interests in 1930. In March, 1931, the Lardeau River Placers, Limited (N.P.L.), was incorporated to prospect the ground south-easterly from Goldhill, but no activity is reported up to the time of writing.

The area north-westerly from Goldhill was acquired by J. Gallo, W. Applegate, and associates, all of Calgary, and a limited amount of prospecting was done early in the present year.

The Lardeau River gravels are known to be auriferous to a certain extent, but no extensive testing of the adjacent ground has ever been made. Results of previous placer-mining efforts in this section are summarized briefly by H. C. Gunning in Geological Survey Memoir 161, "Lardeau Map-area" (see also the Annual Report for 1930).

On Hall creek, close to its junction with the upper Duncan river, M. Greenlaugh, of Lardeau, recently started placer-mining and a small amount of gold has been recovered.

WESTERN MINERAL SURVEY DISTRICT.

NOTES BY HERBERT CARMICHAEL.

LEECH RIVER.

These placers were found in 1864 by Dr. R. Brown's Government exploring expedition, and were worked, off and on, for several years and from \$100,000 to \$200,000 taken out. Creviceing along bed-rock is still carried on to a limited extent when the river is low. The gold undoubtedly comes from the disintegration of numerous small quartz veins in slaty rocks.

CHINA CREEK, ALBERNI DIVISION.

This creek flows into Alberni canal some 6 miles below Port Alberni. The first record of placer gold there is in 1862, when the creek was worked principally by Chinamen, the returns covering several years, amounting to \$40,000. It is reasonable to suppose that after the various gold excitements on the Mainland had died down the streams on Vancouver island would be given some attention; this would especially be the case where so many Chinamen were looking for something to do. In 1883 there were 12,000 Chinamen in British Columbia and in 1881 there were 4,350 in Esquimalt alone; some of these undoubtedly went after placer gold, as China creek got its name from the Chinese working there, and they were also working in 1862 on Bear river, Clayoquot; in fact, as late as 1893 about thirty Chinamen were working creek claims on this river, but the following year they all left suddenly. In 1895 the Gold Commissioner at Alberni reported two placer claims and four hydraulic leases.

WESTERN MINERAL SURVEY DISTRICT (No. 6).

PLACER OPERATIONS IN 1931.

REPORT BY GEO. A. CLOTHIER, RESIDENT MINING ENGINEER (HEADQUARTERS, VANCOUVER).

Leech River Placers.—This area is reached by Canadian National Railway from Victoria to Leechtown, about 40 miles, at the mouth of the Leech river. The early days saw considerable gold taken from bed-rock, but only a little "sniping" has been done here and there for the last several years.

This season some more extensive work was undertaken toward testing the bench-gravels a short distance above the mouth of the Leech where it empties into the Sooke river. J. McDonald and associates put in a dam at a small lake and a light pipe-line from there to the river, giving a head of about 200 feet on a 4-inch monitor. A pit was started about 12 feet above the present river-bed and a cut made into the bank with the object of encountering bed-rock and following back to ascertain whether or not there is an old channel. Some 2,000 yards of gravel was sluiced, opening a cut about 60 feet, without finding bed-rock. A shaft was then sunk 15 feet from the bottom of the cut, getting water but no bed-rock. Little or no values were found in the top gravel. As water was too low for further hydraulicking it was decided to move operations farther up-stream, where a short tunnel had reached the rim-rock. The plant is now in place and another test will be made when the fall rains furnish sufficient water.

The plant is a very serviceable one for the work intended, and although the work has been disappointing in not reaching bed-rock, nothing more, so far as values are concerned, could be expected in the gravel handled.

Woolsey Bros. did some work in trenching and sluicing at the forks about 5 miles up the river, but apparently with discouraging results as the work was stopped.

Some placer prospecting is being done this year in the area at the headwaters of the Leech and San Juan rivers. Placer gold has been known in this section for many years, but so far no concentration has been found anywhere sufficient to constitute a pay-streak.

Sombrio River Placers.—These extensive gravel-deposits are situated at the mouth of and for some distance up the Sombrio river, which reaches the west coast of Vancouver island about 6 miles below Port San Juan. The Sombrio drains the area between the San Juan, Jordan, and Leech rivers and is therefore wholly contained in the geological formation known as the "Leech River formation," the oldest on Vancouver island and gold-bearing.

