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THE MINERAL RESOURCES OF THE
ATLIN MINING DIVISION

BY

W. M. BREWER, M.E.

SUBMITTED BY

WM. FLEET ROBERTSON, Provincial Mineralogist



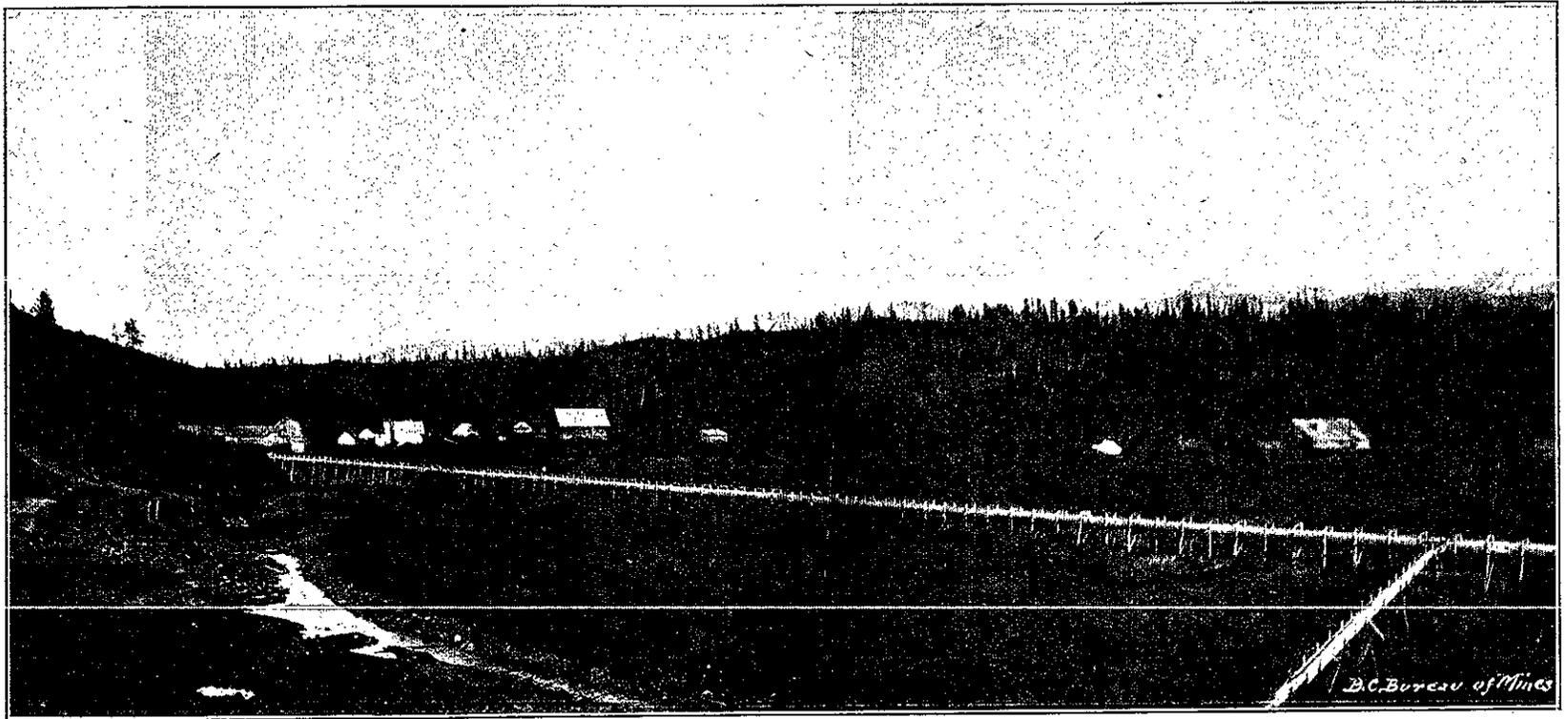
THE GOVERNMENT OF
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Camp of O'Donnel Placer Co., Ltd.—O'Donnel River.

*To the Honourable Sir Richard McBride, K.C.M.G.,
Minister of Mines.*

SIR,—I have the honour to submit herewith Report on the Mineral Resources of the Atlin Mining Division, by W. M. Brewer, M.E., A.I.M.E., prepared this 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, 1915.

MINERAL RESOURCES OF THE ATLIN MINING DIVISION.

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

ATLIN LAKE SECTION.



THE geography and general characteristics of this Mining Division have been very fully described by the Provincial Mineralogist in the Reports of the Minister of Mines for 1900, 1905, and 1911, as well as by D. D. Cairnes in Memoir No. 37 of the Canadian Geological Survey, so that any introductory description by the writer of this report is deemed unnecessary. The town of Atlin was the scene of a disastrous fire during the spring of 1914, when the main business section of the town was burned down, but by autumn this section was rebuilt.

The mining operations carried on during 1914 in the Atlin Mining Division were confined almost entirely to the creeks which have been the annual producers of placer gold since 1899. Except on O'Donnel river and Spruce creek, all of the work done was by hydraulic mining by corporations, each of which controls a sufficient number of leases and water rights to warrant the expenditure of large capital for plants, dams, water-ditches, and flumes.

The attempts made in 1904 to introduce dredges into this district have not been repeated, although it would appear that such a method of mining should be successful in certain parts of the district.

This suggestion is made because near the head of Spruce creek, on Slate creek, and between the headwaters of that creek and the O'Donnel river, as well as on the bars of that river, the writer's attention was called to extensive areas of ground which carry some values, apparently insufficient to pay for ordinary sluicing and shovelling-in by hand, but presumably sufficient to pay by handling on a large scale.

For various reasons, such as lack of gravity-dumpage or inability to obtain water under pressure, this ground is not suitable for hydraulic mining, but may be found adaptable to dredging, provided the bed-rock is suitable and the boulders do not interfere with operating the dredge.

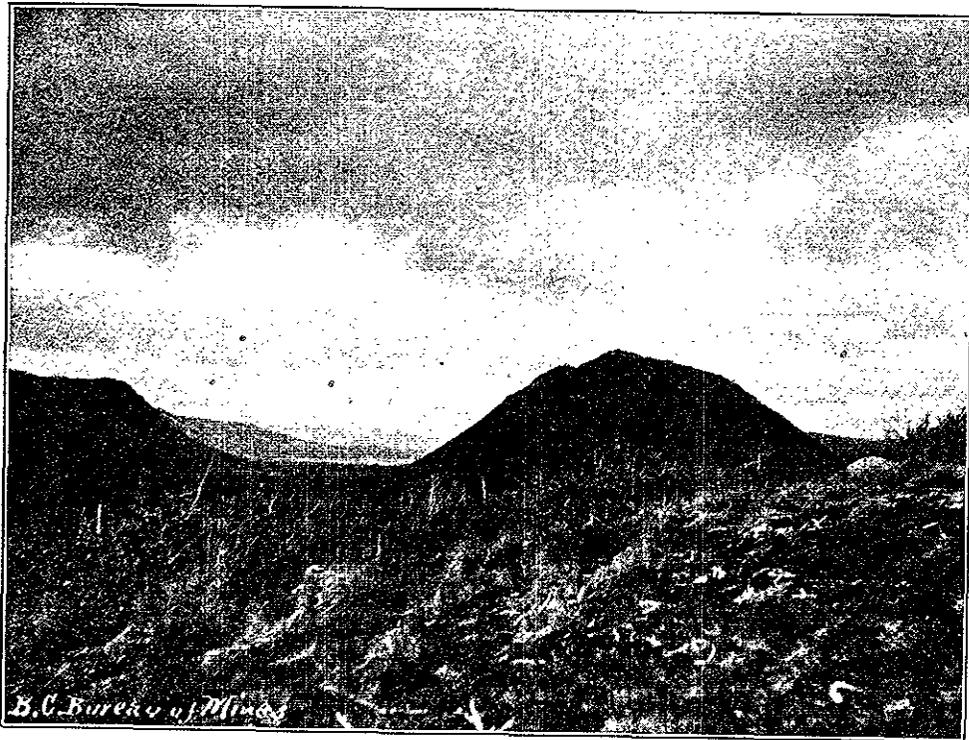
O'DONNEL RIVER.

