

BRITISH COLUMBIA BUREAU OF MINES

BULLETIN No. 3, 1915

THE MINERAL RESOURCES OF THE
SKEENA MINING DIVISION

AND PORTIONS OF THE
OMINECA AND QUEEN CHARLOTTE DIVISIONS

BY

W. M. BREWER, M.E.

SUBMITTED BY

WM. FLEET ROBERTSON, Provincial Mineralogist



THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:

Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1915.

BRITISH COLUMBIA BUREAU OF MINES

BULLETIN No. 3, 1915

THE MINERAL RESOURCES OF THE SKEENA MINING DIVISION

AND PORTIONS OF THE
OMINECA AND QUEEN CHARLOTTE DIVISIONS

BY

W. M. BREWER, M.E.

SUBMITTED BY

WM. FLEET ROBERTSON, Provincial Mineralogist



THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA.

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C. :

Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1915.

To the Honourable Sir Richard McBride, K.C.M.G.,

Minister of Mines.

Sir,—I have the honour to submit herewith Reports on the Mineral Resources of the Skeena and portions of the Omineca and Queen Charlotte Mining Divisions by W. M. Brewer, M.E., A.I.M.E., prepared this past season under your instructions for the Bureau of Mines.

I have the honour to be;

Sir,

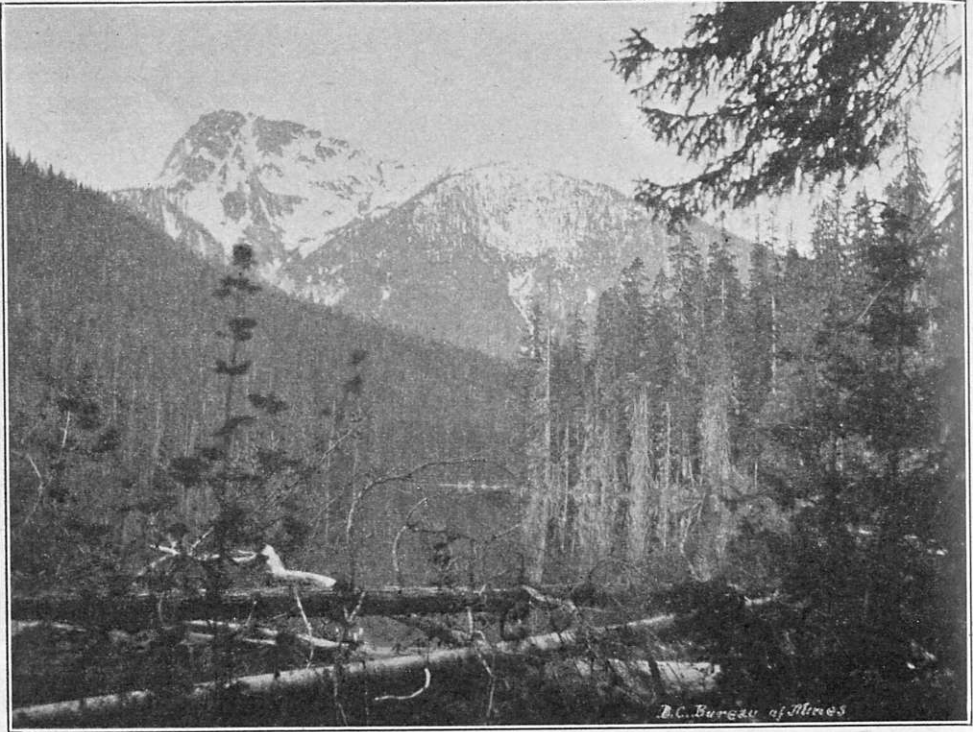
Your obedient servant,

WILLIAM FLEET ROBERTSON,

Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,

February 20th, 1915.



Summit Lake-head—Kleanza Creek.



Chesley's Ranch—Kitsumgallum.

MINERAL RESOURCES

—OF—

Portions of the Skeena and Omineca Mining Divisions.

REPORT BY W. M. BREWER, M.E.

INTRODUCTORY.



PRINCE RUPERT, the western terminus of the Grand Trunk Pacific Railway, is a distributing centre for the Skeena River and the Omineca Mining Divisions. It is the natural starting-point for any one visiting the Skeena River valley and other portions of the Skeena Mining Division, because it is the seat of Government Agency for that section of British Columbia, as well as being the ocean terminus of the transcontinental railway.

On receiving instructions from the Provincial Mineralogist, on May 17th, 1914, to make examinations of the mineral resources of the Skeena valley and adjacent mountains, a start was made from Prince Rupert and the work carried east as far as Lorne creek, a distance of 130 miles by railroad.

In the immediate vicinity of Prince Rupert the metamorphic rocks are designated by R. G. McConnell, of the Canadian Geological Survey, as the Prince Rupert formation. Originally these rocks were mostly argillaceous, siliceous, and calcareous sediments, but they have been intensely altered and converted into mica and hornblende schists and crystalline limestones, with occasional areas of diorite or gabbro. These igneous rocks were intruded prior to the folding of the region and are now represented by coarse hornblende-schists.

East from Prince Rupert the schists have an easterly dip varying from 30 to 70 degrees towards the granite batholith of the Coast range and a north-north-west strike approximately parallel to the western edge of the batholith.

The Grand Trunk Pacific Railway enters the Skeena valley proper at a point nearly opposite to Port Essington, or about twenty-five miles south-east from Prince Rupert. It then follows the valley for a distance of 154 miles from that point in a north-easterly direction to Hazelton, which was, in the past, the head of navigation for stern-wheel steamers.

For about the first sixty miles above Port Essington the rocks traversed belong to the Coast range—coarse-grained granites with some included schists, in which but few discoveries of mineral have been reported up to the present time.

Near the 95-mile post on the railroad, where the Kitsumgallum river empties into the Skeena, is apparently the eastern boundary of the main Coast range, with the Kitsumgallum valley bordering it on the north side of the Skeena and the Lakelse valley on the south side. This great trench, four to five miles wide in places, extends northward to the Nass river and southward across the Coast range to the sea at the head of Kitimat arm, and, according to McConnell, represents an old, partially abandoned valley of erosion, possibly robbed by the Skeena.

East from the Kitsumgallum a second wide range of high mountains, mostly built of schist and granite, is crossed. These connect to the south with the Coast range, and, McConnell says, may be considered a spur from it.

The examination of the mineral resources along the Skeena river and in the mountains adjacent to it on either side of the river really commenced at the Kitsumgallum river, distant from Prince Rupert ninety-five miles, and extended up the Skeena river as far as Lorne creek, or Ritchie Station on the Grand Trunk Pacific Railway, 130 miles from Prince Rupert. Before reporting in detail on the several properties examined, a brief résumé will be given of the general characteristics of this section, a small portion of which is included in the Skeena Mining Division and the remainder in the Omineca Mining Division.

The railroad-station near the mouth of the Kitsumgallum river is named Terrace. The elevation at this point is 241 feet above sea-level.

The Skeena valley, near the confluence of the Kitsumgallum, is some four or five miles wide, and is one of the best-settled sections on this division of the railroad. The settlers are, generally, giving much attention to agriculture, especially to the cultivation of several varieties of berries and vegetables, for which they find a good market in Prince Rupert and Juneau, Alaska.

The Kitsumgallum River valley narrows about two miles above the mouth, but a good wagon-road has been built on the first bench at about 200 feet higher elevation than the valley. Much of the bench land has been cleared, and is being cultivated for a distance of about six miles from the Skeena river, but beyond that point the country is heavily timbered with hemlock, spruce, white fir, and cottonwood, with occasionally areas of considerable extent covered with red cedar.

No rock-outcrops occur near the road until a point fourteen miles distant from the village of Terrace is reached, when some granite ridges are crossed, and from that point to about two miles below the head of Kitsumgallum lake the country-rock is all hornblende granite, which, in some places, has a gneissic structure; especially is this noticeable towards the head of the lake. Igneous dykes of very fine-grained rock, black in colour, often occur as intrusions in the granite.

Kitsumgallum lake, the source of the Kitsumgallum river, is a sheet of water about ten miles long north and south, by an average of two miles wide; the lake is fed from the waters of the Cedar and Beaver rivers, and their tributaries, which flow into the lake at the north end.

About two miles from the head, or north end, of the lake the rock formation changes to a garnetiferous, micaceous, hornblende-schist, then to diorite, and from that to a slate; this slate is first seen on Hall creek about one mile below the head of the lake. The line of strike of these rocks is N. 60° W. and the dip varies, but the average angle is 55 degrees towards N. 30° E.

From the head of the lake to Cedar river, its confluence with the Little Cedar, a distance of about fifteen miles, the rock formation is, apparently, for the most part metamorphic slate, but, from the wagon-road, no exposures can be seen except at some creek crossings.

No occurrences of mineral have been discovered south of a point about two miles below the head of the Kitsumgallum lake, but from that point to near Lava lake, on the summit between the Skeena and Nass rivers, about twenty-two miles farther in a northerly direction, prospectors claim to have found gold-bearing quartz, placer gold, silver-lead-zinc ores, and coal. About sixty sections have been staked for coal licences. All of these occurrences will be described later in this report.

East and north-east from Kitsumgallum lake there is a high range of mountains which forms the watershed between the lake and Skeena river, and is known locally as Goat or Maroon range. The highest peak has an elevation of at least 8,000 feet above sea-level, while several others are from 6,000 to 7,000 feet.

It is in this range of mountains that Hall, Douglas, and Clear creeks, which flow into Cedar river and Kitsumgallum lake, head, as do also Lorne, Fiddler, Hard-scrabble, and Phillips creeks that flow into the Skeena river.

The fact that the creeks mentioned were worked for placer gold some forty years ago is interesting, as well as the further fact that gold-bearing quartz is found in the mountains near the heads of these creeks.

Apparently, so far as is at present known, the boundaries of the mineral-bearing section of the west side of the Skeena river in this portion of the watershed may

be roughly outlined by a line drawn slightly west of north from the mouth of the Kitsumgallum river to Lava lake, a distance of about forty-five miles; thence north-east towards the Kitwanga river for a distance of about thirty miles; thence south-east to the Skeena river at Woodcock Station on the Grand Trunk Pacific Railroad, 145 miles from Prince Rupert, covering an area of approximately 1,200 square miles, and including all of the Kitsalas mountain range which extends in almost an unbroken chain paralleling the west side of the Skeena river.

The rocks of this portion of the Skeena River Division for the most part consist of a wide belt of volcanics, associated with some sedimentary rocks, which have been grouped together by R. G. McConnell as the Kitsalas formation. They are repeatedly intruded by gigantic dykes and stocks, and, in places, are somewhat schistose, but the alteration is nowhere so complete as in the rocks flanking the batholith on the west. Ordinarily they are greenish to purple massive rocks, spotted with large, rounded, and irregular areas of epidote, and lined along fracture-planes with the same material. The formation is made up near the batholith of porphyrites, tuffs, and coarse fragmentals, welded closely together and seldom showing traces of bedding or banding.

A narrow strip along the north-eastern portion of this mineral-bearing zone, or that portion lying between mile-posts 123 and 145 on the Grand Trunk Pacific Railway, should not be included in the Kitsalas formation, but belongs to the "Hazelton group" of McConnell. The beds of the Hazelton formation overlie the semi-crystalline Kitsalas formation. The Hazelton rocks are mostly tufaceous, but, unlike those of the Kitsalas, they are well bedded and banded and are seldom much altered, except in the immediate vicinity of intrusive masses.

On the east side of this portion of the Skeena river the mineral-bearing area, so far as present indications show, is enclosed by boundaries which approximately extend from Woodcock, on the Skeena, south-easterly to the Telkwa river; thence south-westerly across the Kitnaiakwa river to Kitimat arm; thence northerly up the Kitimat river and down the Lakelse river to its mouth, near Copper City. In this area is included the mountains adjacent to the Zymoetz and the Kleanza rivers and other tributaries of the Skeena.

The rocks in this section, generally speaking, belong to the Kitsalas formation, but in places, especially in the vicinity of the Kitnaiakwa river, there are vast belts of feldspathic sandstone and shales of a deep-red colour, as well as grey sandstone and some beds of conglomerate, which apparently belong to the Cretaceous period instead of the Triassic, in which McConnell tentatively places the Kitsalas formation.

Roughly speaking, this mineral-bearing zone has about the same extent—some 1,200 square miles—as the area already referred to on the opposite side of the Skeena river, and is, in fact, the south-eastern extension of that mineral-bearing area. The general trend is from south-east to north-west; the dip of the sedimentary rocks is at varying angles from about 30 degrees to nearly vertical, usually towards N. 29° E.

The mountains on the east side of the Skeena river, especially those forming the watershed between the Lakelse and Zymoetz rivers and between the latter and Kleanza creek, are extremely precipitous, very rugged, with narrow summits and many sharp saw-tooth-like peaks which reach altitudes exceeding 7,000 feet. The deep gulches on the northerly slopes are filled with deep snowslides until late in the summer, and in some instances glaciers have formed near the summits on which the snow and ice never disappear, but on the southerly slopes the snow usually goes off, even at high altitudes, early in the season. During the past summer, after the middle of May, the snow did not interfere below 3,000 feet elevation.

Numerous opportunities are offered for the development of water-power on several of the tributaries of the Skeena river, situated within the boundaries of this mineral-bearing zone, especially on the Zymoetz, Kleanza, and Kitsumgallum rivers, as well as on Phillips, Fiddler, Eliza, Chindemash, and St. Croix creeks. All of these streams have heavy gradients, some showing a difference in altitude of 2,000 feet between their heads and mouths, while all carry large volumes of water.

The timber-supply for lumber is fairly good; for mining timbers and fuel it is excellent. The varieties are chiefly hemlock, spruce, balsam, and cedar.

As many of the prospects are located above timber-line, it would be necessary in such cases to haul mine timbers up the mountains, sometimes to a height of 1,000 feet vertically above timber-line, with the slope of the mountain 33 degrees, but such conditions are exceptional rather than usual.

The fact that excellent crops of berries, vegetables, and hay can be raised within short distances of the locations of the mineral prospects is important, because under such conditions both the mining operator and ranchman will be mutually benefited.

The roads and trails are so located through this section of the Province that travelling is comparatively easy, so pack-horses can be taken to within short distances of the claims.

In this mineral belt on both sides of the Skeena some quite thorough and systematic prospecting has been done; forty years ago the first discoveries of placer gold were made on Douglas and Lorne creeks, while considerable work was done on quartz veins as far back as 1894, but lack of adequate transportation facilities handicapped the operations, so that from about 1898 until about 1908, when the Grand Trunk Pacific Railroad was being graded, but little prospecting was carried on. Since the latter date, however, there has been a number of energetic prospectors working along the belt. It would seem, however, from observations made during last summer, that in this field there are ample opportunities for a much larger number to engage in the work, as the discoveries made since last June prove that this mineral-bearing belt has only so far been scratched.

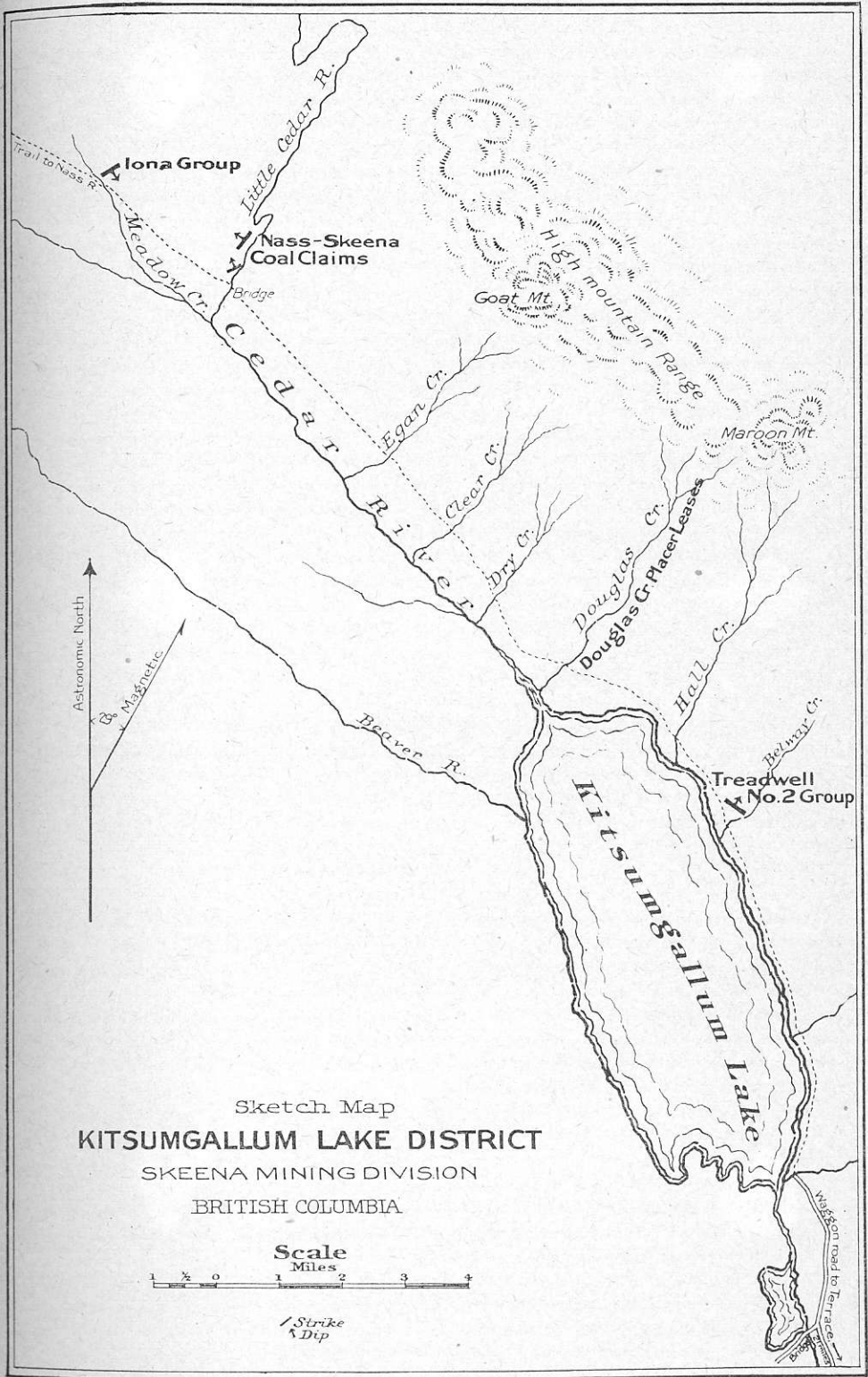
The writer is under very great obligations to many of the prospectors, especially to J. D. Wells and M. C. Kendal, of Kitsalas, and James Darby, of Usk, who were untiring in their efforts to aid him in making a thorough examination of the district.

KITSUMGALLUM LAKE.

This group consists of two mineral claims named *Treadwell* No. 2 and *Juneau*, which are owned by Joseph Belway and Alexander McLaren. This property is situated about twenty-six miles northerly from the village of Terrace, and about two miles below the head of Kitsumgallum lake. The location-line of both claims is along the east shore of the lake, with the northern boundary of the *Treadwell* No. 2 claim forming the southern boundary of the *Juneau* claim. All of the work has been done on the *Treadwell* No. 2 claim.

A short distance south from this property the country-rock becomes more gneissic and micaceous, especially near the ore-body on the foot-wall side, the change from coarse-grained hornblende granite to metamorphosed argillites and schists having taken place a short distance southerly from the southern boundary of the *Treadwell* No. 2 claim. The line of strike of the schists is apparently north, and the dip 30 degrees towards the east, but there has been so much disturbance near the line of contact that it is very difficult to decide which are the original bedding-planes and which are cleavage-planes caused by shearing and pressure. The line of strike of the ore-body is N. 60° W., and the dip where a shaft has been sunk is 55 degrees towards N. 30° E.

There is no well-defined vein-structure; the values, which are principally in free gold, occur in narrow stringers of quartz which form veinlets and lenses in a portion of the schist zone, where rather well-defined cleavage-planes are assumed to be walls. The difference between the barren schist country-rock and the mineralized schist is somewhat difficult to recognize, for apparently the only distinction is that the schist carrying values is a shade darker in colour, is more garnetiferous and has more quartz veinlets as interlamination in it. At places along the surface, the outcroppings when crushed and panned show particles of free gold, and at some other points, notably in one prospect-hole 200 feet distant from the main work and along the line of strike, N. 60° W., which also appears to be the



strike of the mineralized zone in the schist, there are narrow stringers of bornite, some stain of copper carbonates, and iron pyrites.

Judging from some old caved-in openings, said to have been made forty years ago when placer-miners were working on Douglas and Hall creeks, it was presumed that values occurred in the schist along the lake-shore, and that the line of strike followed the shore-line in a nearly north-and-south course, but this work was evidently abandoned because sufficient values could not be found to warrant continuing. A sample taken across 6 feet of this schist in the face of an old open-cut assayed: Gold, 0.18 oz.; silver, 0.7 oz. This open-cut is situated a short distance southerly from a shaft on the lake-shore referred to later in this report. Another sample taken from a narrow quartz stringer in the schist near the old workings assayed: Gold, trace; silver, trace.

A few years ago Joseph Belway, foreman of the road-gang, making a trail along the east shore of Kitsumgallum lake, in blasting the rock discovered particles of free gold visible to the naked eye. This work exposed a strata for about 60 feet along the trail that panned free gold and demonstrated that the line of strike was N. 60° W. instead of north; the width is undetermined—it may reach a maximum of 30 feet in places, judging from panning some of the outcroppings. At a shaft sunk on the lake-shore near the No 1 post of both claims an average sample taken across of 8 feet assayed: Gold, 0.42 oz.; silver, 0.5 oz. This sample was from as deep a point as could be reached, the shaft below being full of water, for the reason it had been sunk so near the lake-shore when the water in the lake was low that it had filled up when the water raised.

Close to the point where the sample was taken particles of free gold, some of them as large as pin-heads, could be easily seen with the naked eye embedded in quartz veinlets in the schist in the open-cut at the collar of the shaft, but any metallics were carefully rejected from the samples.

Development-work consisted of the shaft referred to, said to be 10 feet below the level of the lake, with an open-cut made into the rock above the collar of the shaft, about 8 feet square by 5 feet high at the face; an open-cut about 500 feet from the shaft, in a S. 60° E. direction, about 8 feet long and from 3 to 4 feet deep; an open-cut, where blasting was done in making the trail, about 50 feet long and 4 feet wide; an open-cut about 500 feet southerly from the shaft, from which the owners proposed driving a crosscut adit in an endeavour to locate the ore-body in the mountain, at a depth of about 50 or 60 feet.

DOUGLAS CREEK.

This property consists of seven hydraulic leases, each one-half mile square; the locations take in all of the creek for a distance of three miles and a half up from near the mouth. Douglas creek rises in a high range of mountains situated easterly from Kitsumgallum lake, and flows in a general south-westerly course, emptying into the north end of the lake. No evidence of former placer-mining operations were seen below a point about one mile above the mouth, which is also above the first falls on the creek, where there is a sheer drop of about 20 feet; but above that point there are quite a number of ruins of old cabins in various stages of decay, while the number of old caved-in shafts situated on the benches and the piles of old tailings are silent witnesses to the extent of the work done by the pioneer placer-miners.

The creek is some ten or twelve miles long and, except through some short canyons, will average about half a mile wide, including low benches. The grade of the creek-bed averages about 300 feet to the mile, but there are several falls of from 20 to 50 feet sheer drop.

The pioneers appear to have done good work, and must have taken out a good deal of "pay" as there are evidences that work was carried on for several seasons, which is confirmed by information received from miners who worked on this creek thirty or forty years ago; there are still a few of these men alive, notably Captain Madden, who to-day operates the Government ferry across the Skeena river at Usk.