As described in the Annual Report for 1929, page 369, under Kootenay Central Mining and Development Co., Ltd., these gravel-beds are 400 yards wide, extend a couple of miles up the river, and at the beach are up to 300 feet thick. Many pannings taken in the numerous gullies and ravines cut into the bed by surface waters show gold values throughout the top gravel. The values have been variously estimated at from 7 cents a yard up and operating costs from 2 to 5 cents a yard. The property has all the requisites for an hydraulicking operation and the ground could be cheaply tested by the installation of a small pilot plant.

Beach Placers.—The beach-sands at Wreck bay, on the west coast of Vancouver island a few miles north of Barkley sound, and on the north coast of Vancouver island, principally on each side of the mouth of the Nahwitti river, contain fine free gold associated with the black sands. At certain times, usually after a big storm, and at certain places where there has been a concentration of black sands and gold due to wave-action, sufficient gold has been and can be extracted by ordinary placer methods to pay. An appreciable amount of gold has been recovered from the north end of Wreck bay and some places on the north coast, under such circumstances, from time to time. No process has yet been devised that will successfully treat the general run of beach-sands on a sufficiently large scale to make it a major paying operation.

PLACER-MINING IN BRITISH COLUMBIA.

BIBLIOGRAPHY.

- ATKIN, A. J. R. The Genesis of the Gold Deposits of Barkerville, B.C., and the Vicinity. Geol. Soc., London, Quar. Journ. 60; 389-393 (1904). Abst. Geol. Mag., London (5) 1; 327 (1904). Geol. Mag. (5) 3; 514-516 (1906).
- Some Notes on Gold Occurrences on Lightning Creek, B.C. Geol. Mag. (5) 2; 104-106 (1905).
- ATLIN DISTRICT BOARD OF TRADE. The Gold-fields of Atlin, B.C. 36 pp. and map. London, 1913.
- BALLANTYNE, R. M. Hand Book to the New Gold Fields. Hamilton Adams, London, 1858.
- BANCROFT, H. H. History of British Columbia. 1887.
- BATEMAN, A. M. Geology of the Fraser River Canyon and Vicinity, B.C.: Siwash Creek Area. Can. G.S. Sum. Rep., 1911; 125-129.
- Lillooet Map Area, B.C. Can. G.S. Sum. Rep., 1912; 188-210, map (1914).
- B.C. PAPERS. Government Correspondence *re* Gold Fields from 1856.
- BEGBIE, MATTHEW S. On the "Benches" or Valley Terraces of British Columbia. Royal Geol. Society Proceedings, 1870-71; 133-145 (1871). Am. Journal of Science (3) 2; 142-144 (1871).
- BEGG, ALEX. History of B.C. 1894.
- BOWMAN, AMOS. (Preliminary Report on the Cariboo Gold-bearing Dist., B.C.) Can. G.S. Sum. Rep., 1886; A 5-7 (1887).
- Mining Developments on the Northwestern Pacific Coast and their Wider Bearing. Can. Min. Rev., Vol. 5, No. 7 and No. 8 (1887).
- Report on the Geology of the Mining District of Cariboo, B.C. Can. G.S. Annual Rep. 3; C 49 pp., map (1888). Map, 1895.
- BREWER, W. M. Reports as Resident Mining Engineer, No. 6 District, B.C. In Ann. Reps.
- BROOKS, A. H. Preliminary Report on the Ketchikan Mining District. Prof. Paper No. 1, U.S. Geol. Survey, 1901, *re* Unuk River.
- BROWN, DR. ROBERT LUNDIN. Lond. Geol. Soc. Jr., XXXIX.; 125-126.
- CAIRNES, C. E. Coquihalla Area, B.C. Can. G.S. Mem. 139, 1924.
- Hillsbar Gold Claims, Yale. Can. G.S., 1923, 81 A.
- CAIRNES, D. D. Portions of Atlin, B.C. Can. G.S. Sum. Rep., 1910; 59-89 (1911).
- Portions of Atlin District, B.C. Can. G.S. Mem. 37; 129 pp., map (1913).
- CAMSELL, CHARLES. Tulameen District. Can. G.S. 1909, p. 111. Memoir 26, 1913.
- Platinum Investigations in British Columbia. Can. G.S. Sum. Rep., 1918, Part B; B 28.
- Rover Creek, Nelson Mining Division. Can. G.S. Sum. Rep., 1918; B 28.
- Platinum in Jervis Inlet, B.C. Can. G.S. Sum. Rep., 1918; B 28.
- Preliminary Report on a Part of the Similkameen District, B.C. Can. G.S. No. 936, 1907.
- Explorations in the Northern Interior of B.C. Can. G.S. Sum. Rep., 1915.
- CARLYLE, W. A. Cariboo and Fraser River. B.C. Ann. Rep., 1897.
- CARMICHAEL, HERBERT. Black Sands on Vancouver Island. B.C. Ann. Rep., 1899.
- CARMICHAEL, ALFRED. Placer Mining Methods in the Atlin District, B.C. Mines and Minerals, 27; 241-244 (1907).
- CIRKEL, F. The Bridge River Gold Mining Camp (Lillooet Dist. of B.C.). Can. Min. Inst. J 3; 21-29 (1900). Can. M. Rev., Ottawa, 18; 266-269 (1899).
- CLAPP, C. H. Memoir 96, Can. G.S., 1917: Sooke and Duncan Map Area.
- CLOTHIER, G. A. Reports as Resident Mining Engineer, No. 1 District, B.C. In Ann. Reps.
- CORNWALLIS, KINAHAN. The New Eldorado, or British Columbia. Newby, London, 1858.
- DAVIS, A. W. Reports as Resident Mining Engineer, No. 3 Dist., B.C. In Ann. Reps.
- DAWSON, G. M. Note on the Economic Minerals and Mines of B.C. Can. Pacific Ry. Report on Surveys to Jan., 1877; 218-245. Ottawa, 1877.
- Report of a Reconnaissance of Leech River and Vicinity, B.C. Can. G.S. Rep. Progress, 1876-77; 95-102 (1878).
- Glaciation and Superficial Deposits of Queen Charlotte Islands, etc. Can. G.S. Sum. Rep., 1878-79; page 89 B (1880).