This stream, which is about fifty miles in length, flows in a general south-westerly course into Atlin lake, entering it on the east side at a point about twenty miles south from the town of Atlin. Leases had been located previous to the season of 1914 from a point about nine miles above the mouth for a length of about twenty-three miles up the river.

Prospectors discovered placer gold on this river previous to 1904, and staked individual claims, which they later abandoned because the operations were not profitable. During 1904 leases were granted on the main river, but it was not until 1912 that bed-rock was reached by development-work, when it was found at a depth of 94 feet by Robert McKee, who, as manager for the Canadian-Alaska Exploration Company, was carrying on operations with a Keystone drill on the *Gold Hill* group of leases situated about sixteen miles above the mouth of the river. The unexpected depth of bed-rock caused a suspension of operations, but later prospecting along the bench, about 40 feet higher elevation than the bed of the stream, resulted in the discovery of a pay-streak which caused somewhat of a stampede during 1913 and the location of a number of leases. It was not until the summer of 1914, however,



Fourth of July Creek—Atlin Mining Division.



O'Donnel River.

that any quantity of placer gold was recovered, as it was late in the autumn of 1913 before any water system had been installed; this was done by J. M. Ruffner, who had bonded the *Gold Hill* bench claims and group of leases.

As the grade of the bed of O'Donnel river is flatter than usual in mountain streams, water for sluicing by hydraulic methods has to be brought in by ditches and flumes from Canyon and Berry creeks, tributaries of O'Donnel river.

Canyon creek flows into the river from the north-west and forms a confluence with the river about three miles above the point where the "pay" had been discovered. This fact necessitated the construction of a ditch two miles and three-quarters in length and a flume 1,600 feet in length to deliver water at 200-foot head.

Berry creek flows into the river from the east and empties about one mile and a half below the point where the "pay" had been discovered. A ditch one mile in length, with 600 feet of flume and a pipe-line half a mile long, comprised the construction-work found necessary to deliver this water at 260-foot head. It is estimated that these two sources furnish about 1,000 miners' inches of water.

In addition to the discovery of pay-gravel on the benches, J. M. Ruffner also found "pay" during 1913 in some of the bars along the river-bed, but, in order to work by hydraulic methods, it was necessary to change the course of the river by cutting a diversion-canal, and also to install an elevator to stack the tailings, as the grade of the river-bed is too flat to carry them away. This work, as well as testing with an Empire drill, was finished late in the season of 1914 under the superintendence of Frank Breeze, who succeeded J. M. Ruffner as manager of the North Columbia Gold Mining Company as well as of the O'Donnel Placer Company, Limited.

This company was organized by J. M. Ruffner during the O'Donnel Placer winter of 1913-14 to take over the *Gold Hill* and other leases he Co., Ltd. had previously bonded, and several miners were engaged to make crosscuts or drives into the river-bank to search for the pay-streaks in the bench about 50 feet higher elevation than the bed of the river. This work resulted in exposing gold-bearing gravel in three ancient channels where the bed-rock has wavy lines with dips at varying angles and sometimes quite deep, but at other times shallow.

The bed-rock on which most of the gold is found is a yellow clay similar to that described by the Provincial Mineralogist in the Minister of Mines Report for 1904, and designated by him as the "old yellow channel," noted as occurring on lower Pine and Spruce creeks, and his theories then expressed have been demonstrated by the work on O'Donnel river to be correct. From his report the following abstracts are made:—

"Since the previous visit of the writer (in 1900) the development of the camp has rendered clear many points which were previously little more than indications, and, as such, were given in the Report of 1900. The conclusions then arrived at have been almost exactly borne out by the subsequent work; the area of the field remains the same; the evidence is strengthened that Pine and Spruce creeks at one time joined about Stephendyke and then debouched to the north, towards Trond gulch, emptying into a lake, which then covered all the flats at the Half-way House, and that the present course of these streams below this point is of recent cutting. The 'old yellow channel' has developed along the lines then indicated, but to an extent not then hoped for.

"In 1900 the Provincial Mineralogist attempted to ascertain the direction of flow of this yellow dirt, by taking levels at various points, and while these levels were not conclusive, they indicated a flow, which subsequent work has confirmed, giving a grade to the deposit conforming in direction to the flow of Pine and Spruce creeks, but it is so slight (between 1 and 2 per cent.) that it is difficult to believe that the heavy material in the deposit would be carried by a current produced by such a grade; and, further, the workings of the hydraulic pits, etc., notably that of the North Columbia Company on Pine creek, expose a face in which the heavy boulders and angular fragments are so deposited together as to render it extremely improbable that this deposit is an 'old channel' in the usual meaning of that term—viz., the bed of an ancient stream.

"In Cariboo, and elsewhere in British Columbia, where the placer deposits occur, the 'old channels' contain in themselves the evidence of the direction of their flow; and this is shown by the more or less uniform size of their constituents, by the rounded or flat water-worn form and faces of the gravel, and, above all, by the 'shingling' of the flatter stones in the deposit, while the gold is usually on bed-rock or in some defined stratum.

"All of such evidence of flow is lacking in the old 'yellow deposit' of Atlin, and, while some of the boulders are large and rounded, many are angular, the flat ones often standing on edge, as though so dropped into mud, in still water. The greater part of the deposit consists of granite fragments, now almost decomposed, with resultant clay (kaolin) and grains of silica. While the gold here is found for the most part *near* bed-rock, though not necessarily *on* it, it occurs some height above—more or less throughout the deposit. The characteristics of the deposit did not seem to admit of its having been caused directly from glaciers. The evidence is such as to force the conviction that this deposit was not formed in rapidly running water, but that it was dropped in comparatively still water on a bottom (bed-rock) such as that of a lake or sea, with a *slope*, but not a *channel*. As to exactly how the dirt was deposited, there is room for various theories, but the most probable seems to be that glaciers, carrying in their bases the dirt, slid into a sea or lake and, driven by wind or current into this bay, there melted, the dirt dropping to the bottom, gradually forming the deposit in question.

"This is further borne out by the fact, reported by the Superintendent, that in the *Deeks* pit, on Pine creek, during the hydraulic working, a layer of seashells was found in and near the top of the yellow dirt. This layer was very local, and did not extend to the adjoining pits, and was, unfortunately, all washed away before the Provincial Mineralogist visited the camp.

"It is not very clear where the glaciers were formed, as certainly no quartz has been found in the vicinity which would justify the belief that it is the *madre de oro*."

The bed-rock itself carries only traces of gold, as is shown from assays made of samples taken from the pay-streaks in the drifts. The work of crosscutting the bench has been carried to a distance of 700 feet on the up-stream drive and about 600 feet on the down-stream drive, with about 200 feet between the drives or cross-cuts which have been connected with drifts on the pay-streaks. These pay-streaks were exposed in the up-stream drive at 63 feet, 165 feet, 284 feet, and 433 feet in from the bank of the river, but in the down-stream drive the first pay-streak is missing and the remaining three are exposed at 150 feet, 355 feet, and 510 feet in from the bank.

The system of mining that has been followed consists of drifting on the pay-streak and removing the gravel from above the bed-rock to the height that it carries commercial values, usually 6 or 7 feet, and extending the drifts to the width found profitable in a somewhat similar method to that adopted in opening rooms in a coal-mine on the long-wall system. The gravel roof and walls are found to stand well without timbering. The dumps from the drifts were sluiced during the past summer with satisfactory results.