Some prospecting done by the writer during his examination proved that there is still some "pay" in the creek-gravel, as every pan yielded one or more fairly heavy "colours," and it is quite possible that the holders of the leases will find, by systematic prospecting on bed-rock, sufficient pay to warrant hydraulic mining.

The large boulders above the lower falls, about one mile above the mouth of the creek, would seriously interfere with any dredging, but from that point down to the mouth there is a chance that dredge-mining might be carried on successfully.

During the spring of 1914 the leaseholders had some prospecting-work done on the right limit just above the lower falls, where bed-rock was reached at a depth of about 4 feet. This bed-rock is very hard, massive, and quite smooth, so that there would have been little, if any, chance for gold to be held on it. At another point about half a mile farther up the creek on the right limit a shaft was sunk last spring to a depth of 23 feet without reaching bed-rock. At that depth the water flowed in so rapidly that further sinking was abandoned; other prospect-holes were sunk with the same experience.

On the left limit of the creek above the first falls there are indications of an ancient creek-channel that might prove to carry "pay" enough to warrant hydraulic mining. Systematic prospecting is necessary to prove whether or not the gold is sufficient to warrant operations. If so, there is opportunity to obtain plenty of water at high pressure, either from the upper portion of Douglas creek or from Hall creek, which heads in the same mountain range as Douglas, and also empties into the north end of Kitsumgallum lake. The facilities for dumping tailings are good, and apparently the quantity of gravel available will amount to a very large tonnage.

LITTLE CEDAR RIVER.

In the autumn of 1913 discoveries of coal-outcroppings in the **Nass-Skeena** banks of the Little Cedar river were made by G. F. Moncton and **Coalfields.** P. Chesley, of Vancouver, who were working in the interests of a syndicate formed in Vancouver. Later some sixty sections of land were staked and licences applied for. During the past summer the locators have been employing a force of men prospecting the ground staked, and were so engaged when the camp was visited on June 3rd and 4th, 1914. Owing to the facts that the discoveries had been made so recently and the extent of the territory to be prospected within a limited time, in order to enable Mr. Moncton to decide on the sections which were the most desirable to retain, there has only been superficial work done, consisting of open-cuts where coal-outcroppings occurred; consequently the examination was necessarily very preliminary.

Little Cedar river, which has its source on the summit of the divide between the Skeena and Nass rivers, flows in a generally south-easterly direction and empties into the main Cedar river, which flows into the north end of Kitsumgallum lake. The Government trail from Kitsumgallum lake to Ayanish, on the Nass river, crosses the Little Cedar river on a good bridge about twelve miles northerly from the head of the lake, and it was near this point that the examination was made, during which much assistance was given by both Mr. Moncton and Mr. Chesley, to whom thanks are due for many courtesies.

Coal-seam No. 1.—The coal-outcroppings occur along the steep, west bank of the Cedar river; apparently these outcroppings represent six distinct seams of coal, but further work may show that some of these are duplications from folding or faulting.

So far as could be judged, the coal-measures occupy a synclinal fold and are represented by sandstones of the Cretaceous period, and belong to an isolated field, possibly extending over a width of about two miles and a half and of undetermined length.

The coal outcropping first examined occurs at an elevation of 1,000 feet above sea-level, at a point about half a mile northerly from the bridge. There, an open-cut 12 feet wide and 12 feet high at the face had been made in the river-bank about 20 feet along the strike of the coal-seam.

The strike and dip of the measures at this exposure are very difficult to determine, but appear to be as follows: Strike, N. 70° E., dipping 50 degrees towards N. 20° W.

The floor underlying the coal is a black, graphitic slate, and the roof is sandstone. There is much black shale and a parting of sandstone 12 inches thick, mixed with the coal, which has an aggregate thickness of about 4 feet in the 12-foot face. This coal may prove to be one seam as work progresses, but at the surface the sandstone-parting looked so well defined as to suggest the occurrence of two seams, the lower one being 18 inches thick; this is considered to represent the lowest seam in the field. Above this is 12 inches of sandstone, then 30 inches of coal mixed with a good deal of black shale; above this is a sandstone roof overlain by surface sand and gravel.

It is possible that much of the black shale may cut out when work is carried beyond the surface into more solid material, as after picking into the surface of the cut the percentage of clean coal was found to increase quite materially, while the percentage of shale decreased.

A sample taken across the lower coal-seam, 18 inches thick, below the sandstone-parting, analysed: Moisture, 3.6 per cent.; volatile combustible matter, 3.4 per cent.; fixed carbon, 31.4 per cent.; ash, 61.6 per cent. Another taken across the 30-inch coal-seam, above the sandstone-parting, analysed: Moisture, 4.0 per cent.; volatile combustible matter, 2.0 per cent.; fixed carbon, 45.0 per cent.; ash, 49.0 per cent.

Coal-seam No. 2.—At a point about 200 feet farther north and 60 feet higher vertically, on the river-bank, another coal-outcrop occurs which apparently represents a separate seam higher in the measures. A small open-cut has exposed a thickness of 3 feet of fairly clean-looking coal. This seam shows the same strike and dip as the seam already described; the roof and floor are both sandstone.

A sample taken across this 3 feet analysed: Moisture, 4.0 per cent.; volatile combustible matter, 2.0 per cent.; fixed carbon, 57.5 per cent.; ash, 36.5 per cent.

Coal-seams Nos. 3, 4, and 5.—Following up the river-bank in a general N. 30° E. direction, there are indications of the occurrence of three other seams, but no work had been done on any of these, so that all that could be seen was merely surface showings indicating the occurrence of coal.

Coal-seam No. 6.—About 800 yards distant from No. 1 seam in a general N. 30° E. direction, and about 200 feet higher elevation, just above a sharp bend in the river, a coal-seam outcrops that is considered by Mr. Moncton to represent the sixth seam in the series, in ascending order. While the line of strike of this seam is the same as that of the other seams, yet the dip is much flatter, being at an angle of 22 degrees.

Some work had been done to expose this seam, by open-cutting, preparatory to driving a slope on the coal, an examination of which showed that the seam was 3 feet thick, of fairly clean-looking coal lying between sandstones.

A sample taken across the 3 feet analysed: Moisture, 5.8 per cent.; volatile combustible matter, 4.2 per cent.; fixed carbon, 67.3 per cent.; ash, 22.7 per cent. The percentage of ash carried by each of the samples analysed, the results of which have been given in the foregoing, it is only fair to state, are all average samples of the thickness stated, without sorting or washing to eliminate impurities.

The following analysis is from a sample of coal brought to the Provincial Assay Office by C. F. Moncton, which he stated he took from the No. 6 seam at a later date than that of the writer's visit: Moisture, 4.0 per cent.; volatile combustible matter, 3.2 per cent.; fixed carbon, 63.8 per cent.; ash, 29.0 per cent.; non-coking.

MEADOW CREEK.

This group of claims is located about three miles north-westerly from the Cedar River bridge and on a large creek, locally called Meadow creek, because of the extensive beaver meadows along its course. The group contains four mineral claims, named as

follows: *Alta, Redo, Iona, and Montague*. A brecciated zone in the slate country-rock contains ore-bodies made up of quartz containing chalcopyrite, galena, zinc-blende, iron pyrites, and, possibly, grey-copper.

This zone has been exposed in a deep open-cut, No. 1, at an elevation of 1,250 feet, where the ore outcropped on the surface of the *Iona* claim. The brecciated zone—or vein, as it may be termed—is bedded in a graphitic slate country-rock; the dip is at an angle of 65 degrees towards the south and the strike is N. 80° W., conformable with the dip and strike of the slate.

So far as can be ascertained from an examination of the ore-bodies where they are exposed, it appears as though there was more than one, with a lenticular structure, and that the lenses lie *en eschelon* to each other, or with thin edges overlapping similar to the shingles on the roof of a house, and with wedge-shaped sections of country-rock lying between the overlapping sections of the ore-bodies.

In this open-cut the ore has been broken down from the slate foot-wall, leaving that wall exposed for the length of the cut—25 feet—along the strike. In the face, at the easterly end of the cut, the ore-body is solid and 3 feet wide, but in the westerly face the ore-body shows the indications of lenticular structure, because next to the foot-wall there are 2 feet of solid ore; then 1 foot of slate country-rock; then 1 foot of ore; then the permanent hanging-wall, which, at this point is a cherty slate. In the floor of the cut, which is about 8 feet below the surface, the solid ore is next the foot-wall and about 18 inches wide; the balance of the floor was so much covered with muck and broken rock that it was impossible to see it, consequently there may be a greater width of ore than mentioned.

Two samples of the ore exposed in the No. 1 open-cut were taken; both were from the dump, because the "ore in-place" was too hard to sample with a prospecting-pick. No. 1, a grab sample, about an average of the dump, assayed: Gold, trace; silver, 56.4 oz.; copper, 4.8 per cent.; lead, 6.1 per cent.; zinc, 19.4 per cent. No. 2, a selected sample, assayed: Gold, trace; silver, 177 oz.; copper, 9.2 per cent.; lead, 22.4 per cent.; zinc, 22.8 per cent.

The lenticular structure of the ore-bodies is also shown at a point a short distance westerly from the open-cut No. 1, already described, where another long cut (No. 2) has been made, in which is exposed a lens of ore having its line nearly at right angles to the strike of the country-rock, but the open-cut was so shallow the dip could not be determined.

An adit has been driven in graphitic slate in a N. 10° W. course, with its portal at about 50 feet lower elevation than the open-cuts. This was evidently driven in the expectation of crosscutting the ore-bodies exposed in the open-cuts, but has not yet been driven far enough to intersect the ore-body exposed in the upper or No. 1 cut, and the portal is located too far to the north to hope to intersect the body exposed in No. 2 cut, because if that body maintains continuity along its strike it lies south from the portal of the adit.

Development-work consists of an adit driven 36 feet in length. No. 1 open-cut is 25 feet in length along the strike of the ore by about 8 feet high at the face and about 12 feet wide. No. 2 open-cut is really a shallow, narrow trench 20 feet in length along the strike of the ore.

JOHNSON CREEK.

One of the tributaries of Little Cedar river, known as Johnson Egan's Claims. creek, has received considerable attention from prospectors during the past season, and some nice specimens of silver-lead-copper ores were found as float in the creek-bed, but, so far as could be learned, only one ledge had been located up to June, 1914, and that was by A. Egan, a pre-emptor, whose land is situated on the main Cedar river about eight miles from the head of Kitsumgallum lake.

These claims were not examined, as only one assessment had been done on the claims, which are situated high up in the mountain range at the head of Johnson creek, with rather deep snow covering the surface, and no trail to travel by, the trip necessitating a walk occupying over seven hours by the best walkers in the camp.

The writer was, however, informed by the owner that he had during the season of 1913 sent some samples of ore to the Government laboratory for assay. On inquiry of the Government Assayer, it was found that the samples assayed as follows: No. 1, a sample of quartz and pyrite: Gold, 0.02 oz. No. 2, a sample of quartz and pyrite: Gold, 0.02 oz.; silver, 24.2 oz.; copper, 3.3 per cent.; lead, 27.3 per cent.

MAROON MOUNTAIN.

In the high levels of Maroon mountain near the head of Hall creek, which flows south-easterly and empties into the north end of Kitsumgallum lake, is another section that was receiving a good deal of attention from prospectors during the season of 1914, and several were camped at the head of Kitsumgallum lake waiting for the snow to go off the mountain, which rises to an elevation of nearly 7,000 feet above sea-level.

Some specimens of float and surface outcroppings were shown that were said to have been found in the autumn of 1913 on that mountain which certainly looked as though the ore carried some gold associated with silver, lead, and a little copper. Of course, at the present time, the serious development of the mineral resources of this section must necessarily be slow because of lack of transportation facilities to the railroad.

LAKELSE VALLEY.

The Lakelse river flows from Lakelse lake north-westerly into the Skeena at a point about eighty-three miles from Prince Rupert, or twelve miles below the railway-station at Terrace. The Lakelse valley also includes the valleys formed at the mouths of Eliza and William creeks, which empty in at the head of Lakelse lake.

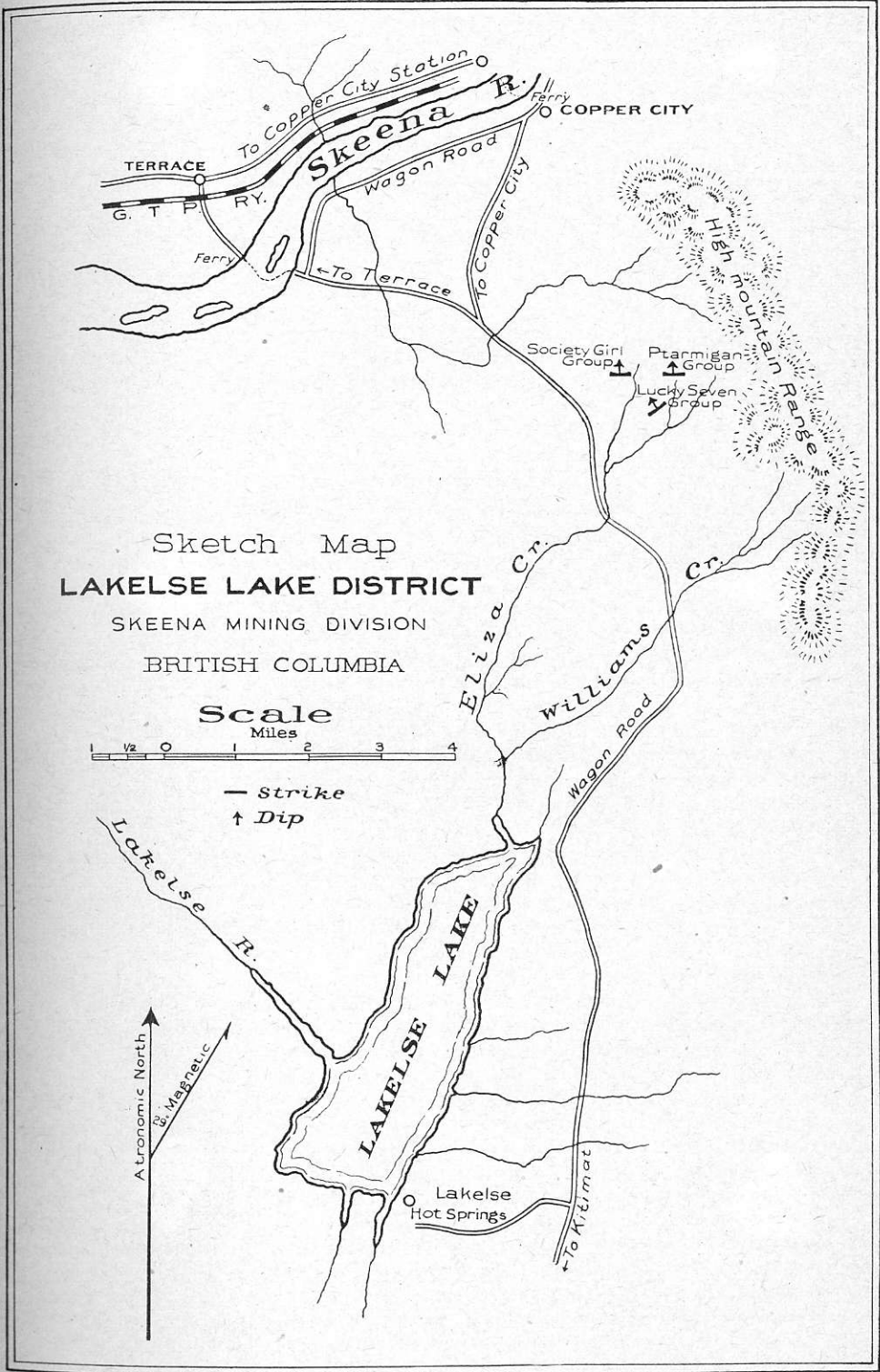
The valley in places is four or five miles wide and forms really the south-eastern extension of the wide depression which extends from Ayansh, on the Nass river, to tide-water at the head of Kitimat arm, with quite low summits between the Nass and Skeena and tide-water. Looking from the summits of the mountain range at the head of Eliza creek, a full view of this magnificent valley can be obtained, stretching from north-westerly to south-easterly farther than can be seen with the aid of a powerful field-glass.

The Lakelse valley is bounded on the north-east side by a high range of mountains known as the Thornhill mountains, in which head Eliza and William creeks with their tributaries. This mountain range forms a portion of the watershed of the Zymoetz river, and is also the dividing line between the Skeena and Omineca Mining Divisions.

Ferries across the Skeena river have been built from both
Lakelse Copper City and Terrace, while good wagon-roads extend up
Hot Springs. the Lakelse valley to the south end of Lakelse lake, where the
hot springs are located, a distance of about eighteen miles. These
springs cover an area of about half an acre and the water near the centre has a
high temperature. The elevation is 300 feet above sea-level and 16.53 feet above
Lakelse lake. The springs were discovered in 1894 by M. C. Kendal, a prospector,
while making a trip from the head of Kitimat arm to the Skeena river, but their
existence was known to the Indians at a much earlier date. Superstition is said
to have caused the Indians to avoid the locality in early days, and is said to have
marked a dividing line beyond which the Skeena River Indians never travelled to
the southward, nor the Coast Indians to the northward.

The owners, H. N. Boss and J. Bruce Johnson, have erected a commodious log
building for a hotel and bath-house. The water is brought from the springs through
an open wooden flume 1,200 feet long, and during my visit the temperature of the
water as it flowed into the bath reached 118° Fahr.

A sample taken by the writer from as near the centre of the spring as it
was possible to reach analysed as follows: Total solids, 83 grains to the gallon,
principally lime, with a little soda and magnesia in the form of chlorides and
sulphates, but contains no potash or lithia.



THORNHILL MOUNTAIN—ELIZA CREEK.

Society Girl Group. This group consists of the *Society Girl* and *Silver Belle* mineral claims, and is owned by Walter Bell and Dan Mason, of Copper City. The No. 2 post of the *Society Girl* is set at an elevation of 4,400 feet above sea-level, or 4,100 feet above, and directly overlooking Lakelse valley. The angle of declination is 32 degrees, as taken from near that post from the edge of a cliff overlooking the south slope of Thornhill mountain and the valley below. The distance from either Terrace or Copper City to the *Society Girl* group is about eight miles.

Ore-bodies.—In a pass at the summit of Thornhill mountain range, with higher peaks to the north and south, some ledges of quartz were found which contained iron pyrites, some galena, and arsenical pyrites. These ledges are very strong and persistent, and can be traced by their outcroppings along a general line of strike east and west across several bare rocky knolls for a distance—in one instance at least—of nearly 1,500 feet, but while all the indications favour the theory of continuity, yet the spaces between the bare cliffs are filled with slide-rock from the higher peaks, so it can hardly be stated that the continuity is maintained without qualifying the statement by this explanation.

The quartz-outcroppings occur on the *Society Girl* claim at elevations from 4,500 to 4,700 feet above sea-level, and open-cuts have been made at the several points where the ore outcrops.

The quartz ledge, which can be traced from point to point nearly across the claim, appears to fill a fissure at the contact between diorite foot-wall and andesite hanging-wall, with the vein material between varying in width from 2 feet 6 inches to 5 feet.

An average sample chipped off across a width of 2 feet 6 inches in one of the open-cuts assayed: Gold, 0.2 oz.; silver, 0.5 oz.

The rock which forms the hanging-wall has in many places small particles of pyrite altered to specular iron scattered through it, which has caused much discussion amongst prospectors. A sample of this rock sent to McGill University for classification is described as follows:—

“This is a cream-coloured rock of close grain, with yellowish stains on weathered surfaces, and bearing cubical pseudomorphs of black, shiny hæmatite after pyrite, up to $\frac{1}{8}$ inch in diameter. The rock presents a very striking appearance to the eye.

“Under the microscope the rock is seen to be composed entirely of feldspar and hæmatite. The feldspar includes both orthoclase and plagioclase, the former being predominant in amount. It occurs in short stumpy laths with a tendency to crystal shapes, though often showing allotriomorphic outlines. A tendency to radial arrangement is seen, but it appears to be connected only with the plagioclase, no case of radial arrangement of orthoclase being met with in the section examined. The feldspars are very fresh.

“There is no quartz in the rock, which from its structure is a dyke rock, and would therefore be called a quartz-free aplite. It shows strong affinities to the bostonites, though lacking the typical structure of that type. Field relations would help in deciding the question as to which group it should be placed in, and doubtless a chemical analysis would throw light on the question.”

Another sample taken from a wide, heavily iron-stained quartz ledge that occurs about the centre of the *Society Girl* claim assayed: Gold, 0.03 oz.; silver, 0.7 oz.

On the *Silver Belle* mineral claim, the north-west corner of which forms the south-east corner of the *Society Girl* claim, some quartz-outcroppings occur very similar in appearance, as regards mineralization, to those on the *Society Girl* claim, and suggest the occurrence of parallel ledges. These should be systematically prospected, but up to the time of the examination, all the work on the group had been confined to the *Society Girl* claim.

Ptarmigan Group. This group consisting of the *St. Paul* and *Ptarmigan* mineral claims, is owned by Fred and Bert Michand and Mrs. Firestone. The *St. Paul* claim joins the *Society Girl* on the north-easterly

side of the latter, while the *Ptarmigan* claim lies adjoining on the north-westerly side of the *St. Paul*, but at a much higher elevation, as the boundary-lines at this point cross the extreme summit of Thornhill mountain and extend down on the north slope of the mountain, which at the time of the visit was covered by a deep snowslide that also covered the open-cut work done in the summer of 1913; so that, while the *St. Paul* claim could not be examined, the *Ptarmigan* could be.

On a rocky cliff, at an elevation of 4,700 feet above sea-level and near the No. 1 post of the *St. Paul* claim, there occurs an outcropping, about 12 feet wide, of quartz containing iron pyrites, galena, and arsenical pyrites. The strike is east and the dip 46 degrees towards north.

Sighting from this outcropping along the line of strike across the adjoining *Society Girl* claim, the line intersects the points where outcroppings occur on that claim, and, although the great quantity of slide-rock that covers the low gaps between the outcroppings render it impossible to establish unbroken continuity, yet it would appear possible that this outcropping may be connected with those on the *Society Girl* claim, and be an extension of the lead.

The length of the outcropping exposed is about 30 feet, and the open-cut work had exposed a face of ore nearly 10 feet high of the same general character as that found on the adjoining *Society Girl* claim.

A typical but not necessarily an average sample of the ore-body, taken by the writer, assayed: Gold, 0.36 oz.; silver, 1.5 oz.; copper, 0.5 per cent.

This group of mineral claims is located on the south slope of **Lucky Seven** Thornhill mountain, and covers the mountain-side from an elevation of about 2,000 feet to an elevation of about 4,000 feet. The **Group.** group comprises three mineral claims—the *Diamond*, *Lucky Seven*, and *Beaver*—and is owned by Olson and Dahl, of Copper City.

Ore-bodies.—There are apparently three veins exposed on the *Diamond* and *Beaver* claims; these are designated as Nos. 1, 2, and 3. The lines of strike are nearly parallel; No. 1 being N. 60° E.; No. 2, N. 60° E.; No. 3, N. 50° E. The angles of the dips are not parallel, as the dip of No. 1 vein is at an angle of 45 degrees towards the north-west; the dip of No. 2 vein is at an angle of from 20 to 35 degrees towards the south-east; and the dip of No. 3 vein is at an angle of 60 degrees towards the south-east.

No. 1 vein outcrops at an elevation of 3,400 feet above sea-level along the west bank of a small creek which flows from the summit of Thornhill mountain through the north-west corner of the *Diamond* mineral claim. This vein is from 8 to 15 inches wide where it has been exposed in an adit drift along the strike, and the same width on the dip as exposed in a series of open-cuts which show the continuity of the vein both below and above the adit level for about 150 feet measuring along the incline of the dip, and 100 feet vertical measurement.