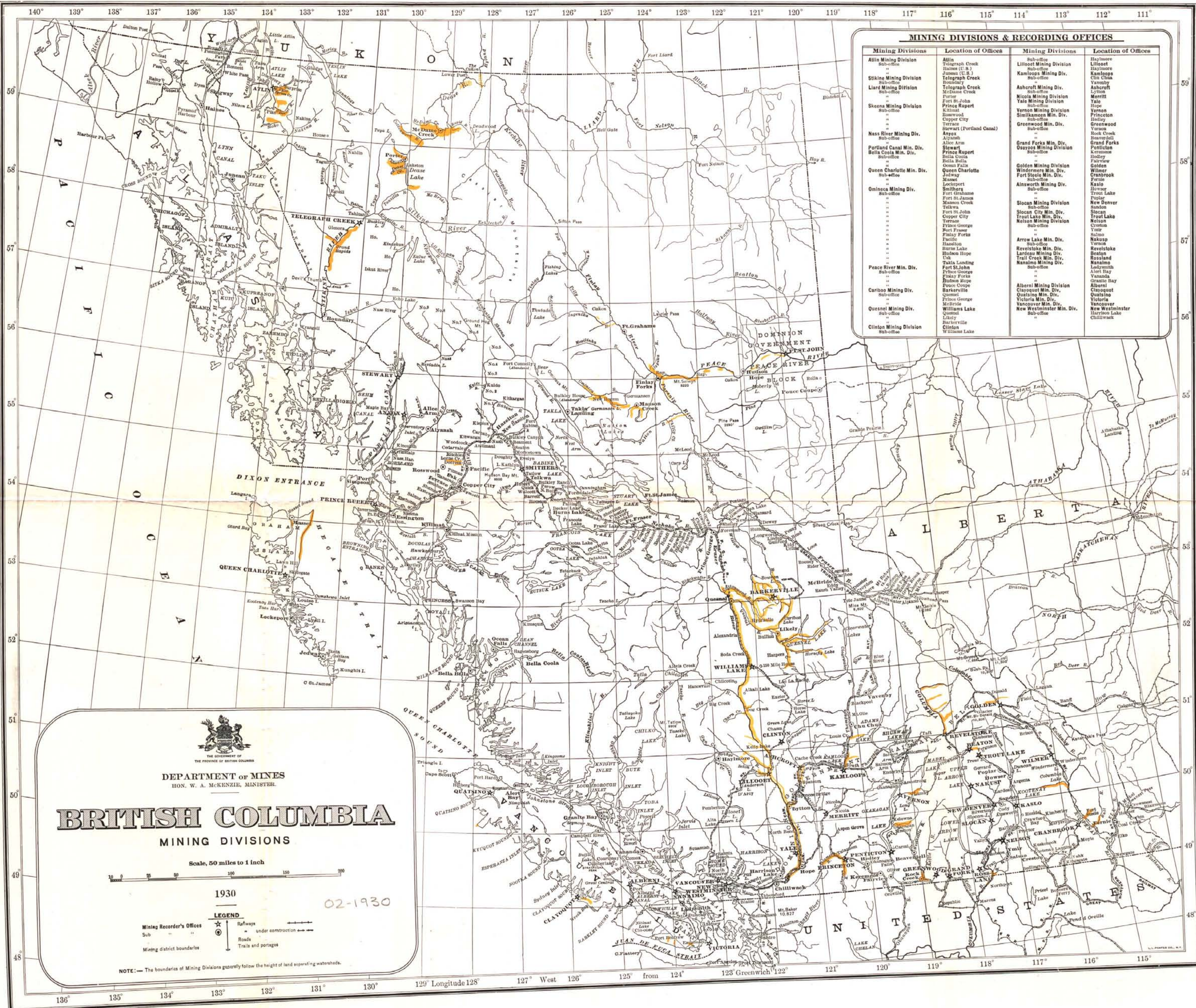
- DAWSON, G. M. General Note on the Mines and Minerals of Economic Value of B.C. Can. G.S. Rep. Progress, 1876-77; 103-149 (1878).
- On the Superficial Geology of British Columbia. Geo. Soc., London, Quar. Jour. 34; 89-123, map (1878).
- Report on the Area of the Kamloops Sheet. Can. G.S. Ann. Rep. 7; B 427 pp., maps (1895).
- Preliminary Report on the Physical and Geological Features of the Southern Portion of the Interior of British Columbia, 1877.
- The Mineral Wealth of British Columbia. Can. G.S. Ann. Rep. 3; R 163 pp. (1889).
- Notes on Hydraulic Mining in British Columbia. General Mining Association of the Prov. of Quebec, Journal, Ottawa, Ont., J 2; 173-176 (1896).
- Cassiar. Can. G.S. Sum. Rep., 1888.
- Similkameen. Can. G.S., 1877 and 8 and 1887, 8.
- DOLMAGE, V. Wreck Bay Beach Placers. Can. G.S. Sum. Rep., 1918; B 38.
- ELLS, R. W. Report on Graham Island, British Columbia. Can. G.S. An. Rep., Vol. XVI., 1906; 19 B.
- EMMENS, NEWTON W. Some Notes on Siwash Creek Section, B.C. Mining World, 34; 937-939. Chicago, 1911.
- EVANS, H. F. The Source of Fraser River Gold (B.C.). Mining and Engineering World, Chicago, 23; 258-259 (1905).
- The Similkameen and its Beds (B.C.). Mining World, 25; 399 (1906). Chicago.
- British Columbia Placers, Past and Present. Mining World, 26; 563, 687, 779 (1907).
- FREELAND, P. B. Reports as Resident Mining Engineer, No. 4 District. In Ann. Reps.
- GALLOWAY, JOHN D. Reports as Resident Engineer and Provincial Mineralogist. In Ann. Reps.
- Similkameen Mining Division. 1913 Ann. Rep.
- Cariboo Mining Division. 1914 Ann. Rep.