In addition to this work, test borings with an Empire drill were made on a bar about half a mile north from the drifting, and a diversion-canal cut in order to straighten the main river-channel, and afford an opportunity for hydraulic mining on that bar during the season of 1915, as well as on the bar directly below the drifting.

The fact that all tailings will have to be stacked by an elevator, on account of the flat grade of the bed of O'Donnel river, will, of course, to some extent handicap operations by hydraulic methods in the river itself, by increasing the cost, not only of handling the gravel, but also of the construction for ditches and flumes to carry water and deliver it under sufficient head, as all of the water required must be taken from tributaries of the river, necessitating quite long ditches and flumes or pipelines, as has already been the case on the leases owned by the O'Donnel Placer Company, Limited.

The success of the operations on the *Gold Hill* leases encouraged other holders to prospect during 1914 and endeavour to locate extensions of the pay-streaks in the ancient channels, and, could water have been easily obtained, there is no doubt but that much more activity would have been manifested. The extent of the pay-streaks lengthwise has not yet been fully determined. One at least of these pay-streaks has been found to extend to the south on to the adjoining lease, where the O'Donnel Partnership, consisting of five partners, has been working during 1913 and 1914 continuously in good "pay" after driving 600 feet to where the pay-streak was exposed. Charles Miller is mining on a lease about one mile south from the Ruffner ground, and reports satisfactory results.

To the north from Ruffner's work, in 1914, drift-mining was being carried on at four points along the O'Donnel river, on the west side, as follows: At the mouth of Gold creek, about half a mile north from Ruffner's drift, where Carpenter and Rasmussen are working on a "lay" from Ruffner; about half a mile farther north by Titus and Boddy, who are also working on a "lay" from Ruffner; about four miles farther north and about one mile above the mouth of Canyon creek, where the Fitzgerald Brothers are drift-mining on their own lease; and at the mouth of Feather creek, sixteen miles above Ruffner's camp, where the Nolan Brothers are also drift-mining on their own lease. The operators of all the leases that were being worked during the past season reported satisfactory results.

During the season of 1914 there was nothing particularly new to record with regard to McKee, Boulder, Ruby, Birch, Wright, Otter, and Spruce, the other producing creeks in the Atlin Mining Division, except that from near Blue canyon to the head of Spruce creek, also on Slate creek, and other tributaries of O'Donnel river, considerable prospecting was carried on, and some placer gold mined from ground that has received but little attention in the past. As the creeks mentioned have all been most fully described annually in the Minister of Mines Reports since 1900, the writer does not deem it necessary to refer at length to them in this report.

The operators on Boulder, Spruce, McKee, and Ruby creeks expressed themselves as especially well satisfied with the results of their work during 1914, not only so far as the actual production was concerned, but also because of the fact that they had been able to do considerable testing and development-work which had demonstrated very promising possibilities for the future.

On all of the streams in the Atlin Mining Division, except on the O'Donnel river, its tributaries, and on Spruce creek, such organization has been effected as places each creek practically under the control of one company or syndicate, thereby ensuring the most satisfactory results, because of the absence of friction between competing interests and the opportunity of adopting every economy in carrying on operations.

No discoveries on hitherto unexplored creeks in the district were reported; in fact, the absence of prospectors was noticeable, but there is still quite an extensive area surrounding the borders of the Atlin camp proper, as it may be termed, that is to-day practically unexplored.

PROPOSED RAILWAY CONNECTIONS.

During 1914 a preliminary survey for a railroad was made from Taku inlet, on the south-eastern Alaska coast, to Atlin, a distance of about 120 miles, but on the outbreak of the war all activity was suspended until such time as normal conditions prevail with regard to investments in new enterprises.

The fact that the preliminary survey showed that the construction of such a railroad was feasible led to the renewal of some activity by owners of mineral claims, the product from which must eventually be shipped to outside smelters, but on which the present freight rates are prohibitory. It also has led to some inquiries with regard to the deposits of magnesite near the townsite of Atlin.

This deposit was fully described by the Provincial Mineralogist in the report of the Minister of Mines for 1904. Since the outbreak of the war in Europe the manufacturers in the United States who use magnesite have been unable to obtain the usual supply from Austria and Greece, and, as deposits of sufficient purity for commercial

purposes are of rare occurrence, there is a possibility that in the near future the Atlin deposits, because of the remarkable purity of the mineral found therein, may receive such attention as will result in development on a commercial scale; in fact, a Vancouver syndicate is now investigating the proposition. Previously, though, because of the lack of all-rail transportation facilities and the high freight rates it has been impossible to mine this magnesite and market it in competition with the imported mineral.

MINERAL CLAIMS.

FOURTH OF JULY CREEK.

This group consists of the *Hurrah, Nellie, Barber, Tom, Big Canyon No. 1, and Big Canyon No. 2* mineral claims, owned by Thomas Vaughan, John Malloy, and Mrs. Evan Lambert, of Atlin.

This property is situated about fifteen miles north from the town of Atlin, on the east side of Fourth of July creek, which empties into Atlin lake about five miles north from the town. Crater creek, a tributary of Fourth of July creek, flows through the *Big Canyon No. 1* claim from south-east to north-west, and it is on this claim that all the development-work has been done.

The country-rock is a coarse-textured, light-coloured granite, porphyritic in some places, and often containing feldspar crystals more than an inch in length. Several dark-green, fine-textured diabase dykes occur as intrusions in the granite, and some of these dykes are mineralized, carrying chiefly galena, arsenical pyrites, iron pyrites, and zinc-blende in a gangue of calcite and quartz. In places these minerals fill fissures and other cavities in the dykes, but often occur as replacements of the brecciated dyke material.

There are four prominent mineralized dykes occurring on the *Big Canyon No. 1* mineral claim at an elevation of about 3,800 feet. These are designated as: No. 1 or the upper dyke, which crosses the eastern end of a deep canyon that forms the bed of Crater creek; No. 2 dyke occurs about 50 feet west from No. 1 in the same canyon; No. 3 occurs about 300 feet west from No. 2 dyke, and outcrops on the south side of Crater creek; No. 4 dyke occurs across the creek from No. 3 and outcrops along a very precipitous hillside, the wall of a deep canyon that forms the bed of the West fork of Crater creek.

Nos. 1, 2, and 3 have their lines of strike parallel to each other, N. 40° E., with their dips varying from 80 degrees, towards the north-west, to vertical. No. 4 dyke has its line of strike nearly east and dip nearly vertical.

On the No. 1 dyke, which shows distinct mineralization for a width of more than 30 feet, two adits have been driven with the line of strike of the dyke; one of these adits is on the southerly side of the creek; this was examined for a distance of 60 feet; the remaining length, said to be 90 feet, was too badly caved in; the other, on the opposite side of the creek, could not be examined because the portal had been filled in by an enormous rock-slide, but Thos. Vaughan, one of the owners who accompanied the writer, informed him that the length of this adit was 100 feet and that it follows the line of strike of the ore-body, demonstrating the maintenance of continuity towards the north-east.

In the adit examined, which is nearly 100 feet below the outcrop, it was found that the mineralization was not confined to the material filling fissures and cavities, but that a large proportion occurred as replacing brecciated dyke material, so that, while the widest fissure did not exceed 12 inches, which generally contains lenses of solid mineral, there were also nodules and kidneys of galena and pyrite scattered through all of the material removed in driving the adit. The same conditions were also exposed in the roof and floor; consequently, concentration must be adopted in any operations carried on, and the results will demonstrate the commercial value of the property. There is ample water-supply for power as well as for concentration. A sample taken as representing the average of the ore as it might be sorted for shipping assayed: Gold, trace; silver, 49.4 oz.; lead 41.2 per cent.

In dyke No. 2 there is a pronounced fissure, averaging about 2 feet in width, filled with calcareous quartz carrying some galena, arsenical pyrites, and iron pyrites, but on this no work has been done.