The ore carries iron pyrites and grey copper in a barytes-quartz gangue, and fills a fissure in a green-coloured granitoid, hornblendic rock. A sample representing an average of the ore across 8 inches in the adit assayed: Gold, 0.14 oz.; silver, 108.7 oz.

No. 2 ore-body, which the owners consider to be the main vein, occurs to the east from No. 1 vein. This outcrops in another creek that flows parallel to that on which the No. 1 vein occurs. No. 2 ore-body has been exposed on both the *Beaver* and *Diamond* mineral claims by a series of ten open-cuts for a distance of about 350 feet up the mountain-side. The lowest exposure is at an elevation of 2,700 feet above sea-level and the highest at about 3,000 feet.

The ore carries iron pyrites and some little galena in a quartz and barytes gangue. The width varies from 2 to 8 feet, averaging about 3 feet. The vein is a strong fissure in a green-coloured granitoid, hornblendic rock, and shows many indications of maintaining persistent continuity.

A sample taken from No. 6 open-cut across a width of 2 feet, representing an average of the ore-body at that point, assayed: Gold, 0.46 oz.; silver, 5.4 oz.

Several well-defined dykes of igneous rock similar to diorite occur as intrusions in the country-rock, and at one point at an elevation of about 3,000 feet a dyke cuts through the ore-body.

No. 3 ore-body occurs on the *Beaver* claim and has been exposed in an open-cut at an elevation of 2,400 feet on the side of the trail leading from the valley to the summit of Thornhill mountain. This ore-body consists of a quartz ledge 3 feet wide where it is exposed, filling a fissure in diorite country-rock. In the quartz at the point where the open-cut has intersected the lead there is no evidence of mineralization beyond iron-stains, and the owners found no values there; but at a point 150 feet lower elevation and about 300 feet horizontally in a S. 50° W. direction, where a crosscut adit has been driven 40 feet, an ore-body carrying values is exposed at the face, which is presumed to be the same as is seen in the open-cut on the mountain-side, as the line of strike, dip, and character of the vein are all similar.

From an outcrop about 50 feet lower than the adit a sample taken by the owners assayed: Gold, 0.75 oz.; silver, 6 oz.; but they did not claim that this sample represented an average of the lead.

Development-work.—On the *Beaver* mineral claim the following work has been done: An adit driven 40 feet, at an elevation of about 2,200 feet, to intersect the No. 3 ore-body; an open-cut about 6 feet long made across the same body; an open-cut about 20 feet long, exposing the No. 2 ore-body at an elevation of 2,700 feet.

On the *Diamond* mineral claim the development-work consists of: An adit, driven as a crosscut in the country-rock, 63 feet in length, at an elevation of 2,850 feet above sea-level; an adit on the No. 1 ore-body has been driven 18 feet in length as a drift at an elevation of 3,400 feet; a series of open-cuts on the No. 2 ore-body varying in length, the longest of which is No. 8 cut, in which the ore-body is exposed for 25 feet.

On the *Lucky Seven* mineral claim no work has been performed.

ZYMOETZ RIVER.

Starting from Copper City, at the mouth of the Zymoetz river—or, as it is sometimes called locally, the Copper river—a wagon-road has been constructed up the valley on the south side of the river for a distance of about two miles, where a substantial bridge spans the river. Here the road forks; the right-hand fork continues as a pack-trail along the south side of the river, while the left-hand fork crosses the river and continues as a pack-trail towards the north to Kitsalas canyon and village, the oldest settlement on the Skeena River between Port Essington and Hazelton.

The trail along the south side of the Zymoetz river continues up the river on that side for about three miles farther to the east, to a point where the river flows through a long box canyon which is spanned by a bridge that in June, 1914, had been condemned as dangerous. This portion of the trail, according to R. H. Jennings, the Road Superintendent, would be abandoned as soon as a new trail had been built on the north side of the Zymoetz river to the main bridge at the forks of the wagon-road.

After crossing on the second bridge the trail is located on the north side of the Zymoetz river for a distance of about twenty-five miles to the big bend of the river. The course of the river here changes from a southerly flow from its source near Hudson Bay mountain to a westerly course to its confluence with the Skeena river near Copper City.

The rock formation in this locality is chiefly granite and diorite, but near the 5-mile post on the trail there is a change to the Kitsalas formation, as classified by McConnell, consisting of volcanics associated with some sedimentary rocks.

The first occurrence of mineral seen occurs about half a mile east from the bridge at the head of the Zymoetz canyon, where the river forms magnificent falls with sufficient flow and head, it is claimed, to furnish about 80,000 horse-power if properly developed.

This group consists of two mineral claims—the *Copper Falls* Group. *No. 1* and *No. 2*, owned by J. D. Wells and E. T. H. Hamblet, of Kitsalas village. In a chloritic schist country-rock there are two parallel stringers of quartz containing some copper mineral. These occur in fractures having their lines of strike N. 75° W. and dipping N. 15° E. at an angle of about 50 degrees.

Although neither of the stringers is wide enough to warrant the assumption that it would pay to mine, considerable prospecting-work was found to have been done; this consisted of a deep open-cut at the outcrop and two adits, one to the east of and about 20 feet below the outcrop; the other almost directly under the open-cut and about 30 feet below. The upper adit had caved in and could not be examined; the lower adit has been driven 30 feet as a crosscut. At a point 10 feet in from the portal one of these stringers had been exposed, and 20 feet beyond, at the face, the second stringer had been cut.

Some small pieces of bornite and chalcocite were found in each of these stringers, yet a sample taken as representing the full width of about 3 inches, upon assaying, yielded only traces of gold, silver, and copper, showing that what little mineral was associated with the quartz gangue was not sufficient to make the property of commercial value.

About half a mile east from the Zymoetz falls a belt of slate was found underlying limestone, with its strike north-west and dip north-east. This limestone is also found on the south side of the river, where some mineral claims have been staked but no work done. The extent of the limestone could not be determined, as it was only exposed on the trail on a hillside for a short distance; where the trail crosses a wide flat all rock formation is hidden by the soil.

Between the 6- and 13-mile posts from Copper City no occurrence of mineral has yet been discovered on the north side of the Zymoetz, but outcroppings of copper ore have been reported on the south side.

Near the 13-mile post, where a very extensive area was burned over by a forest fire some years ago, the *Dardanelle* group of mineral claims was examined.

This group consists of four mineral claims known as the *Trail*, **Dardanelle Group.** *Trail Frac., Independent, and Dardanelle.* The owners are Archie Carmichael, James Crocker, Geo. W. Kerr, and Amos Ross. The claims are located from west to east, the *Trail* being the most westerly, with the *Trail Frac., Independent, and Dardanelle* adjoining towards the east in the order named.

Ore-bodies.—A series of fissure-veins filled with quartz containing minute particles of galena, iron pyrites, and occasionally a little bornite and copper glance, occur on this property. The country-rock is a greenstone schist, very much sheared and slickensided near the veins. There are some dykes of quartz porphyry occurring as intrusions in the country-rock, and one of these dykes at one point forms the foot-wall of a vein and the hanging-wall of another. The veins are very strong, have well-defined walls, with a few inches of talcose gouge separating the vein-matter from the walls, and the fissures cut the schistosity of the country-rock.

The work, consisting of about 100 feet of open-cuts, adit, drift, and shaft, is described later in this report. The work indicates the occurrence of four veins, with lines of strike at angles varying from each other and their dips at angles varying from 58 to 75 degrees. The line of strike of No. 1 vein is east; that of No. 2 vein is N. 70° E.; that of No. 3 vein is N. 75° E.; that of No. 4 vein is N. 65° E. The dip of No. 1 vein is at an angle of 63 degrees towards north; that of No. 2 vein is at an angle of 72 degrees towards N. 20° W.; that of No. 3 vein is at an angle of 75 degrees towards N. 15° W.; that of No. 4 vein is at an angle of 58 degrees towards N. 25° W.

These veins all occur within a comparatively narrow zone, and further work may prove that instead of four veins there are only two, or possibly only one, and that the variations in the lines of strike and the angles of the dips are due to the intrusive dykes which were observed cutting through the country-rock.

On the No. 1 vein an open-cut 18 feet in length, followed by No. 1 adit driven on the vein for 35 feet, shows a body of mineralized quartz 3 feet wide, with both walls of greenstone-schist. An average sample taken across the face of the adit assayed: Gold, 0.1 oz.; silver, 0.3 oz. Another opening, in which apparently the same vein is exposed, is an open-cut (No. 2) 15 feet long by 8 feet high at the face, situated at a point 200 feet east from the No. 1 adit and at an elevation about 50 feet higher up the mountain-side.

A quartz-porphry dyke occurs as an intrusion at this point and forms the foot-wall of the vein. The body of quartz is 3 feet wide at the face of the open-cut, but the mineralization is somewhat less. It appears as though a dyke has cut through the vein between the adit and No. 2 cut.

At a point about 15 feet south-easterly from, and on the same level as, No. 2 open-cut, but on the opposite side of the dyke, a vein occurs filled with quartz, having the dyke for its hanging-wall and greenstone-schist for its foot-wall. This vein has been exposed by an open-cut (No. 3) about 10 feet long, showing the vein to be 18 inches wide. On the same level, about 50 feet farther to the south-east, a small open-cut (No. 4) exposes another body of mineral, 3 feet wide, composed chiefly of iron pyrites in a quartz gangue, filling a fissure in the greenstone-schist.

About 10 feet south-easterly from the foot-wall of the No. 4 vein another quartz-porphry dyke occurs as an intrusion in the country-rock, and at about 100 feet in an easterly direction this dyke cuts across the vein, which can be followed by its outcroppings along the strike N. 75° E. for about 500 feet, and on the *Trail Frac.* mineral claim.

The No. 5 opening is a shaft 12 feet deep on the *Trail Frac.* at an elevation of 500 feet higher than No. 1 open-cut and adit, and about 1,800 feet distant from it in an easterly direction. In this shaft is exposed a vein filled with quartz containing some iron pyrites. The foot-wall of this vein is a quartz-porphry dyke, and the hanging-wall a greenstone-schist. The vein is well defined and averages about 4 feet 6 inches in width, with a few inches of talcose gouge separating the quartz from each of the walls. The quartz in this vein has a "ribbon-structure," and in some of it fine particles of free gold are visible. The outcroppings can be followed for some little distance along the strike on both sides of the shaft. An average sample, taken with hammer and maul across 4 feet at the bottom of the shaft, assayed: Gold, 0.22 oz.; silver, 0.8 oz.

No work has been done on the *Independent* or *Dardanelle* claims. Judging from the appearance of the vein-matter where exposed, it would appear as though it would be a good concentrating proposition, which, with an ample water-power from a near-by creek, could be operated at a minimum cost.

The samples quoted in this report, while they represented averages at the points mentioned, cannot be considered as representing the average of the whole body of mineralized quartz exposed on the property, as such sampling was not practicable.

SALMON RIVER.

The main trail from the *Dardanelle* group of mineral claims continues in an easterly direction up the Zymoetz river, some distance back on a bench which was the scene of a big forest fire in 1912.

Between the 15- and 16-mile posts, but on an abandoned trail, a belt of crystalline limestone occurs, about 200 feet wide, having diorite for the southern boundary and feldspathic sandstone for the northern. The line of strike of the strata of the limestone is N. 80° E., and the dip, where it could be seen, is nearly vertical.

From the 16- to the 18-mile post the rock formation, having been burned over, is well exposed. The rocks belong to the Kitsalas formation, as classified by McConnell, and are made up of volcanics with some sedimentary rocks.

From the 18- to the 21-mile post, near the crossing of the Salmon river, a tributary of the Zymoetz river, the trail crosses extensive flats covered with a fine growth of red cedar, with occasional specimens of yellow cedar, and on these flats the rock formation is hidden.

There are seven mineral claims in this group, named in the **The North West** order they are staked, from south-east to north-west, as follows:
Group. The *Coronation*, *Doctor*, *Lucky Four*, *North West*, *Omineca*, and *Red Seal*, with the *Hopeful* staked south-west from and adjoining the *North West* claim. The owners of the group are T. H. Large, J. Dyer, M. H. Large, and E. J. Large, of Prince Rupert. All the work has been done on the *North West* claim.

It was expected, from information received, that some of the owners would be found working on the ground, but this was not the case on June 18th, when the property was visited, as they had been there earlier and packed in supplies, but had returned to Prince Rupert for more supplies; consequently, in the search for the workings and outcroppings unaided, some may have been overlooked.

The property is situated at the head of Salmon river about four miles, in a northerly direction, from a trapper's cabin on a branch of the main trail known as the 21-mile cabin. The most important showings occur at an elevation of 3,700 to 4,000 feet above sea-level on the southerly slope of a high mountain range that forms the divide between the Zymoetz river and the headwaters of Kleanza creek. A fairly good pack-trail connects the 21-mile cabin with the camp on the property, consisting of two cabins, from which a foot-trail has been made to connect with the mine-workings, situated about a quarter of a mile distant and at about 200 feet higher elevation.

Ore-body.—An intrusive, andesitic dyke, some 120 feet in width, occurs as a bold, precipitous bluff reaching a height of more than 50 feet above a wide bench on the southerly slope of the mountain. The surface of this dyke shows many fissures which apparently maintain continuity both vertically and along their strikes. These fissures all contain such copper minerals as chalcocite, bornite, a little native copper, and a good deal of stain from copper carbonates. All the indications point to the existence of a large amount of low-grade copper ore.

The fractures vary in width from a few inches to about 2 feet, and there are several of them within a width of 70 feet. The spaces on the surface of the dyke between the fractures show considerable mineralization across the entire width of 70 feet, but across 16 feet 6 inches on the north-east side of the face of the dyke the mineralization is more pronounced than across the adjoining 54 feet towards the south-west. No blasting has been done on the face of the bluff to the south-west, although the dyke is about 50 feet wider. The remainder of the width of the dyke, about 50 feet farther to the south-west, shows practically little effect from any mineralizing agency so far as appears from an examination of the surface.

The south-east face of the dyke has been blasted off and the mineral quarried for a width of 70 feet to a height of about 30 feet. All of the material so broken down has accumulated at the foot of the bluff. This represents quite a large tonnage of low-grade ore from which could be sorted several tons of high grade, the remainder being of too low a grade to stand shipping, even if good transportation facilities existed.

It appeared doubtful whether sorting would pay, and, as it is practically impossible to mine the narrow stringers separately, an average sample was taken with a hammer and moil across a width of 16 feet 6 inches of the face of the dyke which assayed: Gold, trace; silver, 1 oz.; copper, 3.8 per cent.; showing it to represent ore of commercial grade.

The rest of the face of the quarry, 54 feet in width, was not sampled; although the mineralization there was not quite as strong as across the section sampled, yet it seemed sufficient to warrant mining if transportation and smelting facilities were favourable.

The outcroppings on the top of the bluff were followed for some considerable distance until the snow-line was reached; where the rocks were bare, the same conditions, with regard to structure and width, apparently prevailed. The dips of the fractures containing the copper minerals are vertical, while the dip at the contact between the andesitic dyke and a soft rock, resembling a black ferruginous sandstone, is at an angle of 75 degrees. The dyke cuts the strata of the slate almost at right angles, the strike of the slate being N. 70° E., with the dip of the strata at an angle of 75° towards N. 20° W.

No work was found on any other of the mineral claims belonging to the group; it was said afterwards, by one of the owners, that practically all of the work had been seen, but not all of the outcroppings.

The distance from the *North West* group northerly to the head of Kleanza creek across the range of mountains forming the divide between that creek and the Zymoetz river is only about three miles in a direct line. It is in this range of mountains

that a great deal of prospecting has been done and about thirty mineral claims located. Had the examination been made about a month later, the divide could easily have been crossed, the summit being about 5,600 feet elevation, although some of the peaks reach nearly 8,000 feet, but the snowslides were so active at the time that any such attempt would have been foolhardy.

From the bridge across Salmon river to the bridge across the Zymoetz river at the big bend, a distance of about nine miles, there have been no mineral claims reported, except near the 25-mile post, where a group of claims was located some years back. Here a bluff on the river-bank was found to contain some particles of native copper, but no work had been done, which is to be regretted, since it is possible that thoroughly systematic prospecting might have been followed by gratifying results. The country-rock crossed for about a mile between the 25- and 26-mile posts is made up of volcanics, some having amygaloidal structure and showing considerable mineralization, but easterly from the 26-mile post to the bridge at the 30-mile post the rock formation, traversed by the trail, is chiefly made up of conglomerate and sedimentary rocks, with the conglomerate overlaying red feldspathic sandstone and shale of a purplish tint.

TREASURE MOUNTAIN.

The mountain range, locally known as Treasure mountain, which rises between this portion of the Zymoetz river and Kleanza creek, presents many characteristics similar to those found on the *North West* group at the head of Salmon river. Kleanza, or Gold creek, as it is locally called, has its source in Summit lake and the several tributaries which head in the northerly slopes of Treasure mountain. A good horse-trail connects this section with the Zymoetz river and also with Kitsalas village, about twenty miles west from Summit lake.

This range of mountains, of which one of the loftiest peaks is locally called Treasure mountain, is extremely rugged, with precipitous slopes, deep basins caused by erosion, and many small watercourses flowing from glaciers on the summits. Above an elevation of about 3,000 feet there is no timber whatever; on the lower slopes there is an ample supply of hemlock, cedar, and balsam for mining, building, and fuel.

The climatic conditions are those usually found in high mountain ranges; heavy snow-storms may be expected on the summits almost any month in the year, as well as rain and fog at lower levels. Two trips had to be made into this section, as in June the danger from snowslides rendered any attempt to reach the summits impractical, but with proper camp accommodations and precautions taken to secure miners against danger from snowslides, work could be carried on during every month in the year.

The lack of transportation is the great drawback. When the Grand Trunk Pacific Railway Company had surveys made up the Zymoetz river and grading was commenced near Copper City some years ago, this section was the scene of much activity, since it would have been comparatively easy to construct a system of aerial tramways for transporting ores from Treasure mountain to the Zymoetz river. However, since the Grand Trunk Pacific Company abandoned the Zymoetz river route, the development of this mineral-bearing section has been practically at a standstill, and owners of mineral claims have been merely performing the necessary assessment-work.

This property is located on the north side of and also on the
Wells Group. summit of Treasure mountain at elevations ranging from 4,300 to 5,600 feet above sea-level. There are seven mineral claims in the group, named as follows: The *Grizzly Circus*, *Wells*, *Simmer and Jack*, *Andesite*, *Mesozoic*, *Giant Powder*, and *Imogen*. These are owned by Lee Bethuren, J. D. Wells, and Eli T. H. Hamblet, of Kitsalas. In addition to the group, there are four claims in which the same owners are also interested—the *Ethel*, *Sampson*, *Pauline*, and *Verona* mineral claims. Some of the boundaries of these join the boundaries of the group, but these last-named claims had not been included in July, 1914.

The property is reached by a branch from the main Kleanza trail, the forks being at the west end of Summit Lake. From this point the course of the South fork of the Kleanza is followed up to its head; there the trail crosses the north-east spur of Treasure mountain, in a pass, at an elevation of 4,600 feet above sea-level, descending 300 feet down the mountain-side overlooking the head of Bell creek, a tributary of the Zymoetz river, and follows around a bench in an easterly direction to the *Grizzly Circus* mineral claim, a distance of about two miles and a half.

The first mineral seen on the property was at this point, where an outcropping of quartz, heavily stained with copper carbonates, is exposed crossing a small water-course, but until some prospecting-work has been done, no material data can be gleaned as to the extent, strike, or dip, since the outcropping, as exposed, did not show its full width nor sufficient length.

From this point the trail was followed on to the adjoining mineral claim, the *Wells*; on this claim, at an elevation of 4,600 feet and about 500 feet from the north-east side line and 200 feet from the south-east end line, near a big snowslide, attention was directed to an outcrop of copper ore at the contact between two igneous rocks, one slightly porphyritic, probably an andesite porphyrite; the other a well-defined intrusive dyke very similar to the dyke described as occurring on the *North West* group.

The width of this dyke is 35 feet; a portion of it has been subjected to fissuring and shearing movements, and the fractures thus formed are filled with chalcocite and bornite ore. These fissures are exposed in a large open-cut 200 feet above where the outcroppings were first seen, and were five in number, occurring in a width of 4 feet 3 inches of dyke, and in which the aggregate width of ore is 1 foot. A sample taken from this width assayed: Gold, 0.06 oz.; silver, 6.0 oz.; copper, 13.7 per cent.

From this open-cut the line of strike of the vein followed the course of a gulch that was partially filled with a snowslide, but the owners of the property had employed men to shovel snow at several places up the gulch where open-cuts had been made in past seasons, so that it was thereby possible to form a fairly accurate opinion of the possibilities of the prospect. The difference in altitude between the open-cut where the sample referred to was taken and the summit of the dyke at the top of the gulch is 800 feet, and by horizontal distance between the two points is about 600 feet.

Sufficient outcroppings were seen to justify the conclusion that the fissured zone in the dyke maintained continuity up the gulch, but whether the ore-bodies in the fissures are persistently continuous or whether they are lenticular cannot be stated, as in so many places in the gulch the snow formed a deep covering, as it did also on the summit, except at one point where the dyke forms a bold bluff, in which outcroppings of copper minerals occur.

A long open-cut has been made across the face of the bluff referred to, which exposes mineralization in the dyke to the foot of the bluff, to a depth of 15 or 20 feet and for a width of 34 feet; this represents a diagonal, rather than a right-angle, crosscut across the face of the dyke. The fissuring in this face was pronounced, but, as the fractures were quite narrow and numerous, it seemed to be impossible to attempt to mine profitably unless the whole width that carried mineral was included.

In order to ascertain the average values represented by the mineralization, two samples were taken across the face of the open-cut; one represented a fair average across 23 feet 6 inches on the north-east end of the open-cut. This assayed: Gold, trace; silver, 0.6 oz.; copper, 0.8 per cent. The other sample represented a fair average across 8 feet adjoining and south-west from the first sample. This assayed: Gold, trace; silver, 0.4 oz.; copper, 0.5 per cent.

Owing to the snow covering the surface between the exposures of the ore in the gulch and the outcroppings last described, it was impossible to trace the connection, if any exists, between them.

The owners of the *Wells* group have confined all the work to the showings described occurring on the *Wells* claim, and, although they reported outcroppings

of ledges showing copper-bearing minerals on other claims in the group, the snow covered the surface of these claims to such a depth as to render any examination impossible.

This group of five mineral claims is located in a south-easterly **Montana Group.** direction from the *Wells* group, and about a mile and a half distant, but across the summit of another spur of Treasure mountain. Owing to the extremely bad weather during the visit to Treasure mountain, the writer was unable to examine this property, although he waited for some days, during which snow and rain storms with heavy fogs in the mountains prevailed continuously.

This group, consisting of six claims, is owned by T. H. Large, **Copper King** J. Dyer, M. H. Large, and E. J. Large, of Prince Rupert. The **Group.** property is located on the summit of the northern spur of Treasure mountain at an elevation of nearly 5,000 feet above sea-level, or about 400 feet higher than the pass at the head of the South fork of Kleanza creek. It is reached by the same trail as the *Wells* group, except that to reach the *Copper King* the traveller branches off to the north from the summit of the pass up the mountain.

The absence of all of the owners and the fact that the guide employed had never been on the property made any examination of the property impossible. From information later received from the owners, it would appear that there were outcroppings of copper minerals very similar to those seen on the *North West* and *Wells* groups, but that there had been too little development-work done to determine any material facts.

This group contains three mineral claims—the *Lake View*, **Avon Group.** *Avon*, and *Maple Leaf*, owned by R. Lowrie, of Usk—and is situated on a small tributary of the South fork of Kleanza creek about half a mile above the forks. The country-rock is a green andesite lying nearly horizontal and in places much altered. To the east there is an intrusion of granitoid rock, and, apparently, a dyke from which occurs on the *Avon* claim, about 40 feet wide, in which is much garnetite, quartz, calcite in well-defined, large crystals, and some brecciation. These rocks form the gangue material in a mineralized zone in the dyke, in which occurs the following minerals: Chalcocite, bornite, chalcopyrite, iron pyrites, and copper carbonates.