- Horsefly Section. 1920 Ann. Rep.
- Cedar Creek Camp. 1922, 1923 Ann. Rep.
- Lightning Creek. 1923 Ann. Rep.
- Peace River Mining Division. 1923 Ann. Rep.
- Spanish Creek. 1924 Ann. Rep.
- Cariboo and Quesnel Divisions. 1924 Ann. Rep.
- Manson Section, Omineca Division. 1924 Ann. Rep.
- Notes on the Cariboo District. Trans. Can. Inst. M. & M., 1925.
- GUNNING, H. C. Geology and Mineral Deposits of Big Bend Map-area. Can. G.S. Sum. Rep., Part A, 1928.
- GWILLIM, J. C. Report on Field Work in the Atlin District, B.C. Can. G.S. Sum. Rep., 1899 (An. Rep. No. 12); A 52-75 (1900). Can. G.S. An. Rep. No. 13, 1900; A 52-62 and map (1900).
- Notes on Atlin Gold Fields (B.C.). Can. M. Inst. Journal, 3 (1900); 97-101. Can. Mining Rev. 19; 69-70 (1900).
- Report on the Atlin Mining District, B.C. Can. G.S. An. Rep. 12; B 48 pp., map (1901).
- Characteristics of the Atlin Gold Fields (B.C.). Can. M. Inst. J. 5; 21-32 (1902). Can. Mining Rev. 21; 13-16 (1902).
- Glaciation in the Atlin District (B.C.). Journal Geology, Chicago, 10; 182-185 (1902).
- The North Thompson Valley (B.C.). Can. M.J. 31; 17 (1910).
- HAGGEN, E. A. Cariboo District of British Columbia. Mining and Eng. Record. Vol. XXVIII., No. 1 (1924).
- HEPBURN, ART. E. Gold Dredging in British Columbia. Mine, Quarry, and Derrick, 1; 187-189 (1915).
- HOBSON, J. B. The Auriferous Gravels of British Columbia. Can. Mining Rev. 14; 18-20 (1895). Gen. M. Ass. Quebec, J 2; 177-189 (1896).
- HOWAY, F. W., and SCHOLEFIELD, E. O. S. British Columbia from the Earliest Days to the Present. 1914.
- JAMES, H. T. Reports as Resident Mining Engineer, No. 1 District, B.C. In Ann. Reps.