Dyke No. 3 is 8 feet wide, and well mineralized with galena, arsenical, and iron pyrites in a gangue composed of dyke material, quartz, and some calcite. A large open-cut had been made at the bottom of the very precipitous side of the deep canyon, the bed of Crater creek, but this was so filled with slide-rock that no critical examination or sampling was possible.

Dyke No. 4 has been somewhat developed by sinking a shallow shaft on the outcropping, where ore is exposed in narrow fissures of the same character and apparently about the same grade as was found in the adit on dyke No. 1. An attempt to crosscut this ore at a depth of about 60 feet was made by driving an adit in the granite country-rock for a distance of 60 feet, but this had not been carried far enough to expose the ore-body.

This property impressed the writer as possessing very promising possibilities if adequate transportation facilities were installed, such as an aerial tramway to Atlin lake.

This group, consisting of the *Lucky, Liverpool, Nanaimo, Paris Imperial Group, Exhibition, and Unknown* mineral claims, is at present owned by W. H. Moore, of Nanaimo, and James Stokes and T. H. Jones, of Atlin. The claims are Crown-granted, and the property, which is better known locally as the *Munro Mountain* claims, was very fully described in the Reports of the Minister of Mines for 1900 and 1904; also in Memoir No. 37 of the Geological Survey of Canada, by D. D. Cairnes, published in 1913. As no new work has been done since 1904, it is not deemed necessary to repeat the description in this report, although the property was visited by the writer.

TAKU ARM.

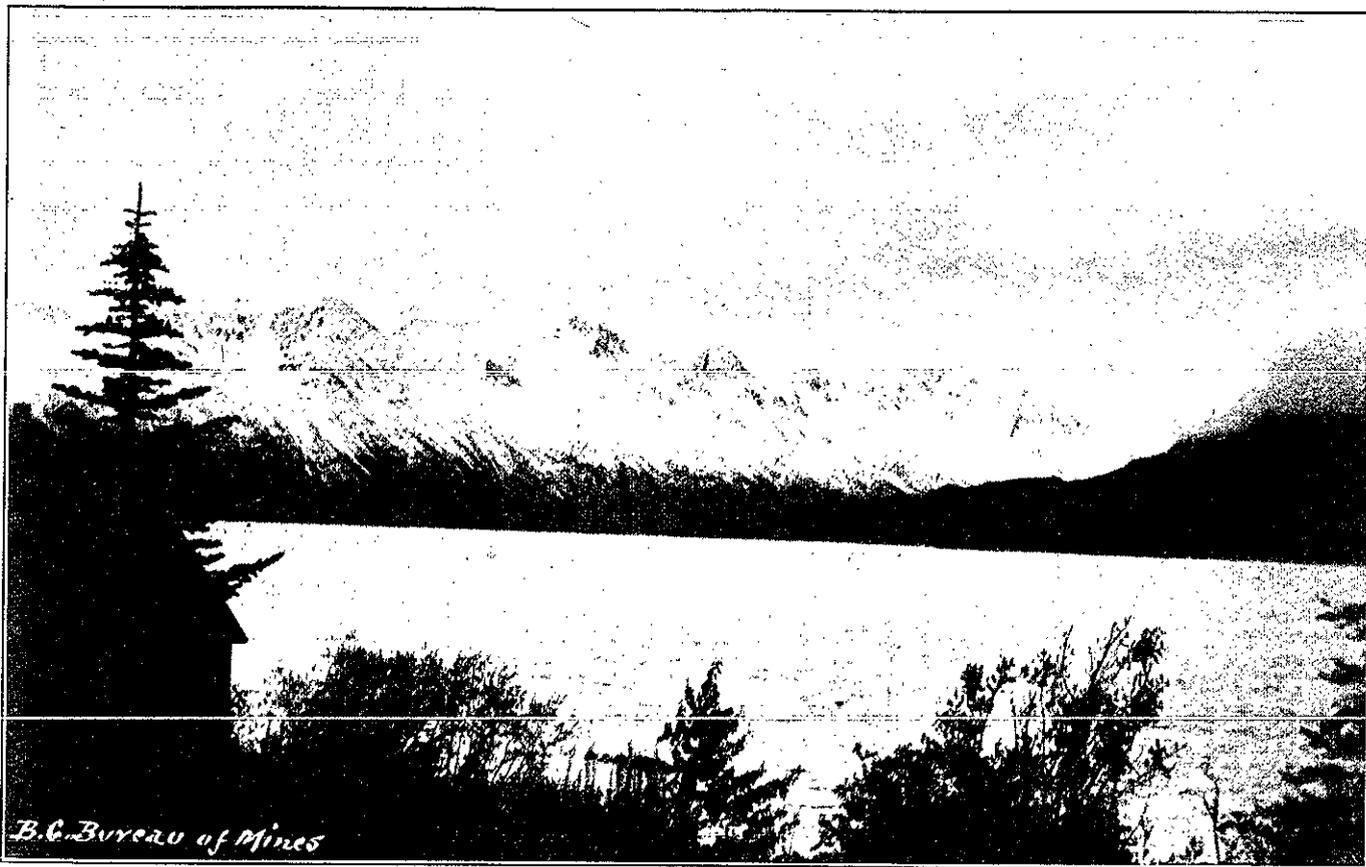
Taku arm, which lies from south to north, is one of the headwaters of the Yukon river; it has its head about thirty-five miles south-west from the town of Atlin and enters Tagish lake about sixteen miles easterly from the town of Carcross, where the White Pass Railroad crosses the foot of Bennett lake, and thus affords the opportunity for water transportation from the railroad to Taku, at the head of the short portage between Taku arm and Atlin lake.

Several groups of mineral claims were located in 1898 and 1899 in the mountains on both east and west sides of Taku arm near the southern end, amongst which are the *Engineer, Northern Partnership, Gleaner, Kirtland, White Moose, and Big Horn* or *Lawson* groups.

This property contains the *Hill, Plato, Engineer No. 1, Northern Partnership No. 1, Northern Partnership No. 2, Daisy, Brook, Group, Fraction, Mickey, Northern Partnership No. 3, No. 4, and No. 5* mineral claims grouped as the *Engineer* mines, and at present owned by Captain James Alexander, who resides on the property. The White Pass Railway's stern-wheel steamer "Gleaner," which plies between Carcross and Taku portage, en route to Atlin, makes regular calls at the camp, although that is situated about ten miles south from the regular steamer route through Golden Gate.

The mineral claims are staked in one block, but in two tiers; the five first named, forming the western tier, are located in a line from north to south, with the western boundary-line in the water paralleling the shore for a distance of nearly a mile and a half. The eastern tier of claims is made up of the remaining five mineral claims and the fraction; these are also staked in line from north to south, with the western boundary-line adjoining the eastern boundary of the first-named tier. The eastern boundary of the property is along a ridge of about 500 feet higher elevation than the shore, and which forms the foot-hills of a high mountain range that is the divide between Taku arm and Atlin lake.

The history of this property is interesting because of the several unusual features connected with its development since the original locations were made in 1899 by a party of locating engineers working for the White Pass and Yukon Railway, who dis-



South end of Taku Arm.

covered a narrow stringer of quartz, carrying particles of free gold, outcropping close to the water on the shore. The locators then organized the Engineer Mining Company of Skagway, Alaska, and began development-work by sinking on the quartz-outcrop on the shore to a depth of 20 feet, which was abandoned because of the excessive inflow of water. The next attempt at development was the erection of a head-frame and shaft-house and the sinking of a two-compartment shaft to a depth of 70 feet. The location of this shaft was on a bluff about 50 feet higher elevation than the shore, and about 40 feet east from the first shaft sunk. A crosscut adit was also driven about 300 feet in length, with the portal located on the shore about 300 feet north from the shafts. This was driven for the purpose of crosscutting a wide vein filled with iron-stained quartz that outcrops on a bluff at 130 feet higher elevation than the shore-line and about 300 feet east from it. The construction of a 2-stamp, tripple-discharge Joshua Hendy mill was also commenced by the company, but was not completed.