Some open-cuts had been made exposing the mineralization, but the work is insufficient to demonstrate the prospective value of the property from a mining standpoint; in fact, nothing more can be said than that on this group of claims there are such showings of mineralization as to commend the property as a prospect with possibilities.

This group contains the following-named mineral claims: **Peerless Group.** *Princess*, *Windy Zone*, *Mountaineer*, *Peerless*, *Empress*, *Wolverine*, and *Ideal*. At the time the property was visited, on July 26th, it was held under bond by Dr. Reich, of New York, together with nine other mineral claims which adjoin the *Peerless* group. This property is situated on the northern slope and extends over the extreme summit of Treasure mountain at elevations from about 2,500 to 5,000 feet above sea-level. As most of the trails were either buried deep by snowslides or had been cut across snowslides and obliterated by heavy rains and summer snow, it was a most difficult proposition to examine, because of the precipitous slope of the mountains, the many deep gulches with practically vertical sides, and immense snow and rock slides. Two attempts were made, the first in June and the second at the latter end of July, to thoroughly examine the occurrence of the ledges of mineral that have been exposed and the work done on this group, but on account of snow and fog it had to be given up after only a partial examination.

The country-rock is, for the most part, greenish- and reddish-coloured andesite. There has been very much disturbance, as evidenced by the large number of intrusive dykes, and these usually show effects from fissuring and shearing, similar to the conditions already referred to on the other groups of mineral claims in this same range of mountains. Usually the fissured zones have their lines of strike from

north-west to south-east at varying angles, but some of them strike almost at right angles to this course and indicate the occurrence of a system of fissuring radiating from some common point. The dips are nearly vertical where any determination could be arrived at.

There have been several open-cuts made to expose the fissured zones in some of the dykes. All of these fissures contain bodies of such copper minerals as chalcocite, bornite, carbonates, and some chalcopyrite in a gangue of quartz usually associated with calcite, the latter being in well-defined and often quite large crystals measuring several inches across the faces.

It was not practicable to make a systematic sampling of these several showings, from many of which very high-grade specimens of chalcocite and bornite can be obtained, but these would not represent an average of the ore-body, as it would have to be mined, as usually this high-grade ore occurs as kidneys or lenses in the fissures more or less regularly deposited throughout the gangue material. Where so many mineral showings are exposed, as is the case on this group of claims, such a systematic sampling is necessary in order to avoid misleading results.

The ore from the *Peerless* group could be transported by aerial tramway to the Zymoetz river or Kleanza creek, but the distance to the latter would be much less than to the former. The probabilities of railroad-construction along either of these streams, whether to connect with the Grand Trunk Pacific or as an independent road with its ocean terminus at Kitimat, are problems for future consideration and will depend upon the tonnage available. Consequently, it is most advisable that the mineral claims, especially where the indications for large tonnage are as pronounced as they are on the *North West, Wells, Peerless*, and other groups in this range of mountains, should be systematically developed by such work as will show the available "ore in sight," together with the values such ore will average when mined.

The opinion of the writer is that a number of the mineralized dykes in this section will produce a large tonnage of low-grade ore, and that it will be found more advisable to develop with that end in view than to attempt to mine for the high grade, which will undoubtedly produce only a limited tonnage, such as would not be as attractive to railroad-builders as the larger tonnage, although of lower grade.

SUMMIT CREEK.

Returning to the main trail up the Zymoetz river, where that river is crossed by a substantial bridge at the confluence of Summit creek, about thirty miles from Copper City, this trail was followed up Summit creek in a north-easterly direction about eight miles to the iron-ore claims located some years back by Mansel Clarke, a prospector from Prince Rupert, and later sold by him to the North Pacific Iron Mines, Limited, of Prince Rupert.

The trail follows near and on the north side of Summit creek for five miles; there the creek is crossed on a good bridge; the trail then continues along the south side of the creek to the summit and headwaters of the Telkwa river.

The mountain ranges on both sides of Summit creek are rugged, with some extensive glaciers within sight, from which rapid mountain streams flow carrying large volumes of water.

The rocks at the mouth of Summit creek are red to purplish sedimentaries, but, a short distance up the creek, granites and granitoid rocks occur with which are associated porphyrites and andesites.

The igneous rocks were found to continue to a point near the 37-mile post, where they form a contact with altered sedimentaries very much stained with iron oxide, and it is in this formation that extensive deposits of iron ore occur.

The property owned by this company is situated on the north side of Summit creek and contains nine claims covering a total area of approximately 375 acres, and extending from the creek up the south slope of the mountain from an elevation of 2,600 feet, the lowest point where the iron ore outcrops, to about 3,000 feet above sea-level. The claims comprising this property are: *The Limonite, Iron Mountain, Iron Valley, Iron Horse, Old Ironsides, Iron Stream, Iron Mask, Iron Slope, and Iron Ridge.*

These claims are located in a solid block, the first three being located along the creek from west to east in the order named, with the second three joining on the north, then two adjoining farther north, and the ninth (the *Iron Ridge*) occupying a portion of the summit of the ridge still farther north, but adjoining the *Iron Mask* on that side.

The outcroppings of iron ore near the creek-bed on the *Iron Mountain* claim were traced diagonally across that claim on to the *Old Ironsides* to the north, and from there to the west on to the *Iron Horse* claim. For the most part these outcroppings cover a very large acreage of swampy ground on a bench about 200 feet higher than the level of the creek-bed, and on the *Old Ironsides* claim the ore also covers the face of a prominent bluff which has a width of about 200 feet at the base and rises to a height of some 300 feet.

A number of open-cuts and trenches have been made at points around the boundaries of the deposit, but no drilling has been yet done to determine the depth on the swampy bench, so that there is not yet sufficient development to warrant an estimate as to the tonnage available. There is no question but that the quantity of iron ore is great, and from the examination made it is considered that the estimate of 7,500,000 tons made by John V. Rittenhouse, of Seattle, one of the owners, may not be excessive.

The analysis of the several samples indicate that this ore should be classed as a limonite rather than what is commonly known as bog-iron ore; according to Dana's classification, where the phosphorus content of the ore is a negligible quantity, such distinction should be made for the reason that a better quality of iron can be made from limonite than from bog-ore. A sample taken, representing a fair average of the solid ore in the deposit at a depth of about 15 feet and about 30 feet in from the surface outcropping, assayed: Iron, 51 per cent.; phosphorus, none; sulphur, 1.7 per cent.; silica, 2 per cent.

Another assay made from a sample submitted to the Provincial Mineralogist at Victoria by the owner gave the following returns: Iron, 50.6 per cent.; sulphur, 0.8 per cent.; phosphorus, none; silica, 1.7 per cent.

Other assays made from samples analysed by Falkenburg and Laucks, of Seattle, gave the following returns: Iron, 53.2, 53.2, and 54 per cent.; sulphur, 2.65, 1.89, and 1.15 per cent.; phosphorus, 0.0016, 0.014, and 0.002 per cent.; silica, 1.31, 1.62, and 1.04 per cent.

From the foregoing analyses it will be seen that this iron ore comes well within the "Bessemer limit" for the manufacture of steel or for car-wheel iron.

At the present time this property is handicapped by the lack of transportation, but the Grand Trunk Pacific Railway Company has had a preliminary survey made, and from that data the length of this railroad from the property to Copper City, on the main line of the Grand Trunk Pacific Railway, would be about sixty miles. The writer was informed by C. C. van Arsdol, chief engineer of the Grand Trunk Pacific Railway Company, that it was perfectly feasible to construct a railroad through this portion of the country via the Zymoetz River route for local freight-haulage, but that there were difficulties to be surmounted which made it inadvisable to incorporate that section in a transcontinental route.

The property is very favourably situated with regard to timber for mining, fuel, and a fair supply for lumber, the varieties being of hemlock and balsam, as well as some cedar. The water-supply furnished by Summit creek would be ample for all purposes, even to developing power for a plant of considerable magnitude.

Mansel Clarke, the discoverer and locator of this property, informed the writer that he had found other outcroppings of both magnetite and limonite iron ore for a distance of about nine miles in a N. 75° E. direction, or on the extreme summit at the headwaters of the Telkwa river, but could not find any deposits that would begin to approach in extent the body on the group of mineral claims examined.

GABRIEL CREEK COALFIELD.

Kitnaiakwa creek flows into the Zymoetz river from the south about three miles below the mouth of Summit creek. At the 28-mile post on the main trail near the

mouth of the Kitnaiakwa river a cable has been stretched across the Zymoetz river with a cage attached. A trail has been built up the Kitnaiakwa to its junction with Gabriel creek, and up that creek to a group of claims staked for coal.

An alternative route to this coalfield is by a trail cut from the east side of the bridge across the Zymoetz river; thence in a south-easterly direction after crossing Summit creek near its mouth to the main trail up Gabriel creek. On the south side of Summit creek a wide belt of purple-coloured shale and red feldspathic sandstone occurs, with the line of strike of the strata N. 40° W. and dip at an angle of about 50 degrees towards the north-east.

At a point in the steep northern bank of the creek at an elevation of about 2,200 feet above sea level, and about two miles and a half above the mouth of Gabriel creek, there are the outcroppings of three seams of black shale with some coal, each about 12 inches thick, with clay-partings of about the same thickness. These coal-seams occur between the red feldspathic sandstone for the roof and a clay floor which overlays a black carbonaceous shale. The line of strike of the coal-seams is about N. 30° W. and the dip is at an angle of about 40 degrees towards N. 60° E.

Some serious attempts have been made to prospect the coal-seams by driving three adits at two levels. The upper is about 40 feet above the bed of the creek and the lower is just above high-water mark. Neither of these adits were in a condition to be examined thoroughly, being nearly full of clay from caving, but the lower one was entered for a distance of 63 feet; the face of the adit, however, was apparently a considerable distance farther. This adit was started to crosscut the formation for the purpose of exposing the coal-seams that outcropped at about 30 feet higher elevation, but, judging from the material on the dump, apparently the adit had not been driven far enough to accomplish this. The adit so far as could be seen along the 63 feet examined, was driven through a sand and gravel bank most of that distance. At about 63 feet in from the portal of the adit seams of clay and black shale were exposed, but beyond that point the adit could not be examined because the walls and roof had caved. A sample of the clay was taken for analysis to ascertain if it was a fireclay, but this test showed that it was not, and that it could only be used for making ordinary red brick.

The upper workings consisted of two short adits, both driven on the same level and parallel to each other, with only a few feet intervening between the portals. Both of these had been driven under an outcropping of coal, but neither of the adits could be entered, as they were filled up by material that had caved in from the walls and roof.

At the entrance of one of these adits the three seams of shale and coal with clay partings could be seen, and from these two samples were taken which were found by analysis to contain the following:—

Sample.	Moisture.	Volatile. Combustible Matter.	Fixed Carbon.	Ash.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Coal	7.9	18.9	38.9	34.0
Shale and coal	10.0	8.5	0.1	81.4

As there had been no other prospecting-work done on any of the several claims staked, it was not possible to obtain any accurate data as to the extent of the coal-measures in this field, but apparently they occupy a narrow, isolated belt, and that their extent along the line of strike reaches to the neighbourhood of the bridge across the Zymoetz river. The geology is much hidden, but at one point on the trail a patch of grey sandstone was found with ammonite fossils. From the position of the coal-outcroppings on Gabriel creek, together with its strike and dip, it would appear that the grey sandstone underlaid the coal-seams; but at what depth is almost impossible to say until boreholes are made.

The varieties of timber present are principally hemlock and balsam, and the supply is sufficient for mining and fuel purposes for several years to come.

Gabriel creek carries a considerable volume of water, and at one point, near the coal-outcrops, at an elevation of 2,200 feet, has an abrupt fall of about 60 feet, and below the falls flows through a box canyon for a considerable distance. The difference in elevation between Gabriel creek at the falls and the Zymoetz river at the mouth of the Kitnayakwa is 1,000 feet, the distance being about three miles.

TWELVE-MILE CREEK—KLEANZA CREEK.

Twelve-mile creek flows into Kleanza creek from the south near the 12-mile post on the main trail between the village of Kitsalas and the bridge across the Zymoetz river on the Copper City-Bulkley Valley main trail.

The *Lucky Jim* group of mineral claims consists of the *Josie*, *Lucky Jim Group*, *Lucky Jim*, *Grey Wolf*, *Silver Hill*, and *Blue Bird* claims, owned by Fred Forrest and J. Gagne. The *Lucky Jim* claim, the earliest location, was staked in 1908; the *Grey Wolf*, adjoining the *Lucky Jim* on the south, was staked in 1909, and the other claims later. The discovery post on the *Lucky Jim* claim is on an outcropping of three narrow stringers containing iron, chalcocite, bornite, epidote, and chlorite.

The country-rock is a fine-grained, dark-coloured igneous rock, probably a porphyrite; apparently this is a very wide dyke, a portion of which has been sheared and fissured; there are many slickensided cleavage-planes, indicating considerable movement after the formation of the dyke. The line of fissuring can be traced for some distance in a northerly direction, but to the south is hidden by slide-rock. The lines of strike of the three main fissures vary from N. 40° W. to N. 5° E. The dips are at angles of from 55 to 78 degrees towards the north-east, N. 65° E., and N. 85° W.

Near the discovery post, where two open-cuts have been made, the fissures carrying mineral spread out in the shape of a fan. The distance between the two outside stringers is 22 feet, with the rock in the intervening space very much crushed, altered, and almost schistose, but in the floor of one open-cut, 15 feet long by 18 feet deep, the fissuring appears to have narrowed to a width of 5 feet, with the mineralization disseminated through that width. At an elevation of 1,900 feet above sea-level and 60 feet below the outcropping, an adit has been driven nearly 60 feet in a N. 5° E. course, following the strike of the middle stringer as it shows on the surface, and apparently exposing that stringer of mineral at the adit level. Towards the face of the adit the mineralization has the same appearance, as far as being disseminated through the dyke is concerned, as in the floor of the open-cut, with the fissured portion of the dyke decreased to a width of 4 feet 6 inches. An average sample taken at the face of the adit across that width showed it to contain only traces of gold, silver, and copper. Although at that particular point the mineralization is of too low grade to give the property any commercial value, it does not necessarily follow that all of the mineralized material in the drift adit is of equally low grade, but it is shown how very advisable it would be to sample the material systematically in order to ascertain what values are contained before doing further work.

There is no question but that the mineral in the narrow stringers will carry values, but it is doubted if mining operations could be profitably carried on by mining the stringers separately, or whether it would pay to hand-sort the ore as much as would be necessary.

On the *Grey Wolf* mineral claim an incline shaft has been sunk to a depth of about 16 feet below the floor of an open-cut made in the face of a bluff in such a way that the face of the open-cut is about 25 feet high, so that, with the depth of the shaft added, there is exposed a vertical section of an igneous dyke about 40 feet high.

This dyke is wide and appears to be very similar in composition, as well as in appearance, to the dyke occurring on the *Lucky Jim* claim, but the fissuring is not as pronounced, for on the *Grey Wolf* there is only one fracture, 12 inches wide, filled with quartz stained by iron and copper minerals. Occasionally particles of chal-

coelite and bornite are found in this so-called vein, but, judging from an average sample taken across it, the mineralization is not sufficient to make it of any value; where sampled, an assay showed only traces of gold, silver, and copper.

FIVE-MILE CREEK.

Between the *Lucky Jim* group and Five-mile creek, which flows into Kleanza creek near the 5-mile post from Kitsalas, no mineral claims had been staked, but there was a camp near the 9-mile post from which a party of prospectors was endeavouring to locate the leads that carried the ore from which pieces of well-mineralized float had broken off and been washed down the mountain streams, but at the time visited the prospectors had not reported any success.

The 5-mile post on the main trail is at an elevation of 1,600 **Five-mile Creek** feet and 700 feet above the level of the bed of Kleanza creek.

Hydraulic On the creek almost directly below the 5-mile post I found some
Leases. placer-miners at work on a hydraulic lease owned by M. C. Kendal, J. D. Wells, J. Gagne, and Glenn Searle. This ground has been worked successfully, in a small way, by Kendal for the past three or four years, but during the season of 1914 it was the intention of the owners to prepare the ground ready to be worked on a larger scale by piping with water under pressure.

The work being done when the property was visited was cutting a drain-ditch through an old creek-channel, and ground-slucing the gravel from this through sluice-boxes in which some fairly coarse gold-dust was being saved. The drain-ditch is to be used to divert the water from the present main channel in order to leave the bed dry. Then a large bed-rock flume will be installed and the gravel in the present bed of the creek washed through it. As this portion of the creek-bed has been sufficiently prospected to establish the probable value of a cubic yard of gravel, the owners anticipate profitable results. The rim-rock on the north side of the creek, where it has been exposed by placer-mining operations, was covered by about 5 feet of gravel; this it is expected will be about the average depth to bed-rock in the channel, which is about 100 feet wide. The bed-rock is a green chloritic, feldspathic rock slightly schistose, probably an andesite, with its line of strike north and south. The grade of the creek-bed is sufficient to furnish good dumpage for tailings.

The water to be used for hydraulicking will be taken from Five-mile creek, at 700 feet higher elevation than the bed of the river, and about half a mile distant.

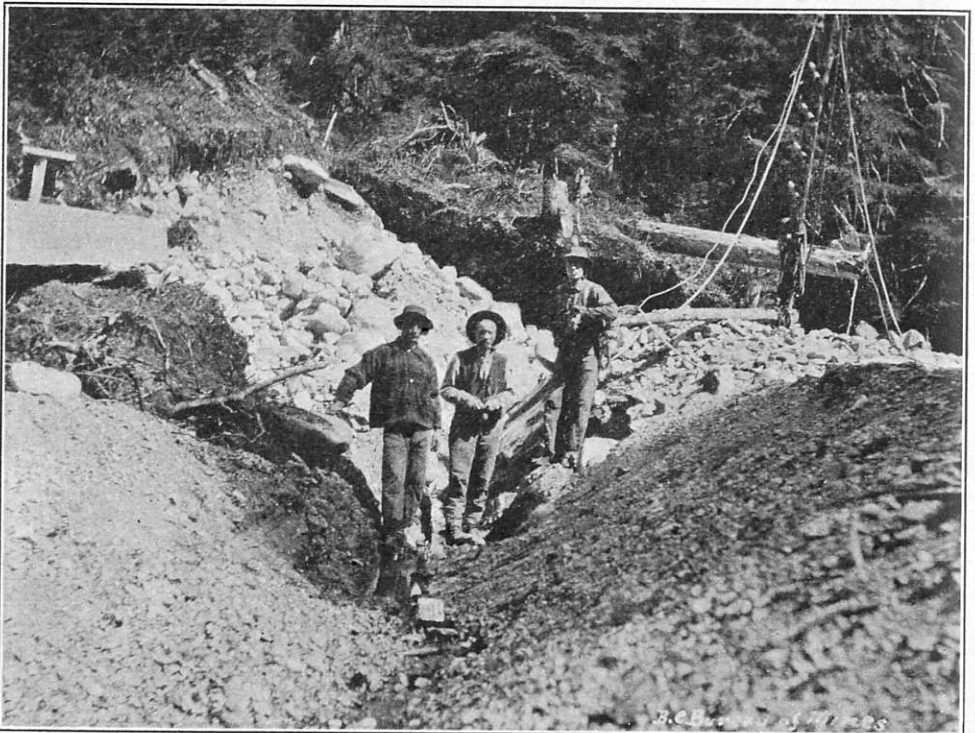
This group of claims is situated three miles east of Kitsalas, **Golden Era** on the southern spur of Bornite mountain, and consists of the
Group. *Golden Era* and *Chloride*, adjoining claims. The property is owned by J. D. Wells, Dyer and Chrystal, of Kitsalas. A vein, containing arsenical and iron pyrites, in a quartz gangue outcrops on the *Golden Era* claim at an elevation of 1,700 feet and about 500 feet north from the southern boundary and close to the dividing line between the two claims. This vein is a well-defined fissure in a diorite country-rock, with good walls and about an inch of talcose gouge separating the vein-matter from each wall. The foot-wall near the vein is slightly gneissic in structure, but the hanging-wall is massive.

The line of strike of the vein is N. 40° W. and the dip is at an angle of 40 degrees towards N. 50° E., or into the mountain-side. An open-cut has been made in which the vein, 18 inches wide, is exposed in the face for 10 feet high and 12 feet long. By the outcroppings the extension of this vein can be traced towards the south-east for a distance of about 200 feet on to the *Chloride* mineral claim adjoining. A sample, typical of the ore-body, but not to be considered as an average, assayed: Gold, 0.26 oz.; silver, 1.4 oz.

An open-cut has been made on the *Chloride* claim about 200 feet south-east from that on the *Golden Era*, in which the vein is exposed, and also a dyke of mica lamprophyre which cuts across both the country-rock and vein at right angles to the line of strike. The width of this dyke has never been determined, nor has any prospecting been done to find the vein on the south-easterly side of the dyke, where the overburden of slide-rock and debris is quite deep.



Cassiar M. Co.'s Hydraulic Plant—Kleanza Creek.



Five-mile Creek Hydraulic Mine—Kleanza Creek.

A second vein has been exposed in a shallow open-cut on the *Chloride* claim about 20 feet higher than the one already mentioned, but so little work had been done on this, and as there were no natural exposures of outcroppings, it was hardly possible to form any reliable opinion about it. Apparently the hanging-wall of the *Golden Era* vein is the foot-wall of the second vein, the filling of which is chiefly iron pyrites with a little azurite and malachite in a quartz gangue. The line of strike and dip of this vein conform with those of the *Golden Era* vein.

The examination of this group of mineral claims left the impression of the advisability of doing more thorough and systematic prospecting in this section, as the geological formation is favourable and the transportation facilities are good.

The *Ibex* mineral claim is situated on the south side of
Ibex. Kleanza creek, almost due south from the *Golden Era* group, and about three miles easterly from Kitsalas. The claim extends from the creek-bed up the mountain-side to the south; the owners are Moody, Richardson, and Scott, of Kitsalas, and R. H. Jennings, of Prince Rupert.

An outcropping of mineral, consisting of iron pyrites associated with copper minerals and galena in an andesite dyke, occurs at the foot of a steep bluff close to the bed of the creek on the south side. The minerals appear as replacements in the dyke rather than as vein-matter in a fissure. There are no well-defined walls, and although outcroppings are found for a distance of some 20 feet along a line of strike, the extent cannot be determined until more work has been done. This has been attempted at a point some 50 or 60 feet up the steep bluff where a short adit has been driven, but so far with only partially satisfactory results. An open-cut has also been made near the level of the creek-bed. A sample, representing sorted ore from the dump at the open-cut, assayed: Gold, 0.12 oz.; silver, 3.5 oz.; copper, 3.8 per cent.

This company, which was organized in 1911, has acquired an
Cassiar Hydraulic Mining Co. hydraulic lease extending for half a mile in length along Kleanza creek, where the bed and bars on each limit average about a quarter of a mile wide. This lease commences at the falls situated about two miles above its confluence with the Skeena river at an elevation of 100 feet higher than the mouth. The officers of the company are Angus St. Marie, general manager; Thos. Falcon, secretary; and Lee Bethuren, superintendent.

Kleanza creek was the scene of placer-mining operations about forty years ago, when the work was carried on with ordinary sluice-boxes by men shovelling in the gravel from the bars on each limit, but there was too much water in the creek and bed-rock proved too deep for hand-work.