- JOHNSTON, W. A. Placer and Vein Gold Deposits of Barkerville, B.C. Can. G.S. Mem. 149.
 — Gold-dredging Possibilities in the Barkerville Area, British Columbia. Trans. Can. Inst. Min. and Met., pp. 165-182 (1922).
 — Placer Mining in Barkerville Area, B.C. Can. Geo. Sur. Sum. Rep. 1921, pt. A; 59-71.
 — Placer Mining in Cedar Creek Area. Can. G.S. Sum. Rep. 1922, Part A.
 — Gold Placers of Dease Lake Area. Can. G.S. Sum. Rep., 1925, Part A.
- JOHNSTON, R. BYRON. Very Far West Indeed. London, 1872.
- JACOBS, E. Auriferous Gravels of Cariboo, B.C. Eng. Mining Jour., 92; 598-602 (1911).
- KEMP, F. J. Geological Relations and Distribution of Platinum and Associated Metals. U.S. G.S. Bulletin No. 193, Series A, Economic Geol. 14: (1902.)
- KERR, F. A. Dease Lake Area. Can. G.S. 1925 Sum. Rep., Part A.
- LANGLEY, A. G. Reports as Resident Mining Engineer, No. 5 District, B.C. In Ann. Reps.
- LAY, DOUGLAS. Reports as Resident Mining Engineer, No. 2 District, B.C. In Ann. Reps.
 — Cariboo and Quesnel Areas. 1927, 1928.
 — Omineca Area. 1927.
 — Fraser River Pre-Glacial. 1926.
- LINCOLN, F. C. Types of Canadian Gold Deposits. Eng. Mining Jour. 91; 470-472.
- MANDY, J. T. Reports as Resident Mining Engineer, No. 1 District, B.C. In Ann. Reps.
- MERRITT, W. H. Gold-bearing Reefs and Placers of Northern B.C. Fed. Can. Mining Inst. Jour. 3; 103-112 (1898). Can. M. Rev. 17; 74-78 (1898).
- MONCKTON, G. F. Notes on the Gold-bearing Lodes of Cayoosh Creek, B.C. Fed. Can. Mining Inst. Jour. 2; 1-4 (1897). Can. M. Review 16; 67-70 (1897).
- MILTON, Viscount W. F., and CHEADLE, W. B. The Northwest Passage by Land. London, 1865.
- MCCONNELL, R. G. (Report on a Geological Exploration of the Finlay and Omineca Rivers, Northern B.C.) Can. G.S. Sum. Rep., 1893, Ann. Rep. 6; A 16-22 (1894). Can. G.S. Sum. Rep. 7; C 40 pp. (1896).
 — Liard and McKenzie Rivers. Can. G.S., Vol. III.; A 69-71 (1888).
 — Stikine River. Can. G.S., Vol. III.; B 47-68.
 — The Law of the Paystreak. Trans. Inst. Min. and Met., Vol. XXI. (1912); pp. 593-605.
- MCCONNELL, R. G., and TYRRELL, J. B. Preliminary Note on Gold Deposits and Gold Mining in the Klondike Region, Yukon District. Can. G.S. Sum. Rep., An. Rep. II., 1898. A 55-62 (1899).
 — The Old Valley Gravels of the Klondike. Can. M. Inst., J 3; 124-127 (1900). Can. M. Rev., 19; 52-53 (1900).
 — Report on the Klondike Goldfields. Can. G.S. An. Rep. 14; B 71 pp., maps (1905).
 — Changes in Post-Glacial Temperatures in the Yukon. Inst. Geol. Congress, XI., Stockholm.
- McEVOY, JAMES. Notes on Hydraulic Mining in British Columbia. Can. Min. and Mech. Rev., Vol. XII., No. 2 (1892).
- McKAY, B. R. Cariboo Gold Fields, B.C. Can. G.S. Sum. Rep. 1918, pt. B, pp. 39-56.
 — Cariboo District, B.C. Can. G.S. Sum. Rep. 1919, pt. B, pp. 36-37.
- NASON, F. L. The Auriferous Gravels of the Upper Columbia River, B.C. Eng. Min. Jour. 61; 279-280 (1896).
 — British Columbia, The Big Bend Dist., W. Kootenay. Eng. Min. Jour. 63; 453-454 (1897).
- NICHOLS, H. G. Reports as Resident Mining Engineer, No. 3 District, B.C. In Ann. Reps.
- O'GRADY, B. T. Reports as Resident Mining Engineer, No. 5 District, B.C. In Ann. Reps.
- O'NEILL, J. J. The Platinum Situation in Canada in 1918. Can. G.S. Sum. Rep., 1918, Part G.; pp. 19.
- PALMER, H. S. Remarks on the Geography and Natural Capabilities of British Columbia and the Condition of the Principal Goldfields. Jour. Roy. Geog. Soc., Vol. XXXIV., pp. 171-195 (1864).
- PEMBERTON, J. D. Vancouver Island and British Columbia. Longmans, Green. London, 1860.
- POITEVIN, EUGENE. Platiniferous Rocks from Tulameen Map Area. Can. G.S. Sum. Rep., 1923; A 84.
- ROBERTSON, WM. FLEET. Reports as Provincial Mineralogist of British Columbia.
 — Special Reports: Atlin Area, 1900 and 1904; Lilloet Area, 1910; Cariboo and Fraser River, 1902; Horsefly Area, 1901 and 1902; Cassiar Area, 1912; Kootenay, East, Wild Horse and Perry Creeks, 1903; Peace River, 1906 and 1908; Omineca, 1908; Similkameen, 1901.