In 1906 active work was suspended because the funds were exhausted and the results were not considered sufficiently satisfactory to attempt to raise more money. Consequently, the original locations were allowed to lapse, but were later restaked by Edwin Brown and partners, who, in 1907, sold out to a syndicate composed of Captain James Alexander, John Dunham, B. G. Nichol, and K. Wawrecka, under the firm-name of the Northern Partnership. These owners started prospecting adjoining ground, and after discovering some other veins, located the *Northern Partnership Nos. 1, 2, 3, 4, and 5* mineral claims; they also finished the construction of the mill, and treated a few tons of high-grade ore by amalgamation.

Captain Alexander about two years ago acquired the interests of his partners and has since continued prospecting and developing on a more comprehensive and systematic policy than had previously been pursued, with the result that he has found ore-bodies hitherto unknown that carried such high values in free gold as to produce, by treatment in the 2-stamp mill, bullion to the value of about \$26,000 during 1913 and about \$20,000 during 1914, but during the latter year he was only working a few men, as the property was being examined by the engineers of a corporation that was contemplating purchasing it.

The *Engineer* group of claims was examined and reported on by the Provincial Mineralogist in 1904 and 1910, his report being published in the Minister of Mines' Reports for those years, and also by D. D. Cairnes, of the Canadian Geological Survey in 1910, whose report is published in Memoir No. 37, issued in 1913. All of these refer to the work done by the old company, and the examinations were made previous to the performance of the development-work hereinafter described, the most important of which is located about 1,000 feet easterly from any work done when either of these examinations were made; in fact, the best showings on the property were only found about two years ago, after thorough and systematic prospecting-work had been done by the present owner.

The geological formations at and in the vicinity of the *Engineer* mines are, according to the report of D. D. Cairnes, of the Canadian Geological Survey, "predominately *Jura-Cretaceous*, finely textured greywackes, shales, and slates of the Laberge series, which range from brownish and dark green to almost black in colour, and are probably to a considerable extent pyroclastic in nature. These beds have been invaded by dykes of andesite and granite porphyry, and are in places faulted, folded, and considerably distorted, but have a general strike about N. 63° W. and dip to the north-east at an average angle of 35 degrees. Most of the ore-bodies occur in the dark to almost black, finely textured Laberge members."

The writer found two well-defined series of vein-structure, and in all nineteen veins were examined, on which more or less work had been done. The outcroppings of sixteen of these are mentioned in the Reports of the Minister of Mines for 1910, and of D. D. Cairnes in Memoir No. 37, already referred to.

The veins which comprise the first series radiate from two central hubs or bodies composed, principally, of quartz, the exposed dimensions of each of which covers an area exceeding 200 feet square. There is a large proportion of shale and slate mixed with the masses of quartz. The veins which comprise the second series

are well-defined isolated fissures which apparently have no relationship to the masses of quartz mentioned, but are usually found in close proximity to intrusive igneous dykes, which sometimes form one or other of the walls of the vein.

The No. E or most recently discovered vein belongs to the second series of veins. This has never been mentioned in any previous report because it is one of those discovered since the examinations referred to were made. It is a clean-cut, well-defined fissure in slate country-rock with excellent walls, and a few inches of talcose gouge separating each wall from the ore-body. The surface outcroppings and the vein-filler to a depth of about 20 feet are composed principally of quartz and calcite, but with more or less brecciated slate and shale intermixed, usually banded. The quartz is considerably stained with iron oxide and pans free gold, but the vein-filling shows little other metallic mineralization until greater depth is reached; then antimonial sulphides occur as kidneys or bunches in the quartz-calcite gangue, with calcite often found to predominate, especially at the deepest level, reached about 120 feet below the surface. This vein on the surface averages about 6 feet wide, has its line of strike N. 23° E., and dips at an angle of 85 degrees towards N. 67° W.

On the surface this vein has been exposed by trenching, from about 6 to 8 feet deep, for a length of about 800 feet on the *Northern Partnership No. 2* mineral claim, or from a point on its northern boundary, 250 feet from the eastern line, diagonally across the claim towards the south-west corner. An adit has been driven drifting along the vein for 250 feet. The portal of this adit is in a swampy gulch where the most northerly outcropping of the vein so far known was found. The height of the backs above the adit vary from about 20 feet near the portal to a maximum of 75 feet at a point about 150 feet from the portal where a winze has been sunk 40 feet deep below the floor of the adit. Down this winze the vein maintains perfect continuity, with the same characteristics found in the adit. The vein-matter between walls varies in width from 6 feet to about 3 feet. Of this width, about 12 inches is made up of practically solid mineral and represents the richest portion of the vein. The mineralization is antimonial sulphide in a quartz-calcite gangue. The wider portion of the vein is chiefly made up of brecciated shale and slate which, with scattered particles of minerals, are cemented together with quartz and calcite. This carries variable values which are free milling, but apparently of low grade; however, no attempt to sample this portion of the vein was made because of its variability.

A sample taken across 12 inches in width and five feet in length at the bottom of the winze assayed: Gold, 71.5 oz.; silver, 50.5 oz.

Another sample taken from the adit about 100 feet beyond the portal and representing the ore associated with calcite gangue assayed: Gold, 14.96 oz.; silver, 9.9 oz.

Another sample taken from the face of the adit and representing 12 inches on the hanging-wall side assayed: Gold, 8.4 oz.; silver, 5.6 oz.

It has been generally assumed that this ore contained tellurium, but the Assistant Assayer reported that in the samples assayed there was no evidence of tellurides.

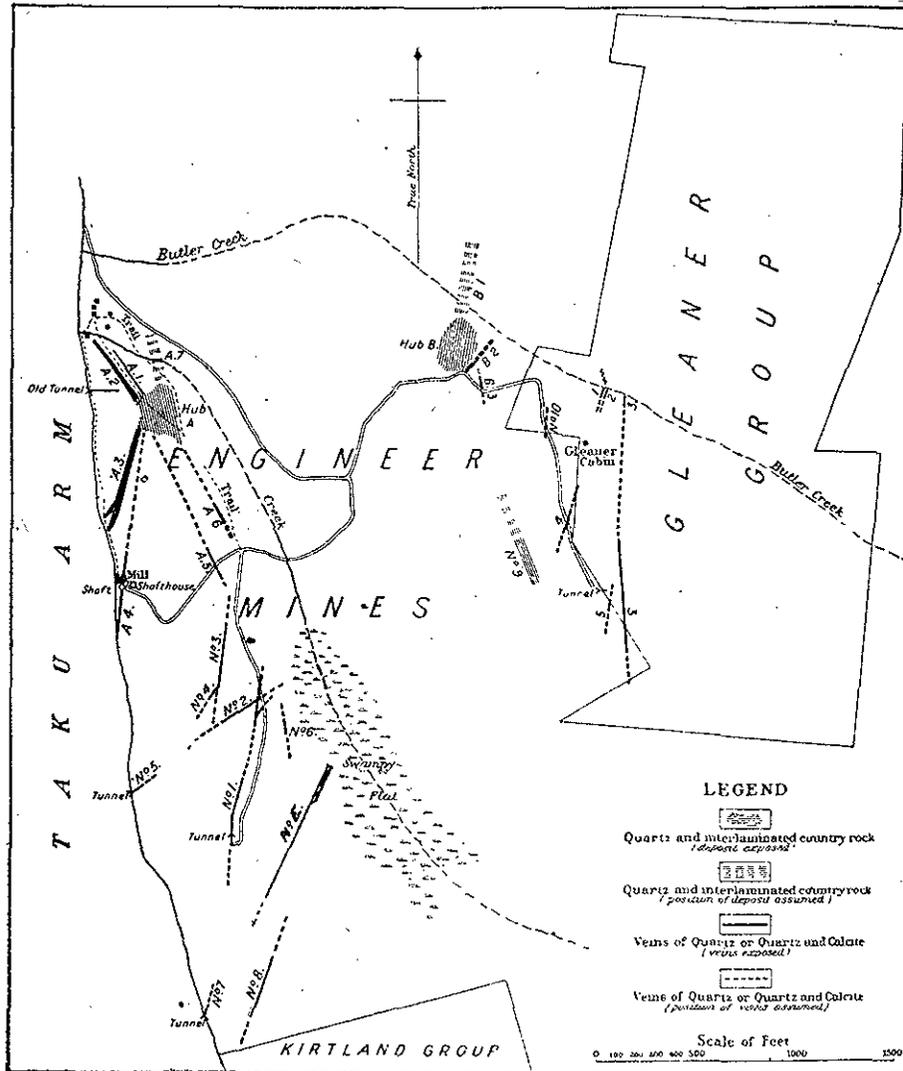
The bullion produced at the *Engineer* mine during 1913 and 1914 was the result of treating the ore from the vein above described in the 2-stamp mill. All the ore treated was that taken out while driving the adit and sinking the winze, together with the product from an upraise to the surface above the winze, and a short stope in each direction from the upraise.