Since the Cassiar Hydraulic Company began operations by the installation of machinery in 1912, various causes, such as high water in 1913 which washed away a considerable length of the flume, have delayed the company from doing actual mining until this past summer, when it was expected, in June, that the results would prove satisfactory. During July, however, the heavy, continuous rains and consequent high water prevented mining. Preparations had been made to bed-rock flume the bed of the stream by the construction of a log dam across it to divert the water from the main channel into a drain-ditch 400 feet long, of an average depth of 10 feet, and width of about 10 feet, but the stream rose so high that the water flowed over the dam, and the construction of the bed-rock flume could not be begun until late in the season.

Instead of constructing a flume from far enough up the creek to bring water with sufficient pressure to hydraulic direct, the company installed a pumping plant, driven by water-power, and the stream used for hydraulicking is pumped through the pipe-line under a pressure of 85 lb. through a 3-inch nozzle.

The pumping plant consists of a 36-inch Worthington centrifugal four-stage pump run by a 42-inch turbine wheel. This pumps the water into a pipe 14 inches in diameter, which is reduced down to 10 inches at the giant, tipped with either a 3-inch, 3½-inch, or 4-inch nozzle; there is also a 10-inch hydraulic elevator. The water to drive the turbine-wheel is brought through a flume 700 feet long by 8 feet

wide by 4 feet high, with a grade of $\frac{1}{2}$ inch to 12 feet. The pumping plant is built in the creek-bed at the head of a box canyon, where a fall of 24 feet in the creek affords most excellent dumpage facilities.

The bed-rock is heavy clay overlying a granitoid rock, but, as it has only been exposed in three places in the drain-ditch, no estimate can be made as to its average depth. In one place, on the bar on the north side of the creek near the falls, this clay bed-rock was reached at a depth of about 5 feet. A shaft was then sunk in the clay a depth of 15 feet, when granitoid rock in-place was exposed, and, as no placer gold could be found in the clay or on the rock, it was taken for granted that the clay was the permanent bed-rock along that portion of the stream.

The rock formation changes about a quarter of a mile above the canyon to a metamorphosed argillite, and above this point the gravel-bar on the right limit of the stream is about 30 feet high, but above bed-rock carries small values. The gravel-bar is much shallower from there down the stream.

The placer gold found in the river is quite coarse; boulders are found in considerable quantity, but not very large, and are easily handled with derricks.

O.K. MOUNTAIN.

This is the local name given to a lofty peak on the south side of Kleanza creek, because, when the snow partially covers the northern spur, the two letters "O.K." are distinctly outlined. Outcroppings of free-milling, gold-bearing quartz were discovered near the base of this mountain some years ago, and the *Golden Crown* group of mineral claims was located.

This group is situated on the opposite side of the Skeena river from the Grand Trunk Pacific Railway about two miles from Kitsalas, and consists of the following-named mineral claims: *The Ruby, Golden Crown, Granite, Lucky Jim Frac., and Noble Five*, owned by J. D. Wells and associates, of Kitsalas. There are apparently three distinct veins on the *Golden Crown* claim, with their lines of strike and dips nearly parallel. These veins are in a sheared zone in the Coast granite which has been much disturbed and faulted by intrusive dykes of mica lamphrophyre, as classified by the Canadian Geological Survey. These dykes are found crosscutting the veins as well as paralleling their lines of strike, and usually dipping at nearly the same angle and in the same direction as the veins. The No. 3 vein is the highest in the series. Its line of strike is N. 40° W. and its dip is at an angle of 40 degrees towards N. 50° E.

At an elevation of 575 feet this vein has been exposed in the No. 4 adit, driven 12 feet along the vein, which is fairly well defined and filled with iron pyrites in a quartz gangue. There is an average width of 2 feet of this quartz exposed in the roof and face of the drift, of which an average sample across the face assayed only traces in gold and silver.

About 150 feet south-west from, and on about the same level as No. 4 adit, the Nos. 1 and 2 veins are exposed in the No. 3 adit. This is driven for a distance of 75 feet in a general southerly course along the veins, both of which are exposed for the length of the adit, and form a junction near the face where the width of quartz is 2 feet, with granite for the hanging-wall and an igneous dyke for the foot-wall, dipping at an angle of 40 degrees towards the east. The igneous dyke parallels the strike of the vein and forms the hanging-wall for about 30 feet from the portal, when the veins appear to cut through it, and it is the foot-wall from that point to the face, appearing to continue as such beyond. The country-rock through which this adit is driven is very much disturbed and broken up, and each of the veins in the drift is only a few inches wide until they unite at the face.

The No. 2 adit is driven at a somewhat higher elevation than No. 3, and apparently exposes both Nos. 1 and 2 veins; also an igneous dyke, similar to the one seen in No. 3 adit, paralleling the strike of the veins for about 15 feet, beyond which the dyke appears to cut out, leaving the country-rock very much less disturbed, and, in the face, a short distance farther, the two veins have formed a junction with the line of strike N. 40° W. and dipping at an angle of 29 degrees towards N. 50° E.

There is, at the face of the adit, quartz of a width of 4 feet between well-defined granite walls, with a few inches of gouge on each wall. An average sample taken across 4 feet of quartz at the face of the No. 2 adit assayed: Gold, 0.12 oz.; silver, 1.1 oz.

The following is a list of assays said to have been made by Allan McCullough, B.A., of Tacoma, Wash., U.S.A., from samples that J. D. Wells, the owner of the *Golden Crown* group, informed me he had taken from various points in the workings on the Nos. 1 and 2 veins:—

Sample No.	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
24	0.35	5.10	Trace.
25	0.49	1.00	Trace.
26	0.16	Trace	<i>Nil.</i>
27	0.18	<i>Nil.</i>	0.40
28	Trace	<i>Nil.</i>	<i>Nil.</i>
29	0.17	0.20	0.20
30	0.38	0.20	0.50

At an elevation of 775 feet the No. 1 adit has been driven in for 115 feet; at the portal there is a quartz-outcrop 5 feet wide, between well-defined granite walls; the quartz carries small particles of free gold and iron pyrites.

The course of the adit for 20 feet is S. 50° E., and from that point to the face, 95 feet beyond, it is S. 35° E. These courses correspond with the line of strike of the fissure, assumed to be the No. 1 vein. At a point 10 feet under cover from the portal of the adit the vein splits, and two veins are exposed in the drift for a short distance. As the lower or No. 1 vein appeared to be the stronger, the course of the adit was slightly changed to conform with its line of strike, and at the point where the turn was made an incline winze has been sunk on the vein 14 feet, following the foot-wall at an angle of 21 degrees, which is 20 degrees flatter than at the portal.

The width of quartz gradually becomes narrower from the portal to the split in the vein, where the No. 1 vein is 18 inches wide, and continues to hold that width in the winze as well as along the strike for 30 feet beyond the turn in the adit, when, 6 feet farther, it decreases to 6 inches wide, where an igneous dyke intrudes. The adit has been driven through this dyke, which is 18 feet wide, and beyond it, for a distance of about 40 feet. The fissure, corresponding with the No. 1 vein, continues through the dyke to the face of the adit, but the vein-matter appears lean and is only about 6 inches wide. Near the face the quartz carries iron pyrites and the walls of the vein are 12 inches apart. A sample taken across 18 inches at a point 50 feet under cover from the portal, where the width of the vein commences to decrease, assayed: Gold, 3.32 oz.; silver, 4.5 oz.

The extreme apex of this vein, so far as the open-cuts show, outcrops at a point about 300 feet easterly from the No. 1 adit, and about 150 feet higher elevation. From the variable values of the samples as shown by the assay returns, it is evident that a very systematic and careful sampling is necessary in order to demonstrate the commercial value of the property, as well as to determine the best method of treatment for the ore. There is an ample supply of water in the Kleanza creek that can be economically developed to furnish all of the power necessary to run a fairly large plant. The timber-supply, consisting principally of hemlock and cedar, is quite plentiful and accessible.

An aerial tramway about two miles in length could easily be constructed to transport ore to the railway-track on the opposite side of the Skeena river below Kitsalas canyon, if such policy was deemed advisable.

BORNITE MOUNTAIN RANGE.

The area, bounded on the west by the Skeena river from Kitsalas canyon to the mouth of Chindemash creek, on the north by Chindemash creek, and on the south

by the lower portion of Kleanza creek, is covered by a range of high mountains locally called the Bornite range. This name was given to these mountains because, about 1890, pieces of float of bornite-copper ore were found by hunters and trappers in some of the watercourses and slides at high altitudes. These discoveries encouraged prospectors to search for the source of the float, and, later, to the location of several groups of mineral claims on the western and northern spurs of the mountain range. Amongst the earlier of these locations were the *Emma*, *Four Ace*, *Ptarmigan*, and *Toulon*. On all of them a considerable amount of development-work was done previous to 1900, but, because of lack of transportation facilities, work was discontinued after Crown grants were obtained, and the properties have remained idle until the present day.

The construction of the Grand Trunk Pacific Railroad revived prospecting since 1910, resulting in the location of the *Continental* group and several other claims on the Chindemash.

This group of claims consists of the *Ptarmigan*, *Ptarmigan Ptarmigan* No. 2, *Arden*, *Blue Grouse*, *Fedora*, *Emerald*, *La Tosca*, *Missouri*, *Tandem Frac.*, and *Transit*. Crown grants were obtained several years ago after a large amount had been spent, but no work has been done since 1902. The property is at present owned by Mrs. S. A. Singlehurst, of New York, who, it is reported, visited it during the summer of 1913 in company with a mining engineer, and, after an examination had been made, expressed the intention of resuming operations when the railroad company had established a regular freight service.

In the Report by the Minister of Mines for 1901 there is a description of this property by Herbert Carmichael, then Provincial Assayer.

The *Ptarmigan* group is situated near the summit of Bornite mountain at an altitude of 5,000 feet and about four miles from Kitsalas in a north-easterly direction. There was a wagon-road constructed about 1902 to connect the claims with the village, and, later, a small shipment of ore was hauled over this road, and transported for treatment, by the Hudson's Bay Company's sternwheel steamer to Port Essington; thence by the S.S. "Boscowitz" to Vancouver, where it was transhipped to the Tacoma smelter. So far as can be learned, there is no record of the values contained in this shipment, but such would have had to be exceptionally high to stand the expense of transportation alone, without considering the costs of mining and smelting.

Outcroppings of galena, bornite, and chalcopyrite in a quartz gangue fill a vein in an igneous rock resembling diorite. The strike of this vein is north and the dip 75 degrees towards the east. The width of the vein varies approximately from 2 to 4 feet.

A shaft has been sunk to a depth of 130 feet, with crosscuts and drifts from the 30-, 60-, and 100-foot levels. At the 30-foot level the drift to the north is 20 feet long and to the south 25 feet; at the 60-foot level the drift to the south is 16 feet long; at the 100-foot level drifts to the north and south total 60 feet in length. In addition to this work there are a number of open-cuts on the surface.

This property consists of the *Emma*, *I.X.L.*, and *Boot Jack Emma Group*. mineral claims, owned by the Skeena River Mining Company, and is situated on the east bank of the Skeena river in the foot-hills of the Bornite mountain range, about half a mile north from the Government ferry across the river to Usk Station, on the Grand Trunk Pacific Railroad, and at the end of the wagon-road connecting Usk with the village of Kitsalas.

At a point 500 feet above sea-level, or 200 feet above the Skeena river, and 1,300 feet east from the river-bank, where the side of the mountain is quite steep, there is outcropping a fissure-vein filled with quartz mineralized with bornite, iron pyrites, and chalcopyrite, lying between well-defined walls, with a few inches of gouge between each wall and the vein-matter. The rock forming both walls is a slightly schistose, close-grained porphyrite.

A few feet below this outcrop a drift adit was driven in 1897 for about 170 feet along the strike of the vein, which is to the east, the angle of the dip being

47 degrees towards the north. In this the vein is not well exposed from the portal to a point 65 feet in because of the timbering; however, sufficient of this ore-body was visible to indicate its continuity. From there to the face of the adit is not timbered, so a close examination could be made. For the first 25 feet beyond the timbering a dyke appears as an intrusion, but beyond the east contact between the dyke and the country-rock the vein-structure is very regular and well defined. The ore-body as here exposed is more than 6 feet wide; at the face of the adit the quartz is narrower and, instead of one body, is divided into several narrow stringers, the widest being about 15 inches, with brecciated country-rock between, but the fissure with well-defined walls remains persistent, and indicated that the quartz in the vein probably had a lenticular structure, with the lenses lying *en eschelon* in the fissure.

As it was not feasible to systematically sample the vein because of the timbering, a fairly average sample was taken from a dump of about 200 tons at the portal of the adit; this sample assayed: Gold, 0.3 oz.; silver, 1.9 oz.; copper, 3.3 per cent.

Three other samples, assayed by Allan McCullough, of Tacoma, the samples having been furnished by the owners, I was reliably informed showed the following values:—

Sample No.	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
1	0.44	Nil.	8.70
2	1.04	0.40	Trace.
3	1.08	Trace	5.90

The vein as exposed in the *Emma* mineral claim is concealed by underbrush until the eastern boundary of that claim is reached at the No. 1 post of the *I.X.L.* claim, at an elevation of 1,000 feet. Near this post there is an extensive outcropping of quartz mineralized with bornite, iron pyrites, and copper carbonates.

An open-cut had been made on this outcropping, exposing a vein from 6 to 10 feet wide, with its line of strike S. 80° E. and apparently dipping at an angle of 58 degrees towards S. 10° W.; but, as there were evidences of local disturbance in the country-rock formation, these directions may prove to be inaccurate when further work is done. A sample representative of the vein-matter, but not taken as an average, assayed: Gold, 0.02 oz.; silver, 8.4 oz.; copper, 6 per cent.

This group contains four Crown-granted mineral claims and **Four Aces Group.** a fractional claim, owned by P. Hickey, of Victoria; John Flewin and George Rudge, of Port Simpson. The property is adjoining the eastern boundary-line of the *Emma* group, at a much higher altitude, on the western spur of Bornite mountain, the westerly portion of the property being at an elevation of 1,900 feet above sea-level.

I found a series of quartz-outcroppings along a general south-easterly course, the widest being 15 feet, which development-work may prove to represent a vein with unbroken continuity. The country-rock is a green andesite and has schistose structure; this structure is quite pronounced near the fissure, which is fairly well defined at the point where development-work has been done near the western boundary of the property.

Several open-cuts were made previous to the issuing of Crown grants about 1902; many of these were found to be more or less filled from caving, but sufficient could be seen to justify the opinion that the property is well worth systematic development, now that transportation facilities are available.

A systematic sampling of all the showings was not possible because of the caved condition of many of the cuts, but a representative sample of the quartz vein-filler where it was 15 feet wide assayed: Gold, 0.03 oz.; silver, 3. oz.

CHIMDEMASH CREEK.

This group of Crown-granted mineral claims comprises the **Toulon Group.** *Portland, Toulon, Mona, Bull Dog, and Montezuma,* owned by the Bornite Mining Company of Portland, Ore., and situated on Chimdemash creek, about 7,000 feet east from the Skeena river. The property is reached

by a good horse-trail connecting with the Usk-Kitsalas wagon-road; the nearest station on the Grand Trunk Pacific railroad is Usk, about three miles distant. Several years ago a right-of-way 7,000 feet long was cleared for an aerial tramway to connect the mine-workings with the Skeena river, but construction was not commenced.

A vein, hereinafter referred to as No. 1, outcrops at 1,200 feet elevation, in which bornite, chalcocite, and copper carbonates occur in a quartz gangue. The line of strike of this vein is S. 30° W. and the angle of its dip 40 degrees towards N. 60° W. Both walls are schistose for a short distance from the vein.

There are also some outcroppings which indicate the occurrence of a second vein about 4 feet wide in close proximity to that just referred to, but the second one, if continuous, would appear to have its line of strike S. 15° E. and its dip vertical.

An adit 80 feet in length has been driven along the strike of the No. 1 vein, in which two distinct faults occur, one 45 feet in from the portal, the second 73 feet in, both of which cut the vein. The first appears to have been a down-throw and has thrust the vein down about 6 feet, as it was found below the floor of the adit beyond the fault by sinking a winze 12 feet deep. Beyond the second fault the vein has not been exposed, although, as a winze was only sunk 7 feet, it is quite possible that by sinking deeper the results might prove satisfactory.

After losing the ore-body beyond the second fault a crosscut was driven into the diorite country-rock 60 feet towards S. 60° E. Apparently this crosscut was made in the expectation of exposing the No. 2 vein, but, if so, the work was abandoned before any definite results were obtained. A sample typical of the ore-body, but not to be considered as an average, assayed: Gold, 0.84 oz.; silver, 11.0 oz.; copper, 8.0 per cent.

About 75 feet below the No. 1 adit a second adit had been driven, but could not be entered as the portal had caved in. M. C. Kendal, who had superintended the work, said that this opening had been driven 130 feet in length in a S. 15° E. direction in diorite country-rock, and that the location of this adit had been selected on the assumption that it would expose the so-called No. 2 vein, on which a winze had been sunk 15 feet deep, all in ore, near the portal of No. 1 adit, but as this was filled up at this time no examination could be made.

A third adit is located 25 feet below No. 2 and a little to the west, in which is exposed a vein 18 inches wide filled with the same character of ore as is in the No. 1 adit. This vein has been drifted on for a distance of 50 feet; its line of strike is S. 15° E. and its dip is at an angle of 45 degrees towards S. 75° W. The country-rock forming the walls of this vein has the same schistose structure as the walls of the No. 1 vein, but, taking into consideration the angle of the dip of the No. 1 vein, it appeared to be more likely that the ore-body exposed in No. 3 adit is a third vein occurring independent of the other two, and is an indication of lenticular structure in the vein formation. In either case a survey, as well as further work, is necessary in order to solve the problem. Considering that the general grade of the ore is so good, and that the indications of an extensive ore-body are promising, this property has possibilities.

This group consists of the following mineral claims: The **Continental Group.** *Sunset, Continental, Sunrise, Morning, and Black Jack*, owned by the Hamblett Bros. and J. D. Wells, of Kitsalas, and J. S. Cowper, of Vancouver. This property is situated on the northern slope of Bornite mountain on the south side of Chindemash creek, about one mile by trail from the creek. The *Black Jack* and *Morning* claims cover the southerly portion of the area occupied by the group, and their boundaries extend up the mountain-side nearly to the summit, or to an elevation of nearly 5,000 feet. The mineral outcroppings exposed are located on the *Continental* mineral claim at an elevation of 3,900 feet.

Two fairly deep open-cuts, one 47 feet long, the other 20 feet long, have been made, with about 100 feet intervening between the southerly end of the longer or No. 1 cut and the northerly end of the No. 2 cut. In each of these a clean-cut fissure-vein, filled with quartz carrying bornite, chalcopyrite, and iron pyrites has been

exposed, although it is concealed by a rock-slide along the 100 feet intervening between the ends of the open-cuts. Both the hanging and foot walls are well defined; the country-rock, belonging to the Kitsalas formation, is diorite and is slightly schistose near the ore-body.

The maximum width of the vein-filler is at the northerly end of the No. 1 open-cut, where it reaches 3 feet, but towards the southerly end of the cut, as well as in the No. 2 cut, the vein is narrower, with a maximum width of about 1 foot. Samples taken, which represented about a fair average from each of the open-cuts, assayed as follows: No. 1 open-cut: Gold, 0.08 oz.; silver, 1.6 oz.; copper, 1.9 per cent. No. 2 open-cut: Gold, 0.04 oz.; silver, 1.4 oz.; copper, 4.1 per cent.

A water-power of considerable capacity can be developed on Chindemash creek, and, while there is no timber above the outcroppings, the supply of hemlock at lower levels is quite abundant.

This claim is one of the earliest locations in the foot-hills of **Mabel Claim.** the Bornite range, and is situated on the south side of Chindemash creek about two miles above its mouth, and is at present owned by J. D. Wells, of Kitsalas. In 1894 Captain Madden, one of the pioneer placer-miners, drove a short adit into the bank of the creek on a quartz ledge, which is 18 inches wide where it outcrops, at a slightly higher elevation; this adit had caved in, so that an examination was not practicable. A sample taken across the outcrop of 18 inches wide assayed only traces in gold and silver.

ST. CROIX AND LEGATE CREEKS.

The mouth of St. Croix creek is situated on the east side of the Skeena river about five miles above the mouth of Chindemash creek; Legate creek is another tributary of the Skeena, which empties in about five miles above St. Croix creek.

St. Croix creek is quite large, and falls about 3,000 feet in the distance of eight miles between the headwaters and its mouth. The source of the creek is an extensive glacier formed on the summit of a rugged, precipitous range of mountains, some of the peaks of which reach an elevation of about 7,000 feet. This range is the watershed between St. Croix and Legate creeks, the last named being much the longer, but with less fall.

The Grand Trunk Pacific Railway has a station called Pittman on the opposite side of the Skeena from the mouth of St. Croix creek, but there is no ferry, the crossing being made by small boat or canoe; there is no trail on the east side of the Skeena above the mouth of Chindemash creek.

The properties on Legate creek are reached from Pacific Station, via Grand Trunk Pacific, crossing near there in a canoe, and following a poor trail up the creek some fourteen miles. Another route is from the *St. Croix* group across the summit of a high mountain range and a glacier, a distance of about six miles. Although there is no trail here, the trip can be made without any great difficulty, except at certain stages of the year, when the conditions on the glacier are such as to endanger life. When the writer visited St. Croix creek it was not advisable to attempt to travel by that route.

From the most reliable information obtainable, it was ascertained that, while there were some good surface showings of such copper minerals as chalcopyrite and bornite, and some outcroppings containing galena and iron pyrites, so very little work had been done it was not sufficiently important to warrant spending the time required to make the trip around by the long route, which would have occupied at least six days, but it is probable that the section is well worth systematic prospecting.

This group of claims is situated about seven miles up St. **Independent** Croix creek on the south side, and reached by travelling over a **Group.** good foot-trail built along the north bank of the creek. The *North Star*, *Copper King*, *Southern Cross*, and *Copper Queen* mineral claims comprise the group, which is owned by J. D. Ross, Stanley Ross, and Carmen Ross, of Vancouver, and Harry Jones, of Pittman. The discovery post on the *North Star* is located at an elevation of 3,360 feet, about a mile and a quarter below the

head of St. Croix creek. About 100 feet south-easterly from this post mineral outcroppings occur in what appears to be an andesite. The mineralization is, for the most part, iron pyrites with some galena, occurring apparently as replacements in the dyke, and as exposed covers a width of about 5 feet.

Some open-cuts have been made along the apparent line of strike in a N. 20° W, direction, but this work had not been carried sufficiently deep to determine the dip or the extent. A sample, typical of the mineralized body, assayed: Gold, trace; silver, 0.8 oz.; copper, 4 per cent.

Other work done on the group consisted of two adits, one of which was driven on the *Copper Queen* and the other on the *Copper King* claim, but in neither of these was any mineralized body exposed; both were driven as crosscuts in the country-rock.

This group of mineral claims contains the *Ruth*, *Jessie*, *St. St. Croix Group*, *Croix*, and *Speedwell* claims, owned by J. D. Ross, of Vancouver, and James Brown, of Pittman, and is situated at the head of St. Croix creek. The mineral outcroppings, so far found, occur on the *St. Croix* claim, very near the summit of the range of mountains that forms the divide between St. Croix, Chindemash, and the headwaters of a tributary of Legate creek, at an elevation of 4,650 feet.

Surrounded by glaciers, but with its summit bare of snow, an igneous dyke stands out as a prominent, precipitous bluff at an elevation of about 2,000 feet above the bed of St. Croix creek. The face of this dyke has been blasted off for a width of 40 feet and to a depth of about 8 feet to prospect a series of fissures exposed on the surface. The face of the open-cut shows that the fissures in the dyke have resulted from shearing movements; they are five in number, each about 12 inches wide, having their lines of strike nearly parallel, but varying from N. 10° E. to N. 15° W., and with their dips at varying angles from 20 degrees towards S. 10° E. to 40 degrees towards N. 75° E.