- SELWYN, A. R. C. Terrace Deposits of Fraser and Thompson Rivers. *Can. G.S. An. Rep.*, 1871-72; 54-56.
- STRETCH, R. H. The Quartz Lodes of the Atlin District. *Eng. Min. Jour.* 70; 370-372 (1900).
- TRIMBLE, W. J. The Mining Advance into the Inland Empire. *Bull. Univ. Wisconsin*, No. 638 (1914).
- TYRRELL, J. B. Notes on the Placer Mines of Cariboo, B.C. *Econ. Geol.*, Vol. 14, pp. 335-345.
- Was there a Cordilleran Glacier in British Columbia? *Jour. Geol.*, Vol. 27; 56-60 (1919).
- UGLOW, W. L. Quartz Veins of Barkerville Area, Cariboo Dist., B.C. *Bull. Can. Inst. Min. and Met.*, Nov., 1922; 1165.
- Bedrocks and Quartz Veins of Barkerville Map-area, Cariboo Dist., B.C. *Can. G.S. Sum. Rep.*, 1922, pt. A; 82-87.
- UGLOW, W. L., and JOHNSTON, W. A. Placer and Vein Gold Deposits of Barkerville, B.C. *Can. G.S. Mem.* 149. 1926.
- The Origin of the Placer Gold of the Barkerville Area, Cariboo Dist., B.C. *Can. Economic Geol.*, Vol. XVIII., No. 6; 541 (1923).
- VALLEAU, F. W. B.C. Minister of Mines' Report, 1901.
- WADDINGTON, ALFRED PENDERILL. *Fraser Mines Vindicated, or a History of Four Months. de Garro*, Victoria, 1858.
- YOUNG, ROSALIND. Mining in Atlin, B.C. *Jour. Can. Min. Inst.*, 1909; 477-494.