There is a possibility that this No. E vein may eventually be proven to be a north-easterly extension of a vein, known as No. 8, which also belongs to the second series and outcrops near the south-west corner of the *Northern Partnership No. 2* mineral claim, or about 1,500 feet from the portal of the adit on No. E vein, but no connection has yet been established; in fact, there is a space of nearly 300 feet wide where no outcroppings have been located, and where the overburden is very deep. The line of strike of the No. 8 vein is N. 15° E. and dip at an angle of 79 degrees towards N. 75° W.

There has been considerable new work done on the No. 8 vein during the past three years, consisting of driving an adit about 40 feet long, in addition to trenching from 8 to 10 feet deep for a length of about 400 feet along the strike of the vein.

This vein is in places 12 feet wide on the surface, but varies very much. The vein-filler is composed chiefly of brecciated shale and slate cemented together with quartz and calcite. Particles of free gold, visible to the naked eye, are frequently seen in the quartz, but there is practically no other mineral showing at a depth so far reached.

The walls are well defined, both being slate, and there is a talcose gouge a few inches wide separating the vein-filler from each wall. Panning tests show that the values are quite variable, and any sampling other than in a thoroughly sys-



Diag. 4. Map showing the vein outcrops on the Engineer mines property, and on the Gleaner group, Atlin mining district, B.C.

From Memoir No. 37, Geological Survey.

tematic manner, which was not practicable, would be very misleading. Some of the ore mined from the development-work was milled with satisfactory results.

On the other veins the development-work has been principally confined to surface open-cuts and trenching, which totals about 4,000 feet in length, while the total length of underground work reaches nearly 1,000 feet, which includes 300 feet of adit and 90 feet of shaft, work done by the original company.

A large proportion of this work has been done on quartz veins, about the average values of which but little is known, except that usually panning tests have shown more or less free gold, while in some instances, notably on the vein known as No. 5, which outcrops in the face of a perpendicular bluff at the water's edge, many particles of gold, visible to the naked eye, are seen in a width of 8 inches of the vein. The full width of the vein-matter between the well-defined walls averages about 18 inches, on which an adit has been driven for a distance of 40 feet. This No. 5 vein is another representative of the second series and cannot be traced to have any connection with the extensive masses of quartz, before referred to, but is closely associated with an intrusive igneous dyke.

No systematic sampling was attempted on any of the veins, as such was not practicable; in fact, the only satisfactory method of sampling, in the writer's opinion, would be actual mill tests of large samples, which could be easily done in the 2-stamp mill. Such sampling would demonstrate what proportion of the large quantity of quartz occurring on the property is available for treatment on a commercial scale.

This group contains six mineral claims owned by Captain W.

The Kirtland Group. Hawthorn, R.N., and Thos. Kirtland, of Atlin. The *Jersey Lilly* mineral claim, one of this group, adjoins the southern boundary of the *Engineer* property, and from there the *Kirtland* group extends southward along the east shore of Taku arm a distance of approximately 8,000 feet. The geological formation of the *Kirtland* property is the same as on the *Engineer* mine, and the veins that have been found resemble those found on that property.

The only work, except prospecting, that has been done on the group is located on the *Jersey Lilly* mineral claim, where two shallow shafts about 10 and 14 feet deep respectively were sunk a short distance from the southern boundary of the *Engineer* mine. These are on two distinct quartz outcroppings. The 10-foot shaft exposes a vein with its strike north-east and dip 88 degrees towards north-west; it is about 3 feet wide and filled with quartz. An average sample taken across the full width assayed only traces in gold and silver. The location of this shaft is about 250 feet south from the *Engineer* line.

The 14-foot shaft is located about 25 feet south from the same boundary-line, and exposes a vein averaging about 5 feet wide, filled principally with quartz, but with considerable brecciated shale and slate, especially in the centre of the vein. The vein has its line of strike N. 23° E., dipping 76 degrees towards S. 57° E., and has been traced on the surface for a distance of about 200 feet, showing the same characteristics for that length.

Only one sample was taken which represented an average of the vein in the shaft, and after assaying showed only traces of gold and silver.

This group consists of three mineral claims and a fraction

The Gleaner Group. that are situated to the east of and adjoining the *Engineer* mine. As no work has been done for several years past and none of the owners were in the vicinity, the property was not examined by the writer, but, from the report of D. D. Cairnes in Memoir No. 37 of the Canadian Geological Survey, the following information is gleaned: That the rock formations on the *Gleaner* claims are the same as on the *Engineer* mine. Also that there are five veins occurring on the property; these are filled with quartz and intercalated layers and fragments of wall-rock which constitute the entire vein-filling with the exception of small amounts of native gold, iron pyrites, and iron oxide.

This group of six mineral claims is situated about twelve
Lawson Group. miles from the shore of Taku arm, on the west side of Big Horn creek, which empties into the west side of Taku arm about ten miles north from the *Engineer* mine. The group is owned by Fred Lawson, who resides on the property, Thos. Kirtland, William Powell, Robt. Pelton, Dan Sullivan, and Agnes A. Lawson. As the season was late and, from the most reliable information that could be obtained, snow covered the surface of the property, which would have prevented a thorough examination, the writer did not visit it.

Memoir 37, Canadian Geological Survey, contains a full description of this group. A brief synopsis of that report is as follows: That the rock formations

on this group and vicinity, with the exception of occasional dykes, consist of fine-textured, greenish amphibolites, micaceous as well as sericitic schists and quartzites. The veins are lenticular in structure and lie practically always conformable to the foliation planes of the enclosing rocks, and generally have their lines of strike about N. 15° E. The largest quartz lens noted by Mr. Cairnes is described as being located on the *Big Horn* claim. This, he says, is over 200 feet in length and from 4 to 24 inches in width, and is composed of quartz, which is in places rust-stained and carries small quantities of galena, chalcopyrite, pyrite, and native gold. Some specimens, he says, were seen in which particles of gold existed, which were as much as $\frac{1}{20}$ inch in diameter, and in other places small leaves and flakes of gold were noted up to $\frac{1}{8}$ inch across.

Since the examination made by Mr. Cairnes in 1910 the writer was reliably informed that the owners had extended the development-work, and also that Mr. Lawson had installed a 1-stamp mill on the property, in which he had successfully treated some of the high-grade quartz.

The Provincial Government in 1910 constructed a wagon-road from *Kirtland*, on the shore of Taku arm, up the valley of the Fantail river to Bighorn creek, and thence up the valley of that stream to the lower terminal of the aerial tramway on the *Lawson* group, and it was over this road that Mr. Lawson and his partners hauled the machinery for the 1-stamp mill, cable and other equipment for the aerial tramway.

RAINY HOLLOW.