In three of the fissures bornite with some chalcocite represents the mineralization, while, in the other two, iron pyrites with occasionally crystals of galena in a quartz gangue fills the fissures. The mineralization appears to be by replacement. A sample taken across 12 inches in one vein assayed: Gold, trace; silver, 16.6 oz.; copper, 8.4 per cent. Another sample taken across 12 inches in another vein assayed: Gold, trace; silver, 0.7 oz.; copper, *nil*. In the floor of the open-cut there were indications that the vein from which the first-mentioned sample was taken was widening.

There are some indications of mineralization of the dyke rock between the fissures, but whether this is sufficient to enrich the entire width of the face of the open-cut across 40 feet to a commercial value depends on so many conditions that no opinion can be expressed until a systematic course of experiments has been conducted.

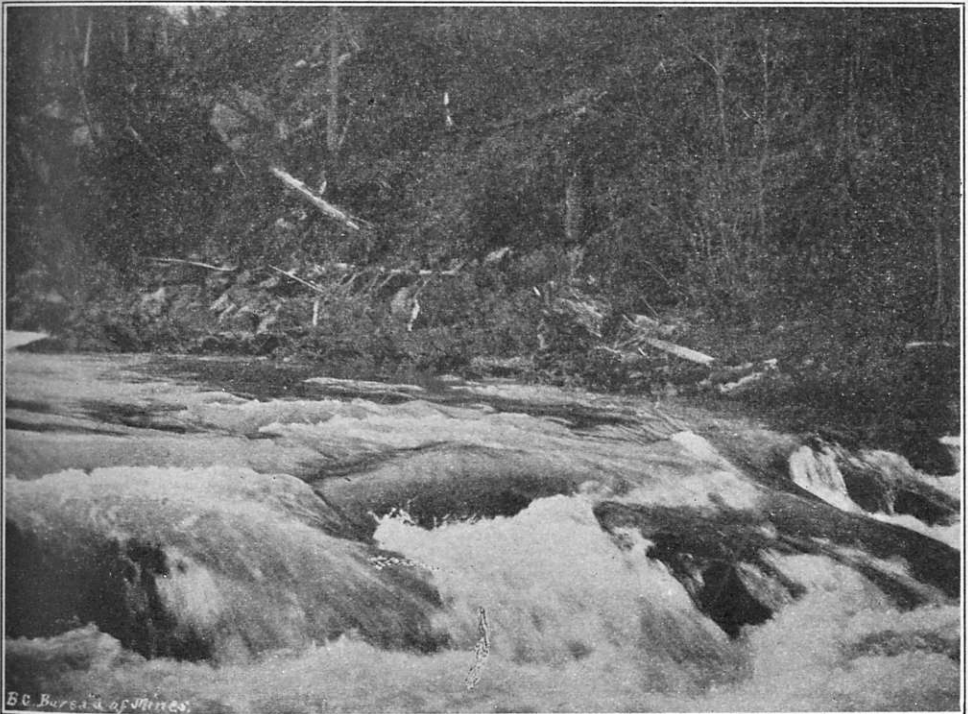
This mineral claim is the most easterly of four claims, not **Rainbow Claim**, grouped, the others being named the *Rambler*, *Excelsior*, and *Royal*. These were staked during the summer of 1914 and are located south-westerly from the *St. Croix* group and south from and adjoining the *Independent* group. The owners are Harry Jones, James Bell, and James Brown, of Pittman, and J. D. Ross, of Vancouver. The *Rainbow* claim, adjoining the *Jessie*, one of the *St. Croix* group on the south-west, is the only one of the four on which any work has been done or on which any discovery of copper-mineral outcroppings had been made up to the time of the examination, on August 26th, 1914, although there are outcroppings of gossan or iron oxides on others which may lead to the discovery of minerals of commercial value.

The outcroppings on the *Rainbow* claim are situated at an elevation of 4,600 feet, or about on the same level as the work on the *St. Croix* mineral claim. These are composed of narrow stringers of iron- and copper-stained rock, with some bornite and chalcopyrite in the cleavage-planes of the igneous country-rock. Thorough prospecting and systematic work may lead to the discovery of an ore-body of commercial value.



B. A. Bureau of Mines

St. Croix Creek.



E. C. Bureau of Mines

Fiddler Creek.

Eagle's Nest Claim. This mineral claim is situated about two miles westerly from the *Independent* group, and on the west side of Cabin creek, a tributary of St. Croix creek, at an elevation of 3,100 feet, and is owned by Peter Lauzon, of Pittman. A wide open-cut has been made in a volcanic dyke rock at a point where the dyke is very quartzose and considerably stained from iron and copper minerals. An average sample across 3 feet of the face of the open-cut, where apparently the strongest mineralization had occurred, after being assayed, proved to carry only traces of gold and silver.

Iron Pot and Copper Dollar Claims. These mineral claims are situated on the North fork of Cabin creek, and are owned by James Brown, of Pittman, and J. D. Ross, of Vancouver. At an elevation of about 2,400 feet and crossing the bed of the creek there occurs a ledge about 25 feet wide of quartzose rock with banded structure. Its line of strike is N. 30° W. and dip vertical. The hanging-wall is a greenstone-schist and foot-wall an igneous dyke. A wide open-cut has been made to crosscut the ledge, and portions of it are said by the owners to yield \$4 a ton in gold, the writer did not take any samples, because such might be misleading unless systematically taken, which was hardly practicable during the examination.

LORNE CREEK.

This creek flows into the Skeena river from the west near mile-post 130 on the Grand Trunk Pacific Railway, and has a history, as narrated by Samuel Booth, an old-time miner, dating back to 1884, when placer gold was first discovered in the creek by Harry McDame (after whom McDame creek, Dease river, is named). Since that time placer- and hydraulic-mining operations have been carried on spasmodically. During the past summer four placer leases have been represented, as follows: Two by the Dry Hill Mining Company, one by Penrose, and one by the Hardscrabble Mining Company.

Dry Hill Mining Co. The majority of the stock in this company is owned by Wm. Tuttle, resident manager, and Charles E. Burgess, of Prince Rupert. The leases owned by the company extend along the north-east side of the creek, one mile up the ancient channel, situated about a mile and a quarter from the present channel, and extending from near the railroad crossing to the point of intersection between the present and ancient channels. The bed-rock is a black, fine-grained carbonaceous, banded tuff.

Work done previous to this year is represented by a pit about 500 feet in length up the old channel by about 30 feet wide at the lower end, and increasing to about 150 feet wide at the face where the gravel-bank is about 180 feet high. This portion has all been worked out to the bed-rock, except a small area in the south-east corner.

The extent of virgin ground is about 3,700 feet in length up the channel from the present face of the pit by about 200 feet wide at the widest portion between the rim-rock on each side. The "pay" on bed-rock is enough to produce satisfactory results from hydraulic operations on a large scale, so far as could be judged from an experimental run. In the past operations were handicapped by an insufficient water-supply; this is being improved by constructing a new flume two miles and a quarter long, 5 feet wide by 3 feet high, to convey 1,800 miners' inches of water from Lorne creek with 350-foot head. About 1,200 feet of this flume had been completed in August, 1914. The lumber being used was cut on the ground by a sawmill installed last year, and Mr. Tuttle, the manager, expects to have the flume completed ready for next season's operations.

The Penrose Lease. This lease adjoins the *Dry Hill* on its western boundary, at the point of intersection of the present and ancient channels, and extends for half a mile up the ancient channel on the south-west side of the present one. This had been worked by Mr. Penrose during the past summer, but work had been suspended a few days before the writer's visit, and, as no one was then on the ground, data as to results could not be obtained.

Hardscrabble Mining Co. This company owns the ground adjoining the *Penrose* lease on the west. No work was being done at the time the property was visited, but some prospecting had been carried on earlier in the season.

FIDDLER CREEK.

Fiddler creek is a tributary of the Skeena river, flowing in from the south-west at a point about two miles and a half southerly from the mouth of Lorne creek.

There are seven mineral claims and a fraction contained in this group, which is owned by John Burns, John Williams, and Richard Doyle, of Doreen, the nearest station to the property on the Grand Trunk Pacific Railway. The names of the claims are as follows: *The Brentford, Hedley, Fiddler, Josie, Nelson, Albana, Royal Sovereign, and Drumbo Fraction*. The property is located on the south side of Fiddler creek about three miles from the Grand Trunk Pacific track. During the past season a good trail has been constructed from the railroad-bridge across Fiddler creek to the *Hedley* claim, where all the work has been done, at an elevation of about 950 feet.

There appears to have been quite an extensive intrusion of diorite, possibly of sufficient extent to occupy the area covered by at least two, if not more, of the claims contained in the *Brentford* group. The country-rock in which this intrusion occurs belongs to the Hazelton formation, and is for the most part made up of tuffs, with dark argillaceous beds and bands alternating. These are considerably altered near the contact of the intrusive mass in which the ore-bearing veins on this property occur.

There are at least two distinct ore-bodies in the *Brentford* group; both are fissure-veins in diorite, having their lines of strike parallel to each other towards S. 50° W., with dips almost vertical.

Development-work has been all performed on the *Hedley* claim, and consists of an adit driven on the No. 1 or main vein a distance of 75 feet, the open-cut to the portal of the adit being about 25 feet long. There are also several open-cuts in a S. 50° W. direction from the adit on the outcropping of the same vein; these cuts have been made on the steep mountain-side above the adit level, and have sufficiently exposed the vein in several places to warrant the assumption of its persistence for at least a distance of 600 feet, and to an elevation of 25 feet above the adit level. There is, in addition to the above-described work, a shallow shaft sunk at a point 50 feet lower than the adit level, but this has not reached rock in place. The adit is closely timbered, and it was not possible to see the roof to measure the width of the ore-body; in the face the ore was 3 feet wide. In the open-cuts the width of the vein of ore was from ½ foot to 4 feet. The outcropping is 60 feet above the adit level at the face of the drift, and at the farthest point on the surface examined the elevation was 125 feet higher than the adit level.

Mr. Burns, one of the owners, stated that outcroppings could be seen at intervals for a farther distance of about 2,000 feet when the snow was off the surface, but no work had been done, and the exposures were long distances apart.

The following list of assays shows the values obtained from samples taken by the writer, which represent the average of the vein-matter for the widths sampled at the points designated:—

Location sampled.	ASSAY VALUES.		
	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
From foot-wall side, face of adit, 2 feet wide	0.07	4.4	0.4
From hanging-wall side, face of adit, 1 foot wide	0.05	7.6	1.1
From outcrop 40 feet above adit level, 18 inches wide . . .	0.04	4.2	Nil.
From outcrop 60 feet above adit level, hanging-wall side, 3 feet wide	0.02	1.0	Nil.
From outcrop 60 feet above adit level, foot-wall side, 1 foot wide	Trace	0.4	Nil.
From outcrop 125 feet above adit level, 6 inches wide . . .	0.2	95.0	Trace.
From dump at portal adit, No. 10 vein, grab sample	0.2	35.8	0.3

The No. 2 vein, which occurs about 50 feet east from the No. 1 or main vein, has been exposed in a narrow watercourse by a series of prospect-holes, but the ore in this vein, so far as proven, is very narrow, varying in width from a streak of rusty decomposed material to a width of 10 inches of ore. The fissure appears to be very persistent as far as followed, a distance of about 200 feet up a very steep mountain-side. An average sample taken across the outcrop where it is 10 inches wide assayed: Gold, 0.08 oz.; silver, 7.2 oz.; copper, 0.8 per cent.

This group contains three mineral claims—the *Boulder*, *Indicator*, and *Intrusive*, owned by L. C. Knauss. The claims are staked in a line from north-east to south-west, the *Boulder* being the north-east claim of the group, with the other two claims staked in the order referred to, towards the south-west. The north-east end line of the *Boulder* claim is about 2,000 feet south-westerly from the north-west end line of the *Josie* claim of the *Brentford* group, at about the same elevation, but on the opposite side of a tributary of Fiddler creek.

The ore-body is exposed only on the *Boulder* claim near the discovery post, at an elevation of 2,250 feet, and occurs as a bedded deposit, with its dip conformable to that of bedding-planes of the argillaceous country-rock. The line of strike of the vein is approximately S. 60° E. and the dip is at an angle of 30 degrees towards N. 30° E.

The ore is galena, iron pyrites, chalcopyrite, and some tetrahedrite in a quartz gangue. The width of the outcroppings vary from 22 to 36 inches, and the vein is exposed in several open-cuts for a distance of about 800 feet, starting from a point about 200 feet vertically above the creek.

Five samples were taken of these outcroppings, each one representing an average of the ore-body for the width sampled and at the point designated. The following list shows the values carried by these:—

Location sampled.	ASSAY VALUES.		
	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
Taken across 12 inches at a point 200 feet from discovery post on <i>Boulder</i> claim	0.4	2.3	Trace.
Taken across 3 feet at a point about 70 feet from same discovery post	0.25	1.4	Trace.
Taken across 1 foot 10 inches wide at a point 62 feet from same discovery post	2.48	7.6	3.4
Taken across 2 feet wide at a point 49 feet from same discovery post	1.96	8.9	0.8
Taken across 1 foot 10 inches wide at a point 9 feet from discovery post	1.43	5.2	0.6

Just north from the discovery post on the *Boulder* claim there occurs a wide, intrusive granite dyke which apparently had cut off the ore-body on the dip, but prospecting late in the summer at a point about 400 feet northerly from the discovery post and about 150 feet lower exposed a vein carrying minerals having the same characteristics as those in the vein on the opposite side of the dyke, and also with its line of strike and dip conformable with the strike and dip of that vein, so that it would appear that this last named is the extension of the vein.

In July last, Martin Welsh, of Spokane, bonded this group of claims and commenced development-work by driving an adit that in October was 140 feet in length. The portal of this adit is located near the discovery post of the *Boulder* claim, immediately south from the granite dyke. The ore-body, which had been left in the roof of the adit, apparently has a width varying from 2 to 4 feet for 60 feet from the portal, where it becomes narrower, the pinch appearing to have been caused by an intrusive granite dyke, through which, however, a vein appears to maintain continuity for 20 feet to where the granite dyke disappears; there this

vein widens to 18 inches, which width it apparently maintains for 30 feet to a well-defined fault which cuts across the adit. Beyond this fault and to the face of the adit, a distance of 30 feet, another fissure is exposed which, while continuous, is only about 4 inches wide. At a few points along the adit for the first 60 feet the ore-body has been broken into above the roof to prove its continuity.

Samples taken representing averages of the widths sampled at the points designated assayed as follows:—

Location sampled.	ASSAY VALUES.	
	Gold.	Silver.
Taken across 4 inches at the face of the adit	Oz. 0.03	Oz. 0.3
Taken across 10 inches immediately east from fault 110 feet from portal of adit	0.02	0.2
Taken across 18 inches at a point 25 feet east from fault 85 feet from portal of adit	0.32	2.5

A rough compass survey showed that the adit, beyond a point about 60 feet in from the portal, was not being driven in a course conformable with the line of strike of the vein. From this point the course is slightly changed, so that the roof of the adit is placed so much below the original ore-body as to conceal it completely and make it appear as though cut off. The fissure followed from that point appears to have no connection with the main fissure which outcrops at the surface. The supply of both timber and water for all purposes is plentiful.

KITSALAS MOUNTAIN.

So far as at present reported, no mineral claims have been staked on the west side of the Skeena river south from Knauss mountain, situated a few miles south from Fiddler creek, until Lowrie creek, near the northern spur of Kitsalas mountain, is reached, some seventeen miles south from Fiddler creek.

This group of mineral claims consists of the *Triune*, *Gold Poor Boy Group*, *Standard*, *Elia*, and *Poor Boy* claims, owned by L. A. Moody, Richard Lowrie, James Gall, and James Darby, of Usk, and is situated in the foot-hills of the northern spur of Kitsalas mountain. On the *Triune* claim an open-cut has been made in a sheared zone in diorite country-rock at an elevation of 500 feet. In this occasionally could be noticed kidneys of quartz containing particles of visible free gold, also quartz containing a little bornite and stained with copper carbonates, but no evidences of the existence of an ore-body of commercial value could be found.

On the *Gold Standard* claim, adjoining the *Triune* on the east, an open-cut in a sheared zone in diorite country-rock 15 feet long, with the face of the cut 12 feet deep, was examined; this was made into the side of the mountain at an elevation of about 800 feet, and showed a vein 18 inches wide filled with quartz, striking east and west and dipping to north, a sample from which assayed: Gold, 0.06 oz.; silver, 1.6 oz.; copper, 0.3 per cent.

Another open-cut, also in a sheared zone in diorite, about 200 feet west from the one just referred to, showed a vein filled with quartz; this vein was 30 inches wide on the surface, but only a few inches wide in the floor of the cut 8 feet below. Judging from all the surrounding conditions, it is considered doubtful if any commercial value could be attached to the discoveries so far made on this group of claims, but further prospecting may reveal better showings.

This group of mineral claims includes the *Queen Ann*, *Cordillera*, *Yellow Pearl*, *Gold Dust*, *Camille*, and *Gold Sentinel*, owned by James Darby, of Usk, and J. D. Wells, of Kitsalas. The property was staked during the spring of 1914, when the finding of rich float led to its discovery; it is situated about two miles and a half southerly from Usk Station, on the east slope of Kitsalas mountain. At an elevation of 700 feet a fissure-vein outcrops in a diorite country-rock. This had been exposed

by a series of open-cuts for a distance of about 500 feet along its line of strike towards S. 30° W., with the dip apparently nearly vertical. The width of vein-filling varies from 1 to 8 feet, but whether the outcroppings are those of a continuous vein or of separate lenses along a general line of strike had not been determined.

The minerals in this vein are chiefly chalcocite and bornite in a quartz gangue, in which can be seen many particles of free gold, visible to the naked eye. The most northerly exposure of mineral is in fairly heavy timber on the *Queen Ann* mineral claim, close to the dividing line between that claim and the *Cordillera*, which adjoins it to the south-west. At this point an open-cut 27 feet long by about 8 feet wide has been made. The No. 2 open-cut is 25 feet distant towards S. 30° W.; this is 10 feet long by about 8 feet wide. The No. 3 open-cut is 75 feet distant in the same direction, which is also 10 feet long by about 8 feet wide. The No. 4 open-cut is 200 feet distant in the same direction; this is 15 feet long by about 8 feet wide. No. 5 open-cut is 25 feet distant in the same direction; this is 21 feet long by about 10 feet wide. No. 6 open-cut is 100 feet distant in the same direction; this is 21 feet long by 10 feet wide. The elevation between the No. 1 and No. 6 open-cuts rises gradually, the difference between the two points being about 100 feet.

The following list of assays shows the values carried by the samples taken:—

Location sampled.	ASSAY VALUES.		
	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
Selected sample from No. 1 open-cut	0.38	9.3	23.4
Average sample across 3 feet from No. 3 open-cut	0.4	3.8	7.1
Shipping-ore from No. 2 open-cut, representing about 10 per cent. of vein-matter	0.7	8.9	10.6
Shipping-ore from No. 1 open-cut, representing about 5 per cent. of vein-matter	0.36	9.5	21.1

In addition to the outcroppings and work referred to, other mineralized outcroppings had been discovered on the mountain at a considerably greater elevation, which indicated a series of veins lying nearly parallel to the line of open-cuts, but no work had been done. From all the indications this group of mineral claims is very promising, and it should be systematically prospected.

This group consists of the *Old Timer*, *Fannie*, *Walker*, and **Old Timer Group.** *Digby* mineral claims, owned by C. W. D. Clifford, J. W. Patterson, and J. D. Wells, of Kitsalas. It is situated on the south-eastern slope of Kitsalas mountain about one mile west from the Canyon, and is reached by a foot-trail which branches off from the wagon-road connecting the old village at the Canyon with Phillips creek.

At an elevation of about 1,800 feet an open-cut has been made across an igneous dyke on the *Walker* claim. This cut is 24 feet long by about 8 feet wide and 12 feet high at the face.

This dyke is very much fractured; there is considerable epidote and some chalcopyrite in a quartz gangue filling the fissures, which strike nearly north and dip vertically. These fissures are narrow, the widest being 2 feet; an average sample taken near the face of the open-cut, assayed: Gold, 0.03 oz.; silver, 0.8 oz.; copper, 3.4 per cent. The surface is so heavily covered with underbrush as to conceal all traces of any possible extension of the fissure along the strike.

This group consists of the *Poor Mine*, *Copper King*, **Copper King Group.** *Star*, and *Big Copper* mineral claims, owned by Peter Brusk and associates. The property is situated on the south slope of Kitsalas mountain near the head of Phillips creek, on the north side, and about five miles west from Kitsalas canyon. It is reached by an excellent trail up Phillips creek, which branches off from the wagon-road from the Canyon at Brusk's ranch.

At an elevation of about 1,900 feet, on the *Copper King* claim, in the bed of a branch of Phillips creek, there is a strong outcropping of quartz carrying bornite, chalcopyrite, and iron pyrites. In an open-cut made in the south-east bank of the branch creek, the walls on each side of this outcropping are so well defined as to indicate a clean-cut fissure in an igneous rock. The line of strike is N. 75° E. and the angle of dip is 60 degrees towards the south-east.

This vein is exposed along the strike for a distance of 80 feet, and has an average width between the walls, including a few inches of gouge between each wall and the ore-body, of about 3 feet. A sample taken representing about an average of the vein assayed: Gold, 0.1 oz.; silver, 3.3 oz.; copper, 12.8 per cent. A selected sample assayed: Gold, 0.03 oz.; silver, 3.8 oz.; copper, 17.9 per cent.

A vein, very similar to the one just referred to, is exposed in another tributary of Phillips creek, situated about 1,000 feet distant towards the east, on the *Big Copper* claim, but at a somewhat higher elevation. On this outcropping no work has been done, and, as there are no rock exposures between the two creeks, it was not possible to trace any relationship between the two outcroppings.

On the *Copper King* claim, near the southern boundary-line and on the north bank of Phillips creek, an adit (No. 1) has been driven in the sheared portion of an igneous rock, where some bornite occurs in the fracture-planes. This adit is 42 feet long, 20 feet of which is in a N. 20° E. direction, and the balance is N. 30° W.; a winze has been sunk at the face 14 feet deep. A little mineral occurs scattered through the country-rock in the cleavage-planes of the fractures as well as in the solid rock, but with no defined walls.

At a point about 50 feet higher elevation than the No. 1 adit and about 200 feet in a northerly direction, on the east bank of a tributary of Phillips creek, another adit (No. 2) has been driven 50 feet long in a N. 70° E. direction; also a winze has been sunk 15 feet deep, but was full of water. This adit crosscuts an igneous dyke showing lean mineralization as specks of chalcopyrite and bornite very similar to the mineralization showing in the No. 1 adit. Near the face of the No. 2 adit a granite dyke is exposed that apparently cuts off the diorite, and further work was abandoned. An average sample of the mineralized diorite assayed: Gold, trace; silver, trace; copper, 0.3 per cent.