TABLE OF CONTENTS.

Placer-mining in British Columbia—	
General Summary, Provincial Mineralogist	5
General Geology, Provincial Mineralogist	10
Platinum, Provincial Mineralogist	13
Fineness of Placer Gold, Provincial Mineralogist	13
Methods of Working, Provincial Mineralogist	16
Synopsis of Placer-mining Laws of British Columbia	19
North-western Mineral Survey District (No. 1)—	
Historical Summary, Herbert Carmichael	23
Placer Operations in 1931, J. T. Mandy	30
North-eastern Mineral Survey District (No. 2)—	
Historical Summary, H. Carmichael	52
Cariboo, Quesnel, and Omineca Divisions, C. W. Moore	55
Appraisal of the Placer Resources of the Pacific Great Eastern Railway Lands, R. W. Brock	68
Placer-mining in 1931, D. Lay	74
Rainbow Creek Placers, Provincial Mineralogist	82
Peace River Mining Division, Notes by Provincial Mineralogist	89
Central Mineral Survey District (No. 3)—	
Notes by J. D. Galloway, Provincial Mineralogist	89
Placer Operations in 1931, H. G. Nichols	90
Southern Mineral Survey District (No. 4)—	
Historical Summary, H. Carmichael	92
Placer Operations in 1931, P. B. Freeland	94
Eastern Mineral Survey District (No. 5)—	
Historical Summary, H. Carmichael	95
Placer Operations in 1931, B. T. O'Grady	98
Western Mineral Survey District (No. 6)—	
Historical Summary, H. Carmichael	101
Placer Operations in 1931, G. A. Clothier	102
Bibliography of Placer-mining in British Columbia	103



MINING DIVISIONS & RECORDING OFFICES			
Mining Divisions	Location of Offices	Mining Divisions	Location of Offices
Atlin Mining Division	Atlin	Atlin Mining Division	Atlin
Stikine Mining Division	Stikine	Lillooet Mining Division	Lillooet
Liard Mining Division	Liard	Kamloops Mining Div.	Kamloops
Skeena Mining Division	Skeena	Ashcroft Mining Div.	Ashcroft
Nass River Mining Div.	Nass River	Nicola Mining Division	Nicola
Portland Canal Min. Div.	Portland Canal	Yale Mining Division	Yale
Bella Coola Min. Div.	Bella Coola	Vernon Mining Division	Vernon
Queen Charlotte Min. Div.	Queen Charlotte	Similkameen Min. Div.	Similkameen
Omineca Mining Div.	Omineca	Greenwood Min. Div.	Greenwood
Peace River Min. Div.	Peace River	Grand Forks Min. Div.	Grand Forks
Cariboo Mining Div.	Cariboo	Osoyoos Mining Division	Osoyoos
Quesnel Mining Div.	Quesnel	Golden Mining Division	Golden
Clinton Mining Division	Clinton	Windermere Min. Div.	Windermere
		Fort Steele Min. Div.	Fort Steele
		Alberni Mining Division	Alberni
		Revelstoke Min. Div.	Revelstoke
		Larriere Mining Div.	Larriere
		Trail Creek Min. Div.	Trail Creek
		Nanaimo Mining Div.	Nanaimo
		Alberni Mining Division	Alberni
		Clayoquot Min. Div.	Clayoquot
		Quatsino Min. Div.	Quatsino
		Victoria Min. Div.	Victoria
		Vancouver Min. Div.	Vancouver
		New Westminster Min. Div.	New Westminster
		Chilliwack	Chilliwack



DEPARTMENT OF MINES
HON. W. A. MCKENZIE, MINISTER.

BRITISH COLUMBIA MINING DIVISIONS

Scale, 50 miles to 1 inch

1930

- Mining Recorder's Offices
- Sub
- Mining district boundaries
- Railways
- under construction
- Roads
- Trails and portages

NOTE: The boundaries of Mining Divisions generally follow the height of land separating watersheds.

Principal gold-placer fields shown in yellow.