This district was reported on by the Provincial Mineralogist in the Minister of Mines' Reports for 1900 and 1907. Since the last date the transportation facilities have been very much improved between Haines Mission, Alaska, on Lynn canal, and the Rainy Hollow camp. Wagon-roads have been constructed by the United States Government up the Chilkat river from Haines to Klukwan, near the junction of the Chilkat and Klehini rivers, where a good bridge has been built across the Chilkat river; thence up the Klehini river to Pleasant camp. From Pleasant camp the British Columbia Government has built an excellent wagon-road to Rainy Hollow, in which camp the Klehini river has its source.

As all of the prospectors who had been in Rainy Hollow camp during the summer had left at the time of the writer's visit—September 3rd—Captain M. C. O'Connors, one of the pioneers of the district, was engaged as a guide to the several mineral claims, and a week was occupied in examining the development-work performed since 1907.

During the summer of 1914 a small stampede of placer-miners occurred to the Klehini river, where more than 100 creek and bench placer claims were located, but, as no one found gold in sufficient quantities to earn wages, these had all been abandoned.

As the geography of the Rainy Hollow camp was described in the Minister of Mines' Reports for 1900, page 765, and 1907, page 43, it is not necessary to repeat it.

During the examination it was found that few mineral claims had been located since 1907, and but comparatively little new development-work had been done in the camp; that practically all of the mineral claims located had been Crown-granted or Crown grants applied for, and the owners were waiting for purchasers to invest. On some of the properties there had been additional development-work performed since the visit of the Provincial Mineralogist in 1907, which is described in the following report.

The *Maid of Erin* mineral claim, owned by Martin Conway, William Burnham, and Richard Kennedy, is situated on the west slope of Mineral peak at an elevation of 3,500 feet. Outcroppings of bornite and chalcocite copper ores in a garnetite gangue are found over an area of about 200 feet in length by about 100 feet in width on the summit of a limestone butte. The strike of the ore in the main workings or No. 1 open-cut is north and dip to west at an angle of 20 degrees; in the No. 2 open-cut, 20 feet north-east from the No. 1, the strike is N. 52° E. and dip at an angle of 72 degrees towards S. 38° E.; in the No. 3 open-cut the strike is east and the dip at an angle of 56 degrees towards the south; in a shaft 15 feet deep situated 60 feet easterly from the face of No. 1 open-cut the strike is N. 72° E., with the dip vertical.

The No. 1 open-cut has been made 8 feet wide at the entrance by 36 feet long towards the south-east to the face, which is 6 feet deep, then turned to the left, or towards north-east, for about the same distance by 10 feet wide, with the face 6 feet wide by about 8 feet deep. These dimensions appear to be nearly the boundaries of this ore-body, which has an average thickness of 3 feet of high-grade ore, the genesis of which is from replacement of a portion of the limestone.

The high grade of the ore is shown by the following assay returns from a sample taken, which represented a fair average of the ore-body exposed in the open-cut: Gold, 0.03 oz.; silver, 33 oz.; copper, 22.5 per cent. In the Minister of Mines' Report for 1900 assay returns from a sample of outcropping are: Gold, none; silver, 44.2 oz.; copper, 34 per cent. In the Report for 1907 the following assay returns from samples from the same ore-body are: Gold, trace; silver, 50.2 oz.; copper, 29.2 per cent.; and gold, trace; silver, 60.8 oz.; copper 37.9 per cent.



B. C. Bureau of Mines.

Looking down Valley of Rainy Hollow—Atlin Mining Division.

In all of the openings where the ore dips at a steep angle, it occurs as narrow stringers more or less mixed with garnetite filling the fissures in the limestone. The rock formation along the westerly side of the limestone is made up of a contact-metamorphosed limestone, with the underlying rock apparently a granodiorite, and no other discoveries of mineral have been reported from that direction. To the east, for nearly a mile from the workings on the *Maid of Erin* claim, the country rock is limestone.

This property possesses sufficient merit to warrant systematic development-work, from the results of which would largely depend whether capitalists would be justified in building a railroad into the camp.

This mineral claim is located to the east of and adjoining the *Elise*. the *Maid of Erin*, and is owned by the same owners as the latter.

There are several outcroppings of bornite ore occurring in limestone, apparently by replacement. The work done has been confined to the necessary assessment-work. Ore has been exposed in several places, but the work is shallow and lacks such system as would demonstrate the value of the claim from a commercial standpoint.

This mineral claim adjoins the *Elise* on the east, and is owned by Mrs. Clara Smith, of Minneapolis, Minn. On this claim there is a gossan-outcropping about 4 feet wide which is quite persistent along its line of strike, N. 20° W. This dip has been exposed in two open-cuts along the line of strike, each about 50 feet long by 8 feet deep, and separated from each other by about 650 feet. The iron mineral—which is probably oxidized pyrrhotite—occurs filling a fissure in limestone and shows no indication of carrying copper or other valuable mineral to the depth the work has been carried.

This mineral claim is situated to the east from and adjoining the *Empress* mineral claim, and is owned by Samuel Weitzman, of Haines, Alaska. There are several outcroppings of iron gossan, with practically the same general line of strike as those on the *Empress* mineral claim, but no work has been done on any of the outcroppings, although several open-cuts have been made in the limestone country-rock.

This mineral claim adjoins the *Corona* mineral claim on the east, and is owned by Dan Sullivan, one of the pioneer prospectors of the camp. At an elevation of 2,000 feet there is an outcropping of iron gossan 20 feet wide occurring at the contact between limestone and altered argillites, with the former on the north-west or hanging-wall side of the mineral. The line of strike of the mineral is N. 50° E. and its dip is 43 degrees towards the north-west.

Three open-cuts have been made to expose the mineral; the No. 1 cut is 20 feet long by 6 feet deep; the No. 2 opening, which is situated about 100 feet north-east from the No. 1, is 8 feet square by 8 feet deep; and the No. 3 cut, which is situated about 20 feet to the south-east of No. 2, is 5 feet deep at the portal, 12 feet long, and 10 feet deep at the face.

The iron mineral, which resembles that on the *Empress* claim, is copper-stained and carries some galena and pyrite in places. A sample taken representing a fair average of the mineralization assayed: Gold, trace; silver, 1.3 oz.; copper, trace.

This mineral claim is situated on Jarvis creek about 1,500 feet N. 30° E. from the north line of the *Hibernian* mineral claim, and is also owned by Dan Sullivan. Jarvis creek, which is a tributary of the Kichini river, carrying a considerable volume of water, has its source in a group of glaciers on the north side of the summit of Mineral mountain, about one mile and a half north-westerly from the *Jarvis* mineral claim, through which it flows.

On the north-east side of the creek, at the summit of a bluff that forms one wall of a deep canyon, which is the bed of Jarvis creek, there occurs an outcropping of gossan filling a fissure between the contact of limestone and hornblende gneiss. An adit has been driven 60 feet along the line of strike of the fissure in a S. 80° E. direction. The portal of this adit is located at an elevation of 2,600

feet, and on Jarvis creek just above high-water line in the deep canyon. The vein averages 2 feet wide and dips at an angle of 50 degrees towards the north. The mineralization consists of nodules of galena and iron pyrites in quartz gangue.

An average sample taken across 2 feet 3 inches in the face of the adit assayed: Gold, trace; silver, trace. Another sample which represented about an average from the dump of ore saved during the progress of work assayed: Gold, trace; silver, 9.6 oz.; lead, 12 per cent.

This mineral claim is situated near Jarvis creek, adjoining the *Jarvis* mineral claim on the north, and is owned by Martin **Victoria.** Conway, Richard Kennedy, and William Burnham, of Skagway, Alaska. Near the contact between crystalline limestone and altered argillites, on a ridge at an elevation of 2,850 feet, the limestone is considerably fissured, and these fissures, which are quite narrow, are filled with iron-stained brecciated material carrying some galena, chalcopyrite, and zinc-blende, but, so far as could be seen, not any body of mineral that could be considered of commercial value.