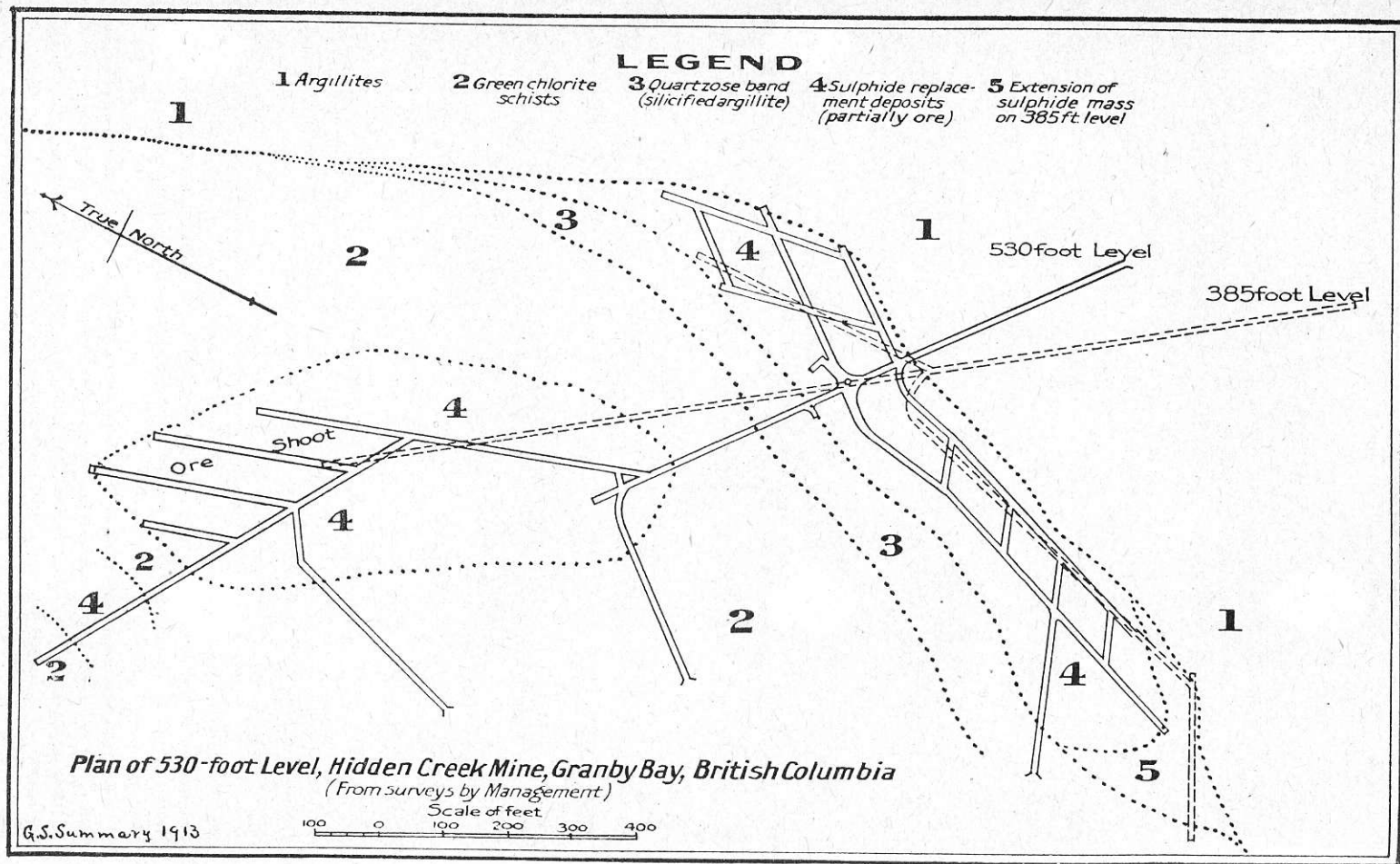
The supply of timber is ample for all purposes; the supply of water in Phillips creek is sufficient to furnish power to run machinery for a plant of considerable capacity.

This group is located one mile north from the Copper City ferry **Virginia Group.** on the west side of the Skeena river, and contains the *Virginia*, *Highland*, and *Erin* mineral claims, owned by A. G. Walker, of Copper City. On the *Virginia* claim an adit has been driven 15 feet under cover beyond an open-cut 15 feet long, into a body of iron-stained, calcareous quartz carrying some epidote, but, so far as at present exposed, no other minerals. A sample across 3 feet assayed only traces of gold and silver and no copper.

GRANBY BAY, OBSERVATORY INLET.

By far the most important event that happened in the history of the mining industry in northern British Columbia during 1914 was the "blowing-in" of the new smelting plant of the Granby Consolidated Mining, Smelting, and Power Co., Limited, at Anyox, on Granby bay, Observatory inlet, about 120 miles north from Prince Rupert. The investment for the construction of the smelter, power plant, machinery at the mines, development, electric railway, and buildings at the smelter and mining camps aggregated \$3,680,000 up to the time the smelter was blown in, during March, 1914.

The Minister of Mines' Reports for the years 1911 and 1913 contained articles descriptive of the occurrence of the ore-bodies and of the partial construction of the plants, written by Donald G. Forbes, M.E., but the history of the property, which is somewhat unusual, has not been mentioned, so a brief summary will be given in this report.



The original mineral claims were located in 1901 as the *Hidden Creek* group by McMillan, George Rudge, and H. B. Flewin, of Port Simpson, and were described as being situated on Ekswan (Goose) bay, this name being changed to Granby bay in 1914. In 1902 the property was bonded for \$40,000 to M. K. Rodgers, of Seattle, as agent for the late Marcus Daly, of Butte, and some serious development-work performed, but, after Mr. Daly's death, it was examined by Horace V. Winchell on behalf of the Daly heirs and allowed to revert to the original locators.

In 1905 a syndicate, formed in Vancouver, B.C., by some of the original Britannia Copper Syndicate, bonded the *Hidden Creek* group from McMillan, Rudge, and Flewin, and expended about \$25,000 in development-work.

In 1908 M. K. Rodgers again became interested in the property, which he purchased for Thos. Hudgins, a banker of Butte, and himself for \$135,000, and continued development-work on a larger scale until 1910, when it was sold to the Granby Company, the purchase price being reported at \$500,000.

The following description of the geology is taken from the report of Donald G. Forbes, M.E., of Victoria, B.C., on page 67 in the Minister of Mines' Report for 1911: "The rock formation in which the ore-bodies occur may be best described as an argillaceous schist; it has been subjected to very considerable alteration, and in some places the fissile structure of the argillaceous bands has disappeared and the rock appears to be massive. This rock formation can be traced for several miles along the shore of the inlet to the adjacent islands, and extends nearly to the summits of the mountains to the west of the property, where the Coast granites are found. The ore-bodies are at some points cut by intrusive dykes, but these dykes have no influence on the nature of the ore, nor on its commercial value."

In the mines previous to July, 1913, there had been done over 16,000 feet of underground development-work, exclusive of diamond-drill holes. Since then and up to July 1st, 1914, the underground development-work has been increased by an additional 5,400 feet of drifts and raises, as well as 6,400 feet of diamond-drill boring. As a result of this later work, the boundaries of the two main ore-bodies have been well defined above the 385-foot level to the surface, at 475 feet higher elevation, on the ore-body known as the Cabin Bluff or No. 1, and 515 feet higher elevation on the Mammoth Bluff or No. 2 ore-body. Levels have been opened at 150 feet, 230 feet, 385 feet, 530 feet, 630 feet, 700 feet, and 800 feet above tide-water. This is the reverse from the usual conditions, because generally the levels are measured from the surface downwards.

Both the Nos. 1 and 2 ore-bodies are elliptical in plan. The No. 1 has the greatest length, being about 1,300 feet along the strike, which is slightly east of north, the dip being 65 degrees to the west. The No. 2 ore-body has been proven to be nearly as long, with a maximum width of about 200 feet. The strike of this ore-body is north-west and dip at an angle of 45 degrees towards the north-east. The distance of barren ground between the two ore-bodies on the surface is about 150 feet, but on the 385-foot level the distance has increased to 800 feet.

The tonnage of "ore in sight" is estimated at 9,563,000 tons, carrying 2.2 per cent. copper and about 30 cents in gold and silver to the ton. This is surrounded by a body of low-grade ore running 0.6 per cent. copper. In this body the tonnage in sight is estimated at 8,589,500 tons. When the high and low grade are considered together, it gives an estimate of 18,152,500 tons of 1.4-per cent. copper ore.

Since the middle of March last, when the smelter was first blown in, until July 1st there had been shipped from the mines 77,377 tons of ore, carrying 2.4 per cent. of copper to the ton. Most of this ore was mined from the No. 1 ore-body from the stopes above the 530-foot level, only 8,476 tons from the No. 2 ore-body having been shipped.

On July 1st, 1914, there was 15,000 tons of broken ore in the mine. During the past season two entirely new ore-bodies, No. 3 and No. 4, were discovered and explored. They are of the same general type as the No. 2 ore-body and in the same mineralized area. The total ore developed in the two bodies is 1,407,500 tons, carrying 1.8 per cent. of copper.

Mining operations are being carried on by three systems, as follows: First, glory-hole from the surface on the 630-foot level on No. 2 ore-body where that level comes to the surface on the south-westerly slope of the Mammoth Bluff; second, Treadwell or shrinkage system of driving drifts along the strike of the ore, making raises about 20 feet high for ore-chutes, with 60 feet between centres, through which only about one-third of the ore broken down is drawn, the balance being left for footage for drills and men; then stoping upwards on an incline in all directions from the tops of the raises the entire width of the ore-body, but leaving pillars across the ore-body from 60 to 120 feet apart and about 30 feet wide at the top, according to the standing qualities of the ground, with intermediate drifts cut through the pillars connecting the stopes along the strike. Third, the system followed in the Granby mines at Phoenix, locally termed "benching."

The arrangement for handling ore is by a gravity system throughout, by chutes, specially designed, from the stopes to the 230-foot level, where the crushers are located, and from the crushers into the ore-cars, each of 25 tons capacity on the 150-foot level, whence it is transported to the ore-bins at the smelter on Granby bay, one mile distant over a 3-foot gauge electric railway laid with 56-lb. rails.

The total length of the electric railroad main line is 3.22 miles, distributed as follows: "A" line on nearly level grade with switchback, connecting the mine with the smelter-yard, 7,913 feet in length; "B" line with 2 per cent. grade, connecting the wharf with "A" line, 7,490 feet in length; copper track with $2\frac{1}{2}$ per cent. grade, connecting "B" line with the smelter, 1,516 feet in length. Spur sidings and yard-tracks total 2.36 miles, consisting of smelter-yard tracks, 2,626 feet; ore and coke tracks on high line, 2,753 feet; charge tracks, 3,167 feet; wharf track, 1,710 feet; sawmill spur, 1,770 feet, storage sidings, 458 feet. There are on the line of this railroad 1.95 miles of trestle-work.

The equipment consists of two 42-ton Baldwin-Westinghouse locomotives, twenty-five hopper-bottom steel ore-cars, each of 25 tons capacity, as well as the necessary flat cars for hauling freight from the docks to the smelter and mine.

The works are on Granby bay, an indenture in the western shore of Hastings arm, which, with Alice arm, merges into Observatory inlet. The Burniston range of mountains, rising to an elevation of 5,700 feet, separates Observatory inlet from Portland canal; the mines and reduction-works are on the eastern foot-hills of this range. The settlement is called Anyox, and, being on deep water, is directly accessible to ocean-going steamers. There are usually two steamers that arrive weekly from Vancouver.

The ore from the mines is weighed in the 25-ton cars on a 40-foot, 80-ton-capacity track-scale; thence is dumped into the ore-bins of 8,000 tons capacity, over the tops of which the tracks from the mine are laid. From the bottoms of these bins the ore is drawn into charge cars running on a track at a level 35 feet below the mine-track.

The furnaces, of which there are three, are 50 inches wide by 30 feet long, and are the regular type of rectangular, water-jacketed matting-furnace made by the Traylor Engineering and Manufacturing Company. The furnaces are provided with $4\frac{1}{2}$ -inch tuyeres at 10-inch centres. The slag-tap is at the side. The converter-room is in one end of the main smelter building, in which are three converter-stands. The converters, of the Great Falls type, are 12 feet in diameter.

The downtakes from the furnaces and the flue from the converter-hoods lead into a large dust-chamber at the side of the main smelter building. From the centre of the chamber the main flue leads up the hill to the reinforced-concrete stack, 22 feet in diameter by 153 feet high, the top of which is about 300 feet above the furnaces.

The Granby Company has secured from the British Columbia Government the right to reclaim a large area of ground by filling in with slag a shallow-water area in Granby bay directly in front of the smelter-site. Thus is a convenient dumping-ground for the slag obtained, and as the dump grows the area of the company's new made land will gradually increase.

Power is generated at a hydro-electric plant on Granby bay just below the smelter-site. The water of Falls creek has been impounded by a crib and rock-filled dam one mile back of the smelter; a 6-foot wooden-stave pipe conveys the water from the reservoir to the Pelton wheels in the power-house at an available head of 400 feet. The power-house equipment includes two electric generators of 938 k.v.a., with exciters; two motor-generator sets of 300 kw. each; three Connersville blowers, with Pelton buckets on fly-wheel of blowers, with a capacity of 48,000 cubic feet of free air a minute, supplied at 3 lb. pressure; and a Nordberg blowing-engine, with a capacity of 21,500 cubic feet of free air a minute at a pressure of 16 lb. A Nordberg compressor is also installed in the building, which has a capacity of 4,000 cubic feet a minute at 100 lb. pressure. The blowing-engine and compressor are provided with buckets on the fly-wheel, the same as the blowers.

The docks on Granby bay are 500 feet long by 50 feet wide, equipped with three travelling ore-bunkers for coke and ore. A concrete fire-proof store building 117 feet long by 60 feet wide, three stories high is located near the dock and is run as a complete department store. One steamer, the "Amur," and six barges, are used in the blister-copper, coke, and lime-rock service.

The smelter town of Anyox, owned by the Granby Company, is built near the dock, and comprises a modern hotel, large recreation-hall, hospital, seventy-five cottages, each containing either three, five, or seven rooms, with bath-room, and furnished with electric lights, water and sewer connections. There are three trunk-line sewers, and waterworks system having 60 lb. pressure to the inch, with the necessary mains, fire-hydrants, and connections with all the buildings. The streets are laid out systematically, walks and roadways planked, and the streets well lighted by electric arc-lights. There is also a sawmill and a brick-mill located on the outskirts of the town; the former having a daily cutting capacity of 25,000 feet board measure, and the latter a daily producing capacity of 25,000 bricks.

Near the mine the Granby Company has built large bunk-houses and mess-houses, as well as a number of residences similar to those at Anyox, and equipped with the same modern conveniences; also a recreation-hall, superintendent's office, and storage building for supplies. The bunk-house is two stories with basement, the last mentioned being furnished with shower-baths, drying-room, and with lockers for the men's clothes arranged along the walls. The first or ground floor is divided into separate rooms, but the upper floor is undivided and designated as the "bull-pen," and is furnished with cots.

BONANZA CREEK.

This group of mineral claims is situated on Bonanza creek, **Bonanza Group.** which flows into Granby bay from the north-west about two miles southerly from Anyox. The Granby Company had been prospecting for several months prior to July last on this property, and in the autumn of 1914 was reported to have acquired it. These mineral claims were amongst the earlier locations in the district, having been staked in 1900, but until the Granby Company began systematic prospecting but little serious attempt had been made as regards development-work, owing to the low grade of the mineral contents of the wide body of schist, which contains numerous veinlets filled with quartz carrying some iron and chalcopyrite.

GLACIER CREEK.

This group contains the *Golconda, Golconda No. 1, Copper Golconda Group. Consolidated, Blue Bird, Blue Bird Extension, and Blue Bird Extension No. 1,* owned by Dr. A. C. Crookall, A. W. Graham, and Patsy Forrest, of Seattle. This property is situated along both sides of Glacier creek, a stream flowing nearly parallel with the course of Bonanza creek, and emptying into Granby bay about a mile southerly from the mouth of that creek. Except assessment-work, no serious attempt at development has been made; during the past summer the claims were surveyed.

The same belt of argillaceous schists, in which the ore on the *Hidden Creek* mines occurs, extends on to and across Glacier creek, as well as up that creek some two miles to the glacier in which the creek has its source.

This group contains the *Copper Crown*, *Red Jacket*, *Red Wing* **Red Wing** *Frac.*, and *Red Wing* mineral claims, staked by Joseph McGrath **Group.** in 1909, when he found a very large quantity of float consisting of lumps and boulders of chalcopryrite, often carrying 8 per cent. of copper mixed with slide-rock from the steep mountains on the northern side of the creek at the foot of the glacier. This property has been surveyed and Crown-granted, but the work done has been confined to the necessary annual assessments.

The same belt of argillaceous schist, common to the country surrounding Granby bay, which in places is altered to mica-schist, extends through the *Red Wing* group, but the igneous dykes found in other portions of this zone are more numerous and extensive than elsewhere.

The mineralized areas in the schist on this group of claims are of less extent than is usually found in this zone, but the values are more concentrated, occurring apparently in well-defined ribs of varying widths across the schist rather than as a mineralized belt along the line of strike of the schist.

Sufficient work has not been done to demonstrate many material facts regarding the possible commercial value of the property, but, in any event, the mining and transportation costs must be much higher than on the Granby Company's property, because of the glaciers on the higher levels within the boundaries of the group; also because of the extreme danger from snow and rock slides, and the attendant difficulty of building a camp near the mine-workings unless a large outlay of capital was made to drive long adits at low levels, with portals beyond the routes of the slides.

GIBSON ISLAND.

This is a small island situated in the northern entrance to Grenville channel, about thirty miles south from Prince Rupert, and on the regular route travelled by the Coast steamers which ply between Victoria or Vancouver and Prince Rupert. The area contained in the island is about 640 acres.

The rock formations occurring on Gibson island are crystalline limestone, hornblende-schists, and diorite, classified by R. G. McConnell, of the Canadian Geological Survey, as belonging to the Prince Rupert formation. At the contact of the hornblende-schist and limestone-outcroppings of copper minerals in a quartz gangue were discovered some years ago and a group of mineral claims was located.

The island is well supplied with timber, chiefly hemlock; the supply of water is fairly good for domestic and mining purposes, but not for power, as the highest points on the island only reach an elevation of about 100 feet above sea-level; consequently the watershed is inconsiderable, and pumping would have to be adopted for concentration purposes.

This group contains the *Copper King*, *Wild Goose*, *Ophelia*, **Wild Goose** *Standard*, and *Nellie* mineral claims, owned by Roy Chrisman, **Group.** Otis J. Benson, J. McDonald, George Keyes, and F. B. St. Amour, of Prince Rupert, B.C. Along a ridge that traverses the *Wild Goose* and *Ophelia* mineral claims at an elevation of about 100 feet above sea-level, there occur several outcroppings made up of such minerals as iron pyrites, chalcopryrite, bornite, a little galena and zinc-blende in quartz gangue. These showings have a general N. 15° W. line of strike, with a vertical dip. The country-rock on the north-east boundary of this mineral belt is hornblende-schist and on the south-west crystalline limestone.

From the work done at the No. 1 open-cut on the *Wild Goose* claim, about 200 feet south-east from the dividing line-between that claim and the *Ophelia* claim, it appears as though the mineralization had the structure of a large lens and that this work exposes the maximum width of the mineralized zone.

The No. 1 open-cut is about 8 feet deep for a length of 20 feet, then about 3 feet deep for a further length of 48 feet. This crosscuts the zone, and a cross-section, commencing at the hornblende-schist wall on the foot-wall side, is as follows: 8 feet

ore in quartz gangue; 4 feet ore mixed with limestone; 1 foot limestone; 1 foot ore in quartz gangue; 1 foot limestone; 1 foot ore in quartz gangue; 1 foot limestone; 5 feet ore in quartz gangue; 38 feet covered with gravel containing some nodules of ore; 10 feet ore in quartz gangue; followed by crystalline limestone on the south-west boundary, which is apparently the permanent hanging-wall. A sample taken from the open-cut by the writer across the 8-foot ore-body assayed: Gold, 0.02 oz.; silver, 3 oz.; copper 6.3 per cent.

In a S. 15° E. direction from the No. 1 open-cut, and also on the *Wild Goose* claim, there are four more open-cuts, and an adit in a distance of about 300 feet. In all of these the mineralization is very similar to that in the No. 1 open-cut, but the width and values appear to gradually decrease.

In a N. 15° W. direction from the No. 1 open-cut, and on the *Ophelia* claim, there are five open-cuts; in these the width of the mineralized zone appears to be about the same as in the No. 1 open-cut, and, judging from appearances, the values are about the same, but no samples were taken for assay, as it was hardly practicable to systematically sample the entire ore-body unless considerable work was done clearing out each open-cut.

Three diamond-drill holes had been bored in 1913, but these were all located several feet from the ore-body on the foot-wall side, and apparently pointed away from the ore-body rather than at an angle which would intersect it, unless the dip changes, of which there does not appear to be any indication.

On the *Copper King* mineral claim, adjoining the *Wild Goose* on the south-east, there is an outcrop of bornite and chalcopyrite mixed with limestone on which no work had been done. From this a sample taken as representing a fair average assayed: Gold, trace; silver, 2 oz.; copper, 1.6 per cent.

PITT ISLAND.

This island is situated about five miles south-east from Gibson island, and it was visited because of information that it contained an extensive deposit of magnetic iron ore. This was found on a point on the north end of the island near Stuart's anchorage, where there is a bluff 50 feet high by about 50 feet wide, made up of practically solid iron ore, occurring in a hornblende-schist country-rock. The apparent line of strike was followed towards the south-east for about 300 feet, and the same character of ore found exposed in a series of several trenches, some of which crosscut the ore-body for about 30 feet. A sample taken assayed: Iron, 59.1 per cent.; sulphur, *nil*; phosphorus, trace.

Mineral Resources of Queen Charlotte Islands.

REPORT BY W. M. BREWER, M.E.

GRAHAM ISLAND.

During a portion of the month of August, 1914, the writer was engaged in making an examination of that portion of Graham island known as the Yakoun coalfields. The earliest report of these coalfields was published in the Annual Report of Canadian Geological Survey, 1873, by James Richardson. The next report was made by the late Dr. George M. Dawson, and published in the Canadian Geological Survey Report for 1878. In the British Columbia Minister of Mines' Report for 1902 there is a description of an examination made by Dr. T. P. Marshall, F.C.S. In the Annual Report of Canadian Geological Survey 1904, Dr. W. Ells describes this district, and the Summary Report of Canadian Geological Survey for 1912 contains a description by Chas. H. Clapp, a member of the Geological Survey.*

During the examination made last summer, the writer met Professor Milnor Roberts, Dean of the School of Mines of the University of the State of Washington, and Livingstone Woerneck, his assistant, who were conducting drilling operations, doing other exploratory work, and making a topographical and geological survey of the coalfields in the interests of the Imperial Trust Company of New York, the present owners of the Wilson and Robertson tracts, containing some 20,000 acres, located nearly fifty years ago as coal lands. The writer is very much indebted to these gentlemen, not only for very efficient assistance in his examination, but also for generous hospitality during his visit.

There are two routes by which the traveller can reach the Yakoun coalfields; one is from Port Clements, situated near the mouth of Yakoun river, at the south-east end of Masset inlet; the other route is from Skidegate inlet, the channel which divides Graham from Moresby island, situated to the south.

By the first-mentioned route the trip can be made by either poling a canoe up the Yakoun river, a distance of about thirty miles, to the mouth of Wilson creek near the northern boundary of the coalfields and about a mile from Camp Wilson, or by walking along the Government trail, which connects Port Clements with Camp Wilson, the main camp in the coalfields; the distance by this trail is about the same as by the river.

By the alternative route the trip is made by boat from Skidegate village to the mouth of Honna river, which empties into Bearskin bay, Skidegate inlet; thence by Government trail to Camps Robertson and Wilson, the distance being about twenty miles.

Considered from a transportation standpoint, there has already been a railroad charter obtained by W. H. Armstrong, of Vancouver, providing for the construction of a road from a safe harbour near Lena island, on Skidegate inlet, northerly to Yakoun lake, at the head of the Yakoun river; thence down the river to Masset, where there is a good harbour. By this route few engineering difficulties would be encountered; an easy grade could be secured most of the distance, and a section of country would be opened for development, a portion of which has already been taken up by pre-emptors, many of whom are doing good work in improving their land.

Another and shorter route by which a railroad could be constructed without much difficulty would be to start from Yakoun bay, at the head of Rennel sound, on the west coast of Graham island; thence across a summit, at an elevation of about 600 feet between the bay and Yakoun lake, a distance of about four miles; thence skirt around the west and north side of Yakoun lake, and from there follow along

* NOTE.—Since this report was written the Summary Report, 1913, of Geological Survey has been published, containing a report on these coalfields by J. D. MacKenzie.

the west bank of the Yakoun river to the north end of the coalfields near the mouth of Wilson creek and about one mile west from Camp Wilson. This route, although much shorter, would fail to open up as great an area of agricultural land unless construction was continued to Masset village, as the west coast of Graham island is generally mountainous.

Camp Wilson is situated on Wilson creek, which flows from the south-east into the Yakoun river about ten miles below Yakoun lake, the source of the river. So far as is at present known, the northern boundary of the Cretaceous coal-measures is only a comparatively short distance from Camp Wilson; in fact, drill-holes that have been bored about five miles north from the camp have exposed only igneous rocks.

The seam on which development-work has been done is known as the Wilson seam, which is underlain by 6 inches of good fireclay, from which Milnor Roberts reports that he has made in the laboratory, a good quality of firebrick.

The coal-measures are found occupying a synclinal trough, the line of strike of the axis of which is about S. 10-20° E. The boundaries of this syncline had not been determined at the time of the writer's visit, neither had the extent of the areas underlain by coal been fully demonstrated, but drilling operations with two diamond-drills were being energetically carried on. Two series of holes are being bored, one series on the dip, the other on the strike of the seam.

In his report, C. H. Clapp refers to this coalfield as follows: "At Camp Wilson the most promising of the coal-seams of Graham island has been opened up by a small amount of development-work. The measures associated with the coal-seam, which has a maximum thickness of nearly 17 feet, are a roof of greenish-grey pebbly sandstone and conglomerate, and a floor of coarse bluish-green sandstone 30 feet thick overlying carbonaceous sandy shale."

During the past summer there has been some prospecting—open-cuts and trenches made on outcroppings of coal designated as the Skid Creek seam. Skid creek is a small tributary of the Yakoun river, emptying into it about one mile north from the mouth of Wilson creek and flowing parallel to the last-named creek. The line of strike of this seam is N. 30° W. and the dip is at an angle of 70 degrees towards S. 60° W. From nine open-cuts made along the line of strike, at intervals, for a distance of 750 feet, the continuity of the coal has been determined, but up to the time of the writer's visit in August no one seam had been found of commercial value, because, while the occurrence is made up of a series of four narrow seams of coal in a total thickness of 10 feet of coal-measures, the thickest seam is the lowest one, and this is only 15 inches of clean coal.

This series of coal-seams apparently represents a distinct occurrence, as the line of strike is several degrees more westerly than that of the Wilson seam, and the dip of the measures is towards the opposite direction from the dip of that seam. It would appear as though probably a narrow anticlinal fold occurred between the two seams, and that the Skid Creek seam occupied a synclinal trough nearly parallel to the one occupied by the Wilson seam.

The development-work on the Wilson seam consisted of Nos. 1, 2, and 3 working openings, two shallow pits, and five diamond-drill holes. On the Skid Creek seam the development-work consisted of a series of open-cuts and trenches, exposing coal along the line of strike.

The No. 1 working opening on the Wilson seam is situated on the east side of Wilson creek, and consists of an adit driven along the coal-seam 54 feet in length, a shaft sunk 26 feet to connect with a winze 14 feet deep, sunk near the portal, from the bottom of which a lower level has been opened and drifts run, totalling 50 feet in length, wholly in coal, with the maximum thickness of 16 feet at the northern face of the drift, but pinching to about 5 feet at the southern face. There is a sandstone-parting in the seam a few inches in thickness, and on the lower level the seam is broken by a small obliquely transverse fault. From a commercial standpoint the thickness of clean workable coal is between 9 and 10 feet for about 20 feet along the north drift on the lower level, commencing at a point 10 feet north from the winze and continuing to the north face; towards the south the seam

pinches, so that, in the drift, the workable clean coal only averages between 4 and 5 feet thick. The line of strike of the Wilson seam is N. 10° W.; the dip varies from 60 to 80 degrees towards N. 80° E.

During the writer's visit the lower level at the No. 1 opening on the Wilson seam was unwatered, and he had a good opportunity to examine the coal-seam *in situ*. The fuel used at the diamond-drill plants on the property is the product from the Wilson seam as mined from the upper and lower levels at the No. 1 opening, but, as the quantity of coal required is comparatively small, mining operations are carried on in proportion to the demand, hence the reason why the workings were full of water.

The coal from this seam is excellent for producing steam, a fact particularly noticed by the writer during his visit, which was practically demonstrated by the results shown in both the diamond-drill plants.

The coking qualities of the Wilson seam are good, so far as shown by the results from laboratory tests made by Milnor Roberts. The percentage of coke contained in the coal is reported from these tests to be 60 per cent. from unwashed coal, with a percentage of 18.07 of pink ash in the coke.

The No. 2 working opening, or Ferguson cut, as it is called, is situated 400 feet south-east from the No. 1 opening, but on the west side of Wilson creek. This opening consists of a long open-cut and a slope sunk on the coal-seam, which is apparently the extension of the Wilson seam, as the line of strike and dip correspond with those at the No. 1 opening. The underground portion of the slope could not be examined, as it was full of water, but the writer was informed by Roberts and Woernecké that the coal-seam had about the same characteristics as were found at the No. 1 opening, but that in the northern end of the drift, where the coal was 13 feet thick, it was somewhat crushed by the occurrence of a fault. On the opposite side of this fault the seam is only 4 feet thick, but in the No. 3 diamond-drill hole, about 300 feet southerly from the No. 2 opening, the seam was again cut at a depth of 156 feet, and showed a thickness of 13 feet.

The No. 3 working opening is an adit, with its portal situated about 75 feet in a north-west direction from the No. 1 opening. The course of the No. 3 adit is north-east, its length is 75 feet, and the Wilson coal-seam is reported to be exposed at the face, but this adit was in such bad condition from caving that an examination was impossible.

In Nos. 1 and 2 of the diamond-drill holes a seam of coal was bored through, and gas was encountered in both. This gas was struck at a depth of 600 feet in the No. 1 drill-hole, situated on Wilson creek about 900 feet south-easterly from the No. 1 working opening, and burned through one entire night. Gas was also struck at a depth of 300 feet in the No. 2 drill-hole, which is also situated on Wilson creek about 600 feet south-easterly from No. 1 drill-hole, and burned so strongly as to endanger the drill-house.

A seam of coal between 3 and 4 feet thick was bored through in the No. 1 drill-hole at a depth of 344 feet; and in the No. 2 drill-hole a seam 5 feet thick was bored through at a depth of 173 feet.

A cross-section of the Wilson coal-seam at the No. 1 working opening, taken across 18 feet near the face of the drift on the lower level, reading from the surface down, is as follows:—

Roof, hard grey conglomerate with pebbles well rounded, 40 per cent. of rock.

	Ft. in.
Hard brown shale	0 1
Coal, bony	0 8
Useful coal	4 0
Clean coal	7 3
Brown and black coaly shale	0 3½
Bony coal	0 2
Hard brown shale	0 1½

Carried forward 12 7

	Ft. in.
<i>Brought forward</i>	12 7
Whitish-grey, coarse argillaceous sandstone with coaly specks	0 5
Coal, broken by faulting, slightly bony	0 10
Coal	0 4
Coal, slightly bony	0 4
Coal	0 2
Brown clay shale	0 0½
Coal	0 5
Green clay shale	0 0¼
Coal	0 8
Hard brown bone	0 2
Coal	0 1
Hard brown clay bone	0 1
Soft brown clay bone	0 2
Coal crushed and broken, with bone	1 2
Bedded calcite vein	0 0½
Coal, bony	0 1
Very hard brown bone	0 3
Bedded calcite vein	0 0⅛
Soft white plastic granular clay, lenticular, 0 in. to 6 in., no rootlets in it, and does not appear to be typical under clay	0 0⅛
— —	
Total	17 10½

No samples of the coal at Camp Wilson were taken by the writer, as the seam had been thoroughly sampled by Charles H. Clapp, and the following analyses published in the Summary Report of Canadian Geological Survey, 1912:—

“ Proximate analysis—		Per Cent.
“ Water		2.44
“ Volatile combustible matter		35.96
“ Fixed carbon		48.64
“ Ash		12.96
		— —
		100.00
		— —
“ Coke		61.60
“ Its character, firm, coherent.		
“ Fuel ratio		1.35
“ Split volatile ratio		3.26
“ Ultimate analysis—		
“ Carbon		70.6
“ Hydrogen		4.8
“ Nitrogen }		9.5
“ Oxygen }		
“ Sulphur		0.8
“ Moisture		2.0
“ Ash		14.3
“ Carbon hydrogen ratio		14.0

“ The other available analyses of the Camp Wilson coal are as follows:—

	Per Cent.	Per Cent.	Per Cent.	Per Cent.
“ Water	2.65	1.06	2.47	1.91
“ Volatile combustible matter ..	38.19	43.48	35.25	35.24
“ Fixed carbon	53.73	46.01	59.36	59.39
“ Ash	5.43	9.45	2.92	3.46
— — — —				
	100.00	100.00	100.00	100.00
	(Firm, Coherent Coke.)		(Non-friable Coke.)	
“ Fuel ratio	1.41	1.06	1.68	1.68”

As the writer was informed by Milnor Roberts that the camp at Camp Robertson was closed for the season, the openings full of water, and nothing could be learned without the aid of a guide, as well as a force of men to unwater the workings, the writer did not visit that camp, which is about eight miles in a southerly direction from Camp Wilson.

The Robertson coalfield forms a portion of the holdings acquired by the Imperial Trust Company of New York. The field had been thoroughly examined for that company by Professor Milnor Roberts during 1913, and had also been reported on by Chas. H. Clapp, of the Canadian Geological Survey, in the Summary Report for 1912. From these sources the writer, who has also been furnished with all the plans and sections by Minor Roberts, has gleaned the following information:—

The coal-measures in the vicinity of Camp Robertson consist chiefly of green, very fine to coarse-grained sandstones, in places argillaceous, composed of the mechanically disintegrated detritus from the Vancouver volcanics and sandy conglomerates. Some of the beds are carbonaceous, and coaly lenses and tree-trunk impressions are common. The rocks are greatly deformed and cut by numerous dykes of dacite and andesite porphyrite. It appears that the general structure in the immediate vicinity is a narrow syncline, striking about N. 40° W., and pitching, and perhaps widening, to the south-east. In the vicinity of Camp Robertson the width of the syncline underlain by the horizon of the coal-seams is probably less than 1,000 feet.

The following analyses of the coal from the Camp Robertson seams are taken from Clapp's report:—

	Per Cent.	Per Cent.	Per Cent.
" Water	0.80	1.33	1.20
" Volatile combustible matter	23.27	35.25	29.13
" Fixed carbon	51.39	42.57	47.52
" Ash	24.54	20.85	22.15
	100.00	100.00	100.00
	(Firm, Coherent Coke.)		
" Fuel ratio	2.21	1.39	1.63"

The development-work done at Camp Robertson consists of an adit driven from the outcrop of a coal-seam, and following the seam through glacial drift until solid rock was reached, when a slope was sunk, in coal, on an incline of 13 degrees for a length of 68 feet; also an incline shaft sunk at another portion of the field to a depth of about 30 feet.

Five cross-sections taken from various points in the work referred to are as follows:—

No. 1.	Total thickness of coal, 3 ft. 10½ in., total thickness of section, 7 ft. 5 in.
No. 2.	" " 2 " 9½ " " " 8 " 9¼ "
No. 3.	" " 3 " 0¾ " " " 7 " 5¼ "
No. 4.	" " 3 " 5 " " " 7 " 5 "
No. 5.	" " 2 " 2 " " " 5 " 6 "

The writer had arranged to visit the section of the west coast of Graham island where some drilling has been done prospecting for oil, but on arrival at Masset he ascertained that the gasoline-launch "Polaris" was absent conveying J. D. MacKenzie, of the Canadian Geological Survey, to the same district, and that there was no other boat available to make the trip. After Mr. MacKenzie returned he informed the writer that at the drilling camp the only work in progress was reaming the drill-hole to insert a new casing, which would occupy considerable time; consequently, in the judgment of the writer, he did not feel warranted in incurring the expense of \$33 a day for charter of boat and supplies for such an indefinite length of time as a trip around the west coast might consume at that season of the year, with the prospect of not being able to witness any operations from which conclusions relative to the existence of oil could be drawn.

As the writer was informed by Milnor Roberts that the camp at Camp Robertson was closed for the season, the openings full of water, and nothing could be learned without the aid of a guide, as well as a force of men to unwater the workings, the writer did not visit that camp, which is about eight miles in a southerly direction from Camp Wilson.

The Robertson coalfield forms a portion of the holdings acquired by the Imperial Trust Company of New York. The field had been thoroughly examined for that company by Professor Milnor Roberts during 1913, and had also been reported on by Chas. H. Clapp, of the Canadian Geological Survey, in the Summary Report for 1912. From these sources the writer, who has also been furnished with all the plans and sections by Minor Roberts, has gleaned the following information:—

The coal-measures in the vicinity of Camp Robertson consist chiefly of green, very fine to coarse-grained sandstones, in places argillaceous, composed of the mechanically disintegrated detritus from the Vancouver volcanics and sandy conglomerates. Some of the beds are carbonaceous, and coaly lenses and tree-trunk impressions are common. The rocks are greatly deformed and cut by numerous dykes of dacite and andesite porphyrite. It appears that the general structure in the immediate vicinity is a narrow syncline, striking about N. 40° W., and pitching, and perhaps widening, to the south-east. In the vicinity of Camp Robertson the width of the syncline underlain by the horizon of the coal-seams is probably less than 1,000 feet.

The following analyses of the coal from the Camp Robertson seams are taken from Clapp's report:—

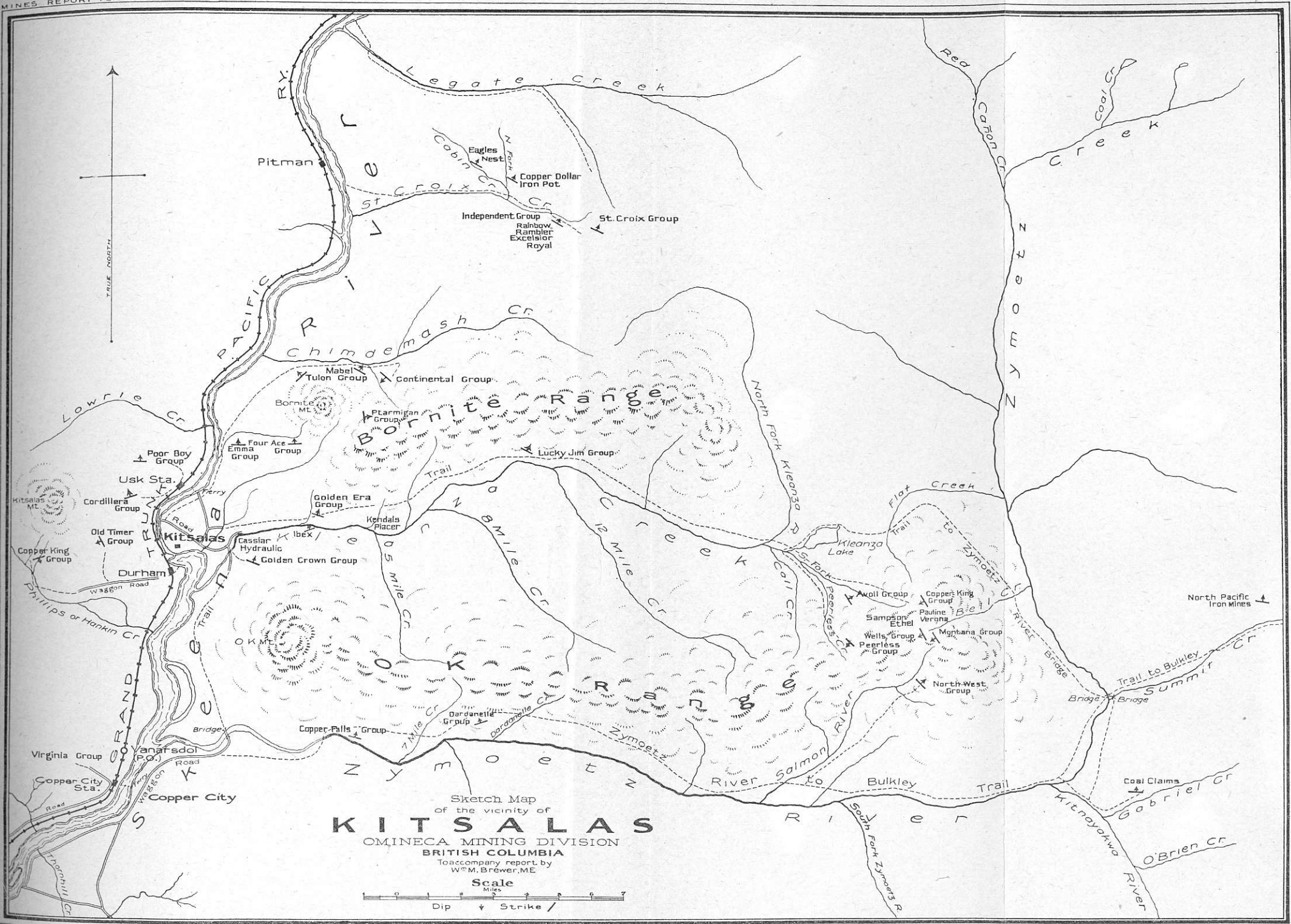
	Per Cent.	Per Cent.	Per Cent.
" Water	0.80	1.33	1.20
" Volatile combustible matter	23.27	35.25	29.13
" Fixed carbon	51.39	42.57	47.52
" Ash	24.54	20.85	22.15
	100.00	100.00	100.00
	(Firm, Coherent Coke.)		
" Fuel ratio	2.21	1.39	1.63"

The development-work done at Camp Robertson consists of an adit driven from the outcrop of a coal-seam, and following the seam through glacial drift until solid rock was reached, when a slope was sunk, in coal, on an incline of 13 degrees for a length of 68 feet; also an incline shaft sunk at another portion of the field to a depth of about 30 feet.

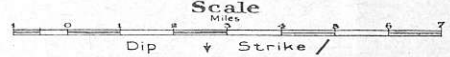
Five cross-sections taken from various points in the work referred to are as follows:—

No. 1.	Total thickness of coal,	3 ft. 10½ in.,	total thickness of section,	7 ft. 5 in.
No. 2.	" "	2 " 9½ "	" "	8 " 9¼ "
No. 3.	" "	3 " 0¾ "	" "	7 " 5¾ "
No. 4.	" "	3 " 5 "	" "	7 " 5 "
No. 5.	" "	2 " 2 "	" "	5 " 6 "

The writer had arranged to visit the section of the west coast of Graham island where some drilling has been done prospecting for oil, but on arrival at Masset he ascertained that the gasolene-launch "Polaris" was absent conveying J. D. MacKenzie, of the Canadian Geological Survey, to the same district, and that there was no other boat available to make the trip. After Mr. MacKenzie returned he informed the writer that at the drilling camp the only work in progress was reaming the drill-hole to insert a new casing, which would occupy considerable time; consequently, in the judgment of the writer, he did not feel warranted in incurring the expense of \$33 a day for charter of boat and supplies for such an indefinite length of time as a trip around the west coast might consume at that season of the year, with the prospect of not being able to witness any operations from which conclusions relative to the existence of oil could be drawn.

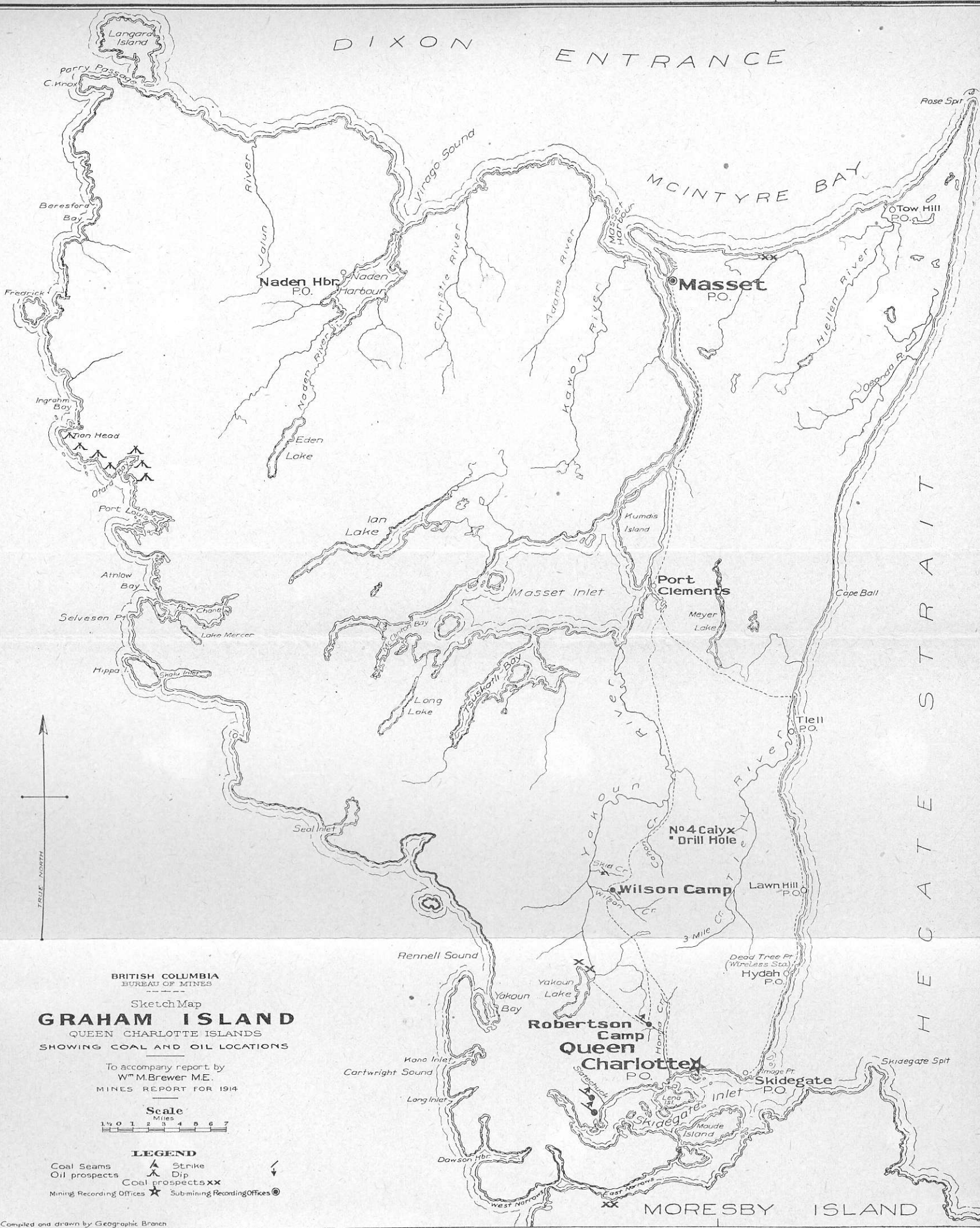


Sketch Map
of the vicinity of
KITSALGA
OMINECA MINING DIVISION
BRITISH COLUMBIA
To accompany report by
W.M. Brewer, M.E.



Drawn by Geographic Branch, Surveyor General's Office.

DIXON ENTRANCE



H E C A T E S T R A I T

BRITISH COLUMBIA
BUREAU OF MINES

Sketch Map
GRAHAM ISLAND
QUEEN CHARLOTTE ISLANDS
SHOWING COAL AND OIL LOCATIONS

To accompany report by
W^m M. Brewer M.E.
MINES REPORT FOR 1914



- LEGEND**
- Coal Seams ▲ Strike ↙
 - Oil prospects △ Dip ↘
 - Coal prospects xx
 - Mining Recording Offices ★ Submining Recording Offices ⊙