From a gulch about 50 feet below the surface a crosscut adit has been driven 70 feet long, but, although this adit crosscuts two narrow fissures, no ore of commercial grade has been exposed. The same conditions were found in a shallow shaft sunk on the summit of the ridge, as well as in two open-cuts.

This mineral claim joins the *Victoria* on the north, and is owned by the same parties. At a point about 800 feet in a N. 10° **War Eagle.** E. course from the work on the ridge on the *Victoria* claim there occurs an outcropping of iron gossan 30 feet wide by about 50 feet long, with its line of strike N. 55° E. and dipping at an angle of 51 degrees towards N. 35° W. The hanging-wall of this body of mineral is crystalline limestone, and foot-wall an igneous dyke. The mineralization appears to be from the alteration of pyrrhotite or iron pyrites. A large open-cut has been made below the outcropping, but no change was noticeable in the mineralization.

This mineral claim is situated on the north side of Wilson **Majestic.** creek, a tributary of Klehini river, emptying into it about half a mile south-east from the mouth of Jarvis creek. The owners are Conway, Kennedy, and Burnham, of Skagway, Alaska. Wilson creek flows through a deep canyon with precipitous walls, and on the north-east side, at an elevation of 3,100 feet, there occurs a bluff made very prominent because of an outcropping of gossan, 30 feet wide, between crystalline limestone and a diorite dyke. The line of strike of this outcropping is N. 10° E. and its dip at an angle of 69 degrees towards N. 80° W. The diorite dyke is about 100 feet wide, apparently an intrusion into the limestone, and has its line of strike conformable with that of the gossan-outcropping.

The work on this occurrence consists of an open-cut 20 feet long by 30 feet wide, by 20 feet high at the face, in which the mineralization shows no change in characteristics from those of the outcropping. As free gold is the only probable value it is likely to carry, and it failed to show any from panning, no sample was taken for assay.

This mineral claim, which is situated adjoining the *Majestic* **New York.** claim on the north, is owned by Captain M. C. O'Connor, of Haines, Alaska. At the contact between crystalline limestone and hornblende gneiss there occurs a vein from 6 to 8 feet wide filled with gossan, which can be traced for several hundred feet on the surface, along a general N. 15° W. line of strike. Several open-cuts have been made, which, while demonstrating the continuity, have failed to show the occurrence of any mineral of commercial value.

This mineral claim is distant about 1,000 feet in an easterly **Adams.** direction from the *New York* claim, and is also owned by Captain M. C. O'Connor, of Haines, Alaska. There occur two well-defined leads on this claim, the gossan-outcropping of which can be traced on the surface for several hundred feet. One of these is 30 inches wide and is situated on the east side of the claim; this is called the No. 1 lead, and is made up of epidote and zoisite, with a little graphite. The other, named the No. 2 lead, occurs about 600

fect from the west side of the claims at an elevation of 3,500 feet, and reaches a maximum width of about 28 feet at one point, about 350 feet distant from the south end line of the claim.

The No. 1 lead, which has its line of strike N. 18° E. and dip vertical, has been opened up at several points by open-cuts and trenches, where the mineralization is an iron mineral, and, so far, shows no other metallic contents. This occurs at the contact between crystalline limestone on its east side and hornblende gneiss on the west side.

The No. 2 lead occurs between two igneous dykes; that on its east side is quartz porphyry, while the dyke on the west side is a diorite which has been intruded into the limestone country-rock. The line of strike of the No. 2 lead is N. 20° E., with its dip almost vertical, but appears to be slightly inclined towards the N. 70° W.

About 800 feet north from the south end line of the claim the quartz-porphyry dyke, which is about 50 feet wide, shows as an intrusion cutting through the diorite dyke, which is 15 feet wide, the line of strike of the former being variable, but usually N. 10° W., and of the latter N. 30° E., and nearly paralleling the lead.

The mineralization in the No. 2 lead is galena and iron pyrites in a garnetite gangue, with the galena usually occurring as kidneys or lenses in the gangue, but at one point near the south-easterly boundary of the lead where a long deep open-cut has exposed the maximum width there is 3 feet of nearly solid galena. A sample chipped across this 3 feet which represented a fairly good average of the cross-section assayed: Gold, trace; silver, 8 oz.; lead 53.5 per cent. The work done on this lead consists of five large open-cuts within a distance of 450 feet along the strike.

This mineral claim is situated south from and adjoining the **Custer.** *Adams* mineral claim, and is owned by Tim Creedon, of Haines, Alaska. On a bluff at an elevation of 3,200 feet there is considerable gossan-outcropping, in which an open-cut 15 feet long by 6 feet wide has been made, with an adit 10 feet long beyond the cut. At the portal of the adit the mineralization occurs at the contact between crystalline limestone and a diorite dyke with the dyke on the east side, but at the face it appears as though the dyke had turned the line of strike of the mineralization and cut it off. On the surface, beyond the face of the adit, and at a level about 40 feet higher, gossan-outcroppings carrying such minerals as copper pyrites, galena, zinc-blende, and iron pyrites are found on both sides of the dyke, with the line of strike N. 50° E.

This work was done at this point because it was assumed that the mineralization was an extension of the lead on the *Adams* mineral claim, but sufficient work has not yet been done on either claim to establish any continuity between the two occurrences. No sample was taken, because it was evident from the appearance of the mineralization in the adit that any attempt to obtain an average sample until more development-work has been done would possibly be misleading.

This mineral claim is situated adjoining but in a south-westerly course from the *Custer* mineral claim, and is owned by **Wonderful.** Conway, Kennedy, and Burnham, of Skagway, Alaska. A long adit was driven on this claim several years back, but could not be examined because of its caved condition. This had evidently been driven in order to develop a contact mineralized zone between crystalline limestone and altered argillites, with its line of strike north-east and dip north-west, but nearly vertical. As the adit could not be examined no samples were taken.

In addition to driving the adit, several open-cuts had been made, in all of which the same character of gossan as is found on the *Custer* and *Adams* mineral claims is exposed, but it is not possible to trace any continuity between the several so-called leads until considerably more development-work has been done.

This group of mineral claims is situated about four miles north-east from the *Custer* mineral claim. It contains fourteen **Three Guards-** mineral claims, and is owned by Al. Smith, Hugh McDonald, Dan **men Group.** Sullivan, Frank Saucier, Lincal Smith, Jim Irving, Chas. Murphy, Frank Murphy, Scotty Jennings, and C. Clayton, local prospectors, with headquarters at Haines, Alaska. E. S. Wilkinson, B.C.L.S., of Victoria, who had been surveying.

this group of mineral claims during the past summer, had just broken up his camp and left, having finished his work previous to the arrival of the writer, who met him en route to Skagway. From him it was learned that none of the owners were in Rainy Hollow; also that the work done was restricted to regulation assessment-work. For these and the further reason that storms had covered much of the higher levels with snow, this group of claims was not examined.

In addition to the mineral claims described and mentioned in this report, there are about thirty other locations in the Rainy Hollow camp, some of which have been Crown-granted, but, as none of the owners were on the ground, and from the most reliable information obtainable the conditions with regard to mineralization were similar to the properties examined, which are considered the most promising in the camp, the writer concluded his work, as the weather was most unfavourable, and returned to Haines.

The impressions that prevail in one's mind after examining carefully the conditions of the Rainy Hollow camp are that without railway connections for transporting ore, machinery, and supplies, the future of the camp is not very promising. The owners of the properties are men of small means unable to stand the cost of development-work while, on the other hand, unless sufficient tonnage of ore is available to furnish freight it will be very difficult to enlist capital into the enterprise of building a railroad; so that a deadlock exists which up to the present time has been impassable, although four different organizations have attempted to float a company to construct a railroad, about forty miles of which would be in United States territory and about twelve miles in Canadian territory.